

0.10
Ref. A084/2104

PRIME MINISTER

Annual Review of Government Funded
Research and Development

The second of the Annual Reviews of Government Research and Development expenditures instituted by Cmnd 8591 (Government observations on the report "Science and Government" from the House of Lords Select Committee on Science and --- Technology) has now been completed and I attach a copy. Responsibility for preparation of the Review lies with the Science and Technology Secretariat in the Cabinet Office, working under the guidance of the Sub-Committee of Chief Scientists chaired by Robin Nicholson.

2. As in 1983, the Review is in two parts. Part I contains a summary of past and projected Government R and D expenditures for the PES period 1981/2 to 1986/7 and a factual commentary on their distribution. This year, Departments and Research Councils were invited to state the primary aim of each of their programmes, whether to advance scientific understanding, to support purchasing decisions, to develop technology etc. This has enabled the Secretariat, in Chapter 2 of this part of the Review, to provide helpful analyses of the distribution by industrial sectors and product groups. Some international comparisons are made in Chapter 3. In general, this Review provides much more analysis than last year's, while also including projected expenditures, as envisaged in Cmnd 8591, for the first time.

3. Part II of the Review contains information on the expenditures and R and D objectives of individual Departments and Research Councils supplementing the summary information in Part I.

- 4. I also attach a copy of a letter from Sir Henry Chilver and note by ACARD giving the Council's views on the distribution of expenditures revealed by the Review, as Cmnd 8591 invited them to do. The Council were able to see a first draft in April and established a small sub-group to give the matter detailed attention over the following two months. You will see from the summary of ACARD's main comments in Sir Henry's letter that they have drawn particular attention to the relatively high level of defence R and D expenditures in the United Kingdom, and have suggested that this could be impairing the country's economic performance. They have also questioned the balance between support for agricultural R and D and for manufacturing R and D and, within manufacturing, they have offered preliminary comments on the distribution of expenditures among different industrial sectors. ACARD will develop their views on this last aspect through a standing sub-committee that the Council have established to consider issues arising from the Review. It is clear from Sir Henry's letter that ACARD regard the Review as a very valuable piece of work.
5. As you know, the review of agricultural support policies whose report was recently submitted to Ministers included an examination of R and D support. The international comparisons of R and D expenditures provided in Section 3 of the Review also were an input to the official group. ACARD's views can be taken into account in further consideration of this subject.
6. ACARD's views on defence R and D, however, raise questions that are not under current interdepartmental discussion. Dr Nicholson considers them highly relevant to a number of current issues, notably the future demand for "high technology skills, and he will be minuting you separately. I too consider that ACARD's arguments should be thoroughly examined, but further thought needs to be given to the boundaries of any study for it to be manageable, and I would also suggest that it might be preferable to delay its start until after the current PES discussions. ACARD's general points may then be taken into account in these discussions in a way which might be difficult if the study were already in existence.

7. If you agree, I will consult with interested Departments (principally the Ministry of Defence, the Treasury and the Department of Trade and Industry) over the exact terms of reference for an interdepartmental examination of the issues raised by ACARD and report further to you. The main focus would be on the economic impact of current defence R and D expenditures, but the study would inevitably involve some aspects of procurement policies. It should be carried out under Cabinet Office chairmanship.
8. The various other comments made by ACARD can, I suggest, be considered by the sub-committee of Chief Scientists and, either individually or collectively, Departments can enter into a dialogue on them with the Council.
9. A declassified version of the 1983 Review was published and received a warm welcome from the House of Lords, from academics and from others interested in science and technology policy. I suggest that it would be appropriate for this Review also to be published, with suitable deletion of classified information relating to future defence expenditures. Dr Nicholson has agreed with the Ministry of Defence what might be said about these. If you agree, I will make arrangements for publication in the autumn. Sir Henry Chilver's letter makes it plain that ACARD have no intention of requesting permission to publish their advice, but Sir Henry and the Chairman of ABRC could, of course, choose to reflect some Council's views in their next joint report.
10. The contents of the Review and ACARD's comments should now be brought to the attention of the Cabinet as an input to current --- PES discussions. I attach a draft Private Secretary's letter.



ROBERT ARMSTRONG

23 July 1984

DRAFT LETTER FROM PRIME MINISTER'S PRIVATE SECRETARY
TO THE PRIVATE SECRETARY TO THE CHIEF SECRETARY

Annual Review of Government Funded
Research and Development

The Prime Minister has received the report from the second of the Annual Reviews of R and D announced in Cmnd 8591 (Government observations on the report "Science and Government" from the House of Lords Select Committee on Science and Technology) together with the views of the Advisory Council for Applied Research and Development (ACARD) on the expenditures covered in the Review.

2. ^{The PM} ~~h~~ She has asked that the Review and ACARD's views (copies attached) should be drawn to the attention of members of the Cabinet, and ^{she} has agreed to publication of the Review with the deletion of classified information relating to defence expenditures.

3. The Prime Minister has noted that ACARD's major comments relate ⁱ first to expenditures on defence R and D, secondly to the balance between the Government's support for R and D for agriculture, fisheries and food and for manufacturing and thirdly, within manufacturing, to the distribution of support among different industrial sectors. She further notes that ACARD will themselves be considering the last aspect in more detail over coming months.



4. The Prime Minister has asked Sir Robert Armstrong to advise her on how the issues raised by ACARD in respect of defence R and D expenditures might best be examined interdepartmentally and to invite the Sub-Committee of Chief Scientists to consider the other comments made by ACARD.

5. I am sending a copy of this letter and the attachments to the Private Secretaries of members of the Cabinet and (without attachments) to Richard Hatfield.

CONFIDENTIAL



St. K. W. P.

ADVISORY COUNCIL FOR APPLIED RESEARCH AND DEVELOPMENT

70 Whitehall, London SW1A 2AS Telephone: 01-233

CABINET OFFICE	
A	5176
12 JUL 1984	
FILING INSTRUCTION	
FILE No.	

CONFIDENTIAL

Sir Robert Armstrong
The Cabinet Office
70 Whitehall
London SW1A 2AS

11 July 1984

c- Dr Nicholson -
Advice & draft
for Prime Minister
please

Card
12/7

Dear Sir Robert

Annual Review of Government Funded Research and Development

You will recall there was opportunity last year for ACARD to make only brief comments on the first of the Annual Review of R & D expenditures announced in Cmnd 8591. The Council considered then that the Review process had made a highly promising start and looked forward to contributing to the 1984 Review.

That promise has been maintained. The Science and Technology Secretariat have assembled a comprehensive set of expenditure figures and some illuminating analyses which I very much hope will be published, following the example of last year's Review. In recognition of the Annual Review as a valuable tool for examining issues in R & D policy, the Council at its last meeting decided to establish a standing sub-committee to consider further aspects of the 1984 Review and to advise upon the 1985 exercise.

This year, the Council were able to appoint a sub-group to consider the data in detail. I attach a note prepared by the sub-group and endorsed by the full Council giving ACARD's observations on the distribution of expenditures shown by the Review. Our main conclusions are summarised in paragraph 30. Briefly, there are:

1. By international standards, the UK spends a comparatively high proportion of its GNP on defence R & D. There would appear to be significant opportunity costs associated with R & D, notably because of its demands on skilled manpower. The justification for conducting so much defence R & D in the UK should be closely examined.

2. The balance between the support provided for R & D in the agriculture, fisheries and food industries, and for R & D in other industries, should be examined.
3. The distribution of expenditures in support of manufacturing industry requires further examination, which the Council intend to set in hand through the new sub-committee.

The Council have also suggested some new lines of approach to improve next year's Annual Review and look forward to entering into dialogue with the Cabinet Office and Departments over both the 1985 Review and their comments on the 1984 Review.

Finally, I should make it clear that ACARD regard their comments on the Annual Review as confidential advice to Government and do not intend to seek permission for their publication.

I should be grateful if you would convey this letter and the attached note to the Prime Minister.

Yours sincerely
Henry Chilver

Sir Henry Chilver
Chairman

CONFIDENTIAL

ANNUAL REVIEW OF GOVERNMENT FUNDED

RESEARCH AND DEVELOPMENT

1984

Cabinet Office

July 1984

CONFIDENTIAL

LIST OF ABBREVIATIONS

AFRC	Agricultural and Food Research Council
DAFS	Department of Agriculture and Fisheries for Scotland
DANI	Department of Agriculture for Northern Ireland
DEmp	Department of Employment
DEn	Department of Energy
DES	Department of Education and Science
DHSS	Department of Health and Social Security
DOE	Department of the Environment
DTI	Department of Trade and Industry
DTp	Department of Transport
ESRC	Economic and Social Research Council
FCO	Foreign and Commonwealth Office
HSC	Health and Safety Commission
IDS	Industry Department for Scotland
MAFF	Ministry of Agriculture, Fisheries and Food
Met. Off.	Meteorological Office
MOD	Ministry of Defence
MRC	Medical Research Council
NERC	Natural Environment Research Council
NI	Northern Ireland
ODA	Overseas Development Administration
OPCS	Office of Population Censuses and Surveys
OS	Ordnance Survey
SDD	Scottish Development Department
SED	Scottish Education Department
SERC	Science and Engineering Research Council
SHHD	Scottish Home and Health Department
UGC	University Grants Committee
UKAEA	United Kingdom Atomic Energy Authority

ANNUAL REVIEW OF GOVERNMENT FUNDED RESEARCH AND DEVELOPMENT 1984

PART I

1. INTRODUCTION

- 1.1 The 1984 Annual Review of Government funded R & D is the second in the series established by Cmnd 8591, the Government's response to the report "Science in Government" by the House of Lords Select Committee on Science and Technology (see Annex A). It thus builds upon the experience gained in assembling the information in the 1983 Review (1), which was published in January 1984 as a contribution to the public discussion of science and technology policy.
- 1.2 The 1983 Review concentrated on assembling a consistent database of Government R & D expenditures for the period 1977/8 to 1982/3, and on establishing procedures for the collection of such information regularly in the future. The balance of these expenditures was analysed, and compared with the balance in 1973/4. It was possible to see from the 1983 Review the overall effect of individual Departments' decisions on R & D expenditures over that period, thus fulfilling one of the Government's objectives in establishing the Annual Review process. Because of the decentralised nature of decisions on Government R & D funding in the United Kingdom, the relevant figures had not previously been brought together in one place on a consistent basis. It should be noted, however, that there is in the UK no "Government R & D Budget" as such; decisions on R & D expenditures are made independently by Departments in the light of their other programmes and priorities. Shifts in the balance do not imply that one area has necessarily gained at the expense of another, but all programmes compete for funding from a set total of public expenditure and for the national resources (skilled staff etc) involved in R & D.
- 1.3 The 1983 Review did not set Government R & D expenditures in any national or international framework in the manner, for example, of the publication "Science Indicators" (2) produced by the National Science Foundation in the USA. This present Review aims to provide such a framework. Decisions on levels of R & D funding must, though, remain a matter for informed

judgement based on knowledge of the prospective subject of study, and taking into account other expenditure priorities. They cannot be determined solely from formal analyses, particularly when the expected output is intangible, eg knowledge to provide an informed basis for policy decisions. However, when the purpose of the R & D is to advance technological development, there is in principle a linkage between R & D expenditures and final products - manufactures, foodstuffs, energy supplies, etc - and analyses that explore these relationships can inform funding decisions. Some data relevant to such analyses are included in Section 4 of this Review.

1.4 R & D expenditures by nationalised industries and other public bodies are not formally included in the Review. Some are substantial and Government, directly or indirectly, has some responsibility for them. Some bodies receive Ministerial approval of corporate plans ; others require Government to approve charges which finance their R & D programmes and other activities; others receive deficit funding from Government and a few have a specific statutory obligation to bring their R & D programmes to Ministers for approval. The size of some of the major nationalised industry R & D programmes is indicated in Section 5 of the Review; it is intended that more detailed information should be included in future Reviews.

1.5 The 1984 Review therefore contains:

in Part I,

- i. a summary of past and projected Departmental and Research Council expenditures (1981/2 to 1986/7)
- ii. an analysis of these expenditures by primary objectives
- iii. some broad international comparisons of government funding of R & D
- iv. data relevant to an examination of the relationship between expenditures related to technological development and aspects of the UK economy;

and in Part II,

- iv. a comprehensive and consistent database of Government R & D expenditures for the years 1981/2 to 1986/7 and statements by Departments and Research Councils of their objectives in funding R & D.

1.6 The following general comments may be made about the expenditure statistics in the Review:

- i. as in 1983, the "Frascati" definition of R & D activities has been employed in order to provide a consistent interpretation of R & D across Departments and to facilitate international comparisons. This covers research in both the social and natural sciences. Further details of this definition may be found in Annex B;
- ii. a principal aim of the Review is to provide information on the volume and distribution of R & D supported by Government that enables valid comparisons to be made with R & D programmes in the private sector and in public corporations. The expenditure figures therefore include costs arising from R & D but falling on other public expenditure votes. For example, they include estimates of the superannuation liability incurred by employing Departments in respect of their staff, and accommodation costs when these are not explicitly included in R & D votes.
- iii. consequently, other tables of Government R & D expenditures, provided for other purposes, may differ from those in the Review. For example, public expenditure estimates use figures aligned to public accounting needs, which do not necessarily include all relevant costs under the "R & D" heading. Statements in Departments' annual R & D reports may include expenditures related to R & D but falling outside the Frascati definition (eg connected with technology transfer) and may not be on the basis of full economic costs. It is hoped that such discrepancies will be progressively reduced;
- iv. the data presented in this Review cover the financial years

1981/2 to 1986/7, reflecting the Government's intention that the Annual Review should consider and influence future expenditure plans. 1981/2 and 1982/3 data are outturn figures, those for 1983/4 are estimated outturn figures based on expenditures up to early 1984 and those for 1984/5, 1985/6 and 1986/87 are based on expenditures consistent with the figures in "The Government's Expenditure Plans 1984-85 to 1986-87" (Cmnd 9143) with the adjustments indicated in (ii) above. Information on expenditures in previous years may be found in the 1983 Annual Review, although because of the emphasis in this year's Review on including all relevant costs, figures for the years prior to 1981/2 may not be completely consistent with those presented here.

- 1.7 Some caution is required in interpreting data on government expenditures through the general funds of universities. These expenditures are referred to under the heading "UGC etc" in the tables, since by far the greater part of this non-specific funding is received by universities in the form of grants from the University Grants Committee (UGC). However, central Government also contributes through fees for home students, and through Department of Education of Northern Ireland grants to the universities in Northern Ireland. The sum involved is large (£555 million in 1983/84 if research into the humanities is excluded) but it is derived from an estimate of the distribution of universities' resources among different functions which may have changed substantially since it was last assessed. The data may therefore be subject to some considerable error, either up or down. The Department of Education and Science and the UGC have set in hand a study which it is hoped will eventually provide better information on the volume and distribution of university research, but as the same resources support both teaching and research functions, it is inevitable, even following this study, that some uncertainty will remain in estimates of research expenditure in universities. The split of this expenditure by primary purpose is also impossible to determine explicitly; this document uses a split based on the breakdown of research effort between different disciplines. (See also Table 4a in Part II and the footnotes to that table.)

- 1.8 A broad-brush exercise such as that set out here cannot fulfill all the objectives set out in Cmnd 8591 for the Review. It can indicate areas

CONFIDENTIAL

where expenditures appear out of line, either with international figures or by comparison with their expected economic significance; these may require further study leading perhaps to changes in policy. It cannot, however, show in detail the possible overlap in individual research programmes funded by different Departments, or the gaps in knowledge that need to be filled. These must be investigated by studies of specific areas. Annex C summarises information gained from the first of these specific studies, on marine science and technology.

1.9 Finally, this Review deals mainly with inputs to the R & D process. The publication "Science Indicators" referred to above attempts to measure trends in outputs through analyses of scientific publications, patents and trade in high technology goods. The conclusions to be drawn from such analyses are not clear-cut, but they potentially provide a useful complement to the presentation of inputs, and may be included in future Reviews.

(1) "Annual Review of Government Funded R & D 1983", HMSO, 1984,
ISBN 011 630825 7

(2) "Science Indicators 1982", National Science Board, National Science
Foundation, Washington DC, USA, 1983

2. GOVERNMENT R AND D EXPENDITURES

- 2.1 Table 2.1 shows actual and planned R & D expenditures for the years 1981/2 to 1986/7, expressed in cash terms on the bases set out in paragraph 1.6. Tables 2.2 and 2.3 are derived from Table 2.1. The former shows individual Departmental and Research Council totals as a proportion of the overall total; the latter shows the expenditures in cost terms, ie constant (1983/4) prices, the relevant deflators being those used in "The Government's Expenditure Plans 1984-85 to 1986-87" (Cmnd 9143) and the Financial Statement and Budget Report 1984-85. Table 2.4 shows the expenditures in index form (1983/4 = 100) using the same deflators. Figures 2.1 to 2.3 illustrate some of the main features of the tables.
- 2.2 The tables show that the broad distribution of Government R & D expenditures will change little in the next few years. Defence R & D, some 80% of which is associated with the development of specific military equipments, accounts for half the total and will rise slightly in relation to civil expenditures. University and Research Council expenditures account for a further 25-26% (falling slightly) and other Departments the remainder. The increase in the proportion accounted for by defence needs continues the trend since 1973/4 noted in the 1983 Review. Total expenditures will rise a little in real terms from 1983/4 levels but changes in individual Departments and Research Councils will be more marked, the greatest relative changes between 1981/2 and 1986/7 (apart from "other Departments" which is a statistical anomaly arising from the change in vote procedures for the Property Services Agency) being the rises in HSC, DTI and MOD (Research) programmes and the decline by 1986/7 in ESRC, DHSS, and UKAEA programmes (but see paragraph 2.9). In cost terms, the largest changes will take place in the MOD (Research) and DTI programmes.
- 2.3 Table 2.5 and Figure 2.4 provide information on the overall distribution of expenditures among different classes of recipient. Each Department's distribution may be found in Part II. Because of the difficulty of estimating the distribution of future expenditures, Departments were not asked to provide these in the same level of detail as past expenditures, although Research Councils have, for their own planning purposes, made estimates of their expected receipts from Departments and elsewhere

(Table 2.6). Table 2.7 expresses the main elements of the distribution of Departmental expenditures, ie excluding the UGC and Research Councils, as a proportion of total Departmental expenditures.

R & D Objectives

- 2.4 The Government fund R & D for a number of reasons. Part II of the Review contains detailed statements of the objectives of funding Departments; these may be classified under six broad headings:

Advancement of science

Work funded primarily in order to increase human knowledge, ie to advance scientific understanding of natural phenomena. This research contributes to the scientific base of the nation and, although originally funded with no specific application in view, much results in long-term benefit through the eventual application of the knowledge gained.

Support for policy formation and implementation

Applied research carried out in order to meet Departments' own needs for knowledge, for example:

to identify and assess policy options (eg on choice of renewable energy resources, to identify measures to deal with difficult-to-let housing estates, etc);

to facilitate forward planning (eg on the efficient use of the radio spectrum);

to make their operations more efficient.

Improvement of technology

Applied R & D, funded by Government but often carried out within the private sector, to advance the technology of different sectors of the UK economy - manufacturing, agriculture, construction etc.

Support for purchasing decisions

Applied R & D which contributes to the specification and development of goods and services required by Government (mainly related to defence needs).

Support for statutory duties

Work which assists Departments to carry out statutory responsibilities or other obligations (eg in connection with the Health and Safety at Work Act or Building Regulations).

Support for other activities

R & D which cannot be classified under the previous headings (eg research to support overseas development). Superannuation contributions which appear in Departments' tables and which cannot be otherwise allocated are included in this category.

In the Frascati framework (Annex B), which is also related to objectives, advancement of science would equate to "basic" research while work under the other objectives would be classified as applied research and experimental development.

- 2.5 Table 2.8 shows the Government's total expenditures analysed into these categories in current cost terms, while Tables 2.9 and 2.10 present the same information as a proportion of total expenditures and in index form at constant prices and Figure 2.5 shows the distribution in 1983/4. Many research programmes contribute to more than one objective; in such cases the expenditure has been ascribed to the primary purpose served by the programme. The changes between 1981/2 and 1986/7 are illustrated in Figures 2.6 and 2.7. The main trends in the balance of expenditures are a shift towards the "technological development" and "purchasing" categories (the second of which is dominated by MOD expenditures) and a corresponding shift away from "advancement of science" and policy orientated research. Principal causes of the latter are the declines in UGC funding and in Government support for UKAEA, as the electricity supply industry assumes responsibility for a larger share of the Authority's work on thermal reactors.

Advancement of science

- 2.6 Table 2.11 shows expenditures in this category in current cost terms while Table 2.12 provides the same information in index form at constant prices. As expected, the main contributors to this table are the UGC and the Research Councils, with funding being maintained approximately level in real terms.

Support for policy

- 2.7 Tables 2.13 and 2.14 show expenditures against this objective in the same way as in the previous tables. The MRC's expenditure does not, of course, relate directly to National Health Service policy but, by contributing to knowledge of new medical procedures, it enables new forms of treatment to be offered and therefore widens treatment options and contributes to the effectiveness of health service provision. The UGC expenditures shown also support medical research. The largest component of UKAEA funding in this category concerns the fast reactor programme which aims to inform future reactor options.

Improvement of technology

- 2.8 Tables 2.15 and 2.16 provide details of expenditures on R & D whose primary purpose to advance the technology of different economic sectors. Section 4 sets these expenditures, and those in the next category, in a broad economic context. The main elements of expenditure are directed towards industrial technology (DTI/SERC/UGC) and agricultural technology (MAFF/AFRC). Overall, a substantial rise in real terms is expected in the next few years.

Support for purchasing

- 2.9 Tables 2.17 and 2.18 show R & D expenditures which support purchasing decisions. This category is, of course, dominated by MOD expenditures which will rise slightly in real terms. As indicated above, the electricity supply industry is to take a larger share in the funding of UKAEA work on thermal reactors and so the cost to Government will reduce.

Support for statutory duties

- 2.10 Tables 2.19 and 2.20 show expenditures incurred in order to improve Departments' discharge of their legal or regulatory obligations. The Department of the Environment, because of its responsibilities for monitoring and reducing pollution, has a major share of this category. DTI expenditure shows a substantial proportional rise because of the move of British Telecom to the private sector and the consequent need for the Department to support R & D related to the supervision of telecommunications services.

Other activities

2.11 Expenditures which do not fall into any of the above categories are shown in Tables 2.21 and 2.22.

Table 2.1

GOVERNMENT R & D EXPENDITURES IN CASH TERMS
£millions
Columns may not sum to totals shown owing to rounding

Department	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Civil Departments						
MAFF (1)	106.8	113.9	120.3	126.5	130.5	133.2
DES	8.3	8.8	8.8	11.4	11.7	11.3
DEn	35.6	32.1	27.8	36.9	39.4	40.7
UKAEA	203.2	212.4	199.0	197.0	196.2	195.3
DoE	38.3	35.9	36.5	41.5	43.0	44.2
ODA	16.3	18.6	20.7	21.6	22.8	24.1
DHSS	28.2	28.9	26.5	25.7	24.2	23.8
HSC	6.2	7.5	8.3	8.8	9.9	11.5
Home Office	11.2	12.2	12.6	13.8	15.0	15.3
DTI	284.9	284.0	343.3	449.9	468.2	462.3
Department of Transport	27.5	25.9	31.7	40.4	44.5	42.0
N I Departments	9.7	9.4	11.1	12.9	13.8	14.1
Scottish Departments	40.8	42.8	47.3	50.7	53.3	54.8
Other Departments (2)	39.4	42.9	31.4	32.8	33.4	33.8
TOTAL Civil Departments	856.4	875.4	925.2	1069.7	1105.9	1106.4
Research Councils						
AFRC	41.4	43.1	45.5	45.9	45.6	46.9
ESRC	15.3	16.4	17.3	16.8	16.5	16.6
MRC	100.6	106.4	112.8	116.2	118.5	120.9
NERC	52.1	55.2	60.0	63.3	65.4	67.4
SERC	212.1	230.0	246.4	269.2	280.2	287.2
TOTAL Research Councils (3)	421.4	451.1	482.0	511.4	526.2	539.0
UGC etc	484.0	535.0	555.0	570.0	588.0	600.0
TOTAL Civil	1761.8	1861.5	1962.2	2151.1	2220.1	2245.4
Ministry of Defence						
MOD (Research)	263.3	304.8	329.2	392.3	405.7	419.8
MOD (Development)	1424.2	1395.8	1575.6	1654.8	1766.0	1854.0
MOD (Staff & Superannuation)	57.1	64.2	67.9	70.1	72.8	74.6
TOTAL Defence	1744.6	1764.8	1972.7	2117.2	2244.6	2348.4
NET TOTAL (4)	3506.4	3626.4	3934.9	4268.3	4464.6	4593.7

Notes

- (1) see list of abbreviations preceeding Page 1
- (2) see Table 21a (Part II)
- (3) excluding commissions from Departments, which are included in Departments' expenditure totals and which form the main component of the commissioned research earnings shown in Table 2.6
- (4) net contribution to public expenditure, ie excluding receipts from the private sector, overseas etc

Table 2.2

DEPARTMENTAL SHARES OF TOTAL GOVERNMENT FUNDED R & D
 figures may not total to 100% owing to rounding

Department	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Civil Departments						
MAFF	3.0	3.1	3.1	3.0	2.9	2.9
DES	0.2	0.2	0.2	0.3	0.3	0.2
DEn	1.0	0.9	0.7	0.9	0.9	0.9
UKAEA	5.8	5.9	5.1	4.6	4.4	4.3
DoE	1.1	1.0	0.9	1.0	1.0	1.0
ODA	0.5	0.5	0.5	0.5	0.5	0.5
DHSS	0.8	0.8	0.7	0.6	0.5	0.5
HSC	0.2	0.2	0.2	0.2	0.2	0.3
Home Office	0.3	0.3	0.3	0.3	0.3	0.3
DTI	8.1	7.8	8.7	10.5	10.5	10.1
Department of Transport	0.8	0.7	0.8	0.9	1.0	0.9
N I Departments	0.3	0.3	0.3	0.3	0.3	0.3
Scottish Departments	1.2	1.2	1.2	1.2	1.2	1.2
Other Departments	1.1	1.2	0.8	0.8	0.7	0.7
TOTAL Civil Departments	24.4	24.1	23.5	25.1	24.8	24.1
Research Councils						
AFRC	1.2	1.2	1.2	1.1	1.0	1.0
ESRC	0.4	0.5	0.4	0.4	0.4	0.4
MRC	2.9	2.9	2.9	2.7	2.7	2.6
NERC	1.5	1.5	1.5	1.5	1.5	1.5
SERC	6.0	6.3	6.3	6.3	6.3	6.3
TOTAL Research Councils	12.0	12.4	12.3	12.0	11.8	11.7
UGC etc	13.8	14.8	14.1	13.4	13.2	13.1
TOTAL Civil	50.2	51.3	49.9	50.4	49.7	48.9
Ministry of Defence						
MOD (Research)	7.5	8.4	8.4	9.2	9.1	9.1
MOD (Development)	40.6	38.5	40.0	38.8	39.6	40.4
MOD (Staff & Superannuation)	1.6	1.8	1.7	1.6	1.6	1.6
TOTAL Defence	49.8	48.7	50.1	49.6	50.3	51.1
NET TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Table 2.3

GOVERNMENT R & D EXPENDITURES IN COST TERMS (1)
 £millions, base year 1983/84

Department	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Civil Departments						
MAFF	120.1	120.1	120.3	120.8	119.5	117.3
DES	9.3	9.3	8.8	10.9	10.8	10.0
DEn	40.0	33.9	27.8	35.2	36.1	35.9
UKAEA	228.5	224.0	199.0	187.7	179.6	171.9
DoE	43.1	37.9	36.5	39.7	39.4	38.9
ODA	18.3	19.6	20.7	20.6	20.8	21.2
DHSS	31.7	30.5	26.5	24.5	22.2	21.0
HSC	7.0	7.9	8.3	8.4	9.1	10.1
Home Office	12.6	12.9	12.6	13.2	13.7	13.4
DTI	320.5	299.5	343.3	429.5	428.8	406.9
Department of Transport	31.0	27.3	31.7	38.5	40.8	37.0
N I Departments	10.9	9.9	11.1	12.3	12.6	12.4
Scottish Departments	45.9	45.1	47.3	48.4	48.8	48.2
Other Departments	44.3	45.3	31.4	31.4	30.6	29.8
TOTAL Civil Departments	963.3	923.4	925.2	1021.2	1012.7	973.9
Research Councils						
AFRC	46.6	45.5	45.5	43.9	41.8	41.3
ESRC	17.2	17.2	17.3	16.0	15.1	14.6
MRC	113.1	112.3	112.8	110.9	108.6	106.4
NERC	58.6	58.3	60.0	60.4	59.9	59.3
SERC	238.5	242.6	246.4	256.7	256.6	252.8
TOTAL Research Councils	474.0	475.9	482.0	488.2	482.0	474.4
UGC etc	544.4	564.3	555.0	544.2	538.5	528.2
TOTAL Civil	1981.7	1963.6	1962.2	2053.5	2033.0	1976.5
Ministry of Defence						
MOD (Research)	296.1	321.5	329.2	374.5	371.5	369.5
MOD (Development)	1602.1	1472.4	1575.6	1579.8	1617.3	1632.1
MOD (Staff & Superannuation)	64.2	67.7	67.9	66.9	66.7	65.6
TOTAL Defence	1962.4	1861.6	1972.7	2021.2	2055.5	2067.7
NET TOTAL	3944.2	3825.3	3934.9	4074.7	4088.5	4043.8

(1) Cash figures as in Table 2.1 adjusted for general inflation as measured by the GDP deflator at market prices. The figures used are consistent with those in Table 1.14 of Cmnd 9143 and Table 5.5 of the Financial Statement and Budget Report, 1984-85

Table 2.4

GOVERNMENT R & D EXPENDITURES IN COST TERMS
INDEX, 1983/84 = 100

Department	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Civil Departments						
MAFF	100	100	100	100	99	98
DES	106	106	100	124	123	114
DEn	144	122	100	127	130	129
UKAEA	115	113	100	94	90	86
DoE	118	104	100	109	108	107
ODA	88	95	100	99	100	102
DHSS	120	115	100	92	84	79
HSC	84	95	100	100	109	122
Home Office	100	102	100	105	109	107
DTI	93	87	100	125	125	119
Department of Transport	98	86	100	122	129	117
N I Departments	99	90	100	111	114	112
Scottish Departments	97	95	100	102	103	102
Other Departments	141	144	100	100	98	95
TOTAL Civil Departments	104	100	100	110	109	101
Research Councils						
AFRC	102	100	100	96	92	91
ESRC	99	100	100	93	87	84
MRC	100	100	100	98	96	94
NERC	98	97	100	101	100	99
SERC	97	98	100	104	104	103
TOTAL Research Councils	98	99	100	101	100	98
UGC etc	98	102	100	98	97	95
TOTAL Civil	101	100	100	105	104	101
Ministry of Defence						
MOD (Research)	90	98	100	114	113	112
MOD (Development)	102	93	100	100	103	104
MOD (Staff & Superannuation)	95	100	100	99	98	97
TOTAL Defence	99	94	100	103	104	105
NET TOTAL	100	97	100	104	104	103

Table 2.5

OVERALL DISTRIBUTION OF FUNDING

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural(1)	1350.0	1476.4	1469.3	1574.5	1624.5	1698.1
Research Councils(2)	60.1	62.3	63.9	67.4	69.0	70.7
Other Government	46.0	74.5	63.1	86.0	90.3	90.7
Departments(3)						
Universities	639.6	697.8)			
Private industry	1395.3	1239.9)			
Public Corporations	54.2	48.3)			
Research Associations	14.4	23.1)			
Overseas	186.0	212.4)			
Non-industrial research	89.4	94.2	)	2767.3	2985.2	3139.6
institutes(4)			)			3212.7
Professional and learned	4.4	4.6)			
societies)			
Persons	40.2	42.7)			
Others	27.3	31.9)			
less Receipts(5)	400.0	383.4	429.1	447.3	460.8	479.0
TOTAL	3507.0	3624.8	3934.5	4265.8	4462.1	4593.3

(1) Expenditures within Departments' and Research Councils' own establishments and headquarters units carried on their own budgets.

(2) Departmental commissions with Research Councils.

(3) Departmental commissions with other Departments' establishments (which are offset against those Departments' votes and are included in the receipts line).

(4) Independent research institutes receiving funds mainly from AFRC, Department of Agriculture and Fisheries for Scotland, NERC and MRC

(5) From other Government Departments, private industry, international subscriptions etc.

Table 2.6

COMMISSIONED RESEARCH WITH RESEARCH COUNCILS

		£ millions					
		81/82	82/83	83/84	84/85	85/86	86/87
AFRC	Central Government	44.6	49.1)	55.3	56.7	56.4	57.9
	Others	3.6	4.3)				
ESRC	Central Government	0.2	0.1)	0.3	0.4	0.3	0.3
	Others	0.1	0.1)				
MRC	Central Government	2.4	2.6)	6.8	6.7	6.3	6.5
	Others	2.7	2.9)				
NERC	Central Government	26.4	23.6)	26.3	24.6	25.4	26.2
	Others	5.1	5.7)				
SERC	Central Government	2.2	2.9)	9.7	9.3	9.2	9.9
	Others	5.7	6.4)				
TOTAL		93.0	97.8	98.4	97.7	97.6	100.8

Table 2.7

DISTRIBUTION OF DEPARTMENTAL R & D EXPENDITURES - PERCENTAGES(1)

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	32.1	37.6	31.8	31.9	31.3	31.9
Research Councils	2.3	2.3	2.2	2.1	2.1	2.0
Universities	1.7	1.6)				
Private Industry	53.6	46.9)				
Public Corporations	2.1	1.8)				
Research Associations	0.6	0.9)	66.0	66.0	66.6	66.1
Overseas	5.5	6.3)				
Non-industrial research institutes	1.1	1.2)				
Professional and learned societies	0.2	0.2)				
Persons	..	..)		
Others	0.9	1.1)				
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

(1) Excluding Research Councils and UGC etc

Table 2.8

PRIMARY PURPOSES FOR GOVERNMENT FUNDED R & D, IN CASH TERMS
Emillions .

PRIMARY PURPOSE	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Advancement of science	590.2	640.6	666.3	697.1	718.3	734.6
Support for policy	466.9	493.6	483.2	501.7	519.4	526.6
Improvement of technology	549.2	568.9	649.8	780.5	810.1	807.4
Support for purchasing decisions	1783.1	1802.0	2004.6	2151.3	2274.2	2378.3
Support for statutory duties	60.3	62.6	65.5	70.0	70.7	73.2
Support for other activities	56.6	58.7	65.5	67.7	72.0	73.5
TOTAL	3506.4	3626.4	3934.9	4268.3	4464.7	4593.7

Table 2.9

PRIMARY PURPOSES FOR GOVERNMENT-FUNDED R & D - PERCENTAGES
columns may not total to 100% owing to rounding

PRIMARY PURPOSE	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Advancement of science	16.8	17.7	16.9	16.3	16.1	16.0
Support for policy	13.3	13.6	12.3	11.8	11.6	11.5
Improvement of technology	15.7	15.7	16.5	18.3	18.1	17.6
Support for procurement decisions	50.9	49.7	50.9	50.4	50.9	51.8
Support for statutory duties	1.7	1.7	1.7	1.6	1.6	1.6
Support for other activities	1.6	1.6	1.7	1.6	1.6	1.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Table 2.10

PRIMARY PURPOSES FOR GOVERNMENT FUNDED R & D IN COST TERMS
INDEX, 1983/84 = 100

PRIMARY PURPOSE	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Advancement of science	100	101	100	100	98	97
Support for policy	109	108	100	99	98	96
Improvement of technology	95	92	100	115	114	109
Support for procurement decisions	100	95	100	102	104	104
Support for statutory duties	104	101	100	102	99	98
Support for other activities	97	95	100	99	101	99
TOTAL	100	97	100	104	104	103

Table 2.11

EXPENDITURES FOR ADVANCEMENT OF SCIENCE
£millions

DEPARTMENT	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
MAFF	..	..	..	..	..	..
DES	8.3	8.8	8.7	11.4	11.7	11.3
DTI	0.0	0.0	0.2	2.0	2.2	2.3
N I Departments	0.1	0.2	0.2	0.2	0.2	0.2
Scottish Departments	1.7	1.8	2.4	2.5	2.7	2.7
Other Departments	11.8	12.7	13.4	14.2	14.4	14.6
AFRC	22.0	22.9	24.6	25.1	24.8	25.5
ESRC	15.3	16.4	17.3	16.8	16.5	16.6
MRC	22.8	23.9	25.6	26.3	26.7	27.2
NERC	46.8	48.9	51.4	53.7	55.5	57.2
SERC	153.5	168.0	173.4	186.0	193.6	199.9
UGC etc	308.0	337.0	349.0	359.0	370.0	377.0
TOTAL	590.2	640.6	666.3	697.1	718.3	734.6

Table 2.12

EXPENDITURES FOR ADVANCEMENT OF SCIENCE IN COST TERMS
INDEX, 1983/84 = 100

DEPARTMENT	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
MAFF	91	105	100	95	97	99
DES	106	106	100	124	123	114
DTI	0	0	100	955	1007	1012
N I Departments	53	88	100	100	103	108
Scottish Departments	80	81	100	98	102	101
Other Departments	99	100	100	101	98	96
AFRC	100	98	100	97	92	91
ESRC	99	100	100	93	87	84
MRC	100	98	100	98	96	94
NERC	102	100	100	100	99	98
SERC	100	102	100	102	102	101
UGC etc	99	102	100	98	97	95
TOTAL	100	101	100	100	98	97

Table 2.13

EXPENDITURES TO SUPPORT POLICY FORMULATION AND IMPLEMENTATION
£millions

DEPARTMENT	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
MAFF	8.1	8.6	9.2	10.2	10.5	10.1
DEn	21.4	19.4	13.8	20.3	21.9	22.5
UKAEA	170.0	179.8	171.6	169.8	173.5	172.0
DoE	15.5	13.7	13.4	15.4	16.1	16.4
DHSS	15.4	14.0	13.2	12.6	13.6	13.7
HSC	1.2	1.5	1.7	1.8	2.0	2.3
Home Office	9.2	9.9	10.5	11.2	12.1	12.4
DTI	16.5	18.5	22.4	24.0	26.2	28.8
Department of Transport	9.0	6.3	7.4	8.6	8.6	8.8
N I Departments	0.7	0.8	0.9	0.9	1.0	1.0
Scottish Departments	7.6	8.2	8.8	9.2	10.1	10.3
Other Departments	17.0	19.9	6.5	7.1	7.3	7.5
MRC	77.8	82.6	87.2	89.9	91.8	93.6
NERC	5.2	6.2	8.4	9.4	9.7	10.0
SERC	0.3	0.3	0.3	0.3	0.2	0.2
UGC etc	92.0	104.0	108.0	111.0	115.0	117.0
TOTAL	466.9	493.6	483.2	501.7	519.4	526.6

Table 2.14

EXPENDITURE TO SUPPORT POLICY FORMULATION AND IMPLEMENTATION IN COST TERMS
INDEX, 1983/84 = 100

DEPARTMENT	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
MAFF	99	99	100	106	105	97
DEn	175	148	100	140	145	143
UKAEA	111	111	100	94	93	88
DoE	131	108	100	110	110	108
DHSS	131	112	100	91	94	91
HSC	84	95	100	100	109	121
Home Office	99	100	100	102	106	104
DTI	83	87	100	102	107	113
Department of Transport	137	90	100	111	106	105
N I Departments	87	98	100	102	101	99
Scottish Departments	97	99	100	99	104	102
Other Departments	292	321	100	103	102	101
MRC	100	100	100	98	96	94
NERC	69	77	100	106	105	104
SERC	142	99	100	94	80	80
UGC etc	96	102	100	98	98	95
TOTAL	109	108	100	99	98	96

Table 2.15

EXPENDITURES TO IMPROVE TECHNOLOGY
£millions

DEPARTMENT	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
MAFF	85.3	91.0	96.0	100.1	103.2	106.3
DEn	5.8	6.4	7.4	10.6	10.5	10.7
UKAEA	3.9	4.4	4.1	4.3	4.2	4.5
DoE	2.5	3.3	3.0	4.0	3.7	3.8
DHSS	2.2	2.4	2.8	3.2	3.1	3.0
DTI	261.0	257.1	315.5	417.7	432.8	424.0
Department of Transport	5.0	6.1	6.6	10.1	14.4	10.8
N I Departments	8.9	8.4	10.0	11.7	12.5	12.8
Scottish Departments	28.2	29.4	31.6	34.0	35.2	36.2
Other Departments	3.6	3.9	4.0	4.2	4.2	4.2
AFRC	15.5	16.0	16.7	16.5	16.6	17.2
SERC	43.3	46.4	54.1	64.1	66.7	67.9
UGC etc	84.0	94.0	98.0	100.0	103.0	106.0
TOTAL	549.2	568.9	649.8	780.5	810.1	807.4

Table 2.16

EXPENDITURES TO IMPROVE TECHNOLOGY IN COST TERMS
INDEX, 1983/84 = 100

DEPARTMENT	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
MAFF	100	100	100	100	98	97
DEn	89	92	100	137	130	128
UKAEA	105	113	100	99	93	96
DoE	93	116	100	127	114	113
DHSS	87	93	100	108	101	96
DTI	93	86	100	126	126	118
Department of Transport	86	97	100	145	199	143
N I Departments	101	89	100	113	115	113
Scottish Departments	100	98	100	102	102	101
Other Departments	100	101	100	101	96	93
AFRC	104	101	100	95	91	91
SERC	90	91	100	113	113	111
UGC etc	96	101	100	97	96	95
TOTAL	95	92	100	115	114	109

Table 2.17

EXPENDITURES SUPPORTING PURCHASING DECISIONS
£millions

DEPARTMENT	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
MAFF	0.1	0.1	0.1	0.1	0.1	0.1
UKAEA	27.4	26.3	22.0	20.2	15.6	15.7
DoE	3.0	2.2	2.4	2.7	2.7	2.6
DHSS	0.1	0.1	0.1	0.1	..	..
Home Office	1.5	1.8	1.5	1.9	2.1	2.2
DTI	..	..	..	..	..	..
Department of Transport	6.5	6.7	5.8	9.1	9.0	9.3
MOD (Research)	263.3	304.8	329.2	392.3	405.7	419.8
MOD (Development)	1424.2	1395.9	1575.6	1654.8	1766.1	1854.0
MOD (Staff & Superannuation)	57.1	64.2	67.9	70.1	72.8	74.6
TOTAL	1783.1	1802.0	2004.6	2151.3	2274.2	2378.3

Table 2.18

EXPENDITURES SUPPORTING PURCHASING DECISIONS IN COST TERMS
INDEX, 1983/84 = 100

DEPARTMENT	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
MAFF	76	86	100	80	80	79
UKAEA	140	126	100	88	65	63
DoE	142	98	100	111	103	98
DHSS	157	214	100	80	54	53
Home Office	112	122	100	119	127	124
DTI	0	0	100	470	450	80
Department of Transport	125	121	100	150	143	142
MOD (Research)	90	98	100	114	113	112
MOD (Development)	102	93	100	100	103	104
MOD (Staff & Superannuation)	95	100	100	99	98	97
TOTAL	100	95	100	102	104	104

Table 2.19

EXPENDITURES SUPPORTING STATUTORY DUTIES
£millions

DEPARTMENT	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
MAFF	10.6	11.3	11.9	13.0	13.4	13.4
DEn	3.2	2.8	2.7	3.5	3.5	4.0
UKAEA	2.0	1.9	1.2	2.4	2.9	3.1
DoE	17.3	16.8	17.7	19.0	19.4	19.8
DHSS	10.4	12.2	10.4	9.8	7.6	7.0
HSC	5.0	6.0	6.7	7.0	7.9	9.2
DTI	2.4	3.1	0.8	1.1	1.9	1.9
Department of Transport	3.9	4.1	8.4	8.8	9.0	9.3
N I Departments	0.1	0.1	0.1	0.1	0.1	0.1
Scottish Departments	0.5	0.4	0.8	0.9	0.9	1.0
Other Departments	2.5	1.9	2.5	2.1	2.1	2.2
NERC	0.2	0.2	0.2	0.2	0.2	0.2
SERC	2.4	2.0	2.1	2.1	1.9	2.0
TOTAL	60.3	62.6	65.5	70.0	70.7	73.2

Table 2.20

EXPENDITURES SUPPORTING STATUTORY DUTIES IN COST TERMS
INDEX, 1983/84 = 100

DEPARTMENT	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
MAFF	100	100	100	104	103	99
DEn	133	106	100	123	118	129
UKAEA	184	163	100	188	215	224
DoE	110	100	100	102	100	98
DHSS	113	124	100	90	67	60
HSC	84	95	100	100	109	122
DTI	358	430	100	140	228	227
Department of Transport	52	51	100	101	98	98
N I Departments	100	102	100	99	100	97
Scottish Departments	64	52	100	101	101	101
Other Departments	112	81	100	95	81	82
NERC	100	100	100	99	98	97
SERC	129	99	100	95	81	82
TOTAL	104	101	100	102	99	98

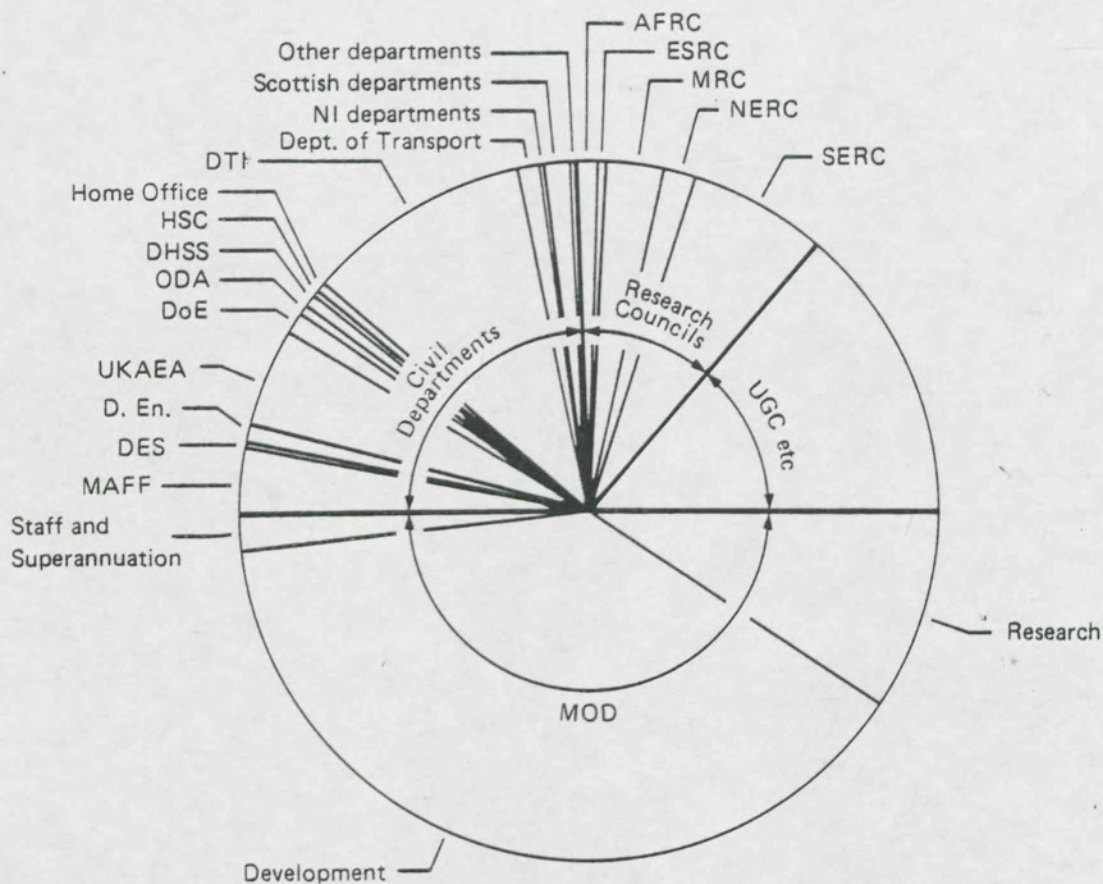
Table 2.21

DEPARTMENT	EXPENDITURES SUPPORTING OTHER ACTIVITIES Emillions					
	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
MAFF	2.8	2.8	3.0	3.1	3.2	3.3
DES	..	..	..	..	..	..
DEn	5.1	3.6	3.9	2.5	3.6	3.6
DoE	..	..	..	0.4	1.1	1.4
ODA	16.3	18.6	20.7	21.6	22.8	24.1
DHSS	0.1	0.1	0.1	0.1	0.0	0.0
Home Office	0.5	0.5	0.6	0.7	0.7	0.7
DTI	4.9	5.3	4.4	5.2	5.1	5.3
Department of Transport	3.1	2.8	3.4	3.7	3.6	3.7
Scottish Departments	2.9	2.9	3.6	4.2	4.4	4.6
Other Departments	4.5	4.6	4.9	5.3	5.4	5.3
AFRC	4.0	4.2	4.2	4.3	4.2	4.2
SERC	12.4	13.3	16.6	16.7	17.8	17.3
TOTAL	56.6	58.7	65.5	67.7	72.0	73.5

Table 2.22

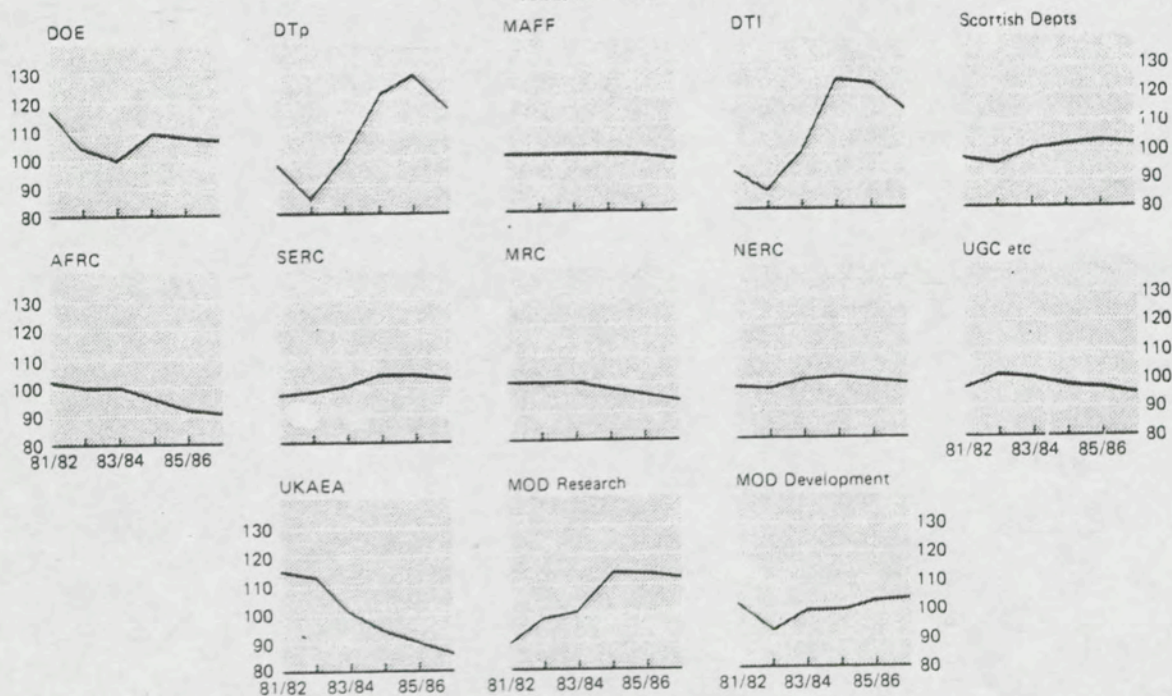
DEPARTMENT	EXPENDITURES SUPPORTING OTHER ACTIVITIES IN COST TERMS INDEX, 1983/84 = 100					
	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
MAFF	104	100	100	99	98	97
DES	76	86	100	100	100	100
DEn	148	97	100	62	84	81
DoE	80	87	100	966	2537	3057
ODA	88	95	100	100	100	102
DHSS	145	106	100	78	16	15
Home Office	92	100	100	109	110	110
DTI	125	125	100	112	106	105
Department of Transport	102	85	100	102	95	94
Scottish Departments	89	85	100	109	110	111
Other Departments	103	97	100	102	100	95
AFRC	108	105	100	99	93	89
SERC	84	85	100	96	99	92
TOTAL	97	95	100	99	101	99

Figure 2.1
GOVERNMENT R & D EXPENDITURE IN CASH TERMS, 1984/85 PLAN



Source: Table 2.2

Figure 2.2
DEPARTMENTAL R & D EXPENDITURES IN COST TERMS
1983/84 = 100



Source: Table 2.4

Figure 2.3

CHANGES IN CIVIL DEPARTMENTAL R & D EXPENDITURES IN COST TERMS
1981/82 - 1986/87

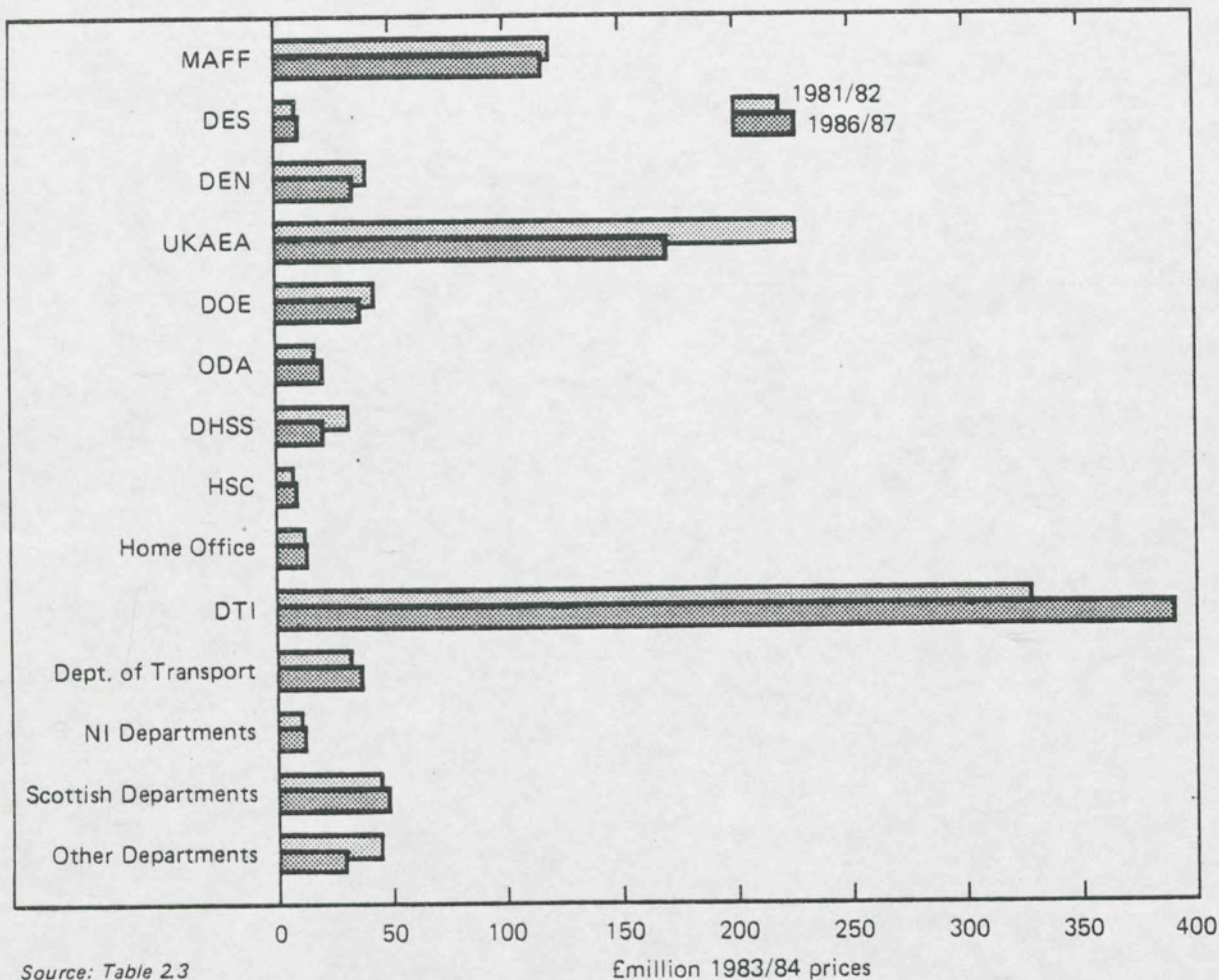


Figure 2.4

OVERALL DISTRIBUTION OF FUNDING, 1982/83

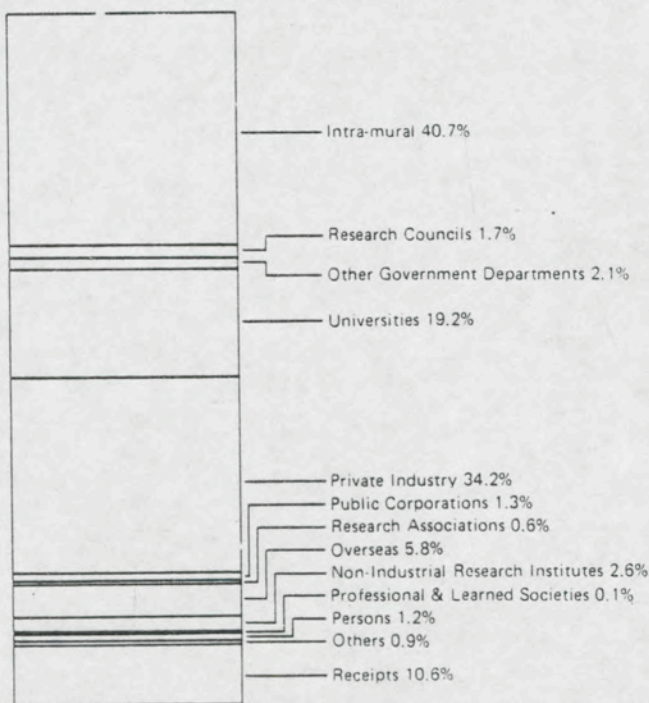
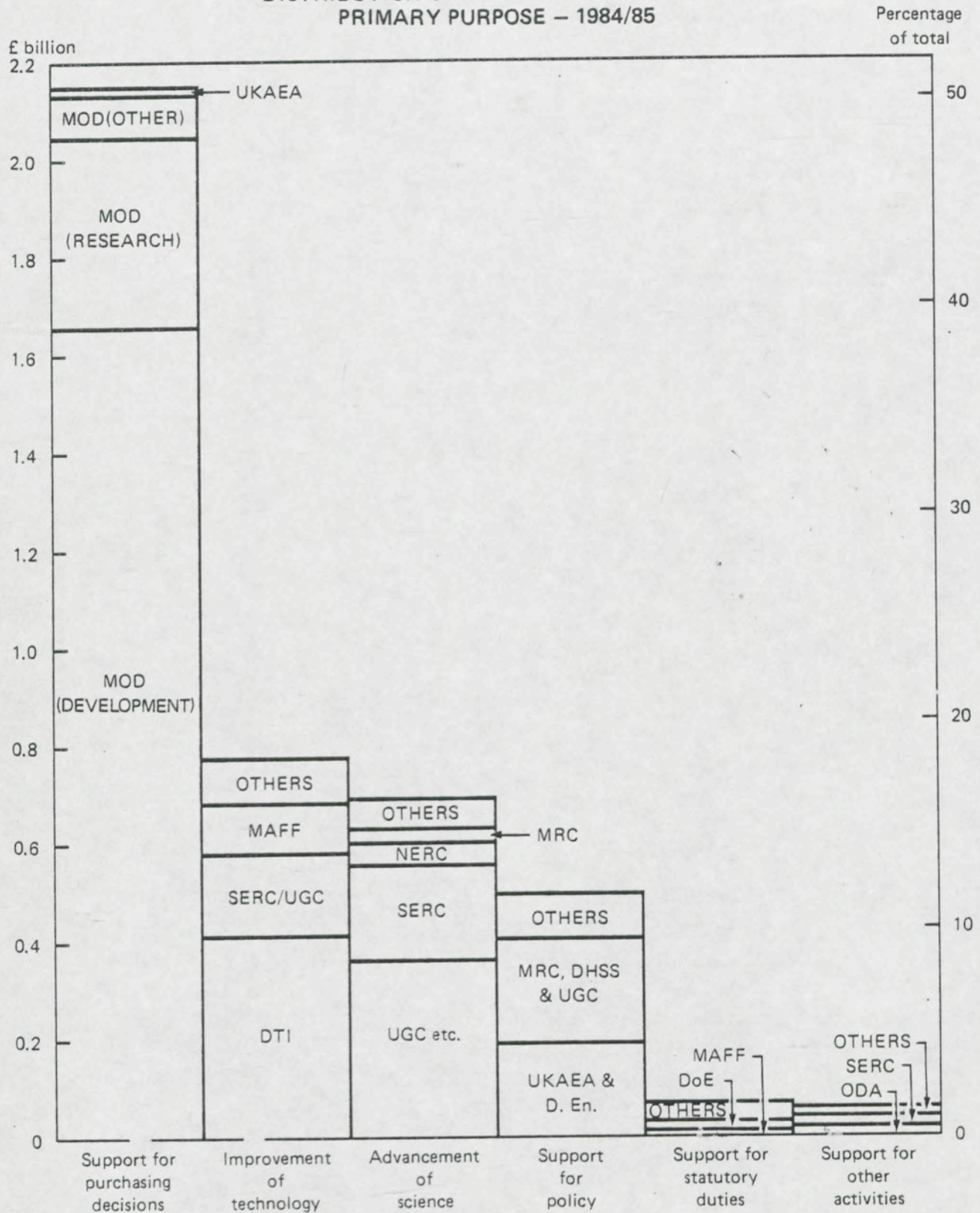


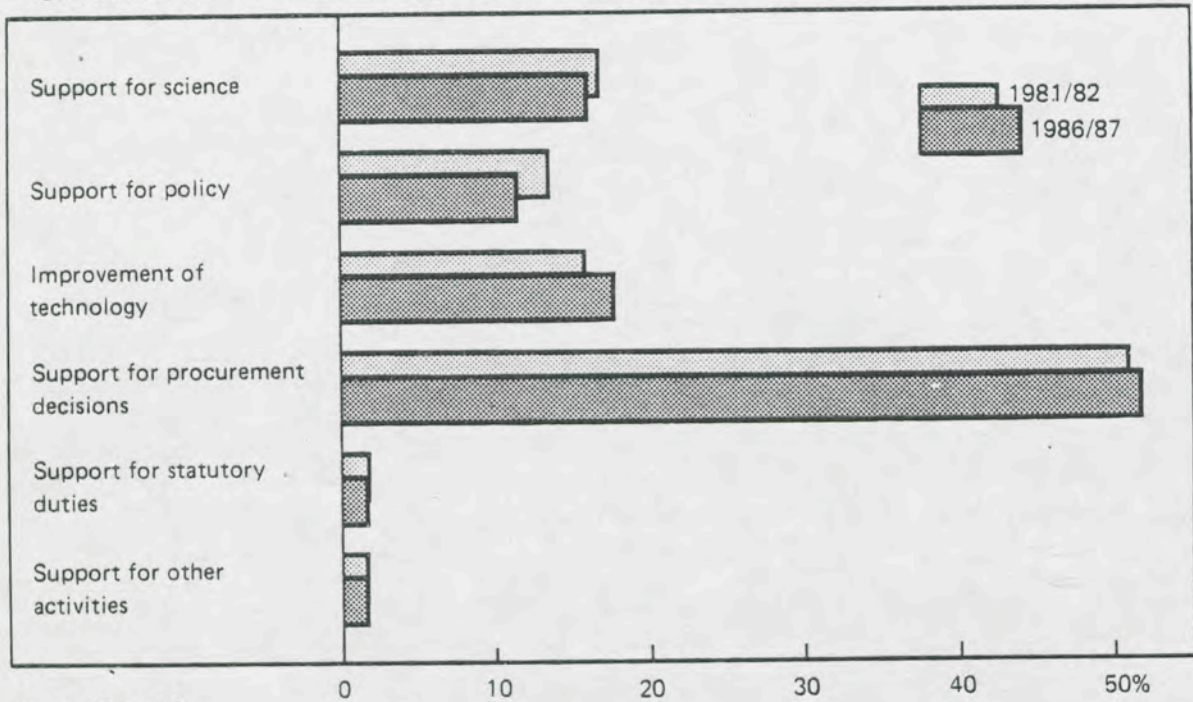
Figure 2.5

DISTRIBUTION OF R & D EXPENDITURES BY
PRIMARY PURPOSE – 1984/85



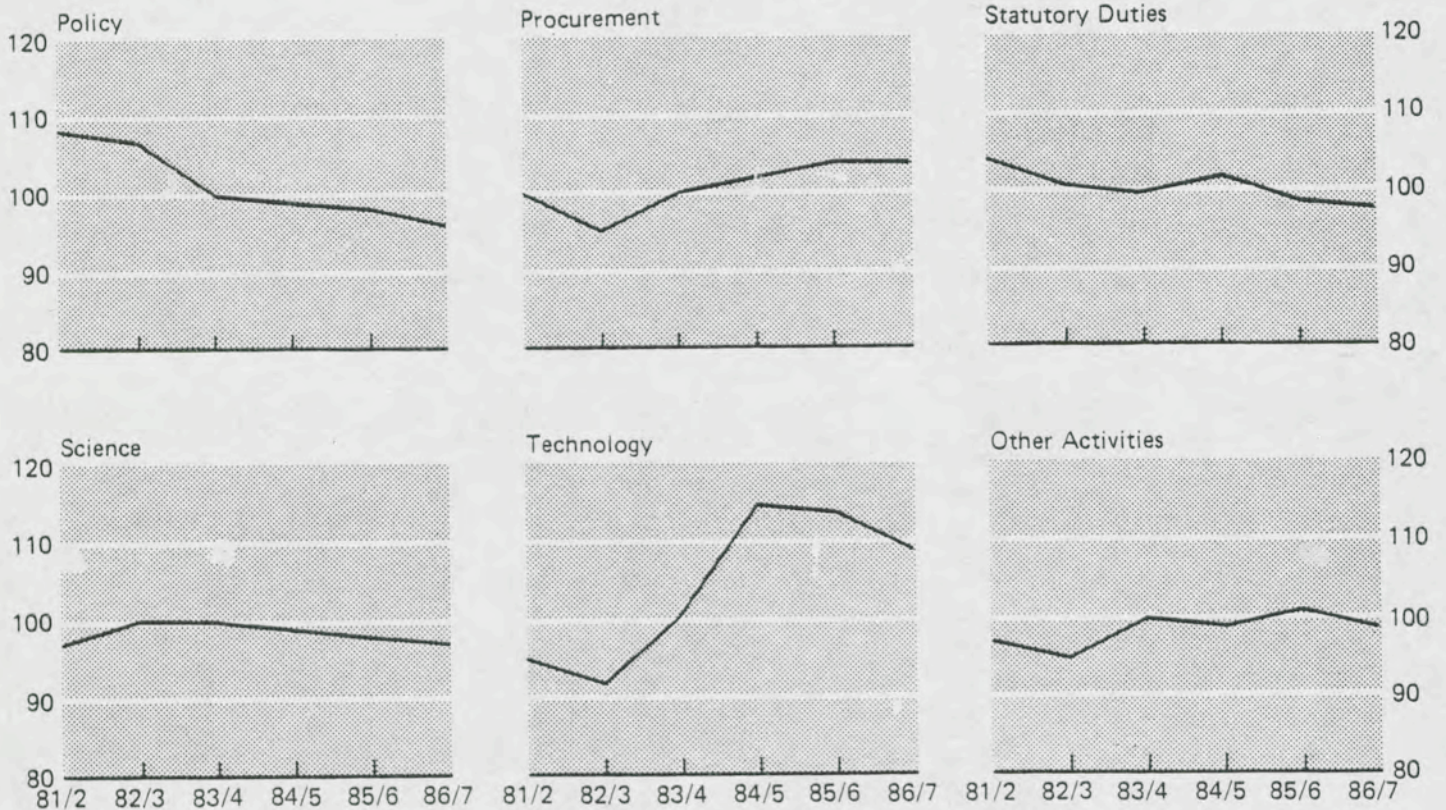
Source: Tables 2.8, 2.9, 2.11, 2.13, 2.15, 2.17, 2.19, 2.21

Figure 2.6
CHANGES IN PRIMARY PURPOSES FOR GOVERNMENT R & D, 1981/82 - 1986/87



Source: Table 2.9

Figure 2.7
CHANGES IN PRIMARY PURPOSES FOR GOVERNMENT FUNDED R & D 1981/82 - 1986/7 IN COST TERMS
INDEX 1983/4 = 100



Source: Table 2.10

3. INTERNATIONAL COMPARISONS

- 3.1 Neither firms nor countries have a "correct" level of expenditure on R & D. Comparisons within their industrial sector will demonstrate to the management of a firm whether their expenditure is in line with that of their competitors. But even if it is not, there may be good reasons for the difference. Similarly, comparisons among countries can show whether the pattern of R & D spending in, for example, the UK differs markedly from that in other major industrialised countries - and can therefore indicate where questions over the balance of expenditure might be asked - but they do not of themselves enable any judgements to be made.
- 3.2 This chapter therefore examines, with the aid of OECD statistics, the broad pattern of government R & D expenditures in six countries - France, the Federal Republic of Germany, Italy, Japan, the UK and the USA. In such comparisons, care is always required because of the different responsibilities of governments, for example in the United Kingdom the nationalised industries undertake R & D which might fall to governments elsewhere. However, in defining how the statistics should be collected OECD seek to ensure that the same activities are included in each country. In general, much greater differences arise from the variation from country to country in government funding of R & D in different sectors of the economy. OECD also seek to allow for the fact that exchange rates do not necessarily reflect purchasing powers by converting national currencies to \$US on a "purchasing power parity" basis, thus facilitating comparisons of the volume of R & D funded in each sector.
- 3.3 Comparisons of absolute expenditures give some indication of the relative resources available for R & D in different countries and therefore the ability of each country to cover a wide spread of scientific and technological developments. Relative priorities within any country may be illustrated by representing R & D expenditures as percentages of its GDP. Table 3.1 shows absolute expenditures and corresponding percentages of GDP for the total of government R & D expenditures, and major subdivisions, in the six countries selected. The data are the latest available, in general for 1981, but the broad outlines of the expenditure patterns revealed change little from one year to another and may be taken to reflect 1984 spending also.

- 3.4 It may be seen that government R & D expenditures, expressed as a proportion of GDP, are substantially smaller in Italy and Japan than in the other four countries. In absolute terms, the dominance of US government expenditures is clear and the high proportion of the national total attributable to defence expenditures in the UK and USA, and to a lesser extent in France, is also evident. Other features include: the high proportion of US expenditures on civil space; the low proportion apparently devoted to "advancement of knowledge" in the US (because American practice is to fund much basic research through "mission orientated" agencies such as NASA) ; the high US expenditure on health research (MRC expenditure in the UK is split between "health" and "advancement of knowledge"); and the difference in GDP terms between the European countries on the one hand and the US and Japan on the other in expenditures for industrial growth.
- 3.5 The contributions of industry, agriculture etc to each country's GDP differ in their relative importance (Table 3.2). It is illuminating to derive, for each country, the ratio between government support for R & D in a broad economic sector, which in general has the aim of improving the technology and hence the competitiveness of that sector, and the sector's contribution to GDP. One aspect that has to be borne in mind is that the manufacturing sector of an economy includes the products of the defence industries. Defence R & D, however, is not undertaken primarily for industrial support purposes. It is therefore appropriate to make the comparison both including and excluding defence R & D expenditures.
- 3.6 The result is shown in Fig.3.1. This shows that in 1981 government R & D expenditures on industrial development and civil space in France, Germany and the UK were all about 0.65% of the contribution of industry to the respective GDPs whereas the proportion in the USA and Japan was much lower. Because of their larger GDPs, French and German expenditures exceeded those of the UK in absolute terms. If defence expenditures are added, the UK figure rises to about 4%, somewhat above that of the USA. There is considerable variability in other figures, but the UK spends, in GDP terms, more than the other countries on agricultural R & D and, in general, less than France, Germany and the USA in other categories.

TABLE 3.1 GOVERNMENT FUNDED R & D IN OECD COUNTRIES, 1981 BY OECD SOCIO-ECONOMIC OBJECTIVE OF THE R & D PROGRAMME

OECD Objective	France		Germany		Italy		Japan		UK		USA	
	\$m(1)	%GDP(2)	\$m	%GDP	\$m	%GDP	\$m 1980	%GDP	\$m	%GDP	\$m	%GDP
1. Agriculture, Forestry, Fishing	272.5	5.1	145.4	2.3	89.2	2.0	642.8	6.4	242.6	5.2	787.0	2.7
2. Industrial Growth	611.8	11.4	797.5	12.5	553.5	12.2	308.7	3.1	483.8	10.4	106.0	0.4
3. Production of Energy	513.2	9.5	1115.5	17.5	730.8	16.1	664.0	6.6	407.9	8.7	3,501.0	12.0
4. Transport & Telecommunications	166.1	3.1	154.1	2.4	10.1	0.2	73.3	0.7	27.5	0.6	869.0	3.0
5. Urban and Rural Planning	92.2	1.7	134.5	2.1	15.2	0.3	59.3	0.6	56.8	1.2	104.0	0.4
6. Environment Protection	73.4	1.4	131.7	2.1	52.3	1.1	86.0	0.9	70.9	1.5	271.0	0.9
7. Health	309.8	5.8	301.8	4.7	83.6	1.8	154.8	1.5	69.2	1.5	4,014.0	13.8
8. Social Development Services	86.1	1.6	301.9	4.7	40.7	0.9	42.9	0.4	65.5	1.4	557.0	1.9
9. Earth and Atmosphere	197.4	3.7	207.9	3.3	56.1	1.2	74.6	0.7	44.3	0.9	662.0	2.3
10. Advancement of Knowledge	1,710.4	31.8	3,104.2	48.7	964.6	21.2	2804.0	28.1	1,403.2	30.0	1,340.0	4.6
11. Civil Space	291.7	5.4	303.1	4.8	174.0	3.8	302.8	3.0	127.9	2.7	4,924.0	16.9
13. Other	46.3	0.9	-	-	13.1	0.3	-	-	-	-	-	-
Total Civil	4,370.8	81.2	6,698.1	105.0	2,783.1	61.2	5,213.0	52.2	3,000.0	64.2	17,134.0	58.9
12. Defence	2,591.3	48.2	646.7	10.1	192.1	4.2	123.7	1.2	3,256.2	69.7	18,413.0	63.4
TOTAL	6,962.1	129.4	7,344.8	115.1	2,975.2	65.4	5,336.7	53.4	6,256.2	133.9	35,547.0	122.3

Source: OECD Science and Technology Indicators, Basic Statistical Series
Volume A, The Objectives of Government R & D Funding, May 1983

Notes

1. \$m - Millions of US \$ at Current Prices and Exchange Rates (Purchasing Power Parities);
2. % GDP - Percentage of Gross Domestic Product * 100.

TABLE 3.2: COMPONENTS OF GROSS DOMESTIC PRODUCT BY KIND OF ECONOMIC ACTIVITY IN OECD COUNTRIES, 1981. PERCENTAGES

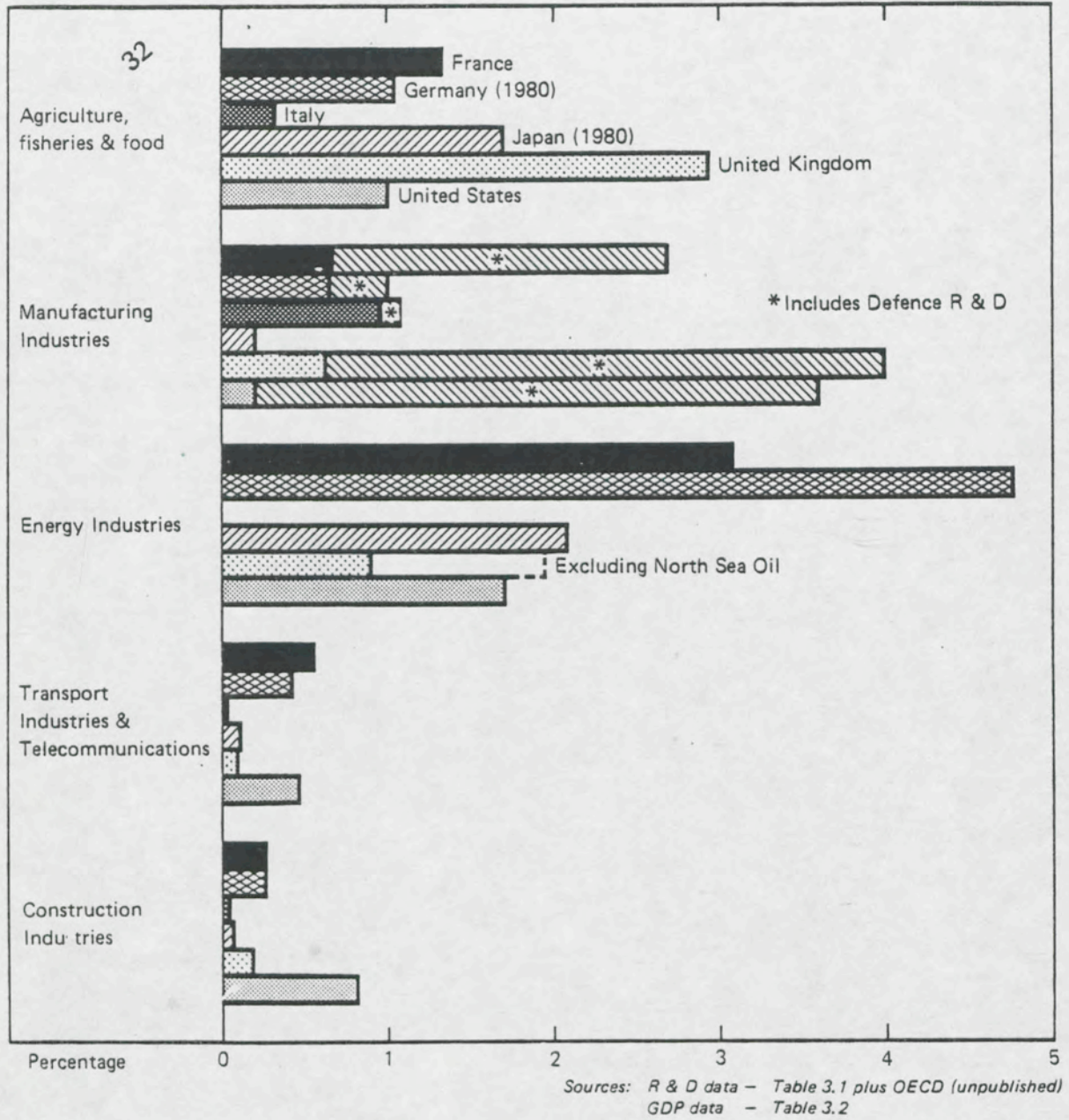
	France	Germany (1)	Italy	Japan (1)	UK		USA
A INDUSTRIES					(2)		
Agriculture, hunting forestry and fishing	3.8	2.1	5.9	3.5	2.0	2.1	2.7
Mining and quarrying	0.9	0.9	29.1	0.5	6.2	1.5	4.4
Manufacturing	25.1	33.1		30.7	20.1	21.2	22.4
Electricity gas & water	2.2	2.6	4.4	2.9	2.7	2.8	2.6
Construction	6.6	6.7	8.0	9.0	5.6	5.7	4.4
Wholesale and retail trade, restaurants and hotels	12.4	11.0	15.2	12.4	8.1	8.5	16.9
Transport storage and communication	5.5	5.7	6.5	6.9	6.8	7.1	6.4
Finance, insurance, real estate, & business services	17.7	10.0	18.5	15.4	13.4	14.0	20.6
Community, social and personnel services	8.1	10.8		11.8	11.7	12.3	8.1
Less: imputed bank service charge	-4.6	-3.7	-4.7	-4.1	-5.0	-5.2	-2.4
Statistical discrepancy	-	-	-	-	-	-	1.3
Sub-total: Industries	77.7	79.2	82.7	88.9	71.4	70.0	87.5
B PRODUCERS OF GOVERNMENT SERVICES	12.4	11.6	13.5	8.8	13.1	13.8	12.3
C OTHER PRODUCERS	0.7	1.8	0.7	1.8	1.4	1.4	-
Import Duties	9.2	0.9	3.1	0.4	14.8	15.6	0.3
Statistical Discrepancy	-	6.5	-	0.1	-0.7	-0.7	-0.1
TOTAL	100.0	100.0	100.0	100.0	100.0		100.0

Source = National Accounts 1964-1981, Organisation for Economic Co-operation and Development Paris 1983, Volume II Detailed Tables

(1) 1980 data

(2) UK Excluding North Sea Oil and Gas

Figure 3.1 Ratio of Government R & D expenditure in support of certain sectors of the economy to the contribution by those sectors to the GDP
International comparison



4. R & D EXPENDITURE AND THE ECONOMY

4.1 Expenditures for the purposes of improving technology or in support of public purchasing decisions have an impact on the economy. Such expenditures have where possible been related to 1980 Standard Industrial Classification (SIC) product groups, the result being Tables 4.1. and 4.2. Defence expenditures particularly appear heavily concentrated in a few product groups, mainly related to aerospace and electronics, but some care is required in interpreting Table 4.2 since a number of major defence products (eg torpedoes) are not easily accommodated within the product group structure and the concentration of expenditures in certain groups may therefore be enhanced. Expenditures to improve technology in agriculture, forestry and fisheries and the construction industry are included in the tables for completeness.

4.2 Other aspects of the UK economy may also be related to these product groups. The latest information on total R & D expenditures in the private sector of industry, public corporations and Research Associations was provided by DTI's 1981 survey, the first results of which were reported in late 1983(1). Table 4.3 therefore concentrates on 1981 and gives information on the distribution by broad industrial sector and by product group of the following aspects of the UK economy in that year:

- Gross output
- Gross value added
- Private industry's funding of R & D
- Exports
- Imports
- Employment

4.3 The distribution of Government R & D expenditures may then be compared with the distributions of these or derived features of the economy, as shown in Figure 4.1. This compares Government R & D expenditures with:

- Industrial R & D expenditures
- Gross output
- Gross value added per employee

Proportion of exports

Balance of trade.

- 4.4 It may be seen that there is, in general, no clear correlation among these aspects of the economy. Aerospace, for example, is heavily supported by Government funds and successful in international markets, but does not have a particularly high gross added value per employee. Chemicals and pharmaceuticals are also successful internationally, have high added value per employee, but receive little Government support for R & D. The relationship between R & D expenditure and commercial success is not straightforward and will need to be explored in more detail in future Reviews.

(1) British Business, 9 December 1983.

Table 4.1

CIVIL R & D EXPENDITURE FOR IMPROVEMENT OF TECHNOLOGY OR IN SUPPORT OF
PUBLIC PURCHASING BY PRODUCT GROUP, WHERE APPLICABLE
£millions

PRODUCT GROUP	81/82	82/83	83/84	84/85	85/86	86/87
1. Extractive industries	4.2	4.7	4.7	5.8	5.9	5.0
2. Mineral oil refining	0.6	0.6	0.6	0.4	0.0	0.0
4. Iron and Steel	8.5	5.0	6.5	7.3	7.4	7.5
5. Non-ferrous metals	4.1	2.8	3.4	3.7	17.7	3.9
6. Bricks, cement building materials	1.3	0.7	0.8	0.5	0.5	0.5
7. Pottery, china and glass	1.4	0.6	1.1	1.1	1.2	1.2
8. Synthetic resins and plastic materials	2.0	3.6	3.9	4.1	4.3	4.3
9. Paint	0.3	0.4	0.4	0.5	0.5	0.5
10. Pharmaceutical products	0.9	1.7	2.4	3.8	5.0	6.0
11. Other chemical products	1.8	2.3	4.5	6.4	8.4	8.7
12. Metal goods	0.0	0.0	0.0	0.0	0.0	0.0
13. Industrial plant and steelwork	3.8	6.4	9.3	6.6	6.8	4.0
14. Metal-working machine tools	4.9	8.3	9.7	7.7	8.1	6.6
15. Construction, earth-moving equipment	2.2	3.6	4.2	2.8	3.1	2.3
16. Other machinery and equipment	9.5	11.2	13.1	11.6	10.4	6.6
17. Office machinery	0.0	0.5	2.0	0.0	0.0	0.0
18. Electronic data processing equipment	13.2	23.4	23.1	19.5	20.1	19.0
19. Insulated wires and cables	0.1	0.1	0.1	0.3	0.1	0.2
20. Basic electrical equipment	0.9	2.8	4.2	1.3	1.5	1.6
21. Telegraph and telephone apparatus	0.7	2.1	5.2	5.2	6.0	6.0
22. Electrical instruments & control systems	7.7	9.6	15.3	18.3	19.9	18.3
23. Radio and electronic capital goods	2.7	5.2	5.5	5.6	5.8	5.8
24. Components other than active components	1.3	1.2	0.4	0.8	1.0	1.1
25. Active components and electronic sub-assemblies	0.1	0.2	0.2	0.3	0.3	0.3
26. Other electronic equipment	2.7	8.2	6.2	12.2	10.2	10.2
27. Other electrical goods	0.2	0.5	4.7	8.9	14.4	14.9
28. Motor vehicles and parts	8.4	8.3	11.8	13.3	10.8	11.4
29. Shipbuilding and repairs	2.5	2.5	2.3	3.1	3.1	3.1
30. Aerospace equipmnt, manufacture & repair	118.6	87.0	112.2	129.9	141.9	131.3
31. Instrument engineering	0.6	1.2	1.3	1.3	1.4	1.7
32. Food and drink	15.9	18.0	18.8	19.6	20.2	22.3
34. Textiles other than man-made fibres	1.8	2.1	1.9	3.0	2.8	2.3
35. Leather, footwear and clothing	1.3	1.0	1.1	2.2	1.8	1.5
37. Paper etc, printing and publishing	1.4	1.0	1.4	2.1	2.1	1.9
38. Processing of rubber and plastics	2.9	2.4	3.0	3.6	4.1	4.6
39. Other manufacturing industries	1.5	1.3	1.7	2.8	3.2	3.7
40. Construction	11.1	11.7	13.3	14.8	15.8	16.5
42. Agriculture, forestry, fishing	161.8	169.0	180.4	187.6	156.5	157.4
TOTAL	403.1	411.3	480.9	518.2	522.5	492.5

Table 4.2

DEFENCE R & D EXPENDITURES - DISTRIBUTION BY PRODUCT GROUP,
WHERE APPLICABLE, 1981/82.

PRODUCT GROUP NO	Emillion
8 - 11	31
13	1
14	1
16	147
18	20
20	5
21 - 24	346
25 - 26	62
27	4
28	26
29	56
30	483
31	125
35	2
37	3
41	5
TOTAL	1317

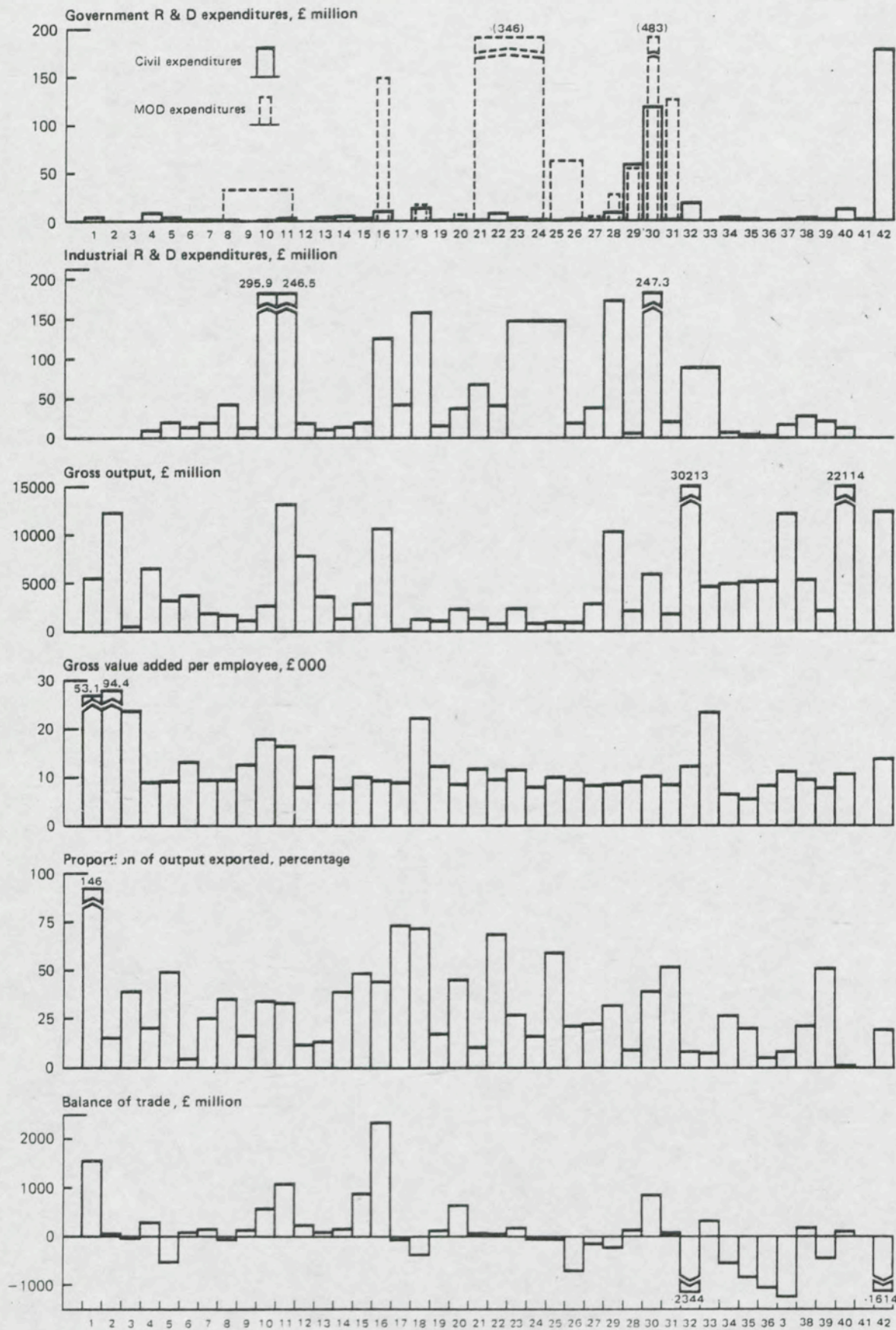
Table 4.3

UK ECONOMIC INDICATORS BY PRODUCT GROUP
Emillions

PRODUCT GROUP	GROSS OUTPUT	GROSS VAL ADDED	INDUSTRIAL R & D	EXPORTS	IMPORTS	EMPLOYMENT thousands
1. Extractive industries	19105	15731	)	( 8122	6577	296.1
2. Mineral oil refining	12335	1621	) 120.0	(1898	1869	17.2
3. Other treatment of petroleum products	539	150	)	( 211	224	6.3
4. Iron and steel	6517	1566	9.3	1330	1033	172.9
5. Non-ferrous metals	3233	600	19.2	1589	2118	65.5
6. Bricks, cement, building materials etc	4255	1664	12.5	203	118	125.5
7. Pottery, china and glass	1979	957	19.3	498	340	101.4
Chemical industry						
8. Synthetic resins and plastic materials	1653	269	41.2	586	659	28.3
9. Paint	1136	364	13.1	184	62	29.0
10. Pharmaceutical products	2641	1255	295.9	892	344	69.8
11. Other chemical products	13143	3727	246.5	4387	3191	224.6
12. Metal goods	7826	3204	19.2	950	739	399.6
Mechanical engineering						
13. Industrial plant and steelwork	3662	1856	10.6	495	419	129.7
14. Metal-working machine tools etc	1318	660	11.5	520	384	82.6
15. Construction, earth-moving, equipment etc	2954	1105	19.9	1420	545	109.5
16. Other machinery and equipment	10665	4521	126.6	4661	2293	486.2
17. Office machinery	189	85	41.4	139	172	9.6
18. Electronic data processing equipment	1270	641	157.4	917	1317	28.9
Electrical and electronic engineering						
19. Insulated wires and cables	1058	367	15.7	177	76	30.2
20. Basic electrical equipment	2324	1020	38.4	1043	405	118.5
21. Telegraph and telephone apparatus etc	1352	725	68.6	131	96	61.0
22. Electrical instruments & control systems	707	333	40.4	485	473	34.5
23. Radio and electronic capital goods	2361	1104	147.5	635	453	95.5
24. Components other than active components	742	378	) 55.4	(117	172	47.1
25. Active components and electronic subassemblies	907	424	)	( 535	624	41.6
26. Other electronic equipment, active compts and electronic sub-assemblies	895	218	19.8	187	904	23.0
27. Other electrical goods	2929	1195	37.5	645	791	144.5
28. Motor vehicles and parts	10317	3265	173.0	3316	3526	381.6
29. Shipbuilding and repairs	2044	1070	5.7	182	65	118.4
30. Aerospace equipment, manufacture & repair	5298	2030	247.3	2329	1506	199.6
31. Instrument engineering	1745	771	20.0	905	869	92.1
32. Food and drink	30213	7637	) 88.2	(2569	4913	623.6
33. Tobacco	4629	786	)	( 354	50	33.3
34. Textiles other than man-made fibres	4917	1793	8.7	1317	1865	267.3
35. Leather, footwear and clothing	5070	2049	4.1	1010	1832	360.1
36. Timber and wooden furniture	5189	1760	2.5	278	1390	216.1
37. Paper etc, printing and publishing	12422	5384	17.5	984	2224	483.6
38. Processing of rubber and plastics	5379	2092	29.2	1126	900	221.1
39. Other manufacturing industries	2154	881	20.7	1104	1567	115.6
40. Construction (1)	22114	12955	13.0	136	22	1252.0
42. Agriculture, forestry, fishing (1)	12487	4901	0.0	893	2507	351.0
TOTAL	231673	93114	2216.8	49460	49737	7694.0

(1) The economic indicators for Construction and Agriculture etc are not necessarily on the same basis as those of the other product groups

Figure 4.1 R & D EXPENDITURE AND THE UK ECONOMY 1981, BY PRODUCT GROUP



5. R & D IN SUPPORT OF PUBLIC PURCHASING.

- 5.1 As Table 2.17 indicated, expenditures in support of defence procurement are by far the largest component of this category. Defence makes great demands of technology and R & D accounts for a correspondingly high proportion of procurement costs, but this proportion has fallen in recent years, as shown below:

	1978/9(O)	1981/2(O)	1984/5(E)
Defence procurement (excluding R & D) £million	2275	4433	6428
R & D as a proportion of procurement	45%	38%	33%

E - Estimate O - outturn

Source - Statement on the Defence Estimates 1984, Cmnd 9227 - II

- 5.2 At the other extreme, the Supply Estimates for 1984/5 show that the Government intend to spend approximately £1600 million on the purchase and maintenance of buildings, £822 of this being for capital works. This is directly supported by a £2.5 million R & D programme (0.3% of the capital expenditure) and, indirectly, by the other research funded to improve building and construction technology (£3.8 million).
- 5.3 The Supply Estimates also show that in 1984/5 the Government intend to spend £943 million on the construction of motorways and major trunk roads and £100 million on their maintenance. This is supported by a £9.1 million R & D programme (1% of capital expenditure).
- 5.4 Substantial R & D programmes in support of public purchasing decisions are carried out by nationalised industries. Some of these come to Ministers for formal approval. Information on these has not been assembled in the same detail as in the remainder of the Review but the

table below indicates the scale of the expenditures. It also includes the capital investment of the industries; some of the R & D, of course, is related to operation rather than purchasing but the division is, in general, not indicated in annual reports.

£million			
	R & D	Capital expenditure	R & D as a proportion of capital expenditure
British Gas	45(1)	801	5.6
NCB	32(1)	740	4.3
CEGB	40(2)	925	4.3
British Telecom	172	1324	12.8
British Rail	14(4)	400	3.5

(1) excluding R & D on utilisation

(2) some UKAEA costs are relevant to the electricity supply industry.

(3) total "investment" expenditure

~~*~~ (4) including Departure of Transport contribution to joint programme.

Sources: 1982/3 annual reports and British Rail.

CONFIDENTIAL

6. "SEEDCORN" RESEARCH

- 6.1 In the past few years concern has been expressed over a possible national decline in "strategic" research. Such research is not formally defined in the Frascati framework but is essentially research which, while having some application in view (ie it is not undertaken purely in order to gain knowledge) is not expected to find application for some years, typically of the order of a decade. In order to gain an insight into Government funding of such long term research, Departments and Research Councils were asked to indicate their expenditures on applied research that would not find application before 1990. In total some £140 million of expenditures, mostly by MOD, DTI and the Research Councils were so classified.
- 6.2 Some care is, though, required in drawing conclusions from this figure. Respondents had some difficulty in identifying expenditures which fell into this category and the true total may therefore be higher. Further, it is possible for research defined in the Frascati framework as "basic" ie that in the "advancement of science" category in the Review, to have long term, but unspecific, application in view and it can be argued that such research should be included in this category. Finally, some research areas (eg plant breeding and weapons development) have long timescales and so results will find application later even though the work is no more speculative or "basic" in character than work in other fields that will find application before 1990. The Advisory Board for the Research Councils are to consider further the definition of strategic research, with a view to the provision of improved data in the 1985 Review.

CONFIDENTIAL

7. MANPOWER IN R & D

7.1 Table 7.1 shows the numbers of qualified scientists and engineers (QSEs) engaged on R & D in Departments and Research Councils in the years covered by the Review. In general, the numbers reflect the decline in Civil Service complement over these years. For comparison, private industry in 1981 employed 67,000 QSEs on R & D (1) and public corporations and Research Associations a further 3000. In 1981/2 there were 19,300 full-time staff undertaking teaching and research in relevant subjects in universities (2) and a further 8000 full-time research staff. In total, these might be taken to be equivalent to about 14000 full time research staff. Government therefore accounted for about 20% of the national total of QSE's engaged on R & D.

(1) British Business, 9 December 1983

(2) Universities Statistical Record, 1981/2, Volume 1

Table 7.1

R & D MANPOWER (PERSONS WITH DEGREE OR EQUIVALENT ONLY)

Department	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Civil Departments						
MAFF	1575	1572	1487	1470	1464	1458
DES	4	4	5	5	5	5
DEn	40	37	37	38	39	39
UKAEA	3430	3481	3509	3392	3160	2957
DoE	615	565	562	559	555	552
FCO	2	2	2	2	2	2
ODA	172	170	170	165	165	162
DHSS	224	228	233	234	234	220
HSC	111	89	107	107	107	107
Home Office	200	187	192	199	203	203
DTI	947	917	783	783	780	770
Department of Transport	395	368	356	339	334	327
N I Departments	113	115	116	116	116	116
Scottish Departments	169	158	193	189	189	189
Other Departments	440	420	456	452	448	448
TOTAL Civil Departments	8437	8313	8208	8050	7801	7555
Research Councils						
AFRC	2585	2590	2595	2550	2345	2175
ESRC	113	102	102	91	100	100
MRC	1472	1499	1500	1500	1490	1490
NERC	1662	1650	1635	1593	1542	1498
SERC	1110	1143	1147	1147	1147	1140
TOTAL Research Councils	6942	6984	6979	6891	6624	6403
TOTAL Civil	15379	15297	15187	14931	14425	13958
Ministry of Defence	5262	5165	4878	4844	4812	4758
TOTALS	20641	20462	20065	19775	19237	18716

CONFIDENTIAL

ANNEX A

BACKGROUND TO THE ANNUAL REVIEW PROCESS

The following is an extract from Cmnd 8591, the Government's observations on the first report of the House of Lords Select Committee on Science and Technology, "Science and Government", dated July 1982.

"The Government have therefore decided to introduce a system of "Annual Reviews of Research". Departments will submit a summary of their research programmes and budgets to be reviewed-inter-departmentally, with independent advice from ACARD, during the early months of the year; this timetable would allow Departments to revise their plans during the next PES cycle in the light of the results of the Review".

"The analyses required will not be a facile choice of areas where more money should be spent. In the Government's view, overall UK expenditure on Research and Development as a percentage of GDP is sufficient. Skillful valued judgements as to allocation of financial and manpower resources are, however, needed. This will involve distinguishing between vital and dormant areas, identifying gaps, disparities and duplications, and considering the opportunity cost of relinquishing certain areas of research. The emphasis will be on review of long-term plans".
(Paragraphs 20-21)

CONFIDENTIAL

FRASCATI DEFINITION OF R&D

The following is an extract from "The Measurement of Scientific and Technical Activities, Frascati Manual 1980", OECD, Paris 1981.

BASIC DEFINITIONS AND CONVENTIONS

2.1 RESEARCH AND EXPERIMENTAL DEVELOPMENT (R&D)

43. Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society and the use of this stock of knowledge to devise new applications.

R&D is a term covering three activities: basic research, applied research and experimental development. Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view. Applied research is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective. Experimental development is systematic work, drawing on existing knowledge gained from research and/or practical experience that is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

2.2 ACTIVITIES TO BE EXCLUDED FROM R&D

44. For survey purposes R&D must be distinguished from a wide range of related activities with a scientific and technological base. These other activities are very closely linked to R&D through flows of information and in terms of operations, institutions and personnel, but they should, as far as possible, be excluded when measuring R&D.

45. These activities will be discussed here under three headings -

- Education and training (see 2.2.1);
- Other related scientific and technological activities (see 2.2.2);
- Other industrial activities (see 2.2.3).

The definitions here are practical and designed solely to exclude these activities from R&D. They are thus slightly different from the broader concepts of scientific and technological services (STS) and "innovation" discussed in an earlier Chapter.

2.2.1. Education and Training

46. All education and training of personnel in the natural sciences, engineering, medicine, agriculture, the social sciences and the humanities in universities and special institutions of higher and post-secondary education. However, bona fide research by post-graduate students carried out at universities should be counted, wherever possible, as a part of R&D.

2.2.2 Other Related Scientific and Technological Activities

47. The following activities should be excluded from R&D except where carried out solely or primarily for the purposes of an R&D project (see also examples in section 2.3.1).

2.2.2.1 Scientific and Technical Information Services

48. The specialised activities of -

- | | | |
|------------------|----|----------------------------|
| - collecting) | | - scientific and technical |
| - coding) | | personnel |
| - recording) | | - bibliographic services |
| - classifying) | | - patent services |
| - disseminating) | by | - scientific and technical |
| - translating) | | information extension and |
| - analysing) | | advisory services |
| - evaluating) | | - scientific conferences |

except where conducted solely or primarily for the purpose of R&D support (eg the preparation of the original report of R&D findings) should be included in R&D.

2.2.2.2 General Purpose Data Collection

49. Undertaken generally by government agencies to record natural, biological or social phenomena that are of general public interest or that only the government has the resources to record. Examples are routine topographical

mapping, routine geological, hydrological, oceanographic and meteorological surveying, astronomical observations. Data collection conducted solely or primarily as part of the R&D process is included in R&D (eg data on the paths and characteristics of particles in a nuclear reactor). The same reasoning applies to the processing and interpretation of the data. The social sciences, in particular, are very dependent on the accurate record of facts relating to society in the form of censuses, sample surveys, etc. When these are specially collected or processed for the purpose of scientific research the cost should be attributed to research and should cover the planning, systematising etc, of the data. But data collected for other or general purposes, such as quarterly sampling of unemployment, should be excluded even if exploited for research. Market surveys are excluded.

2.2.2.3 Testing and Standardisation

50. Refers to the maintenance of national standards, the calibration of secondary standards and routine testing and analysis of materials, components, products, processes, soils, atmospheres, etc.

2.2.2.4 Feasibility Studies

51. Investigation of proposed engineering projects using existing techniques in order to provide additional information before deciding on implementation. In the social sciences, feasibility studies are investigations of the socio-economic characteristics and implications of specific situations (eg a study of the viability of a petro-chemical complex in a certain region). However, feasibility studies on research projects are part of R&D.

2.2.2.5 Specialised Medical Care

52. Refers to routine investigation and normal application of specialised medical knowledge. There may, however, be an element of R&D in what is usually called "advanced medical care", carried out, for example, in university hospitals.

2.2.2.6 Patent and Licence Work

53. All administrative and legal work connected with patents and licences. (However, patent work connected directly with R&D projects is R&D.)

2.2.2.7 Policy Related Studies

54. Policy in this content refers not only to national policy but also to policy at the regional and local levels, as well as that of business enterprise in the pursuit of their economic activity. Policy related studies cover a range of activities such as the analysis and assessment of the existing programmes, policies and operations of government departments and other institutions; the work of units concerned with the continuing analysis and monitoring of external phenomena (eg defence and security analysis); and the work of legislative commissions of inquiry concerned with general government or departmental policy or operations.

2.2.3 Other Industrial Activities

55. These can be considered under two, to some extent overlapping, headings -

2.2.3.1 Industrial Innovation (not elsewhere classified)

56. All those scientific, technical, commercial and financial steps, other than R&D, necessary for the successful development and marketing of a manufactured product and the commercial use of the processes and equipment.

2.2.3.2 Production and Related Technical Activities

57. Industrial production and distribution of goods and services and the various allied technical services in the Business Enterprise sector and in the economy at large, together with allied activities using the disciplines of the social sciences such as market research.

2.3 THE BOUNDARIES OF R&D

2.3.1 The Basic Criterion

58. The basic criterion for distinguishing R&D from related activities is the presence in R&D of an appreciable element of novelty. (Supplementary criteria are suggested elsewhere in the Manual.) One aspect of this criterion is that a particular project may be R&D if undertaken for one reason but if carried out for another reason will not be considered R&D. This is shown in the following examples -

- a. In the field of medicine, routine autopsy on the causes of death is simply the practice of medical care and not R&D; special investigation of a particular mortality in order to establish the side effects of certain cancer treatments is R&D. Similarly, routine tests such as blood and bacteriological tests carried out for doctors are not R&D but a special programme of blood tests in connection with the introduction of a new drug is R&D.

- b. The keeping of daily records of temperatures or of atmospheric pressure is not R&D but the operation of a weather forecasting services or general data collection. The investigation of new methods of measuring temperature is R&D, as are the study and development of new systems and techniques for interpreting the data.
- c. R&D activities in the mechanical engineering industry often have a close connection with design and drawing work. Usually there are not special R&D departments in small and medium size companies in this industry and R&D problems are mostly dealt with under the general heading "design and drawing". If calculations, designs, workshop drawing and operating instructions are made for the setting-up and operating of pilot plants and prototypes, they should be included in R&D. If they are carried out for the preparation, execution and maintenance of production standardisation (eg jigs, machine tools) or to promote the sale of products (eg offers, leaflets, spare parts catalogues) they should be excluded from R&D.
- d. Many social scientists perform work in which they bring established methodologies and facts of the social sciences to bear on a particular problem, but which cannot be classified as research. The following are examples of work which might come in this category and are not R&D: interpretative commentary on the probable economic effects of a change in the tax structure, using existing economic data; forecasting future changes in the patterns of the demand for social services within a given area arising from an altered demographical structure; operations research (OR) as a contribution to decision making eg planning the optimal distribution system for a factory; the use of standard techniques in applied psychology to select and classify

industrial and military personnel, students, etc, and to test children with reading or other disabilities.

End of extract.

The manual then discusses problems at the borderlines between R&D and education and training, other related scientific and technological activities, and other industrial activities. Further chapters cover the classification of institutions involved in R&D, functional classifications, the measurement of personnel and expenditure devoted to R&D, survey procedures, R&D deflators (used for trend analysis in real terms) and exchange rates (to facilitate international comparisons) and the classification of the socio-economic objectives of Government R&D funding.

The Manual is available through HMSO.

MARINE SCIENCE AND TECHNOLOGY

Introduction

1. Cmnd 8591 stated that the Annual Review would seek to identify gaps and overlaps in research expenditure. The information in the first part of the Review is too general for this purpose; more detailed investigations of specific areas of science and technology are required. Marine science and technology was chosen as the first area for study because of the wide range of Departmental and Research Council interests in this field.

The data

2. Following consultation with the principal funding bodies, a two-dimensional scheme for classification of expenditures was drawn up. This reflected both the policy aims arising from Departmental responsibilities and the scientific and technological areas of study. R & D expenditures (using the Frascati definition) were then analysed in accordance with this scheme, the result being shown in Table C.1. More detailed information on the largest areas of expenditure - the design and operation of ships, submarines etc - is shown in Table C.2.

3. Inevitably, some compromises were necessary in the construction of the classification scheme. Work on pollution, for example, is split between three main subject headings, and some research undertaken with the objective of energy production will also be relevant to mineral extraction. But the tables illustrate the range of Departments and Research Councils funding work in particular subject areas - SERC, DOE, MAFF and DAFS, for example, all undertake work on sea bed sediments with the objective of environmental protection; DTI, NERC, MAFF and DAFS undertake work on fish cultivation with the objective of obtaining food from the sea. The tables also illustrate the dominance, over the total field, of funding for defence needs (Figure C.1). In line with the main part of the Review, Figure C.2 shows the distribution of expenditures by primary purposes.

4. In addition to the data on R & D expenditures, information on major capital facilities was also sought. These mainly take the form of ship (or offshore

structure) model testing facilities, details of which are shown in Table C.3.

Commentary

5. As is evident from the list of subject areas, marine science and technology covers a very wide range of subjects. Co-ordination across the whole range may not be required, but it is clearly necessary for all funding bodies to be aware of the interests of others within a particular subject area. Some cross-membership of research committees takes place and joint research programmes exist, but the expected winding-up of the Marine Technology Directorate of SERC in 1985 will remove from some subject areas a focus of research interest.

6. As for the provision of capital facilities, further investigation would be required, including comparisons with other countries, before any conclusions could be reached on whether there was over-provision in the UK. Different facilities have different characteristics and capabilities, but there seems cause for considering whether the present provision of facilities, as shown in Table C.3, is excessive for a shipbuilding industry whose output declined in real terms by some 30% between 1975 and 1981, even when the needs of the off-shore industry are taken into account.

ANNUAL EXPENDITURE ON R&D IN MARINE SCIENCE AND TECHNOLOGY

S U B J E C T A R E A	O B J E C T I V E							TOTAL
	Trans- port	Energy pro- duc- tion	Environ- mental protec- tion	Mineral extrac- tion	Food from the sea	Defence	Under- pinning re- search	
1 PHYSICAL OCEAN ENVIRONMENT			SERC 10 DOE 150 MAFF 3040 DAFS 340				NERC 870 SERC 10	
Circulation - including distribution & monitoring of pollution		DEn 210						
Tides	Mar.aff. 20	SERC 100 DEn 50	Mar.aff. 40				NERC 190	
Dynamics			DOE 170				NERC 1860	
Ocean - atmosphere interactions/climate	Mar.aff. 300	DEn 420	Mar.aff. 610				NERC 740	
Waves	DTI 200	DEn 240 DTI 40 SERC 180					NERC 240 SERC 110	
Chemistry							NERC 910	
Other: Sea ice/Benthic boundary layer processes		SERC 10	DOE 490				NERC 10	
Sub-total	520	1250	4850			3430	4940	14,990
2 SEA BED STUDIES			SERC 30 DOE 580 MAFF 340 DAFS 30				SERC 30 NERC 490	
Sediments								
Survey	SERC 30	SERC 30	DOE 350				SERC 30 DTI 40	
Sea bed investigations/sampling		DEn 150	SERC 60 DOE 450				SERC 30	
Other - Anchoring theory		SERC 20					SERC 20	
Sub-total	30	200	1840				640	2,710
3 UNDER SEA-BED STUDIES			SERC 20 NERC 1130				NERC 2830	
Geology/geophysics				NERC 60				
Mineral exploration/production (oil and gas)		DEn 3500 SERC 240	SERC 40					
Mineral exploration/production (other)			MAFF 10	SERC 50				
Sub-total		4910	50	110			2830	7,900
4 MARINE BIOLOGICAL STUDIES					DAM 110 DAFS 3300 MAFF 3320		DAFS 460 MAFF 1070	
Fish stock assessment					DTI 50 NERC 160 DAFS 120 MAFF 570		SERC 50	
Fish cultivation			DOE 270 MAFF 610 DAFS 480 DAM 10 NERC 1300 SERC 10				SERC 10	
Effects of pollution/waste disposal								
Ecology			DOE 20		DAFS 900 MAFF 1750		NERC 6810	
Basic biology of marine organisms							NERC 1890	
Marine mammals: conservation, exploitation			MAFF 140				NERC 600	
Other: Biogeochemistry/Marine Bacteria							NERC 390 MAFF 130	
Sub-total			2840		10280		11,000	24,120

CONFIDENTIAL

CONFIDENTIAL

OBJECTIVE

SUBJECT AREA	Trans-	Energy	Environ-	Mineral	Food	Defence	Under-	TOT
	port -	pro-	mental	extrac-	from		pinning	
		duc-	protec-	tion.	the		re-	
		tion	tion		sea		search	
5 COASTAL ZONE								
Coastal protection			MAFF 620 DOE 420 SERC 70	DOE 60			SERC 70	
Sedimentation/erosion	DTp 270		SERC 30 NERC 20 DOE 80				NERC 1300 SERC 30	
Hydrocarbon and chemical spill clearance			DTp 920					
Estuary and coastal dynamics	DTp 260		SERC 40 DOE 100				NERC 440 SERC 40	
Other: Estuarine chemistry/pollution			DOE 750				NERC 100	
Sub-total	530		3,050	60			1,950	5,590
6 SHIP, SUBMARINE, SUBMERSIBLE AND MARINE STRUCTURE DESIGN								
Materials			DEn 90 SERC 210				SERC 210	
Hydrodynamics	SERC 40 DTp 50		DEn 470 SERC 110 DTp 20		SERC 30		DTI 1800 SERC 110	
Structural Design	DTI 650 DTp 20		DEn 1990 SERC 440	DOE 80	SERC 30		SERC 440	
Propulsion	DTI 140 SERC 70		DEn 220 SERC 30				DTI 60 SERC 30	
Fabrication/construction			DEn 660 SERC 40				SERC 40	
On-board equipment	DTI 500 SERC 20		SERC 150				SERC 150	
Other: See 6(a), (d) and (e) in Table Y			DEn 200		MAFF 540 DAFC 1310		NERC 750	
Sub-total	1640	4630	80		1,910	78,770	2,540	90,620
7 SHIP, SUBMARINE, SUBMERSIBLE AND MARINE STRUCTURE OPERATION								
Navigation			SERC 20 DTp 440 DTI 800	DEn 80				
Communications	DTp 520 DTI 200		DEn 40 SERC 70				SERC 70	
Safety	SERC 40 DTp 900 DTI 100		DEn 100 SERC 100	SERC 30 DTp 60			SERC 140	
Pollution prevention				DTp 10				
Repair and maintenance			DEn 700 SERC 130	SERC 40			SERC 130	
Other: See 7(a), (c) and (d) in Table Y	DTp 30		DEn 110 SERC 250	SERC 60			SERC 250	
Sub-total	3,050	1,580	200			37,110	590	42,530
8 HUMAN HEALTH AND PERFORMANCE								
Diving			DEn 240 SERC 30 MRC 360				SERC 30	
Non-diving: Ergonomics			DEn 60 MRC 110	SERC 30				
Human safety (including hypothermia)			MRC 390	SERC 20				
Sub-total	500	740				3,140	30	4,410
TOTAL	6,270	13,310	12,910	170	12,190	122,450	25,570	192,870

CONFIDENTIAL

Table C.2

SUBJECT AREA	OBJECTIVE						TOTAL	
	Trans- port	Energy pro- duc- tion	Environ- mental protec- tion	Mineral extrac- tion	Food from the sea	Defence		Under- pinning re- search
6.a. SHIP DESIGN								
Materials								
Hydrodynamics						DTI 1800		
Structural design	SERC 40							
Propulsion	SERC 100							
Fabrication/construction	DTI 100 SERC 70					DTI 60		
Equipment	SERC 50							
Other: Fish trawl design	SERC 20 DTI 500	SERC 150			DAPS 130 MAFF 540		SERC 150	
Sub-total	880	150			1850	15,860	2,010	20,750
6.b. SUBMARINE DESIGN								
Materials								
Hydrodynamics								
Structural design								
Propulsion								
Fabrication/construction								
Sub-total						57,130		57,130
6.c. MARINE STRUCTURE DESIGN (including floating and tethered rigs and semi-submersibles)								
Materials		DEn 90 SERC 210					SERC 210	
Hydrodynamics	DTP 50	SERC 110 DTP 20 DEn 190			SERC 30		SERC 110	
Structural design	DTP 20	DEn 1790 SERC 440	DOE 80		SERC 30		SERC 440	
Propulsion		DEn 220						
Fabrication/construction		DEn 490 SERC 40					SERC 40	
Equipment								
Sub-total	70	3,600	80		60	2,800	800	7,410
6.d. SUBMERSIBLES DESIGN (MANNED AND UNMANNED)								
Materials								
Hydrodynamics		DEn 280						
Structural design	DTI 650	DEn 200						
Propulsion	DTI 40	SERC 30					SERC 30	
Fabrication/construction		DEn 170						
Other - not defined		DEn 200						
Sub-total	690	830					30	
6.e. Unspecified						2,980	750	3,730
TOTAL	1,440	4,630	80		1,910	78,770	3,540	90,220

CONFIDENTIAL

CONFIDENTIAL

CONFIDENTIAL

OBJECTIVE

SUBJECT AREA	Trans-	Energy	Environ	Mineral	Food	Defence	Under-	TOTAL
	port	pro- duc- tion	mental protec- tion	extrac- tion	from the sea		pinning re- search	
7.a. SHIP OPERATION								
Navigation	SERC 20 DTP 440 DTI 800							
Communications	DTP 520 DTI 200							
Safety	DTP 860 DTI 100 SERC 40		DTP 60 SERC 10				SERC 40	
Pollution prevention			DTP 10					
Repair and maintenance								
Other: Hovercraft stability study	DTP 30							
Sub-total	3,010		80			24,580	40	27,710
7.b. SUBMARINE OPERATION								
Navigation		Den 10						
Communications								
Safety	DTP 40							
Pollution prevention								
Repair and maintenance								
Sub-total	40	10				11,940		11,990
7.c. MARINE STRUCTURE OPERATION								
Communications		Den 20						
Safety		Den 100 SERC 100	SERC 20				SERC 100	
Pollution prevention								
Inspection, repair and maintenance		Den 700 SERC 340	SERC 100				SERC 340	
Other: not defined		Den 60						
Sub-total		1,320	120				440	1,880
7.d. SUBMERSIBLES OPERATION (MANNED AND UNMANNED)								
Navigation		Den 70						
Communications		Den 20 SERC 70					SERC 70	
Safety								
Pollution prevention								
Repair and maintenance								
Other: control/not defined		Den 50 SERC 40					SERC 40	
Sub-total		250				590	110	950
TOTAL	3,050	1,580	200			37,110	590	42,530

CONFIDENTIAL

CONFIDENTIAL

Footnotes to tables C.1 and C.2

- i. 'underpinning research' covers work of a fundamental nature with no immediate single objective, but with potential relevance in the longer term to some or all of the other stated objectives.
- ii. figures were as far as possible based on 1983-84 estimated outturns, to the nearest ten thousand pounds, and full economic costs;
- iii. only that work funded through the Science Vote is included in Research Council figures; work commissioned by Departments with Research Councils is included in the Departments' entries.
- iv. expenditure on fish utilisation, freight handling and freight movement through ports was regarded as falling outside the scope of marine science and technology. Research undertaken by the Hydrographer of the Navy was not included because it could not be identified in financial terms. The management costs of the programme at the Marine Technology Support Unit at Harwell were similarly excluded from the Department of Energy's return. Some of the geological studies funded by the Department of Energy Offshore Energy Technology Board (and largely undertaken by the Natural Environment Research Council) were excluded on the grounds that they fall outside the Frascati definition; if these were added DEN's total financial commitment to the field would be some £20 million per annum, ie about twice the figure quoted.

CONFIDENTIAL

TABLE C.3 **CONFIDENTIAL**
 Summary of UK Ship and Offshore Structure Model Testing Facilities

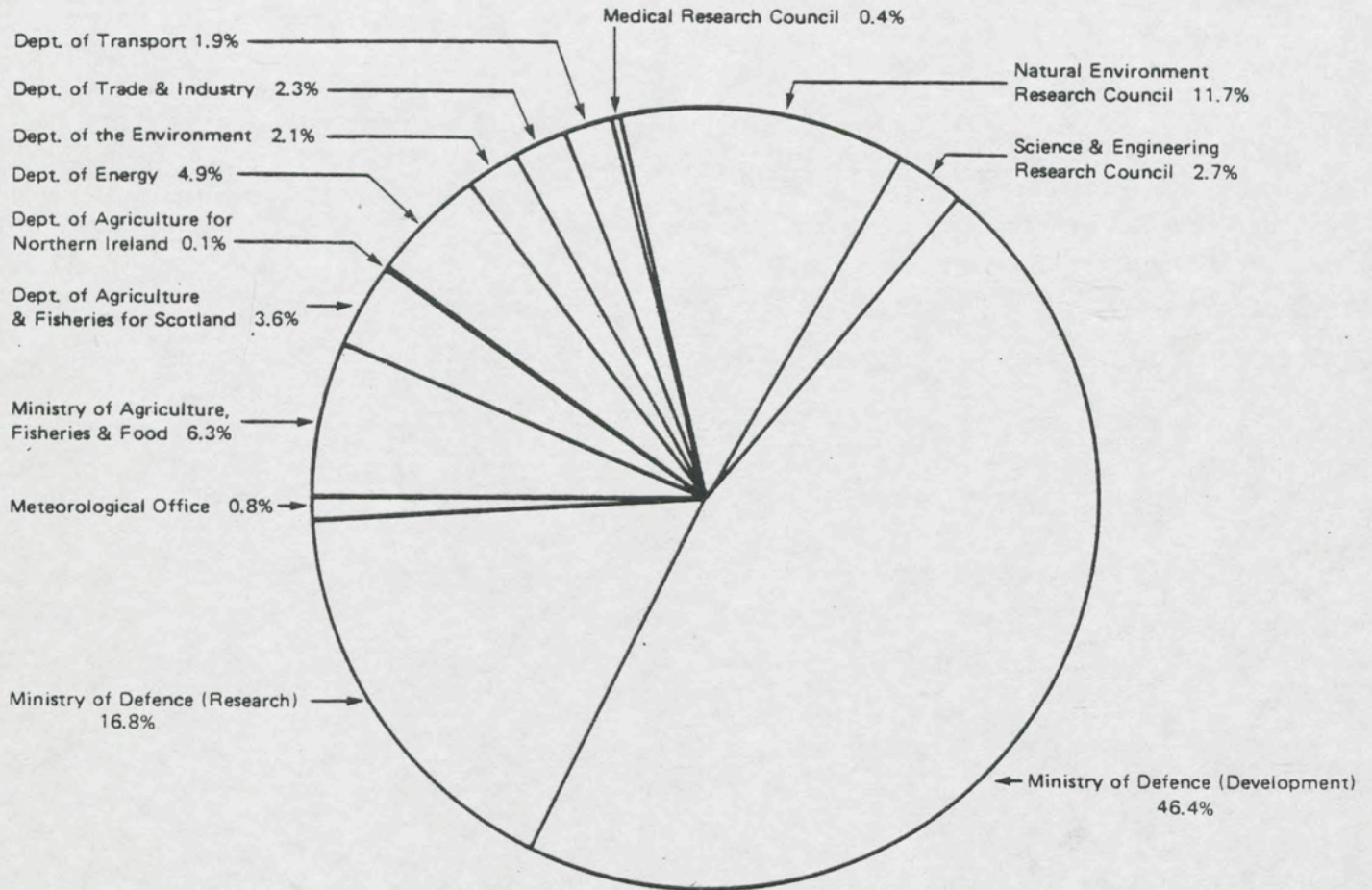
Organisation	Tow- ing tank	Cavita- tion tunnel	Seakeep- ing & manoeuv- ring	Seakeep- ing only	Manoeuv- ring only	Circu- lating water tank	Multi- directional wave tank
NMI	3	2	1*		1	1	
British Ship- builders Hydrodynamics	1						
British Hover- craft Corporation	3	1	1	1			
Glasgow Univ.	1						
Haslar - AMTE	2	2	1			1	
Newcastle University	1	1					
Southampton University	2						
Vosper -Thornycroft	1	1					
H R Ltd							1
Heriot-Watt University				1			
University College, London	1						
Sea Fish Authority, Hull						1	
Wavepower Limited, Southampton				2			
TOTALS	15	7	3	4	1	3	1

* To be modified to provide a multi-directional wave-tank, which will be commissioned in autumn 1984.

CONFIDENTIAL

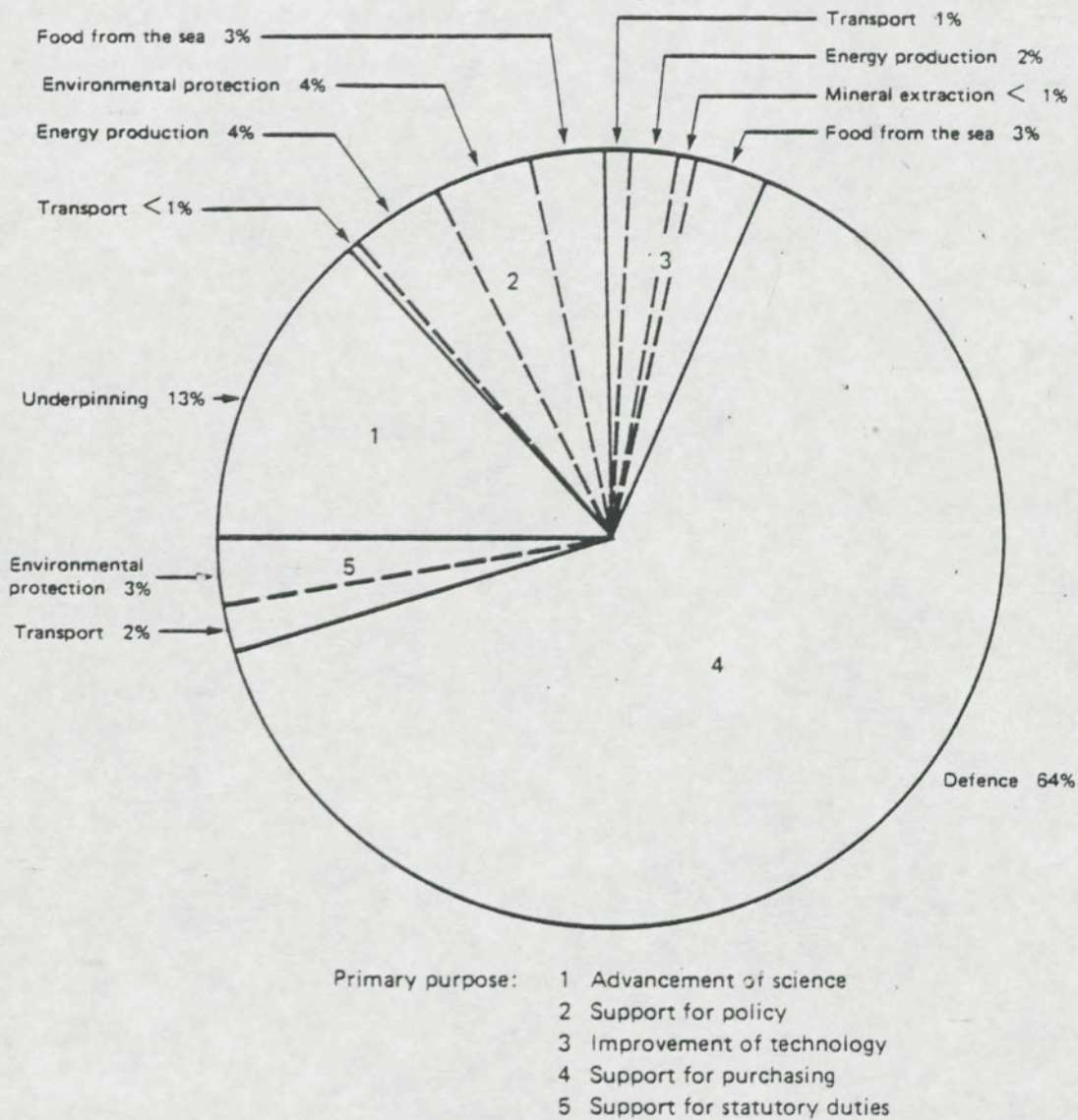
Figure C.1.

GOVERNMENT EXPENDITURE ON MARINE SCIENCE AND TECHNOLOGY
BY FUNDING DEPARTMENT OR RESEARCH COUNCIL
1983/84



CONFIDENTIAL

GOVERNMENT FUNDING FOR MARINE SCIENCE AND TECHNOLOGY
BY PRIMARY PURPOSE
1983/84



CONFIDENTIAL

ANNUAL REVIEW OF GOVERNMENT FUNDED

RESEARCH AND DEVELOPMENT

1984

PART II

Cabinet Office
July 1984

CONFIDENTIAL

ANNUAL REVIEW OF GOVERNMENT FUNDED R & D

PART II

R & D EXPENDITURES OF INDIVIDUAL DEPARTMENTS

CONTENTS	Page No
Introductory notes	1
Ministry of Agriculture, Fisheries and Food	2
Ministry of Defence	5
Department of Education and Science	12
University Grants Committee	16
Agricultural and Food Research Council	17
Economic and Social Research Council	25
Medical Research Council	29
Natural Environment Research Council	37
Science and Engineering Research Council	46
Department of Energy	55
United Kingdom Atomic Energy Authority	58
Department of the Environment	59
Department of Health and Social Security	68
Health and Safety Commission	72
Home Office	75
Overseas Development Administration	77
Department of Trade and Industry	79
Department of Transport	91
Northern Ireland Departments	96
Scottish Departments	98
Other Departments	104
British Library	104
HM Customs and Excise	104
Department of Employment	104
Foreign and Commonwealth Office	105
Forestry Commission	105
Inland Revenue	107
Office of Population Censuses and Surveys	107
Ordnance Survey	107
Welsh Departments	107

CONFIDENTIAL

INTRODUCTORY NOTES

1. This section of the Review contains, for each Department or other organisation with a substantial R & D programme;
 - i. a statement of the objectives of the R & D programme and its principal features;
 - ii. (in the "a" tables) details of the subjects covered by the programme, the primary purpose for which each component was funded and the expenditure in cash terms for the years 1981/2 to 1986/7 (the basis of which is set out in paragraph 1.5 of Part I);and iii. (in the "b" tables) the distribution of funding among different classes of recipient. These tables provide a measure of the work carried out within each organisation since the "intra-mural" component of expenditure includes receipts from other bodies, eg Departments' commissions with Research Councils. These are then identified and subtracted from the other expenditures in order that final totals in both tables should match.
2. Brief details of minor R & D programmes funded by Departments are also included.
3. In the "a" tables, the primary purposes for which the work is being funded are indicated by a numerical code viz:
 1. Advancement of science
 2. Support for policy formulation and implementation
 3. Improvement of technology
 4. Support for purchasing decisions
 5. Support for statutory duties
 6. Support for other activities
4. The use of the symbol .. in the tables means less than £50,000, but not zero.
5. Totals between the "a" and "b" tables may not tally because of rounding.
6. Two Research Councils (AFRC and NERC) have asked for the inclusion of a "c" table showing work commissioned with them by Government Departments. These are not used to calculate the summary tables in Part I of the Review.

CONFIDENTIAL

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD (MAFF)

All MAFF's R & D has the following common objectives:

- i. to advance scientific knowledge relevant to agriculture (including horticulture), fisheries and food in order to increase the efficiency of industry;
- ii. to safeguard and improve the quality of food for the community; and
- iii. to protect the environment and prevent adverse social effects.

Within these general objectives are more specific aims:

- i. sponsorship and support of UK industry
 - a. to maintain and improve the competitive position, efficiency and productivity of the UK agriculture, food and fisheries industries;
 - b. to reduce imports and to increase exports;
 - c. to maintain and improve the quality (including nutritional quality) of fresh and processed foods;
 - d. to reduce wastage;
 - e. to ensure that the producer has available to him appropriate structures, machines, and mechanisation systems and that knowledge is available to use these in the most efficient and effective manner;
 - f. to develop new fisheries from presently under-exploited or un-exploited stocks with commercial potential.
- ii. to aid Government policy and decision making

-in particular to enable the UK Government to negotiate internationally in respect of fish stocks subject to EC agreements with third countries, and in respect of such sensitive subjects as whales and other cetaceans and seals.

CONFIDENTIAL

CONFIDENTIAL

iii. consumer and environmental protection

- a. to protect the safety of food;
- b. to minimize any adverse impact of the agriculture and food industries on the environment;
- c. to protect life and property on both urban and agricultural land against flooding and waterlogging.

iv. conservation

- a. to avoid danger to humans and reductions in the value of UK landings or reduction in the stocks due to fish disease and parasitic infection;
- b. to protect and improve the health and welfare of farm stock;
- c. to conserve the stocks and manage the fishery in respect of those species of fish which are of commercial importance to the UK fishing industry;
- v. to support necessary basic research in support of the other objectives.

CONFIDENTIAL

Table 1a

MINISTRY OF AGRICULTURE FISHERIES AND FOOD
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Food science	1	..	..	..	..	..	..
	2	1.2	1.5	1.6	1.5	1.6	1.6
	3	0.2	0.3	0.3	0.3	0.3	0.3
Agriculture	5	0.1	0.1	0.1	0.1	0.1	0.1
	2	2.1	2.2	2.4	2.5	2.6	2.7
	3	72.4	76.4	81.1	83.9	86.5	89.8
Fisheries	5	6.5	6.9	7.3	7.6	7.8	8.2
	2	4.8	4.9	5.2	6.2	6.3	5.8
	3	4.6	4.7	4.9	5.9	6.0	5.5
Food	5	3.1	3.2	3.3	4.0	4.1	3.7
	3	8.2	9.7	9.9	10.2	10.4	10.8
Flood protection and drainage	5	0.9	1.2	1.3	1.4	1.4	1.5
	6	2.8	2.8	3.0	3.1	3.2	3.3
Royal Botanic Gardens, Kew	6	2.8	2.8	3.0	3.1	3.2	3.3
TOTAL		106.8	113.9	120.3	126.5	130.5	133.2

Table 1b

MINISTRY OF AGRICULTURE FISHERIES AND FOOD
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	57.2	59.2	62.5	67.3	69.9	70.8
Research Councils	46.7	51.0	53.5	54.9	56.0	57.6
Other Government departments	0.7	0.7	0.8	0.7	0.7	0.7
Universities	0.5	1.4)				
Private industry	0.3	0.6)				
Public corporations	..	..)		
Research associations	3.2	3.6)				
Overseas	..	..)	8.2	8.5	8.8	9.1
Non-industrial research institutes	0.1	0.1)				
Professional and learned societies	..	..)		
Persons	..	..)		
Others	1.9	1.9)				
<u>less</u> Receipts	3.7	4.8	4.7	4.9	5.0	5.1
TOTAL	106.8	113.9	120.3	126.5	130.5	133.2

CONFIDENTIAL

MINISTRY OF DEFENCE (MOD)

The R & D programme of MOD has the objective of meeting the needs of the Armed Services for equipment and weapons in a timely and cost effective manner. The research programme is aimed at producing an underlying basis of scientific and technological expertise for application in the short or longer term in the selection, development, production and operation of weapon systems and equipments. Development work, although drawing on the knowledge and expertise obtained from research, is directly related, item by item, to the procurement of specific military equipments, such as particular aircraft or radars, and is the essential forerunner to the production of those equipments.

Research Programme

The research programme is undertaken both intramurally in MOD establishments, and extramurally as funded research in industry, universities and other institutes of higher education. The contributions of these separate sources are brought together into a coherent programme through an integrated management structure within which responsibility for specific fields is delegated to relevant MOD R & D establishments. Within the broad aims of providing the foundations for defence science and technology the research programme has a number of interrelated and significant facets:

- i. Seed corn research. Although MOD makes use of contributions from universities and other institutes of higher education, it is found to be essential for R & D establishments to have an effective programme of 'seed corn' research to form a foundation for future innovation. This is maintained at a level equal to at least 5% of the defence scientific effort available within them.
- ii. Applied research. This is closely co-ordinated with research undertaken by industry on a private venture basis, or with support from other Government sources, and has the following objectives:
 - a. provision of the basis for impartial scientific and technological advice to the Armed Services in the determination of equipment policy and in the formulation of staff targets and staff requirements

CONFIDENTIAL

- CONFIDENTIAL
- b. formulation of weapon and equipment systems concepts
 - c. the evaluation of the likely contributions of proposed weapons and equipments in future operational scenarios, including analysis of the benefits of incorporating advances in technology
 - d. technical input to equipment purchasing decisions
 - e. advice and assistance to industry in application of new technologies in defence equipment
 - f. provision of the basis for the formulation of statutory and safety rules and regulations, such as airworthiness and scientific advice to the Ordnance Board on the safety of munitions.

The research programme covers a wide range of scientific disciplines and technologies. Priorities within it are reviewed annually having regard for the Services' latest assessment of their needs, the timescales of application opportunities, and the varying prospects of making significant progress in different fields. The current trend is broadly to place emphasis on weapons, sensors, under-sea warfare, electronic components and electronic systems, with less attention being given to platforms such as aircraft, ships and tanks which have relatively long life and for which equipment can be up-dated. The major funding contribution of MOD to the Alvey Information Technology programme reflects the importance ascribed by MOD to this area of work. Other disciplines of wide ranging significance for defence equipment include human factors and new materials. Collaborative links exist with our Allies in most active fields of research.

Towards the "development" end of the research spectrum falls the Technology Demonstrator Programme, built up of items of work where a need is seen to prove, before commitment to development and production, that a scientific or technological concept can be exploited in engineering terms at an acceptable cost and within the required timescale. Over the past year, MOD has been placing increased emphasis on such activity and further aeroengine work in this category has, for example, been launched recently. Demonstrator work is undertaken, for the greater part, in industry, on a shared funding basis.

CONFIDENTIAL

Development Programme

Development work is carried out predominantly in industry. Current development programmes cover the whole spectrum of MOD requirements. On the weapon side they include the airborne defence suppression weapon (ALARM), further developments of Rapier and Seawolf and, in the context of international collaboration, anti-tank weapons (with France and the Federal German Republic) and the short range air-to-air missile (also with the Federal German Republic). Important communications projects include the Skynet IV communication satellite and the introduction for air defence purposes of the Joint Tactical Information Distribution System. So far as platforms are concerned, major projects include the Harrier GR5 offensive support aircraft, the Type 23 Frigate and main battle tank improvements (including thermal imaging). The EH101 helicopter being developed in collaboration with Italy has importance not only in anti-submarine warfare, but also in the civil market; both DTI and industry are contributing to the funding of its development. MOD policy continues to be to devolve to industry as much as possible of the project support role previously undertaken by the R & D establishments, with their continuing involvement limited where practicable to the initial conceptional aspects, independent technical assessments and advice on proposals from industry, performance evaluation, and safety and statutory aspects (eg airworthiness). The establishments will, however, have also a continuing role in 'fire brigade' action when unanticipated problems arise in development or in service.

Spin Off

Although the remit of the MOD R & D programme is to obtain the most cost effective equipment and systems for our Armed Services, the Department is strongly aware of the potential value of its research to industry at large. There are, moreover, many instances where advances initiated for defence purposes have been exploited successfully by civil industry. Examples range from new materials and electronic devices to advanced aerodynamics application to civil transport aircraft and jet engines. Nevertheless, there appears to be scope for improving the effectiveness of the spin-off process and to this end arrangements are being made whereby venture capital groups will

CONFIDENTIAL

have better access to the R & D establishments; means are being considered also whereby spin-off from work undertaken by MOD contractors can be further encouraged.

Support to DTI

The MOD also carries out civil work on repayment terms, the principal element of which is civil aerospace and gas turbine research funded by the Department of Trade and Industry.

CONFIDENTIAL

CONFIDENTIAL

Table 2.1a

MINISTRY OF DEFENCE (Research)
 SUBJECT AREAS AND PRIMARY PURPOSES
 £millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Aerodynamics, Structures and Materials	4	27.6	22.6	22.2	25.6	25.9	26.5
Gas Turbines	4	16.2	17.4	13.2	13.8	14.1	14.4
Rocket Propulsion	4	8.6	9.6	9.7	13.1	14.2	14.1
Military Vehicles & Army Engineering Equ	4	9.1	11.9	12.9	17.0	16.6	17.0
Ships and Submarines	4	22.2	23.5	24.4	29.3	29.5	30.1
Guided and Air Launched Weapons	4	24.3	32.5	32.7	40.7	41.4	42.3
Undersea Warfare	4	23.4	26.4	29.4	34.4	35.4	36.1
Conventional Weapons, Armament & Pyrotecs	4	25.6	30.7	32.1	40.4	40.8	41.6
Chemical & biological Defence	4	7.6	9.0	10.8	14.4	16.8	15.0
Electronic Components	4	26.4	27.5	28.1	32.2	33.2	34.0
Electronic Systems	4	41.4	45.1	53.5	62.5	63.4	64.6
Navigation & Avionics	4	21.0	27.6	26.9	29.6	30.1	30.8
Space	4	0.6	0.9	2.0	2.9	3.6	3.7
Other Research	4	9.3	20.1	31.3	36.6	42.6	49.7
TOTAL		263.3	304.8	329.2	392.3	405.7	419.8

CONFIDENTIAL

CONFIDENTIAL

Table 2.2b

MINISTRY OF DEFENCE (Development)
 SUBJECT AREAS AND PRIMARY PURPOSES
 £millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
SEA SYSTEMS							
Ships	4	66.3	71.2	77.5	79.5	75.6	69.6
Weapons	4	214.9	190.8	261.2	301.1	326.7	314.0
LAND SYSTEMS							
Guns, Small Arms, Chemical Defence Store	4	12.6	16.1	17.3	21.9	13.7	15.9
Ammunition, Mines and Explosives	4	23.1	17.8	30.0	10.2	15.4	14.6
Fighting Vehicles	4	36.2	44.7	44.9	61.3	65.4	62.9
Load Carrying Vehicles	4	3.3	3.6	7.6	7.7	6.7	6.8
Engineering Equipment	4	0.7	1.3	1.3	6.5	8.1	9.9
Guided Weapons, Electronic Equip and Ins	4	160.5	127.8	142.7	164.3	157.5	158.8
Other Stores	4	0.1	0.1	0.4	0.2	0.2	0.2
AIR SYSTEMS							
Aircraft, Aero-engines & Air Equipment	4	299.4	271.4	313.3	320.5	366.4	425.6
Guided Weapons & Electronic Equipment	4	213.7	189.3	280.1	262.5	280.0	287.1
CENTRAL STAFF SUPPORT							
IM Development and Other Support	4	393.6	461.7	399.2	419.0	450.2	488.6
TOTAL		1424.4	1395.8	1575.5	1654.8	1766.0	1854.0

Table 2.3a

MINISTRY OF DEFENCE (Other Costs)
 SUBJECT AREAS AND PRIMARY PURPOSES
 £millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Central Staff Element	4	2.9	3.0	2.9	3.0	3.1	3.2
Superannuation	4	54.2	61.2	65.0	67.1	69.7	71.4
TOTAL		57.1	64.2	67.9	70.1	72.8	74.6

CONFIDENTIAL

CONFIDENTIAL

Table 2b

MINISTRY OF DEFENCE
DISTRIBUTION OF FUNDING
fmillions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	559.1	644.5	619.8	680.9	722.4	777.4
Research Councils	0.1	0.1	0.1	0.3	0.4	0.0
Other Government departments	5.4	29.1	14.9	36.2	39.9	39.1
Universities	7.3	8.1)				
Private industry	1165.8	1019.2)				
Public Corporations	22.6	16.1)				
Research Associations	1.4	1.8)	1414.9	1486.5	1574.1	1626.3
Overseas	76.5	105.8)				
Non-Industrial Research institutes	0.8	0.4)				
Others	0.5	0.9)				
less Receipts	95.0	61.1	77.0	-86.7	-92.3	-94.4
TOTAL	1744.6	1764.8	1972.7	2117.2	2244.6	2348.4

CONFIDENTIAL

DEPARTMENT OF EDUCATION AND SCIENCE (DES)

The DES's direct support for research is generally allocated to areas of policy priority. The aim of the programme is to obtain from research information which will:

- i. help to guide policy decisions which need to be taken;
- ii. help to improve the quality of the educational process in areas of policy concern; or
- iii. facilitate, or evaluate the effects of, the implementation of policy decisions.

The aims of the DES research programme are therefore closely linked with the Department's overall policy objectives.

In addition to its own research programme, DES has also promoted research activity via the Further Education Unit and the Schools Council; the Schools Curriculum Development Committee and the Secondary Examinations Council, which have succeeded the Schools Council, can be expected to continue to sponsor research and development in their areas of responsibility.

The DES Science Budget is one of the main sources of public funds for the support of civil scientific research (the other major source being the grant made to the universities through the University Grants Committee). It is the sum of the annual grants-in-aid paid by the Secretary of State for Education and Science (in exercise of his responsibilities under the Science and Technology Act 1965) to the Agricultural and Food Research Council (AFRC), Medical Research Council (MRC), Natural Environment Research Council (NERC), Science and Engineering Research Council (SERC) and the Economic and Social Research Council (ESRC); and to the British Museum (Natural History), the Royal Society and the Fellowship of Engineering.

The purpose of the Science Budget is to develop the natural and social sciences, including engineering, to maintain a fundamental capacity of research and scholarship and to support relevant higher education at the post-graduate

CONFIDENTIAL

level. Research ranging from the most fundamental through to work with a practical application is supported. The Research Councils, which are chartered bodies, support these objectives in various ways. They provide for research by making grants to research workers in universities or elsewhere; and they directly operate research establishments. These may be units associated with universities, or central facilities for the use of universities, or separate institutes which carry out research programmes agreed by the Councils. The Councils participate in international scientific programmes where they see this as the most effective way of undertaking research in a particular field. They are responsible for the UK subscriptions to, and participation in the management of, a number of international research centres/facilities (eg the European Organisation for Nuclear Research (CERN), the European Molecular Biology Laboratory and the International Agency for Research on Cancer) which extend UK research capacity. They also support students undertaking post graduate training, and research fellows.

The Secretary of State is advised on his responsibilities for civil science by the Advisory Board for the Research Councils (ABRC). This advice includes recommendations on the distribution of the Science Budget among the various research bodies. The ABRC membership includes representatives of the Government Departments spending substantial sums in commissioned research in support of their departmental objectives with AFRC and NERC.

Universities' General Expenditure on R & D

Some university expenditure on R & D is funded by specific research grants or contracts, from Research Councils, Government departments, industry, and a variety of other bodies. Additionally, universities support research activity from their own general funds, which are received primarily from grants made by the University Grants Committee (UGC), as well as from student fees and other sources. The UGC allocates resources to universities in the form of block grants covering both research and teaching, within the general principle that university staffs should normally be concerned with both these purposes. In the science fields the intention of the UGC input into research is that it shall provide the basic "floor" of research capability in university departments which is necessary if speculative ideas are to be generated and developed to the stage where they may attract support from external sponsors (the combination

CONFIDENTIAL

CONFIDENTIAL

of these two types of money constitutes the "dual support system"). Since universities' research activities and expenditure cannot be clearly distinguished, and thus the UGC's objectives in funding that expenditure cannot be clearly distinguished from its wider objectives in funding the university system, the assignment of resources to research for the purposes of this review is based on a notional attribution of universities' departmental and central expenditure between research and teaching.

CONFIDENTIAL

Table 3a

DEPARTMENT OF EDUCATION AND SCIENCE
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
General educational research	1	6.1	6.8	7.1	9.4	9.7	9.3
Council for Educational Technology	1	0.5	0.4	0.5	0.5	0.5	0.5
National Foundation for Educational Research	1	..	..	..	..	..	..
Schools Council and two successor bodies	1	1.5	1.4	1.0	1.3	1.3	1.3
OECD - Centre for Education Research and Innovation	1	0.1	0.1	0.1	0.1	0.1	0.1
Other Costs (Total)	6	..	..	..	..	..	..
TOTAL		8.3	8.8	8.8	11.4	11.7	11.3

Table 3b

DEPARTMENT OF EDUCATION AND SCIENCE
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	0.1	0.2	0.2	0.2	0.2	0.2
Universities	2.5	2.1)				
Research associations	0.1	0.1)				
Overseas	0.1	0.1)				
Non-industrial research institutes	0.9	1.3)	8.8	11.5	11.7	11.2
Professional and learned societies	0.2	0.0)				
Persons	..	..)		
Others	4.9	5.6)				
<u>less</u> Receipts	0.2	0.4	0.2	0.2	0.1	..
TOTAL	8.3	8.8	8.9	11.4	11.7	11.3

CONFIDENTIAL

Table 4a

CONFIDENTIAL

UNIVERSITY GRANTS COMMITTEE ETC(1)
SUBJECT AREA AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Medical research(2)	1	28.0	31.0	32.0	33.0	34.0	35.0
	2	92.0	104.0	108.0	111.0	115.0	117.0
Social sciences	1	83.0	92.0	97.0	97.0	100.0	102.0
Natural sciences	1	197.0	214.0	223.0	229.0	236.0	240.0
Engineering and technology	3	84.0	94.0	98.0	100.0	103.0	106.0
TOTAL		484.0	535.0	555.0	570.0	588.0	600.0

(1) The figures under the heading 'UGC etc', here and elsewhere in this document, are estimates of expenditure through universities own funds, but originating from a central government source. The great majority of this expenditure is funded by capital and recurrent grants from the UGC (or, in the case of universities in Northern Ireland, from the Department of Education of Northern Ireland), but it also includes a share attributed to fees from home students, most of which is refunded by DES to the Local Education Authorities which paid the fees.

(2) The following points should also be noted:

- i. The figures are shown rounded to the nearest £million, but since they are estimates they cannot be considered accurate to this level.
- ii. Of a total UGC support for research of some £600 million in the year 1982/83 (including around £65 million on humanities research which is excluded from the table above), the approximate breakdown by type of expenditure is estimated as follows:

	£ million
Academic salaries	- 154
Wages	- 60
Consumables	- 20
Central expenditure attributed to "internal" research	- 199
Central expenditure attributed to research grants and contracts	- 126
Capital expenditure - land and buildings	- 2
Capital expenditure on equipment	- 41
Total	- 601

Table 4b

UNIVERSITY GRANTS COMMITTEE
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Universities	484.0	535.0	555.0	570.0	588.0	600.0
TOTAL	484.0	535.0	555.0	570.0	588.0	600.0

CONFIDENTIAL

AGRICULTURAL AND FOOD RESEARCH COUNCIL (AFRC)

1. The primary aims of AFRC are the advancement of scientific knowledge relevant to agriculture, horticulture and food and the application of this knowledge to increase the efficiency of related industries, without detriment to the environment or to the welfare of farm animals.
2. The AFRC draws approximately half its funds from the Science Budget, with a similar sum from MAFF for commissioned research and about five per cent from other sources including industry. MAFF commissioned research, and that funded by industry, is largely applied. DES funds are devoted to strategic research aimed at increasing knowledge within scientific areas that contribute to an understanding of biological systems and on which agricultural advances may ultimately be based, including wholly novel production systems.
3. The AFRC advises the Department of Agriculture and Fisheries for Scotland on matters concerning the seven grant aided agricultural research institutes in Scotland financed by the Department and which, together with the AFRC institutes and those it grant aids, form the Agricultural and Food Research Service.
4. The AFRC has recently changed the emphasis of its research to increase the investment in university research and in food research at the expense of research in other parts of its programme. To give effect to this change and to enable priorities to be assessed more effectively, its Head Office has been restructured, three Research Committees have been appointed and an additional Research Grants Board set up.
5. AFRC Units in universities have progressively been closed, as they were found to be relatively inflexible and capital-intensive; university research will in future be supported in University Groups appointed to support identified programmes of work for renewable 5 year periods, and Link Groups will be fostered, where appropriate, to bring together cognate research in institutes and universities. Six University Groups and two Link Groups have

CONFIDENTIAL

already been formed. Funds available for short term university research will be increased; they will be disbursed on the advice of the three Research Grants Boards, who receive grant applications from scientists in universities for research they consider important and relevant to AFRC's aims. The Research Grants Boards, consisting mainly of independent academic members, award grants on their merits, and in addition may solicit applications in areas deemed to be of high priority.

6. Council is advised on objectives and priorities by its three Research Committees (Plants and Soils Research Committee, Animals Research Committee and Food Research Committee) whose membership includes scientists, industrialists and the chairman of the appropriate Research Grants Board.

(i) The Plants and Soils Research Committee is concerned with research relevant to the breeding, cultivation, growing and protection of crops, and agricultural engineering relevant to these interests. It considers priorities in four activity areas.

(a) Plant Breeding is carried out in order to improve the quality and increase the productivity of agricultural and horticultural crops by the production of improved genetic material either as finished varieties or as parental material for other breeders to incorporate in finished varieties. Programmes in several crops are based on basic genetics and cytogenetics research that together provide information for advances in breeding technology, and on the genetic structure of crop species to improve precision in conventional breeding programmes. Tissue culture techniques provide alternative approaches for plant breeding, and recently much effort has been devoted to genetic manipulation (cf para 7 below).

(b) Crop Protection research is intended to remove constraints to crop productivity and quality imposed by pests, pathogens and weeds without adversely affecting the natural environment. Understanding of the biology of pests, disease organisms and weeds is essential for effective control measures, and research is necessarily devoted to this area. In the study of the establishment and development of fungal and bacterial disease, more precise immunological and biochemical procedures will be applied to studies of host-pathogen genotype interactions than have previously been available. For elucidating pest movement patterns, electronic methods of detecting and following insects in flight using shortwave radar and infra-red emitters have been developed and are in use experimentally. Naturally occurring compounds

are studied for their potential in controlling behaviour and numbers of pest insects.

(c) Soils and Crop Nutrition research provides for the mapping and description of soils in order to understand their genesis and spatial distribution, and to aid identification and amelioration of the physical and chemical constraints to crop production posed by soil factors. Quantitative approaches are increasingly used, both in the laboratory and in field experiments where micro-electronic techniques have been devised for precise measurements of soil properties. Modelling studies of solute movement and related processes in soil are providing information of value to reduce the levels of fertiliser needed for efficient crop production. Soil microbiology is an important area of study in soil metabolism and organic waste breakdown and may provide for biological control of root-infecting organisms. The genetic regulation of nitrogen fixation in free-living bacteria and in legume symbionts is being investigated with the aim of reducing the usage of nitrogen fertiliser.

(d) Crop production research aims to understand plant processes and establish growing systems for crops so that harvestable yields of defined quality are limited only by the genetic constitution of the crops concerned. Within this research activity area, basic research on photosynthesis forms a co-ordinated programme involving several institutes and universities, the objective of which is to determine which steps limit the total process under different environmental conditions. The photosynthesis programme is complemented by a wide range of work on carbon assimilation, partition and utilisation in many crops at all levels of organisation. Increasingly attention is being paid to the part plant growth substances play in controlling different stages of crop growth and in the partition and deposition of assimilates.

(ii) The Animals Research Committee determines objectives and priorities in the AFRC's research programmes concerned with animal breeding, animal diseases, animal nutrition and production; and research on agricultural engineering relevant to these interests.

(a) Animal breeding. The objectives of the animal breeding programme are to study the physiology of reproduction and methods of reproductive and genetic improvement and manipulation which, by exploiting the diversity of farm livestock, will increase efficiency of output for the future requirements of agriculture and food production. Molecular biology has recently been added to the more traditional aspects of animal breeding within the programme. New work

seeks to identify gene products in poultry as a prelude to genetic manipulation.

(b) Animal disease research aims to improve animal health and welfare by formulating methods of control of the important diseases of farm animals in Britain that cause loss and/or pain and of exotic infections that could cause loss to British agriculture. Research encompasses a wide range of subjects from simple etiological studies to the use of sophisticated molecular genetic techniques. Of particular importance are the multifactorial infectious diseases that cause significant livestock losses; these have to be investigated by multidisciplinary teams set up for the purpose and using high grade experimental facilities. A joint programme with MRC on scrapie disease encompasses central nervous system degenerative conditions in general.

(c) Animal Nutrition research seeks to understand the basic processes of nutrition, digestion and metabolism of farm livestock in relation to the chemical and physical constituents of animal feeds and to predict the response of animal production systems to nutrient intake. In order to understand the functioning of the rumen in farm livestock, the genetics of rumen flora, the metabolism of essential fatty acids, neuroendocrine function in metabolism and the utilisation of absorbed nutrients are currently studied. Monoclonal antibodies are being made for identifying rumen bacteria, and DNA transfer between individual species of rumen micro-organisms is investigated. The chemical structure of plant cell walls is studied because of its importance in understanding breakdown in the rumen.

(d) Animal Production. The objectives of the animal production programme are to conduct research into aspects of production and to combine the components into efficient new and improved systems of food production from the varied vegetation and climatic regions of the UK. Concern with animal welfare is an essential component of AFRS animal production research; programmes studying motivational systems in farm animals, including poultry, involve work on appetite, seasonal and maternal behaviour, and group interactions in natural outdoor environments and in animal pens. A principal objective of research in animal production has been the understanding of the control of growth by the balance of hormones, and this has reached the stage where it is possible experimentally to manipulate hormone levels immunologically to enhance growth.

(iii) The Food Research Committee advises on the objectives and priorities in the expanding food and nutrition programme of the AFRS. Research into the

physicochemical and biophysical properties of proteins and polysaccharides is being expanded, with particular reference to the effects of their functional properties in food processing behaviour and the quality of food. This, together with research into food process engineering, will lead to improvements in the operation of existing processes and will provide information for the development of new technology for novel products of enhanced quality. Improvements in food safety and quality are sought in a programme of research into rapid, modern methods of identifying microbes and microbial products. An increasing effort is being devoted to the research effort in human nutrition which is maintained in collaboration with MRC: emphasis in this programme is placed on nutrition related diseases, food acceptability and intake and maternal and child nutrition.

7. Two important aspects of the Council's work span several research areas.

Agricultural Engineering is not identified as a separate research activity because it usually contributes to a specific commodity or area of work. To ensure that opportunities are not missed in such a wide ranging activity, Council and its Research Committees are advised by an Agricultural Engineering Advisory Committee. The objective of the AFRC engineering research programme is to apply engineering principles and methods to the improvement of farm buildings, machines and processes. There is increasing use of electronic engineering and computing and many improvements in design of building ventilation systems, in grass, grain and hop drying, in control engineering and in electrostatic spraying stem from computer simulation models constructed for the purpose.

Biotechnology forms a major commitment of the AFRC programme, and a member of the Council's staff is the present chairman of the Inter Research Council Co-ordinating Committee on Biotechnology (IRCCCOB) which co-ordinates the activities of the Research Councils in this area. The major part of the AFRC's programme, that on genetic manipulation of crop plants, was critically reviewed in 1983, 5 years after its inception. As a result, emphasis is changing from research on the isolation and characterisation of plant genes, the construction of vectors for transforming plant cells and the regeneration of transformed cells to research on identification of the opportunities for plant improvement by genetic manipulation and the characterisation of these processes at the biochemical level. The conventional areas of plant biotechnology, aimed at providing biological control of organisms, degradation of organic wastes (eg straw or animal waste), and micropropagation of horticultural plants, will

CONFIDENTIAL

continue. The Agricultural Genetics Company was formed in 1983 to exploit commercially the findings from these areas of research. Genetic manipulation now forms a major component of several aspects of animal science. Antigens to several animal disease viruses are being cloned with the objective of producing safer and novel vaccines. Monoclonal antibodies are playing an increasing role in the study of disease organisms of both animals and plants, for the identification of organisms and diagnosis of disease. The Monoclonal Antibody Centre established at the Institute of Animal Physiology is stimulating a wide range of plant and animal studies.

CONFIDENTIAL

Table 5a

AGRICULTURAL AND FOOD RESEARCH COUNCIL
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA		PP 1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Plant breeding	1	2.9	3.0	3.6	4.0	3.9	4.0
	3*	0.2	0.2	0.3	0.3	0.3	0.3
Crop protection	1	2.2	2.3	2.5	2.5	2.3	2.1
	3*	1.7	1.8	1.9	1.9	1.8	1.6
	6*	1.7	1.7	1.9	1.9	1.7	1.6
Crop nutrition	1	2.1	2.2	2.8	2.3	2.0	1.8
	3*	1.2	1.2	1.3	1.3	1.2	1.1
Crop production	1	6.0	6.3	6.6	7.0	6.9	7.0
	3*	2.0	2.0	2.2	2.1	2.1	2.2
Animal breeding	1	1.7	1.8	1.6	1.8	1.8	2.0
	3*	0.8	0.9	0.8	0.9	0.9	1.0
	6*	2.1	2.2	2.0	2.2	2.3	2.4
Animal disease	1	2.1	2.2	2.3	2.1	1.9	1.5
	3*	3.8	3.9	4.2	3.7	3.4	2.7
Animal nutrition	1	1.3	1.3	1.2	1.2	1.1	1.1
	3*	1.2	1.2	1.1	1.1	1.0	1.0
Animal production	1	0.7	0.8	0.8	0.8	0.8	0.8
	3*	1.5	1.6	1.5	1.6	1.5	1.6
	6*	0.2	0.2	0.2	0.2	0.2	0.3
Food science	1	2.1	2.2	2.1	2.4	3.0	4.2
	3*	2.4	2.5	2.4	2.7	3.5	4.8
Other research	1	0.9	0.9	1.1	1.1	1.1	1.1
	3*	0.8	0.8	0.9	0.9	0.9	1.0
TOTAL		41.4	43.1	45.5	45.9	45.6	46.9

* This is considered to be applied R & D - "seedcorn research"

Table 5b

CONFIDENTIAL

AGRICULTURAL AND FOOD RESEARCH COUNCIL
DISTRIBUTION OF FUNDING
Emillions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	34.8	39.9	43.6	45.6	45.2	44.9
Universities	3.7	4.4)				
Non-industrial research	51.1	52.2)	57.3	57.1	56.7	59.9
institutes)				
less Receipts	48.2	53.4	55.3	56.7	56.4	57.9
TOTAL	41.4	43.1	45.6	45.9	45.6	46.9

Table 5c

AGRICULTURAL AND FOOD RESEARCH COUNCIL
SUBJECT AREAS AND PRIMARY PURPOSES
Emillions

Expenditure by the Ministry of Agriculture, Fisheries
and Food on work commissioned with the AFRC(1)

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Plant Breeding	3	4.4	4.9	5.8	5.0	4.8	4.8
Crop Protection	3	7.1	7.8	8.6	7.3	7.2	7.3
Crop Nutrition	3	3.5	3.9	4.2	3.7	3.7	3.8
Crop Production	3	6.2	6.8	6.5	6.6	6.9	7.4
Animal Breeding	3	1.8	1.9	2.4	1.7	1.7	1.7
Animal Disease	3	6.6	7.3	7.2	7.1	7.1	7.1
Animal Nutrition	3	1.3	1.5	1.7	1.6	1.7	1.7
Animal Production	3	6.6	7.3	8.1	7.1	8.1	8.3
Food Science	3	5.8	6.3	5.9	6.0	6.8	7.2
Other	3	0.9	1.0	0.5	0.8	0.8	0.8
TOTAL		44.3	49.0	51.0	52.1	53.1	54.8

(1) This table has been included to illustrate the overall scope and scale of AFRC activities. The data refer to expenditures included in Tables 1a and 1b.

CONFIDENTIAL

ECONOMIC AND SOCIAL RESEARCH COUNCIL (ESRC)

ESRC encourages and supports research in the social sciences. In recent years ESRC has given greater weight to strategic judgements about the relative long-term importance of research opportunities in the social sciences, and in particular research which might assist in the formation of public policy. This trend will continue and will bring ESRC closer to Departments in the choice of topics and to a strategy which will complement work funded by Departments.

A dominant theme, 'change in contemporary Britain: context, adaptation and management' has been adopted for ESRC's research programme for the next five years. It is concerned with understanding what is wrong, what needs to be done and when, and how adaptation might be facilitated. Emphasis on Britain does not imply a parochial view. Work under the theme must improve understanding of influences and pressures from outside leading to change within the UK.

Context

On many criteria contemporary Britain is very different from the society of thirty years ago and underlying sources of change are likely to produce a very different society to today's thirty years hence. Periods of rapid change can give rise to particular problems of understanding. Not all developments set in train by past events, for example, work themselves out before further change is superimposed on them. It is difficult to disentangle the long-term effects of earlier events from the impact of more recent ones. How far are patterns of change cyclical or linear? How far are cycles short or long? And what is the role of discontinuities and inertia? A more substantial and systematic effort will be made either to resolve these and related issues or, at least, to increase understanding of current developments as the basis for further debate.

Adaptation

Change has a different impact when it is rapid relative to the lifespan of the organism concerned. Today, many individuals have to live through several major changes during their own lifetime. This explains many of the lags and apparently irrational delays in adapting to problems that seem physically and economically straightforward. Individuals bring with them impediments from experience and training. Ideologies and belief systems have also changed. Research will be encouraged on the impact of change; on the constructive and

CONFIDENTIAL

destructive reactions to change stemming from the impediments of the past; on the impact of change on human adjustment and maladjustment.

Management

Lying behind ESRC's approach to the management of economic change is the importance of technology, whose effective harnessing will depend largely on British management. The current technological revolution is geared directly to basic science. An important element in the research programme will, therefore, be the identification of obstacles to the development and introduction of new products, processes and systems. Not all the resources to be managed, though, are in industry. The quality of British public administration is attracting substantial and increasing interest in Parliament, the press and among the public. The debate has extended to the nature of Civil Service powers and the need for a wider reform of Northcote-Trevelyan proportions. There is a real possibility that public administration, widely regarded in the past as the Cinderella of the social sciences, will find itself occupying an important place in the wider discussion of strategies for economic recovery.

Particular operational objectives are as follows:

Economic Policy

Two ESRC Committees share an interest in improving the performance of the British Economy, Economic Affairs and Industry and Employment. The first has supported the new Centre for Economic Policy Research and also work on Fiscal Studies. A new programme is to be mounted on Public Expenditure, in association with the Treasury. The second has a particular interest in the competitiveness of individual firms, and especially in the performance of their management. It is expected that a substantial new programme on competitiveness will begin this year.

Social Policy

The Social Affairs Committee has given high priority to work on Health which is likely to continue. A new Centre for Health Economics has been established in York, and a Centre for the study of drug addiction has been set up in Hull. Consideration is also being given to a new programme on the Future of the Welfare State. The public expenditure implications of social policy will be explored alongside the programme on Public Expenditure.

CONFIDENTIAL

CONFIDENTIAL

Environmental Issues

Economic changes have altered fundamentally both the old divisions between town and country and North and South, and the purposes and scope of development planning. A programme will be mounted to analyse the location and land-use aspects of these changes. Environmental issues remain under-researched in their social and economic dimensions. More work will be started on pollution abatement, risk reduction and other contemporary issues especially as these are affected by slow economic growth, and by public expenditure reductions.

Grants support

It is likely that a substantial part (about a half) of research expenditure will continue to be committed through the research grants scheme, and that this will contribute to the sustenance both of timely and promising research and to the nation's research capacity. A growing emphasis will be placed on small grants to support scholars and the protection of major research centres.

CONFIDENTIAL

Table 6a

CONFIDENTIAL

ECONOMIC AND SOCIAL RESEARCH COUNCIL
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Economic affairs	1			(2.3	2.3)		
Education and human development	1			(2.5	2.2)		
Environment and planning	1			(2.1	1.8)		
Government and law	1	15.3	16.4	(2.2	2.1)	16.5	16.6
Industry and employment	1			(2.6	2.7)		
Social affairs	1			(3.5	3.2)		
Other social science	1			(2.1	2.5)		
TOTAL		15.3	16.4	17.3	16.8	16.5	16.6

Table 6b

ECONOMIC AND SOCIAL RESEARCH COUNCIL
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	2.9	3.1	3.3	3.2	2.6	2.6
Other Research Councils	0.2	0.4	0.5	0.3	0.3	0.3
Government departments	0.1	0.3	..	..	..	..
Universities	8.4	8.7)				
Non-industrial research institutes	0.4	0.4)	13.8	13.7	13.8	14.0
Persons	3.6	3.7)				
<u>less</u> Receipts	0.3	0.2	0.3	0.4	0.3	0.3
TOTAL	15.3	16.4	17.3	16.8	16.5	16.6

CONFIDENTIAL

MEDICAL RESEARCH COUNCIL (MRC)

- 1.1 The primary objective of the MRC is to advance knowledge that will improve the health of individuals in the community; this objective includes social, environmental and preventive medicine, as well as the treatment of the sick. To achieve this objective, MRC identifies and encourages studies in developing fields and in new areas, to promote a balanced advance of knowledge ranging from fundamental research to the solution of practical problem in medicine and public health. Where the problems of research require investigations overseas, these are funded in collaboration with the Overseas Development Administration. The Council has a special relationship with the Health Departments in providing advice on medical problems, in undertaking research at the request of the Departments, and in sponsoring a programme of health services research.
- 1.2 In pursuing these objectives in particular areas of medical research, the Council is advised by, and delegates substantial responsibility to, its four Research Boards: Neurobiology and Mental Health; Cell Biology and Disorders, Physiological Systems and Disorders; Tropical Medicine. Each is responsible for awarding support for work within the fields which come under its aegis and for evaluating the progress of that work, as well as for identifying opportunities for new research initiatives in specific areas. The Boards in their turn are assisted by Grants Committees, responsible for making short-term awards, and by a range of specialist advisory committees. Some of the latter are standing committees which keep particular fields under review; others are temporary, set up to take initiatives or to supervise particular investigations; others again are committees appointed jointly by the Council and other organisations to consider issues of common interest. Approximately one-third of Board membership is made up of Health Department officers and nominees; this ensures a strong day-to-day influence of Health Department interests in determining allocation of funds.
- 1.3 Grant applications from medical scientists in the universities for work which they themselves feel is important are considered by the Research Boards and Grant Committees. They are funded according to merit, although applications which are technically competent but of lesser originality may nevertheless be funded if they fall within areas of high social need or where it is seen as worthwhile to foster areas in which hitherto there had been little activity.

CONFIDENTIAL

CONFIDENTIAL

- 1.4 In addition, the Council funds "special project grants", short-term awards given to selected workers to enable them to pursue defined objectives identified by the Boards and their advisory committees. This scheme can bypass the normal machinery of competition as long as the proposed work is judged sound.

- 1.5 Exceptionally, where a long-term need is perceived, the Council may set up a research Unit (or a Division at one of its major institutes) around a particularly talented individual, or to ensure that opportunities for new developments are not missed, or to meet a particular public need. The Council is responsible for nearly 100 such teams, the work of each of which is supervised by the relevant Research Board, to whom it reports in detail every three years. The research programmes of these teams develop and change as new opportunities arise. Units are closed down when they are no longer required, or when a Director leaves and a new leader of equivalent standing cannot be found. Nine new units have been set up since 1976 and the establishment of four others has recently been approved. These ensure a period of stability in funding for research in such important areas as hearing and deafness, trauma, environmental epidemiology, dentistry, tuberculosis, molecular haematology, tumour immunology, child psychiatry, perception and cognition, neuroendocrinology, neuropathogenesis (jointly with AFRC) and anatomical neuropharmacology.

- 1.6 The majority of applications for studentships and research fellowships are considered in open competition, but others are earmarked for the support of training in particular research areas which MRC wishes to encourage at a particular time; for example, currently in biotechnology, child psychiatry, epidemiology, nutrition, anaesthesia, radiotherapy and dentistry.

2. Priorities arise when new scientific developments identify a need to increase the scale of investment in particular fields of research, and where gifted individuals are available to exploit these developments. Many of the research programmes supported by the MRC represent long-term investments in the study of intractably difficult problems: hence, the Council does not produce a completely new set of priorities each year. In times of no growth, resources for the support of new initiatives taken up by the Council must be derived by reducing the level of support in other

CONFIDENTIAL

areas. The major responsibility for identifying priorities rests with the four Research Boards and their advisory committees. The fields covered by the respective Boards, and an indication of their current priorities, are given below.

3. The Neurobiology and Mental Health Board covers the nervous system; fundamental and applied neurobiology and psychology; research into neurological and psychiatric diseases, special senses, anaesthesia and medical sociology. Current priorities are as follows:
 - 3.1 Neurotransmitters in neurological and psychiatric diseases: neurotransmitter abnormalities have been reported in a number of psychiatric and neurological conditions, including Parkinson's disease, Huntington's chorea, schizophrenia, epilepsy and Alzheimer's disease.
 - 3.2 Regeneration: the central nervous system cannot re-wire itself after damage or disease, eg head and spinal injury or stroke. To understand this limitation two sorts of research are carried out. The first is to analyse the developing body and its nervous system to discover the underlying mechanisms of regeneration and what is lacking in organisms that cannot regenerate. The hope is that factors will be identified which, by appropriate manipulation, will cause damaged or surviving parts to grow and compensate for missing parts. The second approach is more direct: to attempt to graft new nervous tissue directly into the brain.
 - 3.3 Vision: new techniques for studying nerve fibres and their connections allow a precise and quantitative description of the structure-function relationships important in the development and operation of the visual system.
 - 3.4 Hearing: in particular to provide artificial electrical input as a substitute for the normal acoustic stimulus in patients with profound hearing loss; to study the function of the cochlea.
 - 3.5 Cognitive psychology: both the theoretical and practical aspects.
 - 3.6 Child psychiatry: in particular the development of normal and abnormal behaviour during childhood and adolescence; the ethological approach to the development of objective methods for describing, recording and analysing behaviour.

CONFIDENTIAL

- 3.7 Employment and unemployment, and effects on psychological and physical health, and on behaviour.
- 3.8 Information technology: work on man-machine interactions contributes to the 'Alvey' programme for advanced information technology.
4. The Cell Biology and Disorders Board covers biochemistry and biophysics, cellular and molecular biology, developmental biology and cell ageing, immunology, genetics and basic microbiology; structural studies, experimental pathology, transplantation, medical physics, cancer, radiobiology and radiological protection. Current priorities are as follows:
- 4.1 Biotechnology: The MRC's intention is to balance support for the exploitation of discoveries with potential applications to the NHS and industry with support for fundamental research, whose success (eg in building up the framework of molecular genetics and in leading to the discovery of monoclonal antibodies) has created the present opportunities. MRC plans to establish a new team - possibly an MRC Unit - in a suitable university setting to serve as another focus for research and training in this area. MRC is giving particular attention to strengthening the following aspects of biotechnology: (a) recombinant DNA technology, (b) monoclonal antibodies, (c) synthetic peptides as vaccines, (d) microbial physiology.
- 4.2 Diagnostic imaging. MRC regards this as an area of great practical importance, particularly in relation to the development and evaluation of techniques which are not invasive and also minimise or eliminate exposure to harmful radiation. Major initiatives cover (a) nuclear magnetic resonance imaging, (b) emission computerised axial tomography, (c) X-ray computerised axial tomographic scanning, (d) ultrasound.
5. The Physiological Systems and Disorders Board covers cardiovascular, respiratory, gastrointestinal, reproductive and urinary systems; blood, infections, nutrition, dentistry, obstetrics and gynaecology, paediatrics, endocrinology, dermatology and environmental medicine. Current priorities are as follows:

CONFIDENTIAL

- 5.1 Nutrition and Health: MRC has strong working links with AFRC in this area. Research is focussed in particular on protein malnutrition, pregnancy, lactation and breast feeding, on studies on nutrition and food absorption in neonates, on the physiology of the colon, vitamin D status and obesity.
- 5.2 Dentistry. Even though the statistics indicate that the incidence of dental caries in children is falling, dentistry is still an expensive item of public expenditure and MRC places great importance on supporting good dental research. A newly established research unit at the London Hospital Medical College will focus on the prevention and treatment of periodontal disease, which is responsible for the loss of more teeth after the third decade of life than dental caries.
- 5.3 Cardiovascular and respiratory diseases. MRC is acutely aware of the importance of these conditions in reducing life expectancy and in lowering efficiency during the working years. Examples of the research supported are studies on the treatment of high blood pressure, the pathophysiology of ischaemic heart disease and the effects of coronary artery bypass surgery, a trial of long-term oxygen therapy for chronic hypoxic cor pulmonale and a major national study of regional variations in coronary heart disease and stroke with reference to environmental, socio-economic and personal risk factors.
6. The Tropical Medicine Research Board covers tropical communicable diseases, malnutrition in the tropics, non-infectious disease as manifest in tropical environments; epidemiology in relation to the tropics, medical entomology, microbiology related to tropical environments, parasitology and the zoology of zoonoses. The Board also advises the Secretary of State for Foreign and Commonwealth Affairs on all biomedical research for developing countries financed from the funds of the Overseas Development Administration. MRC continues to support a range of research designed to throw light on problems affecting Commonwealth countries, UK visitors to those countries and certain patients in the UK. It has always been sympathetic to the needs identified by the World Health Organisation (WHO), and workers in MRC laboratories have been successful in attracting WHO funding for research on the topics identified by that body as priority areas: leprosy, malaria, trypanosomiasis (sleeping sickness),

CONFIDENTIAL

schistosomiasis (bilharzia), leishmaniasis and onchocerciasis. While the MRC supports two Units and a small number of scientific staff based overseas, in recent years it has preferred to give support to researchers based in UK laboratories (who then make working visits overseas as necessary) as a more cost-effective way of supporting tropical medicine research by individuals and small teams.

CONFIDENTIAL

Table 7a

MEDICAL RESEARCH COUNCIL
SUBJECT AREAS AND PRIMARY PURPOSES(1)
Emillions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Neurosciences	1	4.5	4.6	4.8	5.0	5.1	5.2
	2	13.4	13.8	14.5	14.9	15.3	15.6
Molecular and cell biology & immunology	1	3.7	4.0	4.2	4.4	4.5	4.6
	2	11.0	12.1	12.7	13.1	13.4	13.7
Skin	1	0.1	0.1	0.1	0.1	0.1	0.1
	2	0.4	0.3	0.4	0.4	0.4	0.4
Reproduction and development	1	2.8	2.8	2.9	3.0	3.1	3.2
	2	8.4	8.4	8.8	9.1	9.3	9.5
Ageing	1	0.4	0.4	0.4	0.4	0.4	0.4
	2	9.5	11.7	12.3	12.7	13.0	13.2
Cancer	1	1.1	1.3	1.4	1.4	1.4	1.5
	2	1.0	1.2	1.3	1.3	1.3	1.4
Blood and cardiovascular system	1	3.1	3.6	3.8	3.9	4.0	4.1
	2	0.2	0.2	0.2	0.2	0.2	0.2
Respiratory system	1	0.6	0.7	0.7	0.7	0.7	0.7
	2	0.6	0.6	0.7	0.7	0.7	0.7
Environment	1	5.7	5.7	6.0	6.2	6.4	6.5
	2	2.1	1.9	2.0	2.0	2.1	2.1
Services and techniques	1	6.3	5.6	5.9	6.1	6.2	6.4
	2	0.4	0.3	0.3	0.3	0.4	0.4
Gastrointestinal tract	1	1.2	1.0	1.0	1.0	1.1	1.1
	2	0.2	0.2	0.2	0.2	0.2	0.2
Kidney and urinary tract	1	0.6	0.6	0.6	0.7	0.7	0.7
	2	0.1	0.1	0.1	0.1	0.1	0.1
Teeth and associated tissues	1	0.7	0.5	0.6	0.6	0.6	0.6
	2	0.3	0.4	0.4	0.4	0.4	0.5
Endocrine glands	1	0.8	1.2	1.3	1.3	1.3	1.4
	2	1.3	1.4	1.4	1.5	1.5	1.6
Infections (other than tropical)	1	3.8	4.1	4.3	4.5	4.6	4.7
	2	0.2	0.2	0.2	0.2	0.2	0.2
Nutrition	1	1.7	1.9	1.9	2.0	2.1	2.1
	2	0.1	0.1	0.1	0.1	0.1	0.1
Organisation of medical care	1	0.5	0.5	0.5	0.5	0.6	0.6
	2	0.5	0.6	0.6	0.6	0.6	0.6
Tropical medicine	1	4.6	5.1	5.3	5.5	5.6	5.6
	6	0.9	0.9	0.9	0.9	1.0	1.0
Muscle, bone and joints	1	2.7	2.6	2.7	2.8	2.9	2.9
	2	0.6	0.6	0.6	0.6	0.6	0.6
Anaesthetic agents	1	2.5	2.7	3.3	3.3	3.2	3.3
	2	2.5	2.7	3.3	3.3	3.2	3.3
Training awards not readily classifiable	1	100.6	106.4	112.8	116.2	118.5	120.9
	2	100.6	106.4	112.8	116.2	118.5	120.9
TOTAL		100.6	106.4	112.8	116.2	118.5	120.9

CONFIDENTIAL

Table 7b

MEDICAL RESEARCH COUNCIL
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	66.8	70.7	73.1	74.4	74.9	76.4
Universities	25.8	26.2)				
Overseas	1.5	1.8)				
Non-industrial research	3.8	5.0)				
institutes		)	46.5	48.5	49.9	51.0
Persons	4.9	5.4)				
Others	2.8	2.8)				
<u>less</u> Receipts	5.0	5.5	6.8	6.7	6.3	6.5
TOTAL	100.6	106.4	112.8	116.2	118.5	120.9

- (1) The MRC have stressed the difficulty they have had of classifying their R&D by Primary Purpose and the results should be treated as estimates only. They also emphasise that the Subject Areas should not be taken on mutually exclusive. Thus for example, although direct expenditure on "cancer" was £13.7 million in 1983/4, substantial elements of other programmes were (and are) relevant to cancer research.

CONFIDENTIAL

NATURAL ENVIRONMENT RESEARCH COUNCIL (NERC)

The NERC is responsible for encouraging, planning and executing research in those sciences, physical and biological, that relate to man's natural environment and its resources. Such investigations seek to provide a better understanding not only of the nature and processes of the environment in which we live and on whose resources we depend, but also of their influence on man's activities and welfare and, of growing importance today, of man's influence on them.

The fields of research are summarised below and may be broadly defined as: The Solid Earth - its physical properties and mineral resources (geology, geophysics and geochemistry); The Seas - their characteristics and living and mineral resources (physical oceanography and marine ecology); Inland Waters - their characteristics and living resources (hydrology and freshwater ecology); The Terrestrial Environment - the structure, interactions and productivity of plant and animal populations and communities (terrestrial ecology and soil science); Atmosphere - its structure and interactions; and Interdisciplinary Studies of the Physical and Biological Properties of the Antarctic Environment (atmospheric, earth and life sciences).

NERC supports work in its own 9 institutes, in 3 grant-aided institutes and in universities through research grants and support for postgraduates, and indirectly by the provision of research vessels, payment of the UK contribution to the International Phase of Ocean Drilling and the maintenance of large equipment pools. Total NERC support for universities now comprises some 26 % of science budget funding. It is NERC's policy to maintain and, wherever possible, to increase this level of support and to continue to develop collaborative research between its institutes and universities.

The main criteria for deciding on scientific priorities in basic research are the excellence of the research, the extent to which it will complement other work or fill a gap, the development of a new technique or technology allowing a problem to be explored from a new direction, and the recognition of an area as being of particular importance. Decisions are reached through the peer review system with an input from a wide range of experts from the academic profession both at home and abroad, from industry, and from research institutes and

CONFIDENTIAL

CONFIDENTIAL

government departments. Care is taken to ensure that the Science Budget element of NERC's programme of strategic and applied research complements work commissioned by departments. With this in mind, a continuing dialogue takes place between NERC and the departmental Chief Scientists Groups.

NERC has identified a number of areas of high scientific priority on which it is concentrating resources, including deep geology, the marine sciences, biotechnology, estuarine processes and atmospheric processes. The potential of remote sensing in its application to the environmental sciences is being furthered through research programmes in this area on a collaborative basis with other Research Councils, with universities and, notably, with industry.

1. The Solid Earth

Objective: To define the physical properties and mineral resources of the earth and to understand its structure and the processes which have contributed to its formation and evolution.

The community of earth scientists in the UK, in institutes and universities, has a wide range of interests, studying problems of economic relevance and laying the basis for future understanding through a mapping programme that combines advanced skills and techniques from many fields. The work covers and unites the whole range of research from the most basic through strategic to the strictly applied and is of practical importance in the search for energy and minerals, to the construction and water supply industries and in the prediction and alleviation of the impact of such disparate events as earthquakes and radioactive waste disposal. Strategic research funded through the British Geological Survey is important both to the development of basic science and to future application work.

On the continental landmass research concentrates on maintaining an up to date knowledge and understanding of the geology through a detailed mapping programme. This surface coverage is extended to three dimensions by the drilling of deep boreholes and geophysical profiling. Three permanent magnetic observatories are maintained in the UK and a network of

CONFIDENTIAL

seismographs has been developed which now cover a large part of the country, giving results which are used for research into the composition and structure of the earth's core and mantle.

Geochemical research is aimed at dating the sequence of events which have affected the earth and understanding the processes which have led to the evolution of different rock types. Geochemical maps provide a database for mineral reconnaissance programmes. Studies of the motion of liquids filtering through rocks and sediments are vital to understanding the origination of exploitable veins of metallic ores and to clarifying the possible paths of contaminants, notably toxic wastes buried underground.

Research on marine geology and geophysics is carried out in the shallow seas surrounding the UK, where work continues on the location of further deposits of oil and gas, and in the deep oceans, including the International Ocean Drilling Programme. Increased knowledge in these areas is, of course, of value to oil companies and to the Department of Energy; it is also important in furthering understanding of fundamental geological processes. Many of the features of significance to the further development of the theory of plate tectonics occur under the ocean. Their study and further exploration is of importance to the understanding of geological processes. The NERC funded British Institutes Reflection Profiling Syndicate links universities and NERC institutes in an attempt to develop understanding of the deep structure of the earth.

Finally, teams of NERC funded earth scientists are working overseas as part of aid projects to discover mineral and energy resources, and water, in locations in South East Asia, the Pacific, South America and Africa, often in co-operation with UK consulting engineering houses.

2. The Seas

Objectives: To describe and understand the physical and chemical processes operating within the seas and oceans, ranging in scale from estuarial and in-shore phenomena to processes which operate on a global

CONFIDENTIAL

scale. To achieve a more comprehensive knowledge of the characteristics of organisms in the sea, the processes that underlie the structure and function of marine ecosystems and their response to changing external factors.

Despite the fact that they occupy some 70 per cent of the earth's surface, the oceans are an only partially understood part of our natural environment. Again, researches funded by NERC cover the range from highly applied through strategic to basic. The evolution of instrumentation, of the platforms to carry such instruments and of the means to analyse and interpret the data provided by such instruments, is proceeding rapidly.

NERC funds work on waves and currents and their interactions with the atmosphere and the sea floor. The modelling of ocean currents and ocean circulation are seen as a high priority. Ocean circulation is a major determinant of climate and both causes and regulates climatic change. Remote sensing has offered opportunities in this area which promise to further basic understanding and offer opportunities for an increasing range of applied work.

One of the five major priority areas of science within the NERC remit at present is estuarine research. These studies are inevitably multidisciplinary. Physical, chemical and biological processes interact strongly within estuaries and help to determine their capability to deal with pollutant loads without unacceptable environmental damage.

The shallow seas and the shelf break are ocean areas with characteristics which merit particular attention. Work is being carried out on physical mixing processes, bio-geochemical cycling and biological activity in frontal zones and at the shelf break.

Research into chemical processes is aimed at understanding the large scale processes occurring in the oceans and provides information on the composition of sea water, the fluxes of particular materials on the ocean bed and the formation of sediments and post-depositional chemical

CONFIDENTIAL

processes. This work furthers basic understanding and also offers applied opportunities, such as examining the potential effects of radioactive waste sea bed disposal. There are also strong links between this area and climatology (see section on atmosphere) because of the ocean's ability to absorb atmospheric CO₂ and so ameliorate the effect of continued man-made CO₂ production and the possible consequent climatic warming.

Sedimentation studies are aimed at an understanding and quantification of the conditions of sediment deposition, erosion and transportation. Increased knowledge in this area is of value both for engineering and commerce and has major environmental implications in terms of pollution entrainment.

Studies of the biology of organisms and their adaptations and responses to the environment at the behavioural, physiological, biochemical and genetic level are continuing. This is an area of research where marine organisms can prove to be suitable as a means of studying more general scientific problems (such as nerve transmission and larval development).

The ecology of the southern ocean ecosystem has relevance to the continued search for new exploitable living resources. Current research focusses on the role of krill in the southern ocean food web and includes biological studies in relation to its environment and its principal predators.

In addition to the research effort described above, NERC provides the marine information and advisory service to both the industrial and scientific communities throughout the UK.

3. Inland Waters

Objective: To investigate the physics and chemistry of the hydrological cycle involving rainfall, run-off, percolation and groundwater flows, storage and evapo-transpiration. To increase understanding of the ecology of rivers and lakes.

Research (funded in Institutes and in universities) concerned with the entire hydrological cycle has important implications for the examination of land use changes. A major objective of this work has been to solve the problem of measuring evaporation from different types of vegetation in climatic conditions. Continued development of numerical modelling

CONFIDENTIAL

techniques has and will create a UK capability for hydrological forecasting. There is considerable collaboration in this field between NERC scientists and UK consulting engineering houses. Recent work on inland waters has shown a renewed emphasis on water chemistry, particularly in relation to the effects of atmospheric pollution. Research focusses on the interdependence of organisms in rivers and lakes and their response to the input of pollutants. Work is carried out on the linkage between physical, chemical and biological characteristics of streams.

4. Terrestrial environment

Objective: To improve the understanding of organisms, biological processes and ecosystems and provide the scientific basis for environmental management in relation to the assessment of the impact of natural and man-made changes upon organisms and their environments and the exploitation and conservation of relevant natural resources.

Understanding of complex ecosystems has increased through the application of modern methods of observation, analysis, experimentation and modelling to traditional field ecology. Thus it is becoming feasible to forecast the effects of human activities on the environment. Current work examines the implications of increasing urbanisation, of the large scale application of fertilisers and pesticides to the land, the effect of atmospheric pollutants such as acid deposition on soils and forests and the pathways of radionuclides in the environment.

Priority continues to be given to work on the effects of land use options and changes, genetic variation in relation to the environment, virology, population dynamics and soil processes. Recognition of these priorities has led to a reduction in funding for more traditional areas such as applied conservation research and taxonomy.

CONFIDENTIAL

5. The Atmosphere

Objective: To understand the physical and chemical behaviour of the lower atmosphere. To investigate the ionosphere and magnetosphere with particular reference to the Antarctic.

As has been noted above, NERC is devoting increasing resources to work on the chemistry of the atmosphere, particularly in relation to the effect of man-made inputs such as sulphur. Priority work is being carried out into CO₂ cycling within the atmosphere and the climatic effects of increases in CO₂ levels. The particular ionospheric conditions in the Antarctic are being explored through the use of the advanced ionospheric sounder. NERC plays a major part in the World Climate Research Programme.

CONFIDENTIAL

Table 8a

NATURAL ENVIRONMENT RESEARCH COUNCIL
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
The solid earth	1	18.5	19.2	19.9	20.9	21.6	22.2
	2	1.8	2.3	3.5	3.8	3.9	4.0
The seas	1	13.2	13.9	14.4	15.2	15.7	16.2
	2	1.9	2.1	2.7	3.2	3.3	3.3
Inland waters	5	0.2	0.2	0.2	0.2	0.2	0.2
	1	5.2	5.5	5.9	6.3	6.5	6.7
	2	1.0	1.0	1.0	1.2	1.3	1.3
The terrestrial environment	1	7.2	7.7	8.6	8.8	9.1	9.4
	2	0.5	0.6	0.7	0.6	0.6	0.7
The atmosphere	1	2.6	2.6	2.6	2.5	2.6	2.7
	2	0.0	0.2	0.6	0.6	0.6	0.7
TOTAL		52.1	55.2	60.0	63.3	65.4	67.4

Table 8b

NATURAL ENVIRONMENT RESEARCH COUNCIL
DISTRIBUTION OF FUNDING
£millions.

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	66.6	66.9	68.9	76.2	79.0	81.7
Universities	6.4	6.0)				
Private industry	1.5	2.1)				
Public Corporations	..	..)		
Non-industrial research institutes	5.3	5.2)	17.3	11.6	11.8	11.9
Persons	3.7	4.2)				
less Receipts	31.5	29.3	26.3	24.6	25.4	26.2
TOTAL	52.1	55.2	60.0	63.3	65.4	67.4

CONFIDENTIAL

Table 8c

NATURAL ENVIRONMENT RESEARCH COUNCIL
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

Expenditure including Commissioned Research(1)

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
The solid earth	1	18.5	19.2	19.9	20.9	21.6	22.2
	2	21.6	20.4	20.0	20.2	20.8	21.5
The seas	1	13.2	13.9	14.4	15.2	15.7	16.2
	2	7.9	7.3	7.4	7.9	8.1	8.4
	5	0.2	0.2	0.2	0.2	0.2	0.2
Inland waters	1	5.2	5.5	5.9	6.3	6.5	6.7
	2	3.2	3.0	2.8	2.9	3.1	3.2
Terrestrial environment	1	7.2	7.7	8.6	8.8	9.1	9.4
	2	1.5	1.4	1.5	1.4	1.4	1.5
The atmosphere	1	2.6	2.6	2.6	2.5	2.6	2.7
	2	0.0	0.2	0.6	0.6	0.6	0.7
TOTAL		81.2	81.5	83.8	86.9	89.8	92.6

(1) These expenditures include all work commissioned with the NERC from Government Departments. The work has been classified as Frascati R & D, and as primary purpose 2 by the NERC. These assumptions are not necessarily in line with those made by the Departments concerned in response to the present Review. It has been included to illustrate the full scope and scale of NERC R & D, but since it includes expenditure by other Government Departments, the data are not used elsewhere in the Review.

CONFIDENTIAL

SCIENCE AND ENGINEERING RESEARCH COUNCIL (SERC)

The primary function of SERC is to maintain and enhance the research capability of the UK in all areas of pure and applied science and engineering, outside those covered by the more specialised AFRC, MRC and NERC. SERC's responsibilities consequently range over a very wide field from the most fundamental to the severely practical. The Council has pioneered ways of bringing the universities and industry closer together in research on engineering and applied problems of national importance.

In allocating its resources, SERC looks to the peer review system to achieve and maintain high standards of research, and to support programmes regarded as being timely and promising. SERC and its Boards and Committees are made up of representatives from the institutions of higher education, industry and Government. The membership is subject to regular review.

When SERC was formed in 1965, the bulk of its funds went into the "big" science areas of nuclear physics and astronomy. The years since have seen a dramatic shift towards "small" science and engineering. It is SERC's view that "big science" should consume a still smaller proportion of its resources, but the present investment in high energy physics and astronomy is near the minimum necessary if the UK is to keep any first-rate research activity in these subjects. In order to obtain the most benefit from its "big science" expenditure, SERC policy has been, and is, to obtain the maximum amount of international collaboration possible, consistent with the Council's scientific objectives. This policy has been very successful, and further developments are expected.

In engineering, by identifying areas of real practical importance, and co-ordinating the efforts of academic and industrial researchers in an active way, both the intellectual content and the practical effect of university research have been dramatically improved. "Focussed" research of this kind has been carried out within the Council's Specially Promoted Programmes and Directorates, whilst more recently the Science Board has identified "themes" within "core science" for special support. In addition, many activities which the Council supports are co-ordinated with those of other major spending organisations whose interests are complementary to those of the Council. Joint research programmes are undertaken, in particular, with Government Departments and nationalised industries.

CONFIDENTIAL

CONFIDENTIAL

The priorities of the four Boards of the Council are set out in more detail in the following paragraphs.

The Engineering Board covers all the engineering disciplines and technologies. These include materials and information technology as essential enabling and underpinning technologies for the whole of its programme. The Board's priorities are largely reflected by its establishment of Special (In-House) Directorates and its initiative of Specially Promoted Programmes through which it operates in an active mode in the promotion and co-ordination of research in areas or topics that are judged important in the national interest. These embrace:

Special Directorates

- Application of Computers in Manufacturing Engineering
- Biotechnology (jointly with the Science Board)
- Information Technology (primarily related to the Alvey Programme)
- Marine Technology (until September 1985)
- Polymer Engineering (until September 1984)
- Teaching Company Scheme

Specially Promoted Programmes

- Chemical Engineering Committee: Particulate Technology

- Environment Committee: Construction Management in Buildings and Civil Engineering; Energy in Building (shortly to be terminated)

- Information Engineering Committee (Non-Alvey): Instrumentation and Measurement (shortly to be terminated); Radio Communication Systems

- Machines and Power Committee: Coal Technology (jointly with the Chemical Engineering Committee, but shortly to be terminated); Combustion Engines; High Speed Mechanisms (not yet started)

- Materials Committee: Electroactive Polymers; Materials and Energy Conservation in the Materials Processing Industries; Medical Engineering

CONFIDENTIAL

The Board plans for a continuing strong emphasis on industrial involvement in its activities through the Teaching Company Scheme, Co-operative Grants and CASE awards, through co-funded programmes with industry and the continuing strong intervention of its Special Directorates and Co-ordinators for Specially Promoted Programmes.

The Astronomy Space and Radio Board covers astronomy and solar system studies. The great advances made in the understanding of the universe over the last few decades have come largely by astronomers who are able to bring together observations of particular features - eg neutron stars or black holes - over a wide range of wavelengths. UK astronomers have been particularly successful in this period, largely because of the SERC's policy of providing access to a wide range of facilities. This has only been possible through a comprehensive international approach to facilities, whether ground or space-based. The SERC intends to continue this policy, which has proved so productive of science and cost effective with limited revenue. Two major projects to which the Board attaches high importance are the provision of three new optical telescopes at La Palma (two of which are now almost operational) and the provision of a millimetre wavelength telescope in Hawaii. These last two projects are being developed in collaboration with the Netherlands, although the UK is the major partner in the enterprise. The Board intends to seek approval in the near future to fly an atmospheric sounding instrument on NASA's Upper Atmosphere Research Satellite.

Science Board supports basic research in biology, chemistry, physics, and mathematics. These are the "core" sciences which underpin the activities of the other science-based Research Councils and the science-based industries of the nation.

The Board's first priority is for the direct support of universities and polytechnics provided through research grants and studentships. The Board has recently completed a statement of its strategy for support of core science. This includes: steps to ensure the vitality of each of the core sciences; identification of research themes within the core sciences and a review of the balance of support between these themes; support of multidisciplinary research including the establishment of special programmes where necessary; and adequate funding for the very best research ideas of timeliness and promise in any area.

CONFIDENTIAL

The Chemistry Committee has made a more detailed study of the balance of support between themes and has highlighted areas where more work is needed (eg in its theme on synthesis and properties of new materials) or where the emphasis should be changed (eg studies of heterogeneous catalysis under more realistic pressures). Some Committee themes (or sub-themes) are considered to be sufficiently important to be the basis of the new multidisciplinary programmes described in paragraph 21. Other areas such as mathematical biology and non-linear systems (Mathematics Committee themes), molecular recognition and brain/neurochemistry (Biological Sciences Committee) are emerging as areas for further expansion. Other examples from the many Committee themes are: instrumental techniques (Chemistry and Physics Committees); plasma physics (Physics Committee); plant science and productivity (Biological Sciences Committee); quantum fluids (Physics); stochastic modelling, and analysis (Mathematics Committees).

The Board is convinced of the importance of multidisciplinary activities and has recently recognised the need to support new programmes in low dimensional structures, protein engineering and chemical sensors.

The Board also provides the research community with access to expensive central facilities that are necessary for front-line research in many areas of science.

The main objectives of the Science Board over the next five years are:

- i. to develop and fully exploit the Synchrotron Radiation Source at the SERC Daresbury Laboratory;
- ii. to continue to run and enhance the Central Laser Facility at the Rutherford Appleton Laboratory;
- iii. to provide access by UK scientists to the best neutron sources at minimum cost. This will mean continued UK participation in the successful Institut Laue Langevin at Grenoble and seeking major international partnerships in the Spallation Neutron Source (SNS), nearing completion at the Rutherford Appleton Laboratory, so as to allow it to be fully exploited.

CONFIDENTIAL

The Science Board hopes the UK will be able to participate in the proposed European Synchrotron Radiation Facility (ESRF), a hard x-ray high energy storage ring.

The Nuclear Physics Board covers particle physics and nuclear structure physics. Particle physics is carried out wholly on overseas facilities, in particular those at CERN, and nuclear structure uses both UK and overseas facilities. Its priorities over the next 5 years are:

- i. In particle physics there will be an almost complete transition from mainly fixed target experiments to a programme relying largely on colliders. At CERN the Super Proton Synchrotron (SPS) proton-antiproton (pp) collider is being upgraded and the new Large Electron Positron accelerator (LEP) will start operation at the end of the period. About half of the UK particle physicists are planning to work on these machines and experiments for LEP are already under construction. At DESY (Hamburg) an electron-positron (ep) collider HERA will replace PETRA and about a quarter of UK particle physicists will work on this machine. The remainder of particle physicists will use residual fixed target facilities at CERN or non-accelerator experiments. These are priorities which are being pursued by closing other facilities at CERN or reducing other activities.
- ii. In nuclear structure, SERC has recently reviewed its priorities. The Nuclear Structure Facility at Daresbury will first be vigorously exploited at 20 MV and could then be upgraded by superconducting modules from 20 MV to 30 MV. Work on the Oxford Van der Graff accelerator will continue and a modest improvement at Oxford to allow research up to 15 MV is planned. The nuclear structure community will be encouraged to use the 900 MeV electron accelerator at Mainz and it is hoped to provide a magnetic spectrometer for experiments there.
- iii. A new area of interest to both particle and nuclear physicists that will open up in the next few years is the study of meson and quark plasmas produced by relativistic heavy ion collisions. The first steps in this field will be taken at CERN in 1985 with the acceleration of heavy ions in the SPS. The study of new states of matter that could be produced is an exciting possibility and British physicists will be working in this area.

CONFIDENTIAL

CONFIDENTIAL

Table 9a

SCIENCE AND ENGINEERING RESEARCH COUNCIL
SUBJECT AREAS AND PRIMARY PURPOSES
fmillions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
ASTRONOMY SPACE AND RADIO (ASR) BOARD							
Solar systems	1	2.7	2.8	3.0	3.4	3.5	3.7
Astronomy	1	6.6	6.6	7.4	8.3	8.4	9.0
	6	0.1	0.2	0.2	0.2	0.2	0.2
Establishments and other domestic facilities	1	20.3	22.5	21.8	22.8	22.6	22.0
International contributions	1	9.6	9.7	11.6	13.4	16.1	16.3
TOTAL ASR		39.4	41.7	43.4	48.0	50.8	51.6
ENGINEERING BOARD							
Environment	1	0.6	1.0	0.8	0.7	0.7	0.8
	3	2.6	2.9	3.2	3.8	4.9	5.1
Engineering processes	1	0.8	1.3	0.7	0.7	0.8	0.9
	3	4.4	4.6	5.2	5.0	5.1	5.4
Machines and power	1	1.0	1.8	1.1	1.0	1.1	1.1
	3	5.2	5.7	6.3	7.4	8.7	8.6
Materials	1	1.1	2.2	0.7	0.8	0.9	1.0
	3	6.4	6.6	6.9	6.5	7.1	7.3
Marine technology	1	1.3	1.6	1.1	1.1	1.0	0.9
	2	0.3	0.3	0.3	0.3	0.2	0.2
	3	2.5	2.0	2.3	2.3	2.1	2.3
	5	2.4	2.0	2.1	2.1	1.9	2.0
Energy	1	0.0	0.2	0.2	0.2	0.2	0.2
	3	0.0	0.6	0.8	1.2	1.3	1.3
Teaching company	3	1.6	2.1	3.5	5.3	5.8	6.7
Polymer engineering	3	1.9	1.8	2.1	2.2	2.1	2.1
Biotechnology	3	0.0	1.3	2.3	3.2	3.6	4.5
Information technology	3	9.2	11.9	12.8	17.5	17.1	16.3
Establishments and other domestic facilities	3	8.8	6.2	7.7	9.0	8.9	8.2
TOTAL ENGINEERING		50.8	56.8	60.9	71.0	73.4	74.9

CONFIDENTIAL

Table 9a Cont

SCIENCE AND ENGINEERING RESEARCH COUNCIL
SUBJECT AREAS AND PRIMARY PURPOSES

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
NUCLEAR PHYSICS BOARD							
Nuclear structure	1	2.5	2.9	2.1	2.0	2.0	2.0
Particle physics	1	3.9	4.4	5.0	5.6	5.8	6.1
Establishments	1	16.1	17.5	17.5	17.4	18.1	19.4
International contributions(1)	1	24.5	26.6	32.3	35.3	36.0	36.4
TOTAL NUCLEAR PHYSICS		47.0	51.4	56.9	60.3	61.8	63.9
SCIENCE BOARD							
Biological science	1	13.5	13.6	13.8	15.0	16.1	17.1
Chemistry	1	13.7	15.0	14.4	15.7	16.9	17.9
Maths	1	2.5	2.5	2.6	2.8	2.9	3.1
Physics	1	6.5	6.8	7.3	8.0	8.7	9.2
Other research	1	1.0	2.1	2.6	3.6	4.0	4.4
Establishments	1	16.7	19.4	20.2	20.0	20.4	21.6
Other domestic	1	1.1	1.1	1.0	0.7	0.6	0.6
International contributions(1)	1	7.2	6.2	6.5	7.1	6.5	5.3
TOTAL SCIENCE		62.2	66.7	68.3	72.8	76.1	79.2
CENTRAL SUPPORT		12.8	13.7	16.9	17.0	18.2	17.6
TOTAL		212.1	230.0	246.4	269.2	280.2	287.2

(1) While the SERC allocation is increasing, the provision includes additional sums of £5 million and £7.5 million in 1983/84 and 1984/85 respectively and £10 million per annum thereafter in association with the Information Technology initiative (which the Council has had to supplement from within its base allocation) and £7M, £8.5M and £9.5M in 1984/85, 1985/86 granted partially to offset inescapable increases in the cost of international subscriptions.

CONFIDENTIAL

Table 9b

SCIENCE AND ENGINEERING RESEARCH COUNCIL
DISTRIBUTION OF FUNDING
Emillions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	82.1	90.3	90.4	92.8	99.4	101.5
Government departments	1.9	1.9	1.6	1.6	1.6	1.7
Universities	67.7	74.7)				
Research associations	0.1	0.1)				
Overseas	41.2	43.7)	164.1	183.9	188.4	194.0
Persons	27.0	28.5)				
Others	0.1	0.3)				
<u>less Receipts</u>	7.9	9.3	9.7	9.3	9.2	9.9
TOTAL	212.1	230.0	246.4	268.9	280.2	287.2

CONFIDENTIAL

DEPARTMENT OF ENERGY (DEn)

Non-nuclear R & D

1. The overall objective of this expenditure is to support R & D which would not otherwise be undertaken in order to:

- i. establish options for future energy supply, distribution and use;
- ii. provide selective back-up to those industries associated with energy supply, distribution and use, and
- iii. to enable DEn to carry out its statutory and regulatory responsibilities.

Offshore technology

2. This falls into two main areas. First, DEn assists the development of the UK offshore supplies industry in a market worth £3 billion a year. A number of projects have been assisted to the point of commercial exploitation, for instance an improved downhole pump. The overall objective is to maximise the UK share of the market (in recent years it has been around 70 per cent).

3. Second, DEn is involved in work on exploration and recovery technologies. This includes mapping of the seabed of the UK Continental Shelf. Data acquisition is 75 per cent complete and publication of maps 60 per cent complete; and work is on schedule for completion by 1989-90. In addition, a reservoir simulation model, jointly funded with the British Gas Corporation and Britoil, has been developed and co-operative work with the oil industry on enhanced oil recovery is leading to pilot oil field experiments.

Renewable and alternative resources

4. Sufficient progress had been made by early 1982 for a decision to be taken, in the light of advice from the Advisory Council on Research and Development on Fuel and Power, to concentrate on the more promising options. Work on active solar water and space heating is being terminated and that on wave energy reduced to a low level. Priority is being given to wind power and geothermal energy; and modest programmes are continuing on biofuels and passive solar heating.

CONFIDENTIAL

Coal technology

5. The International Energy Agency programme to build and test a Pressurised Fluidised Bed Combustion Facility at Grimethorpe comes to an end in 1984. Participation has improved the UK's position as an informed potential customer and has reinforced our expertise in this new technology.

6. Support is being given to design studies of a combined cycle power plant and to the design of a coal liquefaction pilot plant.

Nuclear R & D

7. The main objectives are to help the electricity industry to exploit current reactors safely and commercially; and to assist in the choice and development of new designs. Most of the expenditure is by the United Kingdom Atomic Energy Authority (UKAEA).

8. Key objectives in the main areas of work are:

Advanced gas cooled reactors

- to assist the nuclear industry to achieve:
 - i. power output at rated levels on all stations by 1988;
 - ii. on-load refuelling at power levels of 70 per cent or higher by 1986-87;
- to provide data to meet evolving safety standards.

Pressurised water reactor safety

- to provide independent information to assist the Nuclear Installations Inspectorate in reviewing safety standards; and specifically
- to quantify reactor behaviour in Loss of Coolant Accidents by 1985.

CONFIDENTIAL

CONFIDENTIAL

Fast reactor

- to retain the option of ordering commercial fast reactor stations when it becomes economic to do so;
- to carry out R & D in international collaboration; and, specifically,
- to achieve sustained operation of the Prototype Fast Reactor at 240 M We gross output and 50 per cent availability;
- to establish by 1991-92 a conceptual design for a commercial scale lead reactor and criteria for the licensing of stations.

Nuclear materials management

- to provide technical advice to the Government on the managing of radioactive wastes;
- to develop plant for the UKAEA to manage their wastes; and specifically,
- to commission a cementation plant in 1987-88 for intermediate level UKAEA wastes;
- to commission a radiochemical facility at Harwell by 1985-86.

Fusion

- to establish whether nuclear fusion can be used to generate electricity economically; and specifically,
- to support the Joint European Torus (JET) project at Culham;
- to help decide by 1988 whether or not the European Community should initiate a project after JET.

CONFIDENTIAL

Table 10a

DEPARTMENT OF ENERGY
SUBJECT AREAS AND PRIMARY PURPOSES
Emillions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Renewable energy sources	2	15.3	12.7	7.7	12.4	12.7	13.0
Oceanography	2	1.5	1.5	1.0	1.4	1.5	1.5
Enhanced oil recovery	2	2.8	2.8	2.3	3.0	3.1	3.3
Reservoir simulation	2	1.0	1.2	1.2	1.4	1.4	1.5
General policy research	2	0.1	0.1	0.1	0.1	0.1	0.1
Energy conservation	2	0.8	1.2	1.5	2.0	3.0	3.1
Underwater initiative	3	0.9	0.8	1.0	1.1	1.1	1.2
Industrial support	3	3.2	2.2	2.9	4.7	3.5	3.7
Energy conservation demo project scheme	3	1.7	3.3	3.4	4.9	5.9	5.9
Safety	5	3.2	2.8	2.7	3.5	3.5	4.0
Coal technology (NCB Coal Marketing)	6	4.9	3.4	3.7	2.3	3.3	3.3
Other costs (Total)	6	0.2	0.2	0.2	0.2	0.3	0.3
TOTAL		35.6	32.1	27.8	36.9	39.4	40.7

Table 10b

DEPARTMENT OF ENERGY
DISTRIBUTION OF FUNDING
Emillions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	2.2	2.1	2.2	2.3	2.5	2.5
Research Councils	1.3	1.3	0.9	1.3	1.4	1.4
Other Government departments	9.2	7.1	6.7	9.7	10.1	10.6
Universities	6.9	4.7)				
Private industry	10.3	10.8)				
Public Corporations	4.5	3.9)				
Research associations	1.1	1.4)				
Overseas	..	0.2)	19.3	24.7	25.8	26.8
Non-industrial research institutes	..	0.1)				
Professional and learned societies	..	..)		
Persons	..	..)		
Others	0.3	0.6)				
less Receipts	0.2	0.1	0.3	0.5	0.5	0.5
TOTAL (1)	35.6	32.1	28.9	37.5	39.3	40.9

(1) The small differences between the totals shown in tables 10a and 10b in the years 1983/84 to 1986/87 are as a result of slightly later estimates being included in Table 10a.

CONFIDENTIAL

Table 11a

UNITED KINGDOM ATOMIC ENERGY AUTHORITY
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Fast reactor	2	82.2	110.9	118.5	103.8	100.1	95.3
Nuclear materials mngmt	2	35.3	17.0	11.1	21.7	25.7	28.0
	5	2.0	1.9	1.2	2.4	2.9	3.1
Fusion	2	18.0	23.4	20.6	20.2	22.1	21.9
Thermal reactor	4	27.4	26.3	22.0	20.2	15.6	15.7
Underlying research	2	18.4	20.9	19.6	20.4	19.9	21.3
	3	3.9	4.4	4.1	4.3	4.2	4.5
Other	2	16.1	7.6	1.8	3.7	5.7	5.4
TOTAL		203.2	212.4	199.0	197.0	196.2	195.3

Table 11b

UNITED KINGDOM ATOMIC ENERGY AUTHORITY
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	315.3	332.9	346.6	363.5	355.3	360.7
Research Councils	0.2	0.2	..	0.1	0.1	..
Other Government departments	0.7	0.9	0.8	0.7	0.7	0.6
Universities	2.2	2.2)				
Private industry	26.0	23.6)				
Public Corporations	1.1	0.7)				
Research associations	..	..)		
overseas	2.1	0.1)	30.0	17.9	17.3	16.1
Non-industrial research institutes	..	..)		
Others	0.1	0.0)				
less Receipts	144.7	148.4	178.5	185.4	177.3	182.2
TOTAL	203.2	212.4	199.0	196.7	196.1	195.3

CONFIDENTIAL

DEPARTMENT OF THE ENVIRONMENT (DOE)

The DOE R & D programme covers a wide range of activities which affect people's social, physical and economic environment and public health. The results of the research are used to guide the progressive improvement of the environment, to make public investment more cost effective and to encourage greater efficiency in the construction industry. Most of the research provides an input to policy and/or assists with commitments within UK legislation or EC Directives and some provides "sponsorship" support to industry. The programme has six main subject areas and the principal themes of each are described below.

Environmental Protection

The environmental protection programme has four main component topics: radioactive waste management, toxic substances, air and noise pollution and general waste management.

- i. Radioactive waste management research is the largest component. DOE's responsibilities for it are set out in Cmnd 6820 (1977) and Cmnd 8607 (1982). Increasing attention will be given in future to research on monitoring the pathways whereby radioactive waste can get back to man or to other targets. The need for this work has been fully demonstrated by the problems at Sellafield. The main aspects of the radioactive waste programme aim to:
 - a. prepare an inventory of wastes;
 - b. develop effective methods for managing and disposing of existing radioactive wastes and those arising in future;
 - c. understand the reasons for public concern about radioactive wastes;
 - d. provide a basis for assessing the suitability of possible underground disposal sites for non-heat generating waste;
 - e. evaluate alternative possible methods of disposal of heat generating waste on land or on or below the sea bed;

CONFIDENTIAL

- f. define the properties of intermediate level wastes, examine treatment techniques and develop procedures for assessing the environmental safety of disposal methods;
 - g. examine the effects of radioactivity on man and the environment;
 - h. evaluate new methods of radioactive waste management (eg solidification of highly-active liquid wastes);
 - i. assess potential techniques for minimising waste production and for decommissioning nuclear facilities.
- ii. The research on toxic substances and pollution control concentrates on the environmental effects of chemicals. Fibrous minerals (particularly asbestos) and toxic metals (such as lead) in dust and in land due for development are of particular concern. The research provides a basis for DOE policy in relation to:
- a. operation of the New Chemicals Notification Scheme (under EC Directive 79/831/EEC);
 - b. limiting exposure to toxic metals, particularly lead and cadmium;
 - c. providing advice on the development of contaminated land;
 - d. evaluation of changing pollution abatement methods.
- iii. The Department has substantially increased the research it undertakes on the effects of acid deposition on ecological systems, but of course this is only one part of a large amount of research on this subject. Air pollution, of which acid deposition is one facet, is becoming an increasingly important national and international issue. Further research will enable DOE to:
- a. develop air pollution policy;
 - b. meet commitments in relation to the control of emissions and observance of air quality standards;

CONFIDENTIAL

- c. evaluate the need for control of acidifying emissions, and the likely effectiveness of different techniques.
- iv. Research on noise pollution aims to identify trends, to evaluate public attitudes to noise nuisance, and determine effectiveness of noise control policy. DOE has specific responsibility for neighbourhood noise policy within the Control of Pollution Act and Planning Legislation.
- v. The research on waste management provides information on the "best practicable environmental option" - the method combining minimal environmental risk and nuisance with reasonable cost. DOE funded the development of new mechanical waste sorting plants which are now being assessed to determine their suitability for applications and commercial exploitation. Treatment of toxic wastes and the behaviour of pollutants within land fill sites are important aspects.

Water

Following the recommendations of the House of Lords Select Committee on the Water Industry, a Research Requirements Committee has been set up by DOE to advise on the balance and policy for future long term water research. The current programme covers coast protection, water quality and conservation and sewerage.

- i. Coast protection research will provide information to aid cost effective design and construction. DOE commissions it as proxy customer for the 86 coast protection authorities who spend some £50m annually in this field:

DOE provided £15m of grant aid under the Coast Protection Act 1949. Research on reservoir safety studies risk associated with possible failures of dams and reservoirs of which there are about 1800 in Britain, and aids improved design; it provides support for the DOE in implementing the Reservoirs Safety Act 1975.

- ii. Research on water quality will assess the causes and effects of impurities in drinking water and their health implications. An intensive research programme on sewage disposal techniques - 1.2m tonnes (dry weight) of sewage sludge is produced annually in the UK and nearly all is disposed of

on land or into the sea - contributes to public health advice. Both drinking water quality and sludge disposal are the subject of EC Directives and International agreements.

- iii. DOE part funds research on sewerage - the major funder is the Water Industry - to improve the design, use and maintenance of sewers. In this case DOE is fulfilling its role as sponsor to the civil engineering industry to achieve cost reductions for sewer replacement and maintenance in the UK.

Planning

Planning research covers not only the review of the statutory planning system and analysis of specific land-use issues, but also evaluation of Inner Cities Policy and the Urban Programme; the assessment and restoration of derelict and unstable land; methods for dealing with environmental and related problems arising from the extraction of coal and other minerals and the assessment of sources of minerals supply and related geological matters.

- i. New research on the planning system provides the basis for recommendations for the introduction of measures to improve the efficiency and effectiveness of local plans, development control decisions and the quality of the information available to inspectors and appellants. Research on specific land use issues will focus on the land-use implications for industry of technological change.
- ii. New Inner Cities Research will evaluate the impact on environment, employment and on the young unemployed of Urban Programme Projects and Expenditure. It will follow up current work on industrial land availability and the accommodation problems facing Inner City firms.
- iii. Research into the problems of derelict and unstable land will provide guidance on cost-effective techniques for the restoration of sand and gravel and metalliferous mine workings, for the restoration to forestry of colliery spoil tips and on methods for ensuring the stability and safety of old limestone workings and for assessing the risk of slippage of unstable slopes.

CONFIDENTIAL

- iv. In the field of energy minerals extraction the main focus of research action, following from the White Paper 'Coal and the Environment', is on spoil disposal and open-cast mining. Research will examine underground and other methods of spoil disposal and the problems of noise abatement at open-cast sites.
- v. The programme on non-energy minerals resource assessment, the aim of which is to provide the information to ensure that an adequate and steady supply of minerals products for industry can be maintained, while keeping financial, social and environmental costs to an acceptable minimum, will continue, but at a more modest level than in previous years. More emphasis is being given to research on alternative sources of aggregates eg. high quality sandstone for road surfacing and Magnesian Limestone.

Rural Affairs (countryside)

The research provides an input to policy on rural affairs, the discharge of responsibilities under the Wildlife and Countryside Act and guidance on the best use of land for conservation, amenity and landscape. Its aims are:

- i. to provide a data base for examination of landscape change and to assess the management and potential of rural common land.
- ii. to provide guidance on ways to maintain and enhance the environment. Subjects include low-maintenance amenity greenspace and arboriculture. This research provides encouragement to local authorities and other land owners to contribute cost-effectively to the quality of the environment.
- iii. to provide understanding of economic issues affecting rural communities. It covers, for example, integration of financial support in rural areas, mobile services, support for village shops and the impact of micro-technology. Research is also aimed at environmental education, sports and recreation eg. problems associated with football hooliganism.

Housing

Housing research falls into two groups; physical characteristics of the housing stock and research on housing in relation to the occupants.

- i. DOE research on physical characteristics of housing stock has three policy aims: to monitor the condition of the stock, including the effects of improvement policies; to advise on cost-effective energy conservation in design, construction and improvement; to prevent and remedy housing defects. Research findings on changes in conditions of the stock contribute directly to the development of improvement policy, particularly by establishing how to secure better value for money from grant aided activity. Energy conservation research is directed towards achieving further energy savings with new building or improved existing dwellings and through the revision of standards. Research on commonly occurring defects will provide advice on how to prevent them or put them right.

- ii. Most of the research about occupants is specific to one or another of the major forms of tenure - owner occupation, the private rented sector and the public rented sector - although there is some global research which monitors the overall social and economic trends in housing. This work provides key information on the development of Government policies, especially those aimed at increasing owner-occupation through various low cost home ownership initiatives, sustaining the private rented sector, and removing obstacles to the efficient operation of the housing market. The accent of research concerned with the public sector is on improving management, particularly "difficult-to-let" estates; and the mobility of tenants in public sector accommodation and access of others to it. Research also identifies the nature and quality of provision for particular groups, eg the disabled, in order to establish and subsequently publicise, examples as good practice.

Construction

The objectives of the construction research programme concern three of DOE's responsibilities. The first is building regulations, where there is statutory responsibility for health, safety and energy conservation. The second is for sponsorship of the industry where the research is intended to improve the

performance and products of the industry, which had a gross output of about £20 billion in the UK in 1982. The third is for the Property Services Agency (PSA) to support its task of building and maintaining the Government estate; in 1982/83 PSA spent £599 million on new construction and £687 million on maintenance.

i. Research in support of building regulations covers:

- a. Foundations and building structures: safe and economic foundations on difficult ground, safety aspects of modern structural codes (including Eurocodes), and investigation of various structural failures.
- b. Fire: basic work on reduction of hazards to life, with new initiatives to examine current requirements to see if they are essential, and to assess their economic implications.
- c. Safety in buildings: this includes an urgent investigation into safety aspects of water heating systems.
- d. Energy conservation: statutory requirements for energy conservation measures in new buildings are set out in the building regulations; these are under constant review to ensure that they are practical and cost-effective.
- e. Utilisation of materials such as timber, concrete and plastics. The aim is to provide information on the expected durability and performance of new materials and the reasons for failure of old ones.

Advice on this research is provided by the Building Regulations Advisory Committee.

- ii. "Sponsorship" research is aimed at improving the performance of the construction industry and its products; support is given to important topics unlikely to proceed without a measure of Government funding. Research covers foundations, materials, the provision of design information, project management, quality assurance techniques, and some aspects of building services. Research on hydraulics civil engineering

CONFIDENTIAL

will in future be included in this programme. Advice on the research is provided by the Research Strategy Committee set up by the Economic Development Committee for Building and Civil Engineering, which takes account of related research.

- iii. Research for the PSA covers building services, building with components to achieve improved performance, the maintenance and preservation of buildings and construction costs.

CONFIDENTIAL

Table 12a

DEPARTMENT OF THE ENVIRONMENT
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Countryside Commission research	2	0.5	0.5	0.5	0.5	0.5	0.5
Nature Conservancy Council research	2	1.6	1.7	1.7	1.7	1.7	1.7
Policy research for the Sports Council	2	0.4	0.5	0.4	0.8	0.8	0.9
Planning, countryside & local government	2	5.4	4.3	4.0	5.0	5.3	5.4
Housing	2	2.5	1.9	1.8	2.4	2.5	2.6
Ancient monuments & historic buildings	2	..	..	..	..	..	..
Env Protection - General	2	5.1	4.7	5.0	5.1	5.3	5.9
Env Protection - Radioactive waste	5	9.3	8.5	9.3	10.3	10.7	10.9
Building and construction	3	2.5	3.3	3.0	4.0	3.7	3.8
	4	3.0	2.2	2.4	2.7	2.7	2.6
	5	4.1	4.6	4.5	4.4	4.3	4.4
	6	0.0	0.0	0.0	0.4	1.1	1.4
Water	5	3.9	3.8	3.9	4.3	4.4	4.5
TOTAL		38.3	35.9	36.5	41.5	43.0	44.2

Table 12b

DEPARTMENT OF THE ENVIRONMENT
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	18.1	15.6	15.5	16.4	17.5	17.6
Research Councils	8.5	6.0	5.8	7.1	7.5	7.7
Other Government departments	1.8	2.1	2.2	2.4	2.5	2.6
Universities	1.9	2.1)				
Private industry	3.3	3.5)				
Public Corporations	6.6	5.2)				
Research associations overseas	2.8	3.6)	15.5	18.1	18.6	19.4
Non-industrial research institutes	0.3	0.3)				
Professional and learned societies	..	..)		
Persons	0.4	0.2)				
Others	..	..)		
<u>less</u> Receipts	5.2	2.8	2.5	2.6	3.1	3.2
TOTAL	38.5	35.9	36.6	41.5	43.0	44.2

CONFIDENTIAL

DEPARTMENT OF HEALTH AND SOCIAL SECURITY (DHSS)

DHSS commissions research in five main fields -

Health and Personal Social Services (HPSS)

Social Security (SS)

National Health Service (NHS) Building and Engineering

NHS Equipment and Supplies

NHS Scientific and Clinical Computer R & D.

HPSS and SS

The primary purpose of the HPSS research programme is to provide the DHSS with the means to evaluate and develop the programmes for the provision of high quality and cost-effective health care and relevant aspects of the social services. Particular attention is given to the effects of advances in medical technology, demographic changes, and changes in economic and social conditions.

About half the HPSS R & D effort is organised through Research Liaison Groups, consisting of departmental officers working with outside experts in relevant academic and scientific disciplines and relevant service provision. These are focussed on particular "client" groups eg "Children", "Elderly"; certain service providers, eg "Nursing", "Local Authority Social Services"; certain disease states eg "Mental Illness", "Mental Handicap", "Physical Disablement"; certain social conditions eg "Homelessness and Addictions", "Forensic". Other less formal working groups, but again with external advice, cover eg Primary Care; Acute Hospital Services; Public and Environmental Health; NHS personnel matters; Finance, Organisation and Planning of Health Services.

Almost all the above work is commissioned in universities, in several of which the DHSS finances research units, mainly in order to strengthen the academic base required to support research needs (eg in health services research and health economics). The only purely 'in-house' research unit is concerned with the Social Security Research Programme which is directed to: the coverage, take up and impact of benefits, evaluation of changes in the benefit schemes, and effectiveness of administration. A good deal of survey work is also carried out in collaboration with the Office of Population Censuses and Surveys.

CONFIDENTIAL

CONFIDENTIAL

DHSS works in collaboration with the Medical Research Council and the Economic and Social Research Council as the Department's interests extend widely from the applied bio-medical (eg clinical pathology, artificial limbs) to the psychosocial (eg residential child care). Almost all the budget of the Office of the Chief Scientist goes on Research rather than Development, the latter being financed by other DHSS funds and by the NHS itself.

Research objectives under the Department's other three R & D sub-programmes are as follows:-

Building and Engineering

The replacement value of the NHS building stock is estimated to be £21 billion and at any one time there are, at planning, design, tender or construction stage some £2 billion of capital and maintenance projects. To support this considerable capital investment Works Group produces guidance to promote the cost efficient operation, maintenance, upgrading and replacement of the NHS Estate. To assist in formulating this body of guidance and to ensure that it is soundly based, private sector and public organisations are commissioned under the R & D programme to carry out research studies and investigations. Currently effort is concentrated on:

- i. The preparation of the revised range of building notes and cost limits for hospital departments.
- ii. The further development and updating of the "Nucleus" design system and the evaluation of the first "Nucleus" hospitals.
- iii. Development work on two low-energy hospitals.
- iv. Research into the most cost effective and efficient facilities for the mentally ill, mentally handicapped and the elderly.
- v. Research into ways of rationalising and improving the management of the estate, including the development of procedures to implement the report on underused property in the NHS.
- vi. Providing advice to the NHS on mitigating the cost consequences of new statutory requirements, including fire precautions.

NHS Equipment and Supplies

The development of medical equipment and supplies of substantial benefit in patient care, treatment or diagnosis; the improvement of the performance and reliability of UK manufactured equipment; the establishment of standards; and the stimulation of British Industry to promote the production of medical equipment and supplies. Of a budget for 1984/85 of £4.8 million it is anticipated that about £3.2 million will be devoted to projects with a direct effect on British industry.

NHS Computer R & D

To provide financial support to bodies, mostly NHS authorities, who assume responsibility for projects for research into, or development of, the use of computers in the management and provision of national health services.

The Department's interest in the use of computers in the NHS lies in:

- i. The development of innovative systems in the fields of primary care and scientific and clinical computing, including studies and investigations into the technical aspects of computing;
- ii. The support of the Government's information technology awareness programme through the sponsoring of suitable projects in the promotion of new technology in the NHS through conferences/seminars and publicity;
- iii. The dissemination of information about computer systems and practices to assist local NHS and Regional management in their decision making roles.

CONFIDENTIAL

Table 13a

DEPARTMENT OF HEALTH AND SOCIAL SECURITY
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Health and personal social services	2	13.4	12.0	11.4	10.8	11.1	11.6
Social Security	2	0.5	0.4	0.4	0.4	0.8	0.4
Standards	2	0.4	0.4	0.4	0.5	0.5	0.5
Standard systems	5	0.6	0.8	..	..	..	..
Information Technology	2	0.2	0.2	0.1	0.0	0.0	0.0
	5	0.0	0.2	0.1	0.2	0.3	0.3
Hospital building	2	0.8	0.9	0.9	1.0	1.1	1.1
Procurement techniques	2	0.0	0.1	0.0	0.0	0.0	0.0
Medical equipment	3	2.2	2.4	2.8	3.2	3.1	3.0
Component database	4	0.1	0.1	0.1	0.1	0.0	0.0
Scientific and clinical	5	0.2	0.1	0.2	0.3	0.4	0.4
Family practitioner services	5	0.5	0.3	0.4	0.3	0.3	0.3
Hospital management and organisation	5	0.2	0.1	0.1	0.0	0.0	0.0
Prescription pricing authority	5	0.6	0.8	..	..	..	..
Statutory regulations	5	0.2	0.2	0.2	0.1	0.2	0.2
Protection and promotion of human health	5	8.2	9.7	9.4	8.9	6.5	6.0
Staffing and training	6	0.1	0.1	0.1	0.1	0.0	0.0
TOTAL		28.2	28.9	26.5	25.7	24.2	23.8

Table 13b

DEPARTMENT OF HEALTH AND SOCIAL SECURITY
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	11.1	12.7	16.2	14.6	12.0	11.5
Research Councils	0.5	0.4	0.2	0.2	0.3	0.3
Other Government departments	1.0	1.0	0.3	0.2	0.2	0.2
Universities	9.5	9.1)				
Private industry	1.5	1.8)				
Public Corporations	..	..)		
Research associations	0.2	0.1)	14.4	13.9	14.7	14.8
Non-industrial research institutes	1.8	1.3)				
Others	3.3	3.6)				
less Receipts	0.6	1.1	4.6	3.3	3.0	3.0
TOTAL	28.2	28.9	26.5	25.7	24.2	23.8

HEALTH AND SAFETY COMMISSION (HSC)

The HSC and its Executive (HSE) have a duty to advise, inform, encourage, inspect and regulate in order to bring about the best practicable levels of health and safety in occupational activities. Their research programme is an integral part of, and is wholly determined by, this practical task.

The objectives of the research fall largely under the two primary purposes of policy definition and meeting obligations and are all directed towards improving the long-term health or reducing the risk of death or serious injury of persons at work.

Obligations

Here research is aimed at assisting field-based staff of HSE (eg Inspectors, Medical Advisers etc) in the enforcement of health and safety requirements. Objectives cover such activities as the development of methods for:

- i. The analysis or evaluation of samples (eg body fluids, air, dusts, materials)
- ii. The forensic examination of impounded equipment (eg from accidents or other incidents)
- iii. The scientific assessments of hazards arising from articles, substances or systems of work
- iv. The monitoring and control of known hazards (eg workplace environments containing explosives, flammable, toxic, carcinogenic substances).

Current priorities include problems associated with asbestos and other dusts, liquid petroleum gas, protective and respiratory equipment and automation of analytical methods to facilitate the handling of large numbers of medical samples.

CONFIDENTIAL

Policy

Research objectives are aimed at providing policy makers with scientific and technological information relating to hazards that may accompany the introduction of new technology and new materials by industry. Such information is also of assistance in the setting of standards, the drafting of regulations, approved codes of practice and other guidance materials.

Current priorities include studies of the dispersion of gas clouds in relation to policy issues concerned with the siting of chemical complexes and the bulk storage of chemicals, and provision of information to facilitate the drafting of underground transport regulations, whilst studies of the problems associated with noise are assuming greater importance.

CONFIDENTIAL

Table 14a

HEALTH AND SAFETY COMMISSION
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Explosions, fire and explosives	2	0.2	0.2	0.2	0.2	0.3	0.3
Major hazards	5	0.7	0.8	0.9	1.0	1.1	1.3
Electrical hazards	5	0.1	0.2	0.2	0.2	0.2	0.3
Nuclear installation hazards	2	0.0	0.0	0.0	0.0	0.1	0.1
	2	0.2	0.3	0.3	0.3	0.3	0.4
Engineering hazards	5	0.8	1.0	1.1	1.2	1.3	1.5
	2	0.1	0.2	0.2	0.2	0.2	0.3
Occupational medicine	5	0.6	0.7	0.7	0.8	0.9	1.0
	2	0.2	0.3	0.3	0.3	0.4	0.4
Environmental hazards	5	0.9	1.1	1.2	1.2	1.4	1.6
	2	0.4	0.5	0.5	0.6	0.6	0.8
Other hazards	5	1.6	2.0	2.2	2.3	2.6	3.0
	2	0.1	0.1	0.1	0.1	0.1	1.0
	5	2.3	2.8	3.1	3.2	3.7	4.3
TOTAL		6.2	7.5	8.3	8.8	9.9	11.5

Table 14b

HEALTH AND SAFETY COMMISSION
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	3.7	3.9	4.3	4.5	5.4	6.8
Research Councils	0.7	0.7	0.8	0.8	0.9	0.9
Other Government departments	0.3	0.3	0.3	0.3	0.3	0.3
Universities	1.1	1.0)				
Private industry	0.9	0.8)				
Public Corporations	..	..)		
Research associations	0.1	0.1)	3.4	3.5	3.7	3.9
Overseas	..	0.2)				
Non-industrial research institutes	0.4	0.9)				
Others	0.1	0.1)				
<u>less</u> Receipts	1.1	0.6	0.4	0.4	0.4	0.4
TOTAL	6.2	7.5	8.3	8.8	9.9	11.5

CONFIDENTIAL

HOME OFFICE

The Home Office funds research in its Research and Planning Unit and in the Technical Services branch of the Police Department.

The objectives of the Research and Planning Unit relate directly to the policy areas that its work covers, ie criminal justice, criminal policy, police, prisons, community programmes and immigration.

The objectives of the R & D work of the Technical Services branch of the Police Department are:

- i. to help the police and fire services to improve their effectiveness, particularly through the use of operational research techniques, the development of new equipment, the application of information technology and the development of improved methods of telecommunications;
- ii. to assist the Prison Department in the improvement of prison security systems;
- iii. to provide advice on the effects of nuclear and conventional weapons and the protection of the civilian population against such effects, including post-attack recovery;
- iv. to develop and improve methods of forensic science and analysis.

CONFIDENTIAL

Table 15a

HOME OFFICE
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Rehabilitaion of offenders	2	0.4	0.4	0.3	..	..	..
Equal opportunities	2	0.3	0.3	0.3	0.3	0.3	0.4
Law services	2	2.0	1.9	2.1	2.2	2.2	2.2
Race relations	2	0.0	0.1	0.1	0.1	0.1	0.1
Prison security	2	0.2	0.2	0.3	0.3	0.3	0.3
Civil defence	2	0.5	0.5	0.8	0.8	0.9	0.9
Police research	2	4.3	4.9	4.8	5.3	5.7	5.9
Forensic science	2	1.0	1.1	1.1	1.3	1.6	1.5
Fire research	2	0.5	0.5	0.7	0.9	1.1	1.1
Telecommunications	3	1.5	1.8	1.5	1.9	2.1	2.2
Research into the voluntary sector	6	0.0	0.0	0.0	0.1	0.1	0.1
Sex discrimination and equality	6	0.2	0.2	0.2	0.2	0.2	0.2
Other costs (Total)	9	0.3	0.3	0.4	0.4	0.4	0.4
TOTAL		11.2	12.2	12.6	13.8	15.0	15.3

Table 15b

HOME OFFICE
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	8.0	8.7	9.3	10.5	11.4	11.6
Research Councils	0.1	0.1	0.1	0.1	0.2	0.2
Other Government departments	0.3	0.2	0.2	0.2	0.2	0.2
Universities	0.6	0.7)				
Private industry	1.5	1.8)				
Public Corporations	..	..)		
Research associations Overseas	..	..)	3.2	3.2	3.4	3.5
Non-industrial research institutes	0.4	0.5)				
Persons	0.1	0.1)				
Others	0.4	0.4)				
less Receipts	0.2	0.2	0.2	0.2	0.2	0.2
TOTAL	11.2	12.2	12.6	13.8	15.0	15.3

CONFIDENTIAL

OVERSEAS DEVELOPMENT ADMINISTRATION (ODA)

ODA funds R & D projects as part of its bilateral aid programme to individual developing countries. In addition ODA funds projects at home or overseas, which are not appropriate to funding from other bilateral aid funds, each of which is expected to benefit several developing countries rather than one.

The main purpose is to sponsor and to support a programme of research aimed at gathering new knowledge and evolving new techniques directly related to the needs of developing countries. The emphasis is on research likely to be of practical use in a reasonable period of time, and special priority is given to R & D of direct relevance to the poorer sectors of the poorer countries with particular reference to the development of the rural sector. The disciplines covered are those related to developing country needs: (i) Agriculture (ii) Fisheries (iii) Veterinary studies (iv) Forestry (v) Medicine and Health (vi) Population studies (vii) Education (viii) Energy (ix) Engineering (x) Building (xi) Transport (xii) Roads (xiii) Hydrology (xiv) Economic and (xv) Social.

Table 16a

OVERSEAS DEVELOPMENT ADMINISTRATION
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Geology	6	0.2	0.3	0.1	..	..	..
Water resources	6	0.8	1.1	1.2	1.3	1.3	1.3
Agriculture environment	6	3.8	4.6	5.1	5.4	5.8	6.1
Animal health and production	6	1.0	1.2	1.1	1.1	1.2	1.3
Trypanosomiasis (animal)	6	0.6	0.6	0.5	0.5	0.6	0.6
Pest control	6	1.1	1.1	1.3	1.3	1.3	1.3
Forestry	6	0.6	0.5	0.5	0.6	0.6	0.6
Fisheries	6	0.3	0.3	0.3	0.3	0.3	0.3
Post-harvest technology	6	2.5	2.4	2.9	2.8	2.8	2.8
Nutrition	6	0.2	0.2	0.1	0.1	0.1	0.1
Medicine and health	6	1.4	1.4	1.8	1.9	2.0	2.0
Economic and social population	6	1.0	1.0	1.2	1.2	1.2	1.2
Education	6	1.0	1.3	1.8	2.2	2.6	3.2
Engineering	6	0.1	0.1	0.1	0.1	0.1	0.1
Construction	6	0.1	0.1	0.2	0.2	0.2	0.2
Transport	6	0.2	0.2	0.3	0.3	0.3	0.3
Energy	6	1.1	1.9	1.9	2.0	2.1	2.1
	6	0.3	0.4	0.4	0.3	0.4	0.4
TOTAL		16.3	18.6	20.7	21.6	22.8	24.1

Table 16b

OVERSEAS DEVELOPMENT ADMINISTRATION
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	4.3	4.2	5.0	4.8	4.8	4.9
Research Councils	1.3	1.6	1.4	1.5	1.6	1.7
Other Government departments	2.1	2.3	2.0	2.1	2.2	2.2
Universities	3.6	3.5)				
Research associations	..	..)		
Overseas	4.7	5.7)				
Non-industrial research institutes	0.4	1.2)	13.6	14.6	14.6	15.8
Professional and learned societies	..	..)		
Persons	..	..)		
Others)				
<u>less</u> Receipts	0.4	0.3	0.5	0.5	0.5	0.5
TOTAL	16.3	18.6	20.7	21.6	22.8	24.1

CONFIDENTIAL

DEPARTMENT OF TRADE AND INDUSTRY (DTI)

The general objective of DTI is to encourage, assist and ensure the proper regulation of British trade, industry and commerce; to increase the growth of world trade and the national production of wealth. The three main ways in which this will be achieved are by promoting:

a climate for British industry and commerce which is as conducive to enterprise and competition as that in any other industrial country

the international competitiveness of British firms through increased efficiency and adaptability

innovation to improve the products, processes and services that British industry and commerce can offer to the world.

All three of these involve DTI in R & D activity. This includes programmes carried out in Government laboratories and industry which maintain and enhance the technological base, and work needed for the regulation of industry and for the protection of the consumer. DTI is advised on its R & D expenditure by five Research Requirements Boards (RRBs). Each has a senior industrialist as chairman and strong industrial representation. The main technological areas of support fall into four broad groups namely: Research Establishments, General Industrial R & D, Aircraft and Aero-Engines and the Space Technology programme. Each has its own objectives.

1. RESEARCH ESTABLISHMENTS

1.1 DTI runs four laboratories

Laboratory of the Government Chemist (LGC)

National Engineering Laboratory (NEL)

National Physical Laboratory (NPL)

Warren Spring Laboratory (WSL)

The objectives of their R & D programmes are to support

- (i) work required by statute eg at the LGC
- (ii) the national standards and measurement system

CONFIDENTIAL

- (iii) Government planning and regulatory functions
- (iv) Departmental policy initiatives
- (v) work of national benefit in new fields and to exploit and enhance mature technology, and to transfer the results to industry
- (vi) the provision of specialised expertise and facilities for industry on repayment.

1.2 Consumer Safety

DTI's Consumer Safety R & D Programme is mainly carried out at the LGC. The general objectives are:

- (i) To improve the general safety of goods.
- (ii) To promote general safety awareness in and around the home.

1.3 Metrology and Standards

DTI's Metrology and Standards programme is primarily carried out at the NPL. The general objectives are:

- (i) To support and develop the national measurement system so that all measurements can be made with the appropriate accuracy for the task in hand and can be authentically related to the appropriate national standards. The British Calibration Service network of measurement laboratories is part of this system.
- (ii) To help UK industry meet international competition by the establishment of a network of accredited (and subsequently internationally recognised) testing laboratories.

2. GENERAL INDUSTRIAL R & D

2.1 Electronics and Information Technology (IT)

The general objectives are:

- (i) To assist the long term growth of components and systems manufactured in the UK electronics and IT industries.

- (ii) To increase the international competitiveness of companies, particularly in the telecommunications automation, process control and instrumentation sectors, by helping them to apply advanced electronics effectively to their products and manufacturing processes.

The specific objectives include:

- (i) The establishment of the basic technology and the development of a manufacturing base for optical fibres and opto-electronic components.
- (ii) The maintenance of a state-of-the-art (manufacturing) capability for integrated circuits.
- (iii) The development of advanced industrial, scientific and medical measuring instruments, with particular emphasis on automatic test equipment, automatic control of production and computer aids for design, test and manufacture.
- (iv) To encourage development of new telecommunications equipment, such as feature or intelligent telephones, particularly by small and medium-sized firms.
- (v) To stimulate the creation and development of new ranges of interactive services and products, such as teletex and in office automation.
- (vi) To encourage further development of micro-electronics based products and processes in all sectors.
- (vii) To support the development and international competitiveness of the computer and software industries, in particular by developing and using state-of-the-art tools and techniques.
- (viii) To encourage further spin-off from MOD R & D.
- (ix) To promote studies of improved radio system design and of the utilisation of the radio frequency spectrum.

CONFIDENTIAL

The Alvey programme of pre-competitive collaborative research into advanced IT is complementary to the Electronics Programme. It is co-ordinated by DTI but also involves SERC and MOD. The general objective is to promote research in the underlying technologies of IT through the collaboration of teams in industrial, national and academic research laboratories. The specific objectives are:

- (i) To build up UK expertise in very large scale integration (VLSI), including a capability to design and make economically 1 micron metal oxide semi-conductors (MOS) and bipolar ICs and to provide secure access to the technology for UK systems companies.
- (ii) To create and maintain in the UK tools and methodologies to produce high quality cost effective software.
- (iii) To build up UK expertise in intelligent knowledge based systems (IKBS), with a target to double the number of UK researchers in this area.
- (iv) To build up UK expertise in the man-machine interface, including flat panel displays and speech and image processing.
- (v) To build up infrastructure and communications technology, including the establishment and operation of an advanced network to link the UK IT community.

2.2 Mechanical and Electrical Engineering

The general objective is to promote UK competitiveness by developing advanced manufacturing technology and assisting its introduction into UK industry.

The specific objectives include:

- (i) To raise the level of technology in computer aided engineering, flexible manufacturing systems and robotics, production machine design and development, welding and assembly.

CONFIDENTIAL

- (ii) To enhance the capability of the process plant industry, especially with regard to hardware manufacturing and in the field of biotechnology.
- (iii) To develop better manufacturing processes and commercially successful new products in the 'heavy' electrical engineering sector.
- (iv) To encourage the application of new technology in the hydraulics industry and those industries providing machinery for the construction, food, drink, packaging, tobacco, plastics, rubber, printing and textile industries.
- (v) To enhance the technical quality of British Standards in engineering.
- (vi) To assist the UK marine industries to obtain a significant share of the world market by making full use of modern technology, particularly of recent developments in data and information handling, combined with satellite communications systems.

2.3 Materials and Chemicals

The general objectives are:

- (i) to strengthen the technological and industrial base of the private sector steel industry and the ferrous castings sector - by enhancing manufacturing efficiency, material quality, technology transfer and product innovation.
- (ii) To enhance the competitiveness of the non-ferrous metals sector - by reducing processing costs, improving properties for end use and by encouraging the use of these metals in high added-value sectors.
- (iii) To enable UK mining houses to compete in world markets.
- (iv) To enhance the industrial exploitation of polymers and ceramics.

CONFIDENTIAL

- (v) To help the UK chemical industry to cope with toxicity and environmental restrictions and generally to maintain the competitiveness of the industry with particular emphasis on the needs of smaller companies.
- (vi) To stimulate UK industry to spend more on biotechnology R & D, for new products and processes.

2.4 Vehicles

The general objective is to help the UK automotive industry to meet international competition, and the requirements of pollution, energy consumption and conservation legislation.

2.5 Textiles and Other Manufactures

The general objective is to help the UK carpets, clothing, fibres, footwear, furniture, leather, packaging, paper, printing, textiles and machinery industries improve their competitiveness by raising quality and lowering production costs with existing product types and by encouraging transfer of technology from outside these traditionally based labour intensive industries.

3. AERONAUTICS

The general objectives are:

- (i) To assist the UK aircraft, aero-engine and aircraft equipment industry to maintain a technological capability that enables it to compete successfully in world markets.
- (ii) To maximise the benefit to the civil sector of the defence R & D programmes

and more specifically

- (iii) To increase the civil aircraft manufacturing business in the UK, particularly in exports during the later years of this decade and the early nineties.

CONFIDENTIAL

These objectives demand the maintenance of a very high level of technological excellence both for international competitiveness and to ensure a continuing demand for UK involvement as partners in international collaborative projects.

Launch aid for the aerospace industry

Launch aid is a form of assistance provided under the Civil Aviation Act 1982 for specific projects in the aerospace industry. It is provided in recognition of the fact that the high cost, long timescales, and high technical and market risks of major aerospace projects reduce their attraction to commercial investors. It takes the form of a contribution, fixed by contract, towards the cost of launching the product in question, and is recoverable by a levy on sales. Most, but not all, of the costs assisted are R & D costs. Launch aid is thus an instrument of industrial sponsorship, aimed at encouraging industry to undertake specific projects which are judged after thorough appraisal to have good prospects of commercial viability. Each case is the subject of collective decision by Ministers. Launch aid provision is made in the PES only for projects already approved.

4. SPACE

The general objective is to help the development of UK companies that can provide hardware (both satellites and ground stations), software and services in the fields in which the UK has chosen to specialise. The specific objectives include:

- (i) The promotion of UK spacecraft capabilities and so to increase the proportion of UK components in UK spacecraft.
- (ii) To keep UK companies abreast of developments in new space applications of potential commercial and technological interest.

Most of the expenditure is with the European Space Agency, which places development contracts with UK industry. There is a small national research programme managed for DTI by the Royal Aircraft Establishment, Farnborough.



PUBLIC PURCHASING

Funds are earmarked within DTI's R & D budget for public purchasing projects.

The general objectives are:

- (i) To enable innovatory products and processes to be demonstrated specifically in the public sector
- (ii) (and thus) To help industry establish international market credibility and competitiveness.

CONFIDENTIAL

Table 17a

DEPARTMENT OF TRADE AND INDUSTRY
SUBJECT AREAS AND PRIMARY PURPOSES
Emillions

SUBJECT AREA	PP 1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
I RESEARCH ESTABLISHMENTS						
COMPUTER AIDED DESIGN CENTRE						
Industrial production	6	3.3	3.3)			
and technology			)	Privatisation		
Other costs	6	0.6	0.8)			
LABORATORY OF THE GOVERNMENT CHEMIST						
Environmental and	2	0.0	0.0	0.1	0.1	0.2
materials science						
Methods of analysing	2	0.0	0.0	0.4	0.4	0.4
chemicals						
Food and nutrition	5	..	..	0.1	0.1	0.1
Other R & D	6	0.3	0.4	0.1	0.1	0.1
Other costs	6	..	0.1	0.2	0.2	0.1
NATIONAL ENGINEERING LABORATORY						
Applied fluid mechanics	3	2.7	3.2	3.5	3.0	3.5
Heat transfer	3	1.4	1.5	1.9	2.5	2.6
Fluid power engineering	3	1.0	0.9	0.5	1.2	1.2
Manufacturing systems	3	3.3	3.3	4.1	6.4	6.6
and metrology						
Materials and structures	3	3.5	3.2	4.0	3.8	4.4
Other R & D	3	1.8	1.0	1.0	0.5	0.5
NATIONAL MARITIME INSTITUTE						
Industrial production	3	0.5	0.3)			
technology)			
Aerospace equipment	3	0.9	0.5)	Privatisation		
manufacturing)			
Shipbuilding & repairing	3	1.9	1.2)			
Other costs	6	0.5	0.3)			
NATIONAL PHYSICAL LABORATORY						
Metrology and standards	2	12.7	14.4	15.8	17.4	19.2
Materials technology	3	2.3	2.8	3.1	3.3	3.4
Information technology	3	1.5	1.6	1.5	1.6	1.6
Other R & D	6	1.5	1.6	1.7	2.1	2.1
Other Costs	6	0.6	0.6	0.6	0.8	0.8
WARREN SPRING LABORATORY						
Support for process ind	3	1.4	1.9	2.2	3.0	2.9
& envmtl matters						
Other costs	6	0.5	0.6	0.6	0.7	0.7
TOTAL RESEARCH ESTABLISHMENTS		42.2	43.3	41.4	47.2	50.4
						52.6

CONFIDENTIAL

Table 17a (Cont)

DEPARTMENT OF TRADE AND INDUSTRY
SUBJECT AREAS AND PRIMARY PURPOSES
Emillions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
II INDUSTRIAL R & D							
Aircraft equipment	3	1.0	1.0	0.5	1.8	2.2	1.9
Alvey programme	3	0.0	0.0	1.5	7.0	15.4	20.4
Biotechnology	3	0.0	0.4	0.7	2.8	5.1	6.4
Chemicals, textiles and paper							
Polymers and ceramics	3	3.5	2.6	4.0	4.9	5.9	7.2
Biotechnology	3	0.8	1.1	3.3	2.6	1.7	1.3
Chemical manufacture	3	1.3	1.3	1.9	2.5	4.1	4.2
Spinning	3	0.4	0.5	0.5	0.9	0.9	0.8
Other textiles	3	0.6	0.8	0.6	1.0	0.9	0.6
Footwear	3	0.8	0.6	0.6	1.2	0.8	0.7
Paper and board	3	0.4	0.4	0.5	0.7	0.7	0.6
Other R & D	3	2.5	1.9	2.3	5.1	4.9	4.3
Electronics	3	11.1	13.0	21.8	32.3	40.0	39.6
Information technology	3	12.1	27.1	27.7	39.4	38.0	36.8
Maritime technology	3	3.9	5.3	7.0	8.4	8.3	8.3
Mechanical and electrical engineering	3	3.9	10.8	13.8	32.8	25.1	40.1
Minerals metals							
Ferrous metals	3	4.1	3.2	4.3	5.4	5.4	5.6
Non-ferrous metals	3	1.9	1.0	1.4	1.9	1.8	1.9
Other R & D	3	0.3	0.1	0.2	0.2	0.2	0.2
Public purchasing	3	2.2	7.3	15.0	16.5	14.0	14.0
Shipbuilding	3	0.0	0.1	0.1	0.5	0.5	0.5
Vehicles	3	7.7	8.1	11.1	14.4	11.4	12.4
Telecommunications	6	0.0	0.0	0.0	0.3	1.0	1.1
Other industrial R&D sponsorship							
Energy efficiency	3	0.1	0.1	0.1	..	..	0.0
Metrology and standards	2	0.2	0.6	1.8	1.8	1.8	1.9
Food & drug manf, bldg mats & constr ind	3	0.0	0.0	0.5	0.9	1.0	1.3
Other R & D	6	0.9	1.6	3.0	3.5	3.5	3.6
TOTAL INDUSTRIAL R&D		59.9	88.4	122.4	187.1	192.8	213.8

Table 17a (Cont)

DEPARTMENT OF TRADE AND INDUSTRY
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
III AERONAUTICS							
Aircraft and aeroengines							
Airframes	3	6.0	7.5	8.6	10.0	10.3	11.0
Aircraft equipment	3	4.2	5.9	6.0	6.3	6.5	6.6
Aero-engines	3	15.3	15.3	19.0	20.1	28.9	29.8
Other R & D	3	0.2	0.2	0.2	0.2	0.2	0.2
Launch Aid & Other Aid							
Concorde performance enhancement	3	0.4	0.0	0.4	0.0	0.0	0.0
Launch aid for Rolls Royce	3	88.9	45.1	65.6	10.4	6.0	-17.0
Launch aid for helicopter projects	3	0.0	10.0	11.0	18.0	14.0	12.0
A320 Launch aid (Airbus)	3	0.0	0.0	0.0	62.0	73.0	86.0
TOTAL AERONAUTICS		115.0	84.1	110.9	127.0	138.9	128.6
IV SPACE							
ESA (Telecommunications)	3			(41.9	38.5)		
ESA (Transport systems)	3	53.3	54.7	(4.9	8.7)	66.3	51.3
ESA (Remote sensing)	3			(1.5	11.9)		
Other ESA activities	3			(2.7	7.4)		
National space programme	3	5.4	7.2	10.3	12.1	13.5	13.5
TOTAL SPACE		58.7	61.9	61.3	78.7	79.8	64.8
V REGULATION							
Future radio systems	2	0.3	0.4	0.5	0.5	0.6	0.8
Contr to Int Bureau of Weights & Measures	5	0.1	0.1	0.2	0.2	0.2	0.3
Consumer safety	6	0.5	0.5	0.4	0.5	0.5	0.5
Office of Fair Trading	2	0.1	0.1	0.1	0.1	0.1	0.1
Marine Directorate		1.9	2.5)				
Civil Aviation Policy		0.1	0.1)	Transferred to DTp			
TOTAL REGULATION		2.9	3.7	1.3	1.4	1.5	1.6
VI OTHER INDUSTRIAL SPONSORSHIP							
Sponsorship (mainly manufacturing)	3	6.2	2.7	6.0	8.6	4.9	0.8
TOTAL OTHER		6.2	2.7	6.0	8.6	4.9	0.8
TOTAL (1)(2)		284.9	284.0	343.3	449.9	468.2	462.3

CONFIDENTIAL

Table 17b

DEPARTMENT OF TRADE AND INDUSTRY
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	55.6	57.5	52.3	56.7	60.1	64.2
Research Councils	0.4	0.3	0.3	0.4	0.4	0.4
Other Government departments	21.7	27.9	31.0	29.5	29.3	29.7
Universities	2.0	1.8)				
Private industry	177.8	169.8)				
Public Corporations	15.7	18.0)				
Research associations	5.3	12.1)				
Overseas	59.7	54.7)	318.9	424.6	456.6	455.3
Non-industrial research institutes	0.3	0.4)				
Persons	..	..)		
Others	0.4	2.5)				
<u>less Receipts</u>	53.4	62.5	61.0	64.1	80.0	87.8
TOTAL	285.6	282.5	341.4	447.0	456.4	461.9

(1) The R & D expenditure reported in this review is that which falls strictly within the Frascati definition. The Department of Trade and Industry responsibilities for technology and innovation range more widely than this. A detailed review of the Department's support for technology and innovation is given in the Department of Trade and Industry report "Technology and Innovation 1983-84", published in October 1984.

(2) The differences in the totals between Tables 17a and 17b are mainly due to some data having been provided rounded to the nearest £million for Table 17a and to the nearest £thousand for Table 17b.

CONFIDENTIAL

DEPARTMENT OF TRANSPORT (DTp)

DTp's research programme contributes to the formation of policy, the framing of national and international standards and regulations and the technical maintenance and efficiency in road, rail, sea and air transport. The main contractor for road transport systems research is the Department's Transport and Road Research Laboratory (TRRL). DTp also supports research commissioned by British Rail and London Transport through joint programmes.

The objectives and purposes of the research undertaken in the subject areas covered by DTp are as follows:

Bridges - primary purpose: purchasing

- i. to improve design standards taking advantage of current knowledge and materials;
- ii. to find the best ways of dealing with ageing and deterioration;
- iii. to improve ability to assess capacity for carrying heavy loads.

Ground engineering - primary purpose: purchasing

- iv. to reduce the whole life costs by optimising the use of in-situ materials in both new construction and maintenance work by means of more effective site investigation, site control and improvements in soil-strengthening techniques;
- v. to improve assessment, design and maintenance methods in areas where soil behaviour forms an integral part of the construction process and is of paramount importance in the interactive support to and long-term performance of structures, earthworks, tunnels, pipes and pavements.

Pavement design, materials and maintenance - primary purpose: purchasing

- vi. to develop and test new pavement design formulations of concrete and bituminous materials;
- vii. to develop methods for the assessment of road pavement strength and conditions;

CONFIDENTIAL

- CONFIDENTIAL
- viii. to develop techniques for assessing optimal timing and nature of road maintenance works;
 - ix. to develop recommended construction techniques for minimal whole-life costs (construction, maintenance and user costs).

Highway planning and evaluation - primary purpose: policy

- x. to develop improved techniques for the design and economic evaluation of highway schemes and road junctions, and for predicting traffic flows and speeds;
- xi. to develop techniques for environmental appraisal and the development of special instrumentation.

Traffic management, communications and control - primary purpose: obligations

- xii. to make safer and more efficient use of existing road systems by improvement in traffic management and associated signals and communication equipment;
- xiii. to design and appraise traffic management measures at roadworks.

Road user safety - primary purpose: policy

- xiv. To save lives and reduce injuries.

Vehicle design and safety - primary purpose: obligations

- xv. to ameliorate the environmental effects (noise, vibration damage and air pollution) arising from road vehicles;
- xvi. to provide an adequate basis of technical advice to enable policies, regulations, standards and legislation to be framed to take full account of changes in technology and economics which will affect the design, construction, mechanical and fuel efficiency of vehicles.

CONFIDENTIAL

Transport and disabled people - primary purpose: policy

- xvii. to develop systems of transport that enhance the mobility of the disabled, through improvements in the design of public service vehicles, taxis and cars, the improvement of infrastructure and the development of new services.

Public Transport and Transport Planning - primary purpose: policy

- xviii. to provide information on the demand for travel, public transport provision (subsidy, efficiency, organisation, alternative services, infra-structure investment) and energy use, so far as required for policy decisions.

Freight - primary purpose: policy

- xix. to encourage the development of freight transport that is more efficient, safer and less damaging environmentally by gathering and interpreting information on UK freight transport and its effects on society;
- xx. to assist in the formulation and implementation of policies, fostering new technology as appropriate.

Ports - primary purpose: policy

- xxi. to provide information and statistics that will help to improve efficiency in the ports industry.

Joint DTp/British Rail programme - primary purpose: sponsorship

- xxii. to improve the operational efficiency of the railway system;
- xxiii. to reduce capital and maintenance cost;
- xxiv. to achieve the maximum utilisation of investment resources to the long term benefit of the railway;
- xxv. to reduce manpower and increase productivity;

xxvi. to achieve economy in the use of energy consistent with the Board's commercial and financial policies and with the need to adopt a flexible strategy so that options are available;

xxvii. to enhance the export prospects of the UK railway manufacturing industry.

Joint DTp/London Transport Executive Programme - primary purpose:
sponsorship

xxviii. to reduce the capital, operating and maintenance costs fo the LT rail system, and the improvement of performance, reliability and passenger environment in service so as to attract increased patronage.

Marine and Shipping - primary purpose: obligations, sponsorship and policy

xxix. to help discharge responsibilities in a national and international context for

- a. the safety of merchant ships and fishing vessels;
- b. the health and safety of persons on ships;
- c. the prevention of pollution of the sea from ships and
- d. the clearing up of marine pollution.

xxx. to promote, where appropriate in partnership with the General Council of British Shipping, the efficiency and international competitiveness of the British shipping industry.

Aviation - primary purpose: obligations

xxxi. to investigate the effects of various parameters on measurements of noise from aircraft in flight for purposes of noise certification.

CONFIDENTIAL

Table 18a

DEPARTMENT OF TRANSPORT
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Highway Planning	2	2.4	1.6	1.3	2.2	2.2	2.3
Road user safety	2	2.7	2.4	2.8	3.2	3.2	3.3
Transport and disabled people	2	..	..	..	..	0.2	0.3
Public transport and transport planning	2	2.2	1.8	2.3	2.5	2.2	2.3
Freight	2	0.6	0.3	0.5	0.5	0.5	0.5
Ports	2	1.1	0.1	0.5	0.2	0.2	0.3
Joint R & D with BR	3	3.5	4.1	4.3	4.5	4.7	4.9
Joint R & D with LT	3	1.6	1.9	2.4	5.6	9.7	5.9
Bridges	4	2.1	2.8	2.3	3.9	3.9	4.0
Ground engineering	4	1.8	1.5	1.3	2.0	2.0	2.0
Pavement design	4	2.6	2.4	2.2	3.2	3.2	3.3
Traffic management	5	2.0	2.6	3.1	3.4	3.4	3.5
Vehicle design and safety	5	1.9	1.5	2.1	2.0	2.0	2.0
Aircraft noise measurement	5			(0.1	0.1	0.1	0.1
Technology (NPL)		Transferred from DTI(
Marine safety (General)	5			(2.1	2.3	2.4	2.6
Pollution control and prevention	5	0.8	0.7	1.0	1.1	1.1	1.2
Support of ODA	6	1.6	1.1	1.4	1.5	1.5	1.5
Other costs (Total)	6	1.6	1.8	2.0	2.2	2.1	2.2
TOTAL		27.5	25.9	31.7	40.4	44.5	42.0

Table 18b

DEPARTMENT OF TRANSPORT
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	18.1	16.6	17.3	20.9	20.4	21.1
Research Councils	..	..	..	..	..	..
Other Government departments	0.3	0.4	1.9	2.0	2.1	2.1
Universities	1.6	1.6)				
Private industry	3.4	3.2)				
Public Corporations	3.5	4.1)	12.5	17.5	22.0	18.8
Research associations	0.1	0.1)				
Others	1.8	2.2)				
<u>less</u> Receipts	1.3	2.2	..	..	..	..
TOTAL	27.5	25.9	31.7	40.4	44.5	42.0

CONFIDENTIAL

NORTHERN IRELAND DEPARTMENTS

DEPARTMENT OF AGRICULTURE FOR NORTHERN IRELAND ^A

The largest proportion of R & D expenditure in Northern Ireland is in the agriculture and food sectors. Research and specialist scientific, advisory and diagnostic work is designed to develop methods which increase the efficiency of production of and improve the quality of food. R & D work in this area is also designed to minimise environmental disturbance while maximising agricultural benefits.

DEPARTMENT OF HEALTH AND SOCIAL SECURITY NORTHERN IRELAND

Research in the general field of health and social services is funded by the Department of Health and Social Services, Northern Ireland, through its Clinical Research Advisory Award Committee. This aims to support research projects over a maximal period of 3 years, provided there is a clear potential benefit either in improvement of the quality of clinical care or in the acquisition of information capable of improving the delivery of social services.

CONFIDENTIAL

Table 19a

NORTHERN IRELAND DEPARTMENTS
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Economic and social sciences	1	0.1	0.2	0.2	0.2	0.2	0.2
	2	0.2	0.2	0.2	0.2	0.2	0.2
Water research	2	0.3	0.3	0.4	0.4	0.4	0.4
Public expenditure	2	0.1	0.1	0.1	0.1	0.1	0.1
Priorities							
Energy	2	..	..	..	0.1	0.1	0.1
Environment (roads service/finance)	2	0.1	0.1	0.1	0.1	0.1	0.1
	5	0.1	0.1	0.1	0.1	0.1	0.1
Industrial development and production	2	0.1	0.1	0.1	0.1	0.1	0.1
Industrial development Board R & D	3	2.3	2.1	3.1	4.6	5.1	5.1
Agriculture and food R & D	3	6.6	6.3	6.8	7.2	7.5	7.7
TOTAL		9.7	9.4	11.1	12.9	13.8	14.1

Table 19b

NORTHERN IRELAND DEPARTMENTS
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	6.6	6.5	6.9	7.2	7.5	7.8
Other Government departments	..	..	..	..	..	..
Universities	..	..)		
Private industry	2.2	2.0)				
Research associations	0.1	0.1)				
Non-industrial research institutes	1.4	1.5)	4.8	6.4	6.9	7.0
Persons	..	..)		
Others	..	..)		
less Receipts	0.6	0.7	0.7	0.7	0.7	0.7
TOTAL	9.7	9.4	11.1	12.9	13.8	14.1

CONFIDENTIAL

SCOTTISH DEPARTMENTS

DEPARTMENT OF AGRICULTURE AND FISHERIES FOR SCOTLAND (DAFS)

DAFS commissions programmes of agricultural R & D work at the seven Scottish Agricultural Research Institutes and three Scottish Agricultural Colleges, all of which it funds and administers. The Institute programmes consist of basic and applied research which aim to extend scientific knowledge and to identify options which could be used to improve the efficiency of the agricultural and related industries. This research makes a distinctive contribution to the overall programme of the Agricultural and Food Research Service and also includes work of specific relevance to the soils, climate, crops and livestock of northern Britain. The Colleges concentrate on development work, including systems of production, and this is undertaken in close association with their advisory and educational activities. The aim is to develop and demonstrate how new knowledge can be used to improve the technical and economic efficiency of agriculture (including horticulture), particularly in Scotland, and such development work accounts for about one quarter of the total cost of the commissioned R & D work. Within its overall aims DAFS's main objectives are:

- a. to classify, characterise and map the distribution of differing soil types in Scotland to provide a sound base of soil information for agriculture and other land-use requirements and to encourage the use of this information;
- b. to improve knowledge of soil and crop nutrition so as to maintain and improve soil fertility and structure and, through a programme of the relevant plant sciences, to devise crop and soil management strategies to improve crop production;
- c. to develop greater understanding of the soil, plant and engineering factors affecting the cost-effective production of high quality, fresh and conserved forages and their utilisation in cost-effective milk, beef and sheep production, with particular attention given to hill and upland conditions;
- d. to study the science of animal production and to encourage the synthesis of research findings into farming systems which offer farmers flexibility to adapt to changing market conditions and costs;

CONFIDENTIAL

- e. to control and, as far as possible, eliminate the wide spectrum of disease and parasitic organisms which affect farm animals and which currently constrain the achievement of high yields;
- f. to seek further knowledge of factors affecting the efficiency of digestion of feedstuffs, absorption of nutrients and their metabolism in ruminant and non-ruminant animals (including work of relevance to human nutrition);
- g. to promote increased efficiency in economic terms through better understanding of production economics, market requirements and price/supply outlook; and
- h. to investigate aspects of the utilisation of plant and animal products with a view to maximising quality and marketability as traditional or novel foods.

The commissioned R & D work includes work on both new research opportunities and on industry needs. So far as new opportunities are concerned it is not feasible to specify target benefits in advance of the work, but it is sometimes possible to do so in the case of some industry problems, such as the incidence of a particular disease of crops or animals. DAFS endeavours to meet the need to establish targets, as far as is practicable, by carrying out systematic reviews of each sector of its commissioned work every four years, on a rolling basis. These reviews include the assessment of progress achieved and the establishment of priority objectives for the next four years. In setting these objectives consideration is given not only to scientific criteria but also to other factors such as the recommendations of the industry and of relevant organisations in the agricultural field and the R & D programmes of MAFF and the AFRC.

R & D undertaken by DAFS' Agricultural Scientific Services arises almost entirely from its statutory and regulatory functions concerning crop protection and improvements, pest control and pesticide residues. The R & D objectives fall into the following categories - improvement of seed testing methods and identification of plant varieties; development of pest and disease

CONFIDENTIAL

CONFIDENTIAL

control in potatoes and other crops especially through official certification (classification) schemes; protection of crops and imported foodstuffs against non-indigenous and important indigenous pests, and improvements of regulation of pesticide use and pesticide residues.

The Royal Botanic Garden's R & D work is almost exclusively basic research in plant taxonomy, and is closely interwoven with other activities involved in running gardens of scientific/amenity interest and in providing training schemes for horticultural students.

A large part of the R & D on fisheries is to fulfil statutory responsibilities and, in co-ordination with MAFF, to aid the formulation of policy and the provision of advice. Examples are the assessment of fish stocks; the setting of catch limits and quotas, and development of appropriate gear, with a view to conserving stocks; licensing the dumping of material at sea consistent with protecting the environment; and the diagnosis of notifiable fish diseases.

INDUSTRY DEPARTMENT FOR SCOTLAND (IDS)

The objective of research funded by IDS is to assist in improving understanding of the influences affecting industrial and economic development in Scotland, including the effects of policy measures. The programme complements work commissioned by UK departments and by the Scottish Development Agency.

SCOTTISH DEVELOPMENT DEPARTMENT (SDD)

Only applied research is commissioned by SDD and this provides information on those issues or developments particular to Scotland, which are not dealt with by the larger research programmes of UK Departments. Reflecting the Department's responsibilities, the main areas of research are water and waste disposal, pollution, housing, planning and local transport. The objectives of research are related to (a) broad policy and decision making issues where there is a need to define the scope and content of possible new initiatives or review the impact of past decisions, particularly where decisions on capital expenditure are involved and (b) providing the detailed information upon which advice and guidance is offered to local authorities and statutory undertakers in pursuance of SDD's regulatory role, including matters of public health and safety.

CONFIDENTIAL

SCOTTISH EDUCATION DEPARTMENT (SED)

Two separate research programmes are administered by SED, the objectives of which are (1) to encourage research and related development into all fields of education so as to maximise the effectiveness of education in Scotland, and (2) to promote the effective and efficient use of social work services by supporting studies which examine areas of policy and practice of particular significance.

SCOTTISH HOME AND HEALTH DEPARTMENT (SHHD)

The Chief Scientist Organisation (CSO), on the Health side of SHHD, has responsibilities to identify, encourage, promote and support R & D relevant to improvement of the NHS in Scotland. An overall policy committee (the Chief Scientist's Committee) and four specialist committees deal with R & D issues and assess applications in the broad fields of health services and biomedical research, equipment for the disabled, and innovative scientific and medical equipment. In addition, reviews of topics, problems and research needs are undertaken by Working Groups established for specific tasks and disbanded on completion of their work. Research is not conducted "in house" but funded through grants to universities and other institutions which provide for the support of long term research units, major research programmes and shorter term projects. Close liaison, on occasion involving jointly funded research, is maintained with the DHSS and relevant Research Councils, in particular MRC.

From the outset (in 1973) the CSO has developed objectives and research policies by identifying major health problems affecting Scotland and health burdens imposed upon the NHS with the purpose of developing relevant research initiatives. For example, major research initiatives (usually stemming from a review by a Working Group and often promoted through the establishment of a research unit) have been taken in the fields of health care of the elderly; coronary heart disease; mental health; dentistry; health economics; and health and behavioural change. Smaller, but nevertheless important initiatives, often arising opportunistically have also been taken in areas such as head injuries; monitoring of perinatal mortality; computerisation of electrocardiograms; the evaluation of new services and screening; and nuclear magnetic resonance. Against this background an increasing and substantial proportion of the CSO's

resources is being devoted to the maintenance and development of longer term units and programmes. However, the CSO continues actively to encourage the submission of spontaneous applications for research relevant to the broad objectives of the Organisation. The majority of these are for shorter term projects.

As far as the Home side of the SHHD is concerned, the research covers crime and allied social problems, the criminal justice process and the treatment of

offenders. By funding research of this kind it is hoped to achieve a better insight into the causes of crime. Recommendations arising from reports of the findings of these research projects are often incorporated into the criminal justice system.

Table 20a

SCOTTISH DEPARTMENTS
SUBJECT AREAS AND PRIMARY PURPOSES
£millions

SUBJECT AREA		PP 1981/82	1982/83	1983/84	1984/85	1985/86	1986/87

Agriculture							
Animal products	3	11.4	13.1	13.8	13.8	14.5	14.9
General agricultural research	3	4.2	4.6	4.9	5.1	5.3	5.4
Veterinary medicine	3	4.2	2.7	2.9	2.9	2.8	2.9
Crops		7.6	8.2	9.2	11.2	11.6	12.0
General planning of land use	3	0.3	0.2	0.3	0.3	0.4	0.4
Construction and planning of buildings	3	0.5	0.6	0.6	0.7	0.7	0.7
Other agricultural research	5	0.6	0.5	1.3	1.4	1.4	1.4
Fisheries	1	7.4	8.2	8.6	8.8	9.8	9.9
Education	2	0.2	0.2	0.2	0.3	0.3	0.3
Health	5	2.9	3.0	3.6	4.3	4.5	4.7
Other research	2	1.5	1.5	1.9	2.0	2.1	2.1

TOTAL		40.8	42.8	47.3	50.7	53.3	54.8

Table 20b

SCOTTISH DEPARTMENTS
DISTRIBUTION OF FUNDING
£millions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87

Intra-mural	9.4	10.0	11.6	11.9	13.1	13.3
Research Councils	0.1	0.1	0.1	0.1	0.1	0.1
Other Government departments	0.1	0.1	0.1	0.1	0.1	0.1
Universities	0.4	4.0)				
Private industry	0.1	0.1)				
Public Corporations	..	..)		
Research associations	..	..)	35.5	38.5	40.0	41.2
Non-industrial research institutes	20.4	21.6)				
Persons	..	..)		
Others	10.3	10.4)				

TOTAL	40.8	42.8	47.3	50.7	53.3	54.8

CONFIDENTIAL

OTHER DEPARTMENTS

THE BRITISH LIBRARY

The British Library Research and Development Department's remit is to support library and information research in order to improve the transfer and use of information.

The specific objectives of the research are to:-

- i. facilitate the improvement of library and information services
- ii. encourage the development of information-handling skills
- iii. stimulate awareness and use of information sources
- iv. encourage and evaluate the application of new information technologies
- v. stimulate modern education and training of library and information personnel
- vi. effect co-ordination throughout the information community.

HM CUSTOMS AND EXCISE

The objective of the research undertaken by HM Customs and Excise is to aid the investigation and detection of smuggling and other offences connected with the Department's value added tax and revenue duties.

DEPARTMENT OF EMPLOYMENT (D Emp)

The objectives of D Emp's research programme are:

- a. to assist Government policy-making and decision making on questions of employment, industrial relations, pay and prices, in furtherance of the strategic objective of improving the efficiency of the labour market;
- b. to assist D Emp in carrying out its statutory executive functions, which include investigations of the costs and effectiveness of individual Departmental measures and activities.

The disciplines employed in the programme are mainly those of economics and applied sociology. The methodologies include the design, conduct and analysis of surveys of behaviour and attitudes, or alternatively the analysis (often

econometric) of the results of existing data from surveys and administrative records. Individual research projects may be designed to identify or clarify policy problems, to establish behavioural relationships which are relevant to the assessment of the probable consequences of alternative policy options, or to estimate the economic and social effect of existing policies. Exceptionally, a large scale project may have multiple objectives because of the economies of including multiple questions in a single survey.

Research priorities are determined mainly by perceived policy needs, taking account of the needs of other Government Departments as well as those of the D Emp Group. Results are normally published and the contribution which they may be expected to make to users outside government, and their likely contribution to informed public debate, are also taken into account.

FOREIGN AND COMMONWEALTH OFFICE (FCO)

The objectives of FCO's research programme are the improvement of telecommunications systems. Currently research is concentrated on the development of equipment for the automatic control of radio systems.

FORESTRY COMMISSION

The Forestry Commission's objectives are twofold, reflecting its normal departmental role as the country's Forestry Authority as well as its direct involvement in forestry as owner of the national forest estate or Forestry Enterprise. The Commission's R & D objectives flow directly from its Authority roles which are:

- i. To advance knowledge and understanding of forestry and trees in the countryside.
- ii. To develop and ensure the best use of the country's forest resources; and to promote the development of the wood-using industry and its efficiency.
- iii. To undertake research relevant to the needs of forestry.

CONFIDENTIAL

CONFIDENTIAL

- iv. To combat forest and tree pests and diseases.
- v. To advise and assist with safety and training in forestry.
- vi. To encourage good forestry practice in private woodlands through advice and schemes of financial assistance and by controls on felling.

Forestry Commission research is conducted or commissioned by the Research and Development Division which also performs a number of technical services. Objectives of the research programme, which aims to benefit both the Forestry Enterprise and private forestry are as follows:

- i. To increase and publish knowledge bearing on the practice of forestry in Britain.
- ii. To improve understanding of the way in which management influences the quantity and quality both of wood produced and of environmental benefits.
- iii. To develop working methods improving the effectiveness of men and machines in ways compatible with the environment.

The bulk of the Division's work is applied, with objective basic research undertaken where the need exists and circumstances demand. Research tasks can be broadly broken down into four headings all of which combine to move the supply curve for forest products, both goods and services, to the right.

- i. enhancing the volume production of wood; including the reduction of losses,
- ii. enhancing the quality of wood,
- iii. increasing the environmental benefits of forests and trees,
- iv. increasing the cost effectiveness of forest operations.

CONFIDENTIAL

INLAND REVENUE

Inland Revenue supports R & D jointly with Customs and Excise, Treasury and ESRC, with the objective of securing independent advice on the effects of fiscal policy that relate to Inland Revenue's interests.

OFFICE OF POPULATION CENSUSES AND SURVEYS (OPCS)

The objectives of the OPCS R & D programme are to increase knowledge of (a) the structure of the population and the underlying determinants of population change ie mortality, fertility and migration; (b) the incidence of disease and mortality among special high risk groups in the population and (c) the most effective methods for household surveys. OPCS also carried out household surveys, at the request of other government departments, to increase knowledge of the social structure of the population in areas of direct concern to current social policy. During 1983/4 surveys covered such topics as child nutrition, the living standard of the unemployed, the further education of children aged 16 and over, and the drinking habits of adolescents.

ORDNANCE SURVEY (OS)

The R & D programme of OS is directed towards applied research in support of its main activities and the development of new products and production methods, although some "mission oriented" basic research may be necessary from time to time. Applied research is supported in the fields of geodesy, photogrammetry and cartography and projects of direct relevance to the OS are sponsored at British universities and research institutions.

The programme's main objective is the development and introduction of more efficient and cost effective techniques, equipment and systems for the production and dissemination of topographic data in forms best suited to the needs of users.

WELSH OFFICE

Research sponsored by the Welsh Office is aimed at assisting the achievement of its functional policy objectives.

CONFIDENTIAL

In the broad context of economic policies, work is directed at a better understanding of the relationship between the Welsh and UK economies; at clarifying the relationship between transport investment and economic development; and at assessing rural areas' transport needs and ways of meeting them.

Research in support of social policies concentrates on three main fields. The objectives of the environmental research programme are to achieve improved understanding of and better methods of controlling the effects of the processes causing pollution, erosion and instability of the Welsh environment, which comprises the atmosphere, land and water, particularly water used for public supplies. Educational research is directed at the development of resources and techniques for determining the nature and extent of learning problems and for assisting the assessment and improvement of pupil performance, and in particular at the preparation of materials for Welsh medium education. In the broad field of health care, research covers the delivery of health and personal social services, aspects of the care of the elderly and mentally handicapped people, and medical research on the development of improved techniques and equipment for diagnosis and treatment.

CONFIDENTIAL

Table 21a

OTHER DEPARTMENTS
DEPARTMENT AND PRIMARY PURPOSES (1)
£millions

DEPARTMENT	PP	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Government Actuary	2	0.1	0.1	0.1	0.1	0.1	0.1
Office of Arts and Libraries	6	2.0	2.0	1.9	2.2	2.2	2.3
Natural History Museum	1	7.8	8.4	8.9	9.3	9.3	9.3
Royal Society	1	4.2	4.5	5.0	5.3	5.5	5.7
HM Customs & Excise	6	0.1	..	0.1	0.1	0.1	0.1
Department of Employment	2	4.8	5.5	4.0	3.9	4.1	4.1
Foreign and Commonwealth Office	2	0.2	0.1	0.1	0.2	0.2	0.2
Forestry Commission	3	5.1	5.5	5.6	6.0	6.0	6.0
Inland Revenue	2	-	-	..	..	..	..
Ordnance Survey	6	0.6	0.8	1.0	1.1	1.1	1.0
Office of Population Censuses and Surveys	2	3.5	3.5	2.4	2.3	2.4	2.5
Property Services Agency(2)	4	9.1	10.8	-	-	-	-
HM Treasury	2	0.2	0.2	0.3	0.4	0.4	0.4
Welsh Office	2	1.6	1.5	1.9	2.1	2.1	2.3
TOTAL		39.4	42.9	31.4	32.8	33.4	33.8

(1) In this table, several separate sub-programmes have been aggregated for the sake of conciseness, and the primary purpose code shown is that of the largest component. In the summary tables in Part I, however, those sub-programmes have been included in the form in which they were originally submitted.

(2) Expenditure by the PSA on buildings for R & D. These costs were transferred to Departments' own programmes from 1983/84.

CONFIDENTIAL

Table 21b

OTHER DEPARTMENTS
DISTRIBUTION OF FUNDING
Emillions

SECTOR	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Intra-mural	28.2	31.0	20.2	20.5	20.7	20.6
Research Councils	..	0.1	0.1	0.1	0.1	..
Other Government departments	0.3	0.3	0.3	0.3	0.3	0.3
Universities	3.5	4.0)				
Private industry	0.6	0.7)				
Public Corporations	0.1	0.2)				
Research associations	..	..)	11.2	12.2	12.5	12.9
Overseas	..	..)		
Non-industrial research institutes	1.5	1.7)				
Professional and learned societies	4.4	4.5)				
Persons	0.4	0.5)				
Others	0.3	0.2)				
less Receipts	0.4	0.4	0.2	0.2	0.2	0.2
TOTAL	39.1	42.8	31.7	32.8	33.4	33.7