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PREM 19/2835

PART 8

MT

Confidential Filing

Maintaining the strength of the Science Base

Science Budget

SCIENCE & TECHNOLOGY

Part 1: Sept 83

Part 8: December 88

Fold: "End Report or Annual Review of Government Funded R+D"

Referred to	Date	Referred to	Date	Referred to	Date	Referred to	Date
~~11.12.87~~							
~~4.12.88~~							
~~19.12.88~~							
~~23.12.88~~							
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~~2.5.89~~							
30.6.89							

PREM 19/2835

PT 8 ENDS

PART 8 ends:-

SIR F. TOMBS TO PM. 30.6.89

PART 9 begins:-

J. FAIRCLOUGH TO AT. 4.7.89

ACOST
Advisory Council on Science and Technology
70 Whitehall, London SW1A 2AS
01-270- 0109

Qn 0349

CONFIDENTIAL

The Rt Hon Margaret Thatcher MP
The Prime Minister
10 Downing Street
London SW1

30 June 1989

Dear Prime Minister,

NATIONAL PRIORITIES ADVICE 1989

I enclose the Advice which ACOST has prepared during the last twelve months. It extends a number of the themes which we included in our submission to you in May 1988.

We have made a number of recommendations to Government while at the same time acknowledging the progress made in shifting resources from near market to the science base in line with our Advice last year. In particular the Advice focusses on the requirement for more civil R & D in the UK if we are to ensure future competitiveness. This affects both small firms and the development of longer term enabling technologies. The planned decline in Government R & D spending after 1990/91 is of concern.

The Council's work on benefits from international cooperation and the availability of highly skilled manpower for research and development is in progress and we expect to provide substantial advice to you next year. The Council is embarking on a new study of the science base to review its standing now compared with ten years ago.

Last year you forwarded the Advice and its recommendations to Ministers and those sections which were more general in their interest for scientific policy went under non-confidential basis to the Research Councils. It would be very helpful if this could be done again this year.

In my letter last year I indicated the Council's willingness to prepare advice on specific issues of interest to the Government. We have done this in the case of Global Environmental Research and will be considering in parallel with Ministers the Mid-term review of the EC Framework Programme. I am keen to develop further this responsive role for ACOST.

Yours sincerely,

Francis Tombs

SIR FRANCIS TOMBS

CONFIDENTIAL

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ADVISORY COUNCIL ON SCIENCE AND TECHNOLOGY

ADVICE ON NATIONAL PRIORITIES FOR SCIENCE AND TECHNOLOGY: 1989

1. There have been some encouraging developments in the last year. The recovery of manufacturing industry has continued. There has been increased funding for the science base and a number of the steps taken to make existing funding more effective. But further actions are needed to sustain this improvement. According to the latest figures available from the Organisation for Economic Cooperation and Development (OECD) the level of civil R & D expenditure in the United Kingdom remains lower than most of our competitors on both a per capita basis and as a percentage of GNP. The right level for the United Kingdom cannot be prescribed on either a national or sectoral basis. Research and development alone will not necessarily increase competitiveness and innovation. Better education, management, marketing, production and quality are equally important. Nevertheless the Council believes that in order to ensure future competitiveness civil R & D funded by industry needs to rise further, particularly in smaller and medium size enterprises. Continued Government support in real terms for civil R & D including that for leading researchers in the science base is also vital.

2. As a consequence the Council is concerned about the availability of young people trained in science and engineering. In view of shortages forecast it would like to see further impetus to measures being taken to increase the number of teachers in these subjects and to making young people aware of the attractions of careers in science and engineering. The Council is embarking on a special study of the issues, in particular the effectiveness of current initiatives to improve the situation.

3. The Council's work has again been hampered by the lack of suitable statistics in the Annual Review of R & D published by

the Government. Despite the difficulties of sectoral attribution there is need for more analysis of spend on enabling technologies. The industrial data should as far as possible be collected on a comparable basis with that for Government, although there may be some difficulty with definitions. The Council recommends that the benchmark surveys on industrial R & D should be processed more rapidly and give greater emphasis to smaller firms. The changes planned for the Central Statistical Office should help this. There is also a need for better public and private sector manpower figures to establish the flow of science and technology personnel between different sectors.

GOVERNMENT BUDGET FOR S & T

4. The Government's latest Public Expenditure White Paper forecasts that its expenditure on science and technology will be £5.50 bn in financial year 1989/90, £5.43 bn in 1990/91 and £5.39 bn in 1991/92. Within these figures there is a shift from near market research as shown by the decline in the forecasts of expenditure by the Departments of Energy and Trade and Industry (including launch aid) and the Ministry of Agriculture, Fisheries and Food. The Government's action in this respect is welcome, as is the substantial increase in the allocation to the science base of £300m over 3 years. The Council believes that this redistribution is a move in the right direction. However, Government support for R & D beyond 1989/90 should be maintained at a level sufficient to allow for additional funding in areas such as the environment and longer term technologies.

Science Base

5. In particular, the Council considers that funding for the science base should be sustained in real terms at least at the higher level determined for 1989/90. The Council's support for interdisciplinary research has been confirmed by the

establishment of eight centres by the Research Councils, with a further nine approved. It welcomes the review being undertaken by the Advisory Board of Research Councils (ABRC) of existing Interdisciplinary Research Centres (IRCs). The Council has taken a close interest in global environment research and has made recommendations about this (see paragraphs 19, 20, 21). The Council believes that it is timely to review the changing pattern of funding in the science base and the implications for the future health and vigour of UK science: it is setting up a study of the £1.5 bn a year spent on this by the University Funding Council (UFC) and the Research Councils which will include consideration of administrative processes.

Department of Trade and Industry

6. In general the Council is of the view that the Department of Trade & Industry is taking a too detached role in technological leadership. The move away from near market support puts emphasis on longer term technology developments but current practice in DTI reveals very little strategic thinking on these. The overall level of DTI's support for R & D should be maintained. This is important at a time when there are encouraging trends in private sector support for R & D. The Council notes that a large part of the DTI's budget in 1988/89 was devoted to general industrial collaborative projects and requests DTI to provide more detail of their strategy for this, particularly in respect of longer term technology developments.

7. The Council believes that one of DTI's most important roles is in supporting research links between industry and universities to facilitate the transfer of knowledge to where it can be exploited. The LINK initiative has got off to a slow start and more attention needs to be paid to the bureaucratic delays in authorising projects, also to increasing its attractiveness to participants and involving more Departments

and Research Councils.

8. Although there are signs that the number of LINK projects supported by the Science and Engineering Research Council (SERC) and DTI is increasing substantially there remains a question mark against the present commitment by other Government Departments to stimulating the desired number of university/industry programmes. The Council recommends that the Government review its position on this.

9. The DTI laboratories are finding it difficult to fulfil a useful role and while aware of the move to agency status planned for some of these the Council is not convinced that longer term objectives and the management of their technology assets are adequate.

Department of Energy

10. The phasing out of funding for the United Kingdom Atomic Energy Authority's (UKAEA) fast breeder reactor (FBR) and fusion (national programme) research is in line with ACOST advice. There is no question about the high standard of some of the research in the UKAEA and at present the Authority attracts some of our best graduates. But the Authority appears to have lost its way and it is doubtful that it can survive even in reduced form by taking on work for non-nuclear sectors such as the North Sea industry, safety and environment. Because of its importance to the overall R & D activity in the UK, the Council is proposing an investigation of the future research role of the UKAEA and will be discussing this with the Department of Energy.

11. The Council considers that closer attention should be paid to the funding of longer term energy research and technology following privatisation of the gas industry and shortly the electricity supply industries. It would like to be informed of discussions in the Advisory Council on Research and

Development for Fuel and Power (ACORD) on this.

INDUSTRIAL R & D

12. The resources devoted by the private sector to R & D continue to be disappointing although recent increases are encouraging. The latest figures show that in 1987 20% of private sector R & D was Government funded. This has fallen from around 30% in 1983. Much of the difference has been made up by foreign sources (mostly multinationals). Between 1986 and 1987 (the latest figures available) industry own-financed R & D increased by a commendable 12.8% in current prices, whilst support from Government fell by 11.7%.

13. In order to stimulate further industrial R & D, the Council makes three recommendations. Firstly, there would be considerable advantage if the consultancy opportunities offered to the private sector through the Enterprise Policy (Cmnd 278) were extended to cover the formulation and management of R & D programmes. Secondly, within the Policy, steps should be taken to increase the awareness of the importance of R & D to those, particularly smaller, companies who carry out little or no R & D at present.

14. Thirdly, the Council although pleased by the recent decisions of the Accounting Standards Committee to issue guidelines for reporting levels of R & D, recommends that this is extended to cover R & D carried out under contract. Also the cut-off at £80m turnover for private companies should be reduced to £30m so that the very group which should be encouraged is included.

15. A useful step in stimulating industry to undertake more risky longer term investment might be a venture capital fund established by Government on the launch aid model which could be applied to smaller scale product development and longer range development projects. An example might be a

demonstration optical fibre network which has been recommended by the Council. (See paragraph 27). Others include transport technology. ACOST will examine this further.

Barriers to Growth

16. Small firms play a vital role in developing and in introducing new technology into the economy but the innovation process in the smaller firm (up to 500 employees) is different from that in its larger counterpart. Their innovation processes are necessarily dominated by near-to-market factors. Smaller firms face resource barriers and strategic management barriers to maintaining a momentum of innovation to aid their growth. These barriers are a matter for Government concern since they weaken the competitive process.

17. Recent changes in DTI policy on innovation support tend to favour larger firms through emphasis on collaborative research, and very small firms through the Small Firms Merit Award for Research and Technology (SMART) and regional assistance programmes. Generally, firms in the range of 50-500 employees are neglected by these changes although efforts have been made to attract good proposals from companies with up to 200 employees. New schemes are needed to stimulate their innovative activities. These might include a national competition to participate in the strategic and applied research programmes of Government agencies. Also, a national competition for innovation projects should be set up with 100 awards per year. Where appropriate smaller companies should be actively encouraged to participate in DTI cooperative research programmes.

18. The DTI's Enterprise Initiative is making a valuable contribution to the management process in smaller firms. The Council recommends that the Initiative be extended to include a technology audit programme, advising firms on their

intellectual property and related matters such as technology licensing. The Council recommends also that the new Training and Enterprise Councils (TECs) organise regional competitions to identify innovative, best practice schemes for management training in smaller firms and to encourage more employment of people with science and technology skills.

GLOBAL ENVIRONMENT RESEARCH

19. The Council's Global Environment Research (GER) Working Group has recommended a number of actions which are necessary in establishing a proper role for the United Kingdom in an international context. ACOST endorses current activities in monitoring, data collecting and modelling. But more emphasis is needed on basic science to provide better information on the chemical and biological parameters which are used in modelling. In international projects such as the World Ocean Circulation Experiment (WOCE) our contribution should be roughly in line with GNP, within any agreed total cost.

20. In GER the private sector has a role to play in both the conduct and funding of research. Its highest priority is research into possible substitutes for chlorofluorocarbons (CFCs) and alternative technology. The Council are discussing with the Centre for the Exploitation of Science and Technology (CEST) a possible study of the commercial opportunities arising from increased concern for the global environment in order to identify opportunities for UK industry.

21. Although aware of the steps taken by the SERC and the Natural Environment Research Council (NERC) to set up a coordinating committee, the Council would like to see a directorate to `task force' UK involvement in GER established under the auspices of NERC with participation of major organisations such as the Meteorological Office. The Council also recommends the formation of a greenhouse gases review group with similar administrative arrangements as for the

existing Stratospheric Ozone Depletion Review Group. This would give scientific advice to the directorate. The Council supports the proposal for the ERS-2 satellite to monitor atmospheric and ocean changes so that any gap between the ERS-1 and the launch of the polar platform is obviated.

EXPLOITABLE SCIENCE

22. Following their analysis of thirteen key areas of emerging technologies, the Council's committee is considering in more detail the four principal groups: advanced materials, life sciences, advanced manufacturing technology, and control and communications.

23. Advances in high-performance structural materials are expected to lead to major changes in the engineering and materials industries in the near future. The market for ceramics in electronic applications is already large and increasing. Polymers and polymer composites, ceramics and metal matrices offer advantage in a wide range of products and processes, and are areas of intensive development overseas. In the UK, the chemical, aerospace and defence industries are playing a leading role in these developments, but the reported lack of commitment in other industrial sectors, is worrying. Further progress in the UK will require substantial commitments to generic research, particularly to process technology and characterisation, and to education and training where there is a serious lack of qualified engineers and scientists. The Council welcomes the establishment of three IRCs for polymers, advanced materials and surface science and DTI's new programme on Materials launched this April. It also welcomes the establishment by SERC of a Materials Commission. However, the importance of processing and production needs to be stressed and industrial links with the IRCs are important in this.

24. The Council's previous recommendations on life sciences

concentrated on the human genome. The establishment of a UK programme in this subject is a welcome development. The key areas in life sciences selected for study by the Council are animal biotechnology and transgenics, plant biotechnology, biotechnology, pharmaceuticals, neurobiology, bio-instrumentation, bio-processing and biomedical engineering. A field of outstanding promise where the UK is in the forefront is stem cell biology. The Council endorses the high priority given to this by the Agricultural and Food Research Council (AFRC). There is serious concern over the shortage of skilled scientists in these areas of life sciences and over the weak position of the UK in the relevant instrumentation and process plant industries.

INTERNATIONAL CO-OPERATION

25. The Council has considered the objectives and mechanisms which might be appropriate for the review of the European Framework Programme. Key elements of their conclusions are that the review should include a forward look beyond 1991 to minimise the discontinuity at the end of the current programme; that since most projects are barely a year old scrutiny of management would be more profitable than assessment of achievement; that the review should include a look at sample projects (including some involving the Joint Research Centres) as well as programmes; that elements of administration such as proposal preparation, oversubscription and exploitation should be examined closely.

26. The benefits of the European cooperative research project EUREKA to the UK have also been considered and a comparison drawn between EUREKA and the Framework Programme. The Council supports strongly the concept of EUREKA particularly in view of its minimal international bureaucracy and its industry-driven nature. It endorses the DTI drive to increase UK participation in EUREKA, but couples this with a criticism of the extensive delays inherent in the Department's approval

process. More emphasis should be put on including smaller companies.

FOLLOW UP TO PREVIOUS ACOST/ADVISORY COUNCIL ON APPLIED RESEARCH AND DEVELOPMENT (ACARD)

a. Opto-Electronics

27. The recommendation regarding a grouping of companies to help focus attention on international competitiveness has already been implemented by the industry. The Council is pleased by the Government's recent increased funding for opto-electronics research by £15m. The Council repeats its view that it would be desirable for the Government to create the environment for a demonstration optical fibre network for which the industry has expressed strong support.

b. Software

28. The Council has considered, with the aid of a round-table meeting with industry, the changes which have taken place since publication of the ACARD report in 1986. It notes that whilst the report was not well received at the time, many of its recommendations have been implemented. The main concerns of the industry are currently the failure of Government Departments to use their considerable purchasing power to the best advantage of the UK industry and the taxpayer; the slow progress to universal adoption of best practice, particularly in safety-critical systems; the lack of consistent statistical data to support business plans; and a shortage of skilled resources. These issues are being discussed with DTI with a view to developing advice.

c. Medical Equipment

29. The Council has reviewed recently the state of the Medical Equipment industry since the ACARD report of 1986. It

concluded that much progress has been made. There is a need for a wider awareness in the industry of the research supported by the Department of Health, DTI, SERC and the British Technology Group. The Department of Health should include industry representatives on its R & D funding committees as far as possible. There is also a need for the Department to study further the opportunities in the primary health sector.

SUMMARY

30. The Council remains concerned that the UK is not undertaking enough civil research and development and hence has fears that our improving competitive position in manufacturing will be endangered. The increase in funding for the science base for the next three years is welcomed and should be sustained in real terms. The establishment of IRCs is a considerable step forward in focussing effort into excellent areas of science but, as is the case so far, these should not be at the expense of support for individual leading researchers.

31. A fundamental requirement in the UK is to increase interest in and desire to become involved in science and technology amongst younger people. Our future science and industrial base depends on it.

32. Government budgets are planned to slightly decline in the future, particularly with the ending of near market R & D support. This is at a time when there are encouraging trends in the private sector.

33. A review of the role of the Government research laboratories and the intention to make some of them into agencies provide an opportunity to establish a customer base and to consider the management of their technical assets.

34. Government departments particularly the DTI are not sufficiently considering their role in the support of longer term important technologies.

35. Small firms lack expertise and capital to enter the second stage for their growth potential. More competitive schemes like SMART are needed.

36. The exciting new fields in materials and biotechnology require renewed emphasis to enable young researchers to become established. The UK is strongly placed in stem cell biology and this should be built upon. In global environment research we should exploit our strengths in basic sciences, modelling and satellite instruments.

37. The UK should increase international cooperation through EUREKA. The review of the EC Framework Programme needs to take account of management, over-subscription, a forward look beyond 1991 and exploitation.

RECOMMENDATIONS

1. Government support for R & D beyond 1989/90 should be maintained at a level sufficient to allow additional funding in areas such as environment and longer term technologies. Also funding for the Science Base should be sustained in real terms at least at the higher level determined for 1989/90.

2. New measures should be taken to increase the level of civil R & D in the UK.

i. Consultancies available to companies under the DTI's Enterprise Policy (Cm 278) should be extended to cover the formulation and management of research programmes (Paragraph 13)

ii. Also within the Policy steps should be taken to increase

awareness of the need for R & D particularly by those smaller companies which do no R & D at present. (Paragraph 1, 13)

iii. The Accounting Standards Committee should be requested to include contract R & D in their requirements on R & D reporting; also private companies with turnover down to £30m pa should be brought under the recommendation. (Paragraph 14)

3. The DES and others should give renewed impetus to measures to increase the number of science and mathematics teachers in British schools. (Paragraph 2)

4. The Annual Review and collection of statistics should be changed to include more analysis on spend by technologies and on scientific and engineering manpower. The Government should process comprehensive information on industrial R & D more rapidly. (Paragraph 3)

5. The DTI should develop their strategies for the support of longer term research for critical technologies. They should also examine the objectives and management of technological resources in their research establishments. (Paragraphs 6, 9)

6. The Government should review its promotion of industry-university R & D links. (Paragraph 8)

7. For small firms the DTI should

- extend schemes like SMART to companies between 50 and 500 employees

- support technology audits in small firms through the Enterprise Initiative. This should include advice on intellectual property

- encourage small firms to participate in DTI cooperative research programmes and to cooperate with IRCs

- request the new TECs to organise regional competitions to identify best practice schemes for management training in smaller firms and to encourage more employment of people with S & T skills (paragraphs 16, 17, 18).

8. In GER the Government should

- promote basic science in GER more strongly, particularly for chemical and biological factors

- establish a directorate to 'task force' UK participation in domestic and international research

- establish a greenhouse gases review group (Paragraph 19, 20, 21)

9. The DTI should take steps to increase the involvement of UK firms and organisations in EUREKA. (Paragraph 26).

10. The Department of Health should include industry representatives on its R & D funding Committees and include industry at an early stage in developments in primary health care. (Paragraph 29).

30 June 1989

Note
Overtaken: I spoke to
Mr Fairclough & persuaded him
that his procedure of individual
response by dept was wrong. He
has submitted revised proposals for
a single coordinated reply
AT 4/7

CONFIDENTIAL

W0156

MR TURNBULL

30 June 1989

ACOST: NATIONAL PRIORITIES ADVICE

Sir Francis Tombs will be sending the Prime Minister a copy of ACOST's annual Advice on S & T priorities shortly. This minute offers advice on how the response should be handled.

2. Most of ACOST's comments are directed at specific Departments' programmes. I would therefore suggest that the Advice should be circulated to those Departments - as Sir Francis will be requesting - and that they be asked to send comments straight to ACOST. Although ACOST were sent a composite response last year in a letter from the Prime Minister in September, I think direct comments from individual Departments would be more appropriate to this year's Advice. Sir Francis will suggest that selected parts of the Advice should also be sent to the Research Councils. I would be happy to discuss with DES which parts to send.

3. I am therefore enclosing a draft letter for the Prime Minister to send to Sir Francis acknowledging the Advice and ACOST's work over the last year and indicating how the response to the Advice will be handled this year. I also enclose a draft minute for you to send round Departments when you circulate the Advice and offer guidance on its handling.

4. I am copying this minute to Richard Wilson and Trevor Woolley.

JOHN W FAIRCLOUGH
Chief Scientific Adviser

DRAFT MINUTE FROM THE PRIME MINISTER TO SIR FRANCIS TOMBS

NATIONAL PRIORITIES ADVICE 1989

Thank you for your letter of 30 June and for sending me the Advice which ACOST has prepared during the last 12 months.

As you suggest, I have arranged for the Advice to be circulated to Ministers in charge of Science and Technology spending Departments and have asked them to let you have comments on your recommendations directly. The Advice will also be made available to the Chief Secretary before he begins his discussions with spending Ministers in the forthcoming Public Expenditure Survey.

I am grateful for the work which the Council has done over the last year including its advice on Global Environmental research. I enjoyed the opportunity to attend your Council's meeting in February and look forward to the seminar of young scientists which you are arranging for September. I hope the advice which your Council will offer on the mid-term review of the EC Framework Programme and the studies you have set in hand on Manpower and the Science Base for next year will yield useful results.

DRAFT LETTER FROM ANDREW TURNBULL TO PRIVATE SECRETARIES OF E(ST) MINISTERS

ACOST: NATIONAL PRIORITIES ADVICE 1989

I am enclosing a copy of the annual Advice on S&T Priorities which Sir Francis Tombs has sent to the Prime Minister and a copy of her reply.

In line with Sir Francis' suggestion, the Prime Minister has asked for the Advice to be forwarded to Departments. It should be for them to judge how far to take the Advice into account in their own S & T programmes and in the bilateral discussions with the Treasury in the forthcoming Public Expenditure Survey. She would be grateful if Departments would in due course send comments on ACOST's recommendations directly to them, consulting other Departments and the Chief Scientific Adviser as necessary. She would also be grateful if the Chief Scientific Adviser would discuss with the Department of Education and Science whether particular sections of the Advice might be made available to the Research Councils.

I am sending a copy of this letter to the Private Secretaries of other members of E(ST) and to Sir Robin Butler and John Fairclough.

ADVISORY COUNCIL ON SCIENCE AND TECHNOLOGY

ADVICE ON NATIONAL PRIORITIES FOR SCIENCE AND TECHNOLOGY: 1989

1. There have been some encouraging developments in the last year. The recovery of manufacturing industry has continued. There has been increased funding for the science base and a number of the steps taken to make existing funding more effective. But further actions are needed to sustain this improvement. According to the latest figures available from the Organisation for Economic Cooperation and Development (OECD) the level of civil R & D expenditure in the United Kingdom remains lower than most of our competitors on both a per capita basis and as a percentage of GNP. The right level for the United Kingdom cannot be prescribed on either a national or sectoral basis. Research and development alone will not necessarily increase competitiveness and innovation. Better education, management, marketing, production and quality are equally important. Nevertheless the Council believes that in order to ensure future competitiveness civil R & D funded by industry needs to rise further, particularly in smaller and medium size enterprises. Continued Government support in real terms for civil R & D including that for leading researchers in the science base is also vital.

2. As a consequence the Council is concerned about the availability of young people trained in science and engineering. In view of shortages forecast it would like to see further impetus to measures being taken to increase the number of teachers in these subjects and to making young people aware of the attractions of careers in science and engineering. The Council is embarking on a special study of the issues, in particular the effectiveness of current initiatives to improve the situation.

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14. Thirdly, the Council although pleased by the recent decisions of the Accounting Standards Committee to issue guidelines for reporting levels of R & D, recommends that this is extended to cover R & D carried out under contract. Also the cut-off at £80m turnover for private companies should be reduced to £30m so that the very group which should be encouraged is included.

15. A useful step in stimulating industry to undertake more risky longer term investment might be a venture capital fund established by Government on the launch aid model which could be applied to smaller scale product development and longer range development projects. An example might be a

demonstration optical fibre network which has been recommended by the Council. (See paragraph 27). Others include transport technology. ACOST will examine this further.

Barriers to Growth

16. Small firms play a vital role in developing and in introducing new technology into the economy but the innovation process in the smaller firm (up to 500 employees) is different from that in its larger counterpart. Their innovation processes are necessarily dominated by near-to-market factors. Smaller firms face resource barriers and strategic management barriers to maintaining a momentum of innovation to aid their growth. These barriers are a matter for Government concern since they weaken the competitive process.

17. Recent changes in DTI policy on innovation support tend to favour larger firms through emphasis on collaborative research, and very small firms through the Small Firms Merit Award for Research and Technology (SMART) and regional assistance programmes. Generally, firms in the range of 50-500 employees are neglected by these changes although efforts have been made to attract good proposals from companies with up to 200 employees. New schemes are needed to stimulate their innovative activities. These might include a national competition to participate in the strategic and applied research programmes of Government agencies. Also, a national competition for innovation projects should be set up with 100 awards per year. Where appropriate smaller companies should be actively encouraged to participate in DTI cooperative research programmes.

18. The DTI's Enterprise Initiative is making a valuable contribution to the management process in smaller firms. The Council recommends that the Initiative be extended to include a technology audit programme, advising firms on their

intellectual property and related matters such as technology licensing. The Council recommends also that the new Training and Enterprise Councils (TECs) organise regional competitions to identify innovative, best practice schemes for management training in smaller firms and to encourage more employment of people with science and technology skills.

GLOBAL ENVIRONMENT RESEARCH

19. The Council's Global Environment Research (GER) Working Group has recommended a number of actions which are necessary in establishing a proper role for the United Kingdom in an international context. ACOST endorses current activities in monitoring, data collecting and modelling. But more emphasis is needed on basic science to provide better information on the chemical and biological parameters which are used in modelling. In international projects such as the World Ocean Circulation Experiment (WOCE) our contribution should be roughly in line with GNP, within any agreed total cost.

20. In GER the private sector has a role to play in both the conduct and funding of research. Its highest priority is research into possible substitutes for chlorofluorocarbons (CFCs) and alternative technology. The Council are discussing with the Centre for the Exploitation of Science and Technology (CEST) a possible study of the commercial opportunities arising from increased concern for the global environment in order to identify opportunities for UK industry.

21. Although aware of the steps taken by the SERC and the Natural Environment Research Council (NERC) to set up a coordinating committee, the Council would like to see a directorate to 'task force' UK involvement in GER established under the auspices of NERC with participation of major organisations such as the Meteorological Office. The Council also recommends the formation of a greenhouse gases review group with similar administrative arrangements as for the

existing Stratospheric Ozone Depletion Review Group. This would give scientific advice to the directorate. The Council supports the proposal for the ERS-2 satellite to monitor atmospheric and ocean changes so that any gap between the ERS-1 and the launch of the polar platform is obviated.

EXPLOITABLE SCIENCE

22. Following their analysis of thirteen key areas of emerging technologies, the Council's committee is considering in more detail the four principal groups: advanced materials, life sciences, advanced manufacturing technology, and control and communications.

23. Advances in high-performance structural materials are expected to lead to major changes in the engineering and materials industries in the near future. The market for ceramics in electronic applications is already large and increasing. Polymers and polymer composites, ceramics and metal matrices offer advantage in a wide range of products and processes, and are areas of intensive development overseas. In the UK, the chemical, aerospace and defence industries are playing a leading role in these developments, but the reported lack of commitment in other industrial sectors, is worrying. Further progress in the UK will require substantial commitments to generic research, particularly to process technology and characterisation, and to education and training where there is a serious lack of qualified engineers and scientists. The Council welcomes the establishment of three IRCs for polymers, advanced materials and surface science and DTI's new programme on Materials launched this April. It also welcomes the establishment by SERC of a Materials Commission. However, the importance of processing and production needs to be stressed and industrial links with the IRCs are important in this.

24. The Council's previous recommendations on life sciences

concentrated on the human genome. The establishment of a UK programme in this subject is a welcome development. The key areas in life sciences selected for study by the Council are animal biotechnology and transgenics, plant biotechnology, biotechnology, pharmaceuticals, neurobiology, bio-instrumentation, bio-processing and biomedical engineering. A field of outstanding promise where the UK is in the forefront is stem cell biology. The Council endorses the high priority given to this by the Agricultural and Food Research Council (AFRC). There is serious concern over the shortage of skilled scientists in these areas of life sciences and over the weak position of the UK in the relevant instrumentation and process plant industries.

INTERNATIONAL CO-OPERATION

25. The Council has considered the objectives and mechanisms which might be appropriate for the review of the European Framework Programme. Key elements of their conclusions are that the review should include a forward look beyond 1991 to minimise the discontinuity at the end of the current programme; that since most projects are barely a year old scrutiny of management would be more profitable than assessment of achievement; that the review should include a look at sample projects (including some involving the Joint Research Centres) as well as programmes; that elements of administration such as proposal preparation, oversubscription and exploitation should be examined closely.

26. The benefits of the European cooperative research project EUREKA to the UK have also been considered and a comparison drawn between EUREKA and the Framework Programme. The Council supports strongly the concept of EUREKA particularly in view of its minimal international bureaucracy and its industry-driven nature. It endorses the DTI drive to increase UK participation in EUREKA, but couples this with a criticism of the extensive delays inherent in the Department's approval

process. More emphasis should be put on including smaller companies.

FOLLOW UP TO PREVIOUS ACOST/ADVISORY COUNCIL ON APPLIED RESEARCH AND DEVELOPMENT (ACARD)

a. **Opto-Electronics**

27. The recommendation regarding a grouping of companies to help focus attention on international competitiveness has already been implemented by the industry. The Council is pleased by the Government's recent increased funding for opto-electronics research by £15m. The Council repeats its view that it would be desirable for the Government to create the environment for a demonstration optical fibre network for which the industry has expressed strong support.

b. **Software**

28. The Council has considered, with the aid of a round-table meeting with industry, the changes which have taken place since publication of the ACARD report in 1986. It notes that whilst the report was not well received at the time, many of its recommendations have been implemented. The main concerns of the industry are currently the failure of Government Departments to use their considerable purchasing power to the best advantage of the UK industry and the taxpayer; the slow progress to universal adoption of best practice, particularly in safety-critical systems; the lack of consistent statistical data to support business plans; and a shortage of skilled resources. These issues are being discussed with DTI with a view to developing advice.

c. **Medical Equipment**

29. The Council has reviewed recently the state of the Medical Equipment industry since the ACARD report of 1986. It

concluded that much progress has been made. There is a need for a wider awareness in the industry of the research supported by the Department of Health, DTI, SERC and the British Technology Group. The Department of Health should include industry representatives on its R & D funding committees as far as possible. There is also a need for the Department to study further the opportunities in the primary health sector.

SUMMARY

30. The Council remains concerned that the UK is not undertaking enough civil research and development and hence has fears that our improving competitive position in manufacturing will be endangered. The increase in funding for the science base for the next three years is welcomed and should be sustained in real terms. The establishment of IRCs is a considerable step forward in focussing effort into excellent areas of science but, as is the case so far, these should not be at the expense of support for individual leading researchers.

31. A fundamental requirement in the UK is to increase interest in and desire to become involved in science and technology amongst younger people. Our future science and industrial base depends on it.

32. Government budgets are planned to slightly decline in the future, particularly with the ending of near market R & D support. This is at a time when there are encouraging trends in the private sector.

33. A review of the role of the Government research laboratories and the intention to make some of them into agencies provide an opportunity to establish a customer base and to consider the management of their technical assets.

34. Government departments particularly the DTI are not sufficiently considering their role in the support of longer term important technologies.

35. Small firms lack expertise and capital to enter the second stage for their growth potential. More competitive schemes like SMART are needed.

36. The exciting new fields in materials and biotechnology require renewed emphasis to enable young researchers to become established. The UK is strongly placed in stem cell biology and this should be built upon. In global environment research we should exploit our strengths in basic sciences, modelling and satellite instruments.

37. The UK should increase international cooperation through EUREKA. The review of the EC Framework Programme needs to take account of management, over-subscription, a forward look beyond 1991 and exploitation.

RECOMMENDATIONS

1. Government support for R & D beyond 1989/90 should be maintained at a level sufficient to allow additional funding in areas such as environment and longer term technologies. Also funding for the Science Base should be sustained in real terms at least at the higher level determined for 1989/90.

2. New measures should be taken to increase the level of civil R & D in the UK.

i. Consultancies available to companies under the DTI's Enterprise Policy (Cm 278) should be extended to cover the formulation and management of research programmes (Paragraph 13)

ii. Also within the Policy steps should be taken to increase

awareness of the need for R & D particularly by those smaller companies which do no R & D at present. (Paragraph 1, 13)

iii. The Accounting Standards Committee should be requested to include contract R & D in their requirements on R & D reporting; also private companies with turnover down to £30m pa should be brought under the recommendation. (Paragraph 14)

3. The DES and others should give renewed impetus to measures to increase the number of science and mathematics teachers in British schools. (Paragraph 2)

4. The Annual Review and collection of statistics should be changed to include more analysis on spend by technologies and on scientific and engineering manpower. The Government should process comprehensive information on industrial R & D more rapidly. (Paragraph 3)

5. The DTI should develop their strategies for the support of longer term research for critical technologies. They should also examine the objectives and management of technological resources in their research establishments. (Paragraphs 6, 9)

6. The Government should review its promotion of industry-university R & D links. (Paragraph 8)

7. For small firms the DTI should

- extend schemes like SMART to companies between 50 and 500 employees

- support technology audits in small firms through the Enterprise Initiative. This should include advice on intellectual property

- encourage small firms to participate in DTI cooperative research programmes and to cooperate with IRCs

- request the new TECs to organise regional competitions to identify best practice schemes for management training in smaller firms and to encourage more employment of people with S & T skills (paragraphs 16, 17, 18).

8. In GER the Government should

- promote basic science in GER more strongly, particularly for chemical and biological factors

- establish a directorate to `task force' UK participation in domestic and international research

- establish a greenhouse gases review group (Paragraph 19, 20, 21)

9. The DTI should take steps to increase the involvement of UK firms and organisations in EUREKA. (Paragraph 26).

10. The Department of Health should include industry representatives on its R & D funding Committees and include industry at an early stage in developments in primary health care. (Paragraph 29).

30 June 1989

FILE KK

CONFIDENTIAL

10 DOWNING STREET
LONDON SW1A 2AA

From the Private Secretary

JOHN FAIRCLOUGH
CABINET OFFICE

NATIONAL PRIORITIES ADVICE 1989

I enclose a letter Sir Francis Tombs has today sent to the Prime Minister. I should be grateful for your advice on handling and for a draft reply that the Prime Minister might send to Sir Francis.

I am copying this minute to Richard Wilson (Cabinet Office).

Kacg.

PAUL GRAY
30 June 19899

CONFIDENTIAL

KK

10 DOWNING STREET

DOMINIC

With the compliments of

As discussed,

GEORGE GUISE

8 May 1989

£1 each (including a £500 interest-free loan). Not surprisingly, as the share price soared company with far greater resources might be the answer to the company's long-term problem: what to do when Tricure an order for three submarines from Malaysia (although the company will neither confirm nor deny that points for the yard as the years roll out; there are trigger points when decisions will have to be made."

Report says UK science is in good shape

by Jane Bird, Technology Editor

WHILE working at Cambridge university's biochemistry laboratory, Terence Kealey noted a puzzling attitude among British scientists.

Each year the laboratory increased its workforce, yet each year staff morale sank. Influenced by academic pressure groups, such as Save British Science, researchers were coming to believe that their livelihood was threatened.

Kealey decided to do some scientific analysis. The results, he claims, suggest that far from sickening, British science has flourished during the Thatcher decade. In his report, published last week by the Centre for Policy Studies, a right-wing think-tank, he describes its problems as "those of success rather than failure".

By measuring the quality of output in terms of the number of times academic papers are cited, Kealey found that in 1986 Britain was second only to America for life sciences and physical sciences, and third after America and West Germany for chemical science.

In quantity, too, the record is impressive. In 1982 Britain far exceeded its European and Japanese rivals with 432 papers published per million population, compared with 295 from West Germany and 275 from Japan.

On staffing, Kealey found a hefty expansion in British universities. Over the 10 years from 1977 the number of researchers more than doubled, from 7,508 to 15,606, while the number of permanent dons was maintained.

He also points out that the British government spends more on academic science, relative to the country's GDP, than does America's or Japan's. It is industry that is failing to contribute, he claims. As a percentage of GDP, British companies spend less on research and development than companies in Japan, West Germany, America and France.

"There has been a significant increase in the number of people being trained, but they are being let down by the system of funding which allows them to do short-term research until they are 30 and then leaves them high and dry without a permanent job," he says.

Kealey admits that Britain is suffering a decline in quality and quantity of output because although the position is good, it is not as good as it used to be. Britain's share of Nobel laureates is also diminishing, but Kealey argues that "we start from a spectacularly high base". Now that Britain is regaining wealth, he believes thousands of opportunities in universities will be created.

Save British Science, he warns, could have a damaging effect by discouraging young people from pursuing science just at a time when opportunities are opening up.

Professor Denis Noble, the Oxford physiologist who founded Save British Science

Noble: protesting

in 1986, accuses Kealey's report of "very clever manipulation of the facts. It documents the decline in British science and argues that we can afford to do worse because we start from such a high base."

Kealey agrees that there is a brain drain. He says there is some cause for concern about the quality of those who have left but says the numbers are "not alarming" — a net emigration of 246 scientists in the 10 years from 1975.

It is a view echoed by Sir George Porter, president of the Royal Society, who says: "The brain drain is often exaggerated, but the problem is that our very best people are attracted to the United States because they can earn three times their British salaries."

He agrees with Kealey that academics should be given the opportunity to negotiate pay individually.

"It is ridiculous to pay a doctor of divinity with two students the same as a Nobel Prize winner or the head of a huge engineering department," Porter says.

Kealey also recommends that permanent academic staff should be subject to a performance review every 10 years, and obliged to re-apply for their jobs if they appear unsatisfactory.

He also calls for charitable donations to universities, and industrial support for research, to be tax-deductible, and for funding to be transferred from the University Grants Committee to the research councils, which are more flexible and efficient.

Noble responds: "If Kealey thinks the state of science is so good, why does he want it to be radically changed?"

As evidence that Save British Science is succeeding, Noble cites the government's announcement last November of an extra £100m funding for science, and in January of its plans to double the total number of students in higher education over the next 20 years.

"Kealey's report is already out of date and he appears to be so caught up on a wave of criticising Save British Science that he is out of touch with the fact that ministers have come round to our way of thinking."

Sunday Times :- 7 May

cc John Fairclough NAPA AF SJW 10/5

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SRL\LTR\2178.GME

8 May 1989 R10 pgs.

The Prime Minister
10 Downing Street
London
SW1A 2AA

Dear Prime Minister,

Thank you for your letter. I have much enjoyed working on ACOST in spite of its high workload coinciding with the not insubstantial load caused by my simultaneously building a new company here in Cambridge.

It could of course be that my ACOST duties kept me from distracting my colleagues here and therefore, has been a major factor in the success of Scientific Generics!

I look forward to continuing to work with the ACOST Emerging Technologies Committee.

Yours sincerely

Professor G M Edge
Chief Executive

Scientific Generics Limited
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cf to file

HJ2DND

10 DOWNING STREET

LONDON SW1A 2AA

From the Principal Private Secretary

2 May 1989

The Prime Minister was very grateful to you for bringing Mr David Horrobin's name to her attention and she has read his note on the Government funding of science with interest. His view that funding should not be monopolised by large teams of researchers is one that the Prime Minister strongly endorses. Some of his other ideas seem less soundly based, e.g. allocating a flat rate amount to all academics. While it is difficult to make judgments about whether research funds should be allocated, this proposal solves the problem by making no judgments at all.

Andrew Turnbull

The Right Honourable Sir Nicolas Browne-Wilkinson

ANDREW TURNBULL 27 April 1989

HORROBIN'S PAPER

Horrobin correctly identifies the central problem: how to indentify and assess the value of original thought?

There is then so much muddled thinking that it is hard to know where to start. He gives several anecdotes of where the blundering machinery of establishment got it wrong and I can think of many more: - Einstein himself was refused a research post after graduating because he did badly in finals. He took a clerical job in the Berne patents office and developed relativity theory in the evenings at home!

There are three basic fallacies in Horrobin's paper:

1. Government should financially encourage "practical" work.

He makes much of the Yorkshire clockmaker story which is developed into a truly bizarre proposal for billion pound prizes.

The argument seems to be a thinly disguised plea for near-market Government funding which has already done much harm to our engineering industry (eg GEC). By contrast, the chemical and pharmaceutical industries show how strong corporations become when their managements have to provide both the funding and marketeering required to stay ahead. They win their own billion pound prizes from the huge profits subsequently made from successful discoveries.

Competition and the market place is the way to encourage that research which leads straight to economic benefit.

2. University appointment in itself should be the determinant of research funds.

Many universities are infested with idlers occupying tenured posts who have been brain dead for years. The proposal

that university appointment in itself should entitle someone to £400,000 over 10 years is appalling. Exasperation often makes us wish to abolish organisations like the Research Councils and the whole peer review bureaucracy in one swipe. But to replace it with academic roulette would be worse!

3. Leading experts are always wrong and 'difficult' mavericks are always geniuses.

It is true that the whole ABRC bureaucracy needs a great shake. In particular, the SERC, managing a budget of £400 million, has become an outrageous bureaucracy with great potential for missing talent. Although Horrobin confines his attack to the MRC, the positive side of his criticism applies in spades to the SERC.

Certain kinds of research must be funded with high capital intensity and be undertaken by groups. The corralling of funds is necessary. The great challenge is how to achieve the maximum efficiency of spend without discouraging true original thought. One answer is to give great intellects, like Max Perutz, the real levers of power over research funding. There should certainly be less bureaucratic processes and "peer" reviews.

The answer is not to disperse this country's limited research funds over everyone with 'a bee in his bonnet'. As the Prime Minister said in the Royal Society speech, that would spread the honey too thinly. However much we smarten up the allocating mechanism with people like Perutz, Einstein and Faraday distributing the basic science budget, there will always be the occasional genius sitting in his garret who was not taken seriously because everyone thought his ideas were crazy. Indeed it would be a dreary world if such beings never rose up to astonish us.

GEORGE GUISE

10 DOWNING STREET

From the Principal Private Secretary

Mr Guise.

I would welcome a quick assessment of this note – at most one side – so that I can put it into the weekend box.

Some of the ideas would appeal to the Prime Minister, others are silly or ill-thought out as the prize. Until the research is done, how does one know the value of the savings and hence of the prize, which being unknown has much less attraction.

AT

20/4

cc Mr Guise R 24/4

010

THE VICE-CHANCELLOR

Royal Courts of Justice
Strand
London WC2A 2LL

21st April, 1989.

Prime Minister (4)
Attached is the note Sir Nicholas mentioned to you. Some of the ideas, eg. the importance of giving small science a chance, are in tune with yours. Otherwise automatic grants to all dons are silly. George Guise has provided a commentary.
AT 22/4

Andrew Turnbull, Esq.,
10, Downing Street,
London SW1.

Dear Mr Turnbull,

We met at dinner last night in Lincoln's Inn. I later sat next to the Prime Minister at dessert and mentioned the views of David Horrobin on the Government Funding of Science. The Prime Minister showed some interest and, in case she wishes to pursue it, I enclose some papers which might be of interest.

I cannot vouch personally for David Horrobin: I have only met him once and that at breakfast. However he is an impressive chap combining apparently great academic distinction with sufficient entrepreneurial skills to break into the charmed magic circle of the big pharmaceutical companies. His ideas seem to tie in fairly well with those of the Prime Minister in other spheres - hence my raising his name.

Yours sincerely,

Nicholas Robin McKenzie

GOVERNMENT FUNDING OF SCIENCE

David F. Horrobin, Chief Executive, Efamol Holdings PLC and Scotia Pharmaceuticals Ltd, Woodbridge Meadows, Guildford GU1 1BA, England.

Introduction

The aims of Government funding of science should be two fold:

1. To ensure a steady supply of able research scientists and of innovative concepts developed by those scientists.

2. To ensure that innovative scientific concepts are applied practically as effectively and as rapidly as possible.

Britain has traditionally been relatively good at the first and relatively bad at the second. At present changes in the organisation of science are taking place which will lead to a concentration of resources on those lines of research which to scientific experts seem most promising, and on those centres which seem most likely to perform excellent studies. Committees of leading authorities will make the decisions as to which individuals and which centres will be supported.

This is a recipe for disaster which will ensure that British science performs both of its functions badly. It will, however, be welcomed by many leading scientific experts because it will concentrate power in their hands. Those hands are demonstrably unsafe from the points of view of both creative basic science and practical application.

The Government seems to have been seduced by its scientific advisers into applying principles which are anathema to it in other areas.

Ensuring the supply of innovative scientists and concepts

The history of science demonstrates that important advances usually come from completely unexpected directions, and that the advances are commonly strongly opposed by the leading experts of the time. The most creative scientists are like the most creative artists - mavericks who are often difficult to deal with. Britain's greatest successes in science were achieved prior to 1960, when research workers were largely supported by funds disbursed through their own universities and when there was no central control as to how the money should be spent. This led to enormous diversity of effort, and out of that diversity much brilliant science was born.

Concentration of resources on individuals and on fields thought by experts to be promising will ensure that the most creative - and difficult - individuals and the most innovative fields of research will frequently go without any support.

Leading experts have consistently failed to identify the individuals who should be supported and to give experts more power is folly.

Here are two examples. Peter Mitchell was interested in trying to understand mitochondria, the energy generating structures within the cell. His ideas completely failed to attract substantial research support and he left the university world and funded his research himself. After twenty years of effort he won the Nobel Prize for Medicine, a very rare example of an unshared prize.

In the 1950s Hugh Sinclair proposed that essential fatty acids might play a role in several major diseases. Lord Florey, co-discoverer of penicillin, told Sinclair that he was wasting his time. Sir Hans Krebs, perhaps the most distinguished biochemist ever to work in Britain, refused to let Sinclair work in the Dept. of Biochemistry in Oxford. For 30 years Sinclair completely failed to gain funding for his research. Our company has now demonstrated that Sinclair's views were largely correct. We are making them the basis of our medical and financial success.

The only way to ensure that the creative mavericks are not deprived of money is to provide the opportunity for all research scientists with university appointments to do research. There are less than 3000 academics in all the medical schools in the UK. If the Medical Research Council were to be disbanded, £40,000 per year could be given to each one. This would enable everyone good enough to get a university appointment to obtain research funding. Such apparent inefficiency of distribution is the only way to guarantee that our most creative scientists are not missed out. The apparent efficiency of concentration of resources is likely to turn out to be monstrously inefficient becase there is a high risk that the money will go to the bright, safe people at the top of the second division, while the brilliant, difficult people in the first division may receive nothing.

Many details of the proposal are too complex to set out in this preliminary position paper. However, here are some examples of the fine print. Funding could initially be guaranteed to newly appointed academics for a period of 10 years. Thus each researcher would be guaranteed a minimum of £400,000. A scheme which enabled researchers to "borrow" funds from future years would enable them to handle both running expenses and the purchase of substantial capital items. After ten years academics who were totally unproductive would be dropped, while those who showed evidence of research energy would receive another ten year grant. In the end perhaps two thirds of the academics would continue to receive grants, giving them £60,000 per year each, excluding any contributions from the private medical research charities.

Ensuring that innovative research concepts are practically applied

The leading experts are even less likely to make reliable judgments about likely practical applications of basic research. Here are two examples.

Sir Peter Medawar, Director of the Medical Research Council laboratories and Nobel Laureate, did much of the laboratory research which led to the concept of the possibility of organ transplantation. But Sir Peter was completely opposed to the practical application of his own ideas in the field of renal transplantation. For many years he prevented the Medical Research Council from giving substantial support to research in this field.

X has been President of the Royal Society of Medicine and of a series of other leading medical organisations. He has a claim to be Britain's leading gastro-enterologist. For the past ten years he has systematically blocked research on an extract of an Indian plant which offers a revolutionary approach to the treatment of gastric and duodenal diseases. This research originated in a Dept. of Surgery in a leading UK medical school. Six months ago the project was about to be terminated because of inability to obtain research grants. Our company took it on ... within a short time we have found that the maverick investigators are right and the leading authority is wrong. The project could turn into a major British pharmaceutical success.

Thus, even when they are intimately involved in a field, leading experts cannot be trusted to make reliable judgements about practical applications of science. At this stage of the development of a scientific concept, there is no sensible way in which Government can be directly involved in funding research since its expert committees are almost certain to make the wrong decisions. Again it must be emphasized that highly creative scientists are often very difficult people who do not endear themselves to experts who have often gained "expert" status by solid committee work rather than by scientific discovery.

What Government can do is to encourage the development of a market for practical research concepts. This is in addition to the existing commercial market which often works unsatisfactorily. Committees of experts within large companies are often just as unsympathetic as government expert committees to the innovative scientist. Some additional method must therefore be employed to stimulate practical application of science.

The precedent is what I believe is the first example of British Government support for practical research.

Prizes for practical research

In 1714 the City of London and the Royal Navy petitioned Parliament to find an answer to the problem of measuring longitude accurately while at sea. Absence of an accurate method was leading to losses of ships and battles. Parliament agreed that the problem was important but took the view that it was incompetent to direct such a research programme. Parliament decided to provide a stimulus, a prize of £20,000 for a practical, viable answer. At the time this was a truly astronomical sum.

As a consequence there was an amazing outpouring of research activity, almost all of it privately financed. The problem was solved with minimal Government expenditure. The value of the prize was, of course, rapidly recouped. Against all the odds the prize was won by a Yorkshire clockmaker, someone whose efforts would never have been supported if the Government had set up a committee of experts to direct a research programme. In fact, several leading academics behaved disgracefully and did all they could to prevent Harrison getting his full award until the King himself intervened.

There is no reason why the same principle should not be applied to the solution of [illegible] problem. The principles set down in 1714 are still valid: the solution must be practical and must work, rather than be clever, and the value of the prize must be very large indeed. Only if the prize is very large will private and institutional investors be willing to fund research into possible solutions.

A suitable sum might be the value of the savings occurring in one year because of application of the solution, less the cost of the solution. For example, suppose that current treatment of a disease costs £1000 million a year. Suppose that a treatment is devised which cures the disease but which costs £100 million a year. The prize would then be £900 million. The prize should be tax free.

A prize of this magnitude would ensure that everyone involved in research and in the funding of research would be interested in solving the problem. The individual university researchers funded annually without strings would inevitably wonder if their research might be relevant. A tremendous diversity of research projects would be generated. Some would come from the application of the Government's grants to the universities, probably much more would come from private and institutional investors. Such diversity of effort would very probably lead to an answer. Within a year of the application of the solution the Government would be showing a profit. Most interesting of all, failure would cost the Government virtually nothing!

Economists could set out the costs of almost everything that the Government buys in terms of health. A long list of prizes could then be established for solutions which save costs and improve the quality of care. For rare diseases, in order to provide sufficient stimulus, the prize might be equal to five or ten years' savings: in the

long term the Government would still save money.

Since many health problems are international, if one country started such a scheme, others might be persuaded to join in, so increasing the amount of cash available. For example, it is reliably estimated that within five years the Governments of countries in Europe and North America will be spending about £20,000 million per year on treatment of people with AIDS. If all those countries cooperated, the value of the prize money could therefore be as high as that. Winning the prize would be the equivalent of acquiring a company twice the size of ICI or Glaxo. There can be no doubt that research funding would pour in from all sources and also that the lines of research being supported would become much more diverse than at present. Negotiating such international prizes would become a delightful exercise for diplomacy. There can be few international projects where failure costs almost nothing and success can only save money!

Conclusions

Any reading of scientific history indicates that leading experts can almost never be trusted to make decisions about what basic research is worth supporting, or about what innovations should be practically applied.

The proposals set out in this paper provide answers to both problems. These proposals will be vigorously opposed by the scientific establishment since under them that establishment will lose most of its power. They will be equally vigorously supported by the most innovative scientists and by those most interested in practical applications of science. These scientists will be liberated from the dead hand of the experts and given the opportunity to show what they can really do.

The principles have been furthest developed in medicine but they could be applied to the whole of science and engineering. Obvious problems like the funding of "big" science and of capital expenditure, could be dealt with by relatively modest extensions to the basic framework.

I believe that these proposals are consistent with the basic philosophy of the present Government.

In contrast, the reorganisation of science currently being put into practice is, I believe, fundamentally opposed to the Government's philosophy.

DAVID F. HORROBIN

Curriculum Vitae

Born 6 October, 1939, Bolton, England. UK and Canadian citizenships.

1953-58	King's College School, Wimbleton, England.
1958	State Scholarship and the top Domus Scholarship to Balliol College, Oxford.
1961	Worked with the Flying Doctor Service for 4 months.
1961-62	President Balliol Junior Common Room.
1962	The top first class honours degree of the year in physiology. Awarded the three major medical student prizes, the Theodore Williams Scholarships in Anatomy and in Physiology and the Martin Wronker Prize in Medicine, the only time that all three prizes have been won by the same person.
1962-63	Medical Research Council Scholarship in Antomy. Research on neuroendocrinology with Professor G.W. Harris.
1963	Elected to a Fellowship, Magdalen College, Oxford University.
1963	Leader of the Oxford University Expedition to Nepal to study human blood groups.
1963-65	Research and teaching in physiology, Magdalen College.
1965	D Phil (Oxford PhD) in Neurophysiology.
1965-68	Clinical studies and lecturing and research in physiology, St. Mary's Hospital Medical School, London.
1968	BM BCh, Oxford University (equivalent to the North American MD).
1968-69	Internship.
1969-72	Professor and Chairman of Physiology, Nairobi University Medical School, Kenya.
1972-75	Reader in Physiology, University of Newcastle upon Tyne Medical School, England.
1975-79	Professor of Medicine, University of Montreal.
1979-84	Director, Efamol Research Institute.
1984-	Managing Director, Efamol Ltd, Guildford, England.

Memberships include: Medical Adviser and then President, Schizophrenia Association of Great Britain (1972-), British Medical Association, Royal Society of Medicine, The Physiological Society, Society for Endrocrinology (UK), The Endrocrine Society (US), American Federation for Clinical Research, Canadian Society for Clinical Investigation, Canadian Oncology Society, American College of Nutrition.

DAVID F. HORROBIN (Curriculum Vitae) continued

Founder and Editor of Medical Hypotheses (Advisory Board: Sir Karl Popper, Sir John Eccles, A.C. Guyton, Linus Pauling), the only journal in medicine fully devoted to ideas and criticisms of ideas.

Founder and Editor of Prostaglandins, Leukotrienes, and Medicine, one of two journals in this very rapidly growing field of investigation.

Author or co-author of approximately 300 publications in the scientific literature, mainly in the areas of hypertension, prolactin, prostaglandins, essential fatty acids, alcoholism, and schizophrenia.

Eczema cure backed by Nobel laureate

By David Thomas

Financial Times
22 October 88

SIR JAMES BLACK yesterday rounded off a week in which he won the Nobel Prize for medicine by giving his seal of approval to a natural cure designed to stop people scratching.

Sufferers from eczema, the skin disease which affects more than 2m people in the UK, can now seek relief from a new drug, Epogam, which comes in capsule form and is based on evening primrose oil, a favourite natural remedy of the American Indians.

Epogam's launch yesterday by a new company, the Guildford-based Scotia Pharmaceuticals, was transformed from what might have been a run-of-the-mill occasion in the world of pharmaceuticals into a media event by Sir James's presence.

Sir James, the scientist whose path-breaking work in beta blocker drugs for heart disease won him the Nobel citation, was on hand to endorse Epogam in his role as a non-executive director of Scotia, a division of Efamol, a health care group.

Britain's latest Nobel prize-winner said he relished working with a small new company like Scotia. "I happen to be a Schumacher convert to the idea that small is beautiful," Sir James explained with just a hint of irony, since his life's work has helped to make the fortunes of some of the world's largest pharmaceutical companies.

Unusually for a "natural" cure, the drug has won the Department of Health's approval for use in prescriptions. Dr David Horrobin, Scotia's chief executive, said the company intended to devise other compounds based on natural products. Among the diseases it is investigating are rheumatoid arthritis, diabetes, certain types of cancer, psychiatric and heart disorders.

Sir James launched into a long discourse on how Scotia's research excited him scientifically for its implications for cell biochemistry. "That is the big challenge facing biotechnology today," concluded Sir James after an explanation which left the journalists scratching their heads.

Man in the news, Page 8

Reprinted from Nature, Vol. 324, No. 6094, p. 221, 20 November 1986

Glittering prizes for research support

David F. Horrobin

Could public support for research be cheapened, and made more productive, by following the eighteenth-century precedent of the British government's prize for a means of measuring longitude?

The crisis in British universities, the shortages of research funds and the insistent demands that science should serve the economic needs of the nation which supports it, ought to require a fundamental rethinking of our approach to the financing of science. I see much evidence of panicky tinkering by both the scientific community and the government, but few indications of radical thought.

We should perhaps consider what may be the first example of parliamentary funding of research, which is also one of the most successful. Because it is such an excellent precedent, those in power might take it seriously. The hero is Mr John Harrison, born in 1693 the son of a poor Yorkshire carpenter, a self-educated clockmaker and the toast of Neil Armstrong at a twentieth century 10 Downing Street dinner.

Petition

In a petition to the British Parliament on 25 March 1714, Captains of Her Majesty's Ships, Merchants of London and Commanders of Merchant Men demanded a solution to the problem of measuring longitude at sea. Failure was causing innumerable navigational disasters with the loss of ships, men, goods and battles. The government, wisely, chose not to throw money at the problem by supporting research by experts who, by definition, had failed to solve it. Instead, they arrived at an astonishing proposal: a prize of £10,000 was offered for a method that would reliably measure longitude to within 1°; £15,000 for a method accurate to within 40′; and £20,000 for a method accurate to within 0.5°. In 1714 those sums were truly astronomical. Anyone winning the prize would become not merely comfortable but genuinely rich.

The result was an outburst of private research on longitude. The problem and the prize were known to everyone. They are mentioned in Swift's *Gulliver's Travels* and a Hogarth cartoon shows a lunatic obsessed with them. Theoretically, it was known that one way to solve the problem was to make a timepiece so accurate that it would tell the time at Greenwich even after many weeks at sea, much buffeting and drastic changes in temperature. Comparison of that time with local time would then allow an accurate calculation of longitude.

None of the experts believed that a timepiece could be so accurate. An array of bizarre and complex proposals was put forward by the Fellows of the Royal Society and their friends, but all failed. Only poor, provincial, self-taught John Harrison believed that a clock could be made to the required standards. His story is well known: his production of increasingly reliable, robust and accurate chronometers, their objective success in Royal Navy trials, his denigration by the eminent gentlemen of the Royal Society, the attempts by the Society's experts to deny him the prize legitimately won, the anger of the King when he heard about these academic machinations and Harrison's final triumph with grant of the full £20,000 at the age of 80. But the lessons to be drawn from this remarkable story are as valid now as they were in the eighteenth century.

- The announcement of a cash award sufficiently large to make the winner enormously wealthy will generate a phenomenal outpouring of research directed to the solution of practical problems. Such research will be privately financed and will cost the donor nothing but the cost of the award.
- Such an award will lead to unprecedented cross-fertilization of fields of endeavour. If the prize is large enough, scientists whose speciality may appear remote from the problem will be stimulated to think about it.
- The definition of success must be crystal clear, practical and open to verification by non-experts. The solution need not be brilliant or sophisticated, nor need it meet with the intellectual approval of experts. The only condition is that it must work.
- There must be no limitation on the categories of people allowed to succeed. The challenge must be open to non-experts and to the sons of poor carpenters.

Prizes

The government should decide what problems it wants solving. In my field of medicine, obvious problems whose solutions would save a great deal of money include schizophrenia, eczema, multiple sclerosis and Alzheimer's disease. People from other fields should be able to produce long and comparable lists. Economists could then work out what each particular problem costs the nation, and a prize could be offered for a practical approach which would either eliminate the problem or reduce the cost of solution. The prize should be the value of the savings made during one full year.

Some of the prizes might turn out to be very large indeed, tens or even hundreds of millions of pounds. Even greater amounts would be possible if, say, the European Community, the United States and other countries acted together, as they might well do if the scheme cost little or nothing. The prize should be given tax free to the individual, company or group producing an answer.

The advantages of the scheme would be many, but include:

- The cost of initiating the scheme would be trivial. After the first year, a successful solution would save millions.
- Researchers of all kinds would be encouraged but not forced to work on practical problems. They would also be encouraged to extend their range of expertise.
- There would be large inflows of private venture capital into research as individuals, companies and others chose to support research directed towards the solution of problems attracting the larger prizes.
- There would probably be rapid progress in basic science. Many now suffer from the illusion that basic discoveries always precede practical research. Historical evidence suggests that the traffic is just as frequently in the other direction. We have forgotten the story of Pasteur. Brilliant people devoting themselves to practical problems, such as the spoiling of wine or dying silkworms, may end up by discovering new fundamental principles.
- The enterprise would be cash-generating rather than cash-consuming. Governments would be delighted with science instead of looking at it with a jaundiced eye.
- Last, but by no means least, the huge cash prizes would put money into the hands of the most practically creative members of society. The money would certainly be spent in interesting ways; on further research, on enterprising investment or even on innovative techniques of personal consumption.

The idea would cost almost nothing to put into operation. It would rejuvenate science and transform attitudes to science. It should be given a try. □

David F. Horrobin is managing director of Efamol Ltd, Woodbridge Meadows, Guildford GU1 1BA, UK.

CONFIDENTIAL

cc BG

10 DOWNING STREET

LONDON SW1A 2AA

22 March 1989

From the Private Secretary

Dear Tom,

NEW CLINICAL RESEARCH CENTRE

The Prime Minister has seen your Secretary of State's minute of 20 March.

She is distressed to learn that funds have been allocated to study a project which she does not consider should be contemplated: she feels that the £2 million expenditure is a waste of the additional resources provided for science in the 1988 Public Expenditure Survey. She commented that, were such a project to go ahead, the costs involved would pre-empt a large amount of research that could otherwise proceed. If relocation was to be considered, she thinks the right direction would be to move activities out of London. She therefore believes that the exploratory work should focus on other options, including for example leaving the CRC at Northwick but placing it under the direct control of the RPMS at Hammersmith.

I am copying this letter to the Private Secretaries to Members of E(ST), to Sir Robin Butler and to John Fairclough (Cabinet Office).

Yours,
Paul

(PAUL GRAY)

Tom Jeffrey, Esq.,
Department of Education and Science.

CONFIDENTIAL

PRIME MINISTER

NEW CLINICAL RESEARCH CENTRE

A total and deliberate waste of money designed to pre-empt a decision which must never be taken

You will recall the MFC's proposal for an expensive new National Centre for Clinical Research and Training at Hammersmith. On several occasions you have made clear to colleagues your serious reservations about this.

Kenneth Baker (Flag A) reports the latest position. He has now allocated £2m. for planning and preparatory work, but emphasises that he is not at this stage seeking formal approval for the proposal. However it is clear he would like to have your support in principle for the new Centre.

Ian Whitehead (Flag B) raises a number of reservations about the proposal. He recommends you should raise a number of specific queries, and press for the feasibility study also to examine the alternative option of leaving the CRC physically at Northwick Park but placing it under the direct managerial control of the RPMS at Hammersmith.

Content for me to minute out in the terms suggested by Ian Whitehead?

No — this will be £2m wasted. The excellence of research does not depend on the extravagance of the building. You will be stopping an overwhelming amount of research by spending this amount of money on bricks and mortar. What a waste of your resources

[illegible signature]

pp Paul Gray

21 March 1989

MJ2DJM

PRIME MINISTER 21 March 1989

NEW CLINICAL RESEARCH CENTRE

Support for a new 'National Centre for Clinical Research and Training' at Hammersmith is quickly gaining momentum. Kenneth Baker has now given his own in-principle support for a new centre. In his note, he explains the reasons for his decision to allocate £2m for detailed planning and some advance work.

In short, the new centre would be a major expansion of the Royal Postgraduate Medical School ('RPMS') in Hammersmith at a cost of just under £50m. The Clinical Research Centre ('CRC') in Northwich Park would be closed.

The main arguments for a new centre in Hammersmith are as follows:

- The MRC has argued that the creation of a critical mass of professionals would be able to compete more effectively with other world class institutions. A new centre would build on the RPMS's hands-on experience of clinical research and teaching skills along with the CRC's emerging strengths in basic scientific research.

- In the past, the Northwick Park district general hospital (and CRC) has not attracted many leading clinical scientists. And the absence of postgraduate education has deprived the CRC of direct recruitment of the best young scientists into research. Consequently, the standard of research has fallen below expectations.

But I believe there are a number of problems with the proposal.

First, is critical mass and cross-fertilisation of ideas under one roof worth £50 million?

Second, should we expand one of our central London teaching hospitals at a time when transport, housing and recruitment mitigates against this move?

Third, what will happen to the hospital network in North-West Thames? Presumably, the CRC would be expanded to fill the empty space at the expense of other hospital closures.

Fourth, will this be the first phase of a much larger development on the Hammersmith site (including an adjacent school sports field)? The ABRC has already reduced the scale of the MRC proposal from a £90m to a £50m project. And will the research teams at the National Institute for Medical Research in Mill Hill be moved to Hammersmith at some point?

A cynic or sceptic may easily view the RPMS proposal as empire building.

One compromise may be to place the CRC under the direct managerial control of the RPMS. The CRC would then operate as a satellite of Hammersmith, building on its strengths in basic molecular biology. Basic research requires minimal day-to-day contact with patients. If necessary, this option could be made more pallitable by increasing the level of funding by 5-10%.

At this point, the RPMS, MRC and DES have set their sights on one option only - a national centre in Hammersmith. The feasibility study will be limited to this option (terms of reference are attached). Treasury officials are concerned that this straight-jacket will ignore other possible options. It is crucial that the scope of the study be expanded further.

Recommendation

A note should be sent to Kenneth Baker asking if the feasibility study could examine the alternative option. At a minimum, the third and fourth questions (noted above) should be addressed by Kenneth Baker and Kenneth Clarke.

Ian Whitehead

IAN WHITEHEAD

MRC CLINICAL RESEARCH INITIATIVE: PROPOSED NEW NATIONAL CENTRE FOR CLINICAL RESEARCH AND TRAINING BASED ON THE ROYAL POSTGRADUATE MEDICAL SCHOOL

FEASIBILITY STUDY

DRAFT TERMS OF REFERENCE

1. Working within the overall planning framework set by the Steering Committee jointly chaired by Lord Dainton and Dr Rees [paras 36-40 and Annexes B and C of MRC note of February 1989 attached], and having regard to the series of detailed reviews and option appraisals already undertaken since 1984 [Annex A], the bodies noted below are to submit reports no later than 31 May 1989. Taken together, these will test the feasibility of completing a new National Centre for Clinical Research and Training at Hammersmith Hospital by 31 March 1994 within a capital cost ceiling of £46.5 million at 1988 prices (in addition to the £2 million allocated for 1989/90).

2. All of the studies listed below will take for their policy context the initiative's fundamental aims of harnessing basic science to clinical research and disseminating the benefits into practice [paras 9-12] and the proposed scientific, clinical research, and postgraduate training programmes [paras 13-26]. The conduct of these studies, including consultants' fees where appropriate, will be paid for from the £2m allocation from the 1989-90 Science Budget. Pending the completion of these studies and a Government decision on the project, no expenditure on advance works (site clearance, land purchase) will be incurred without prior Government approval.

. The Steering Committee itself will, in co-operation with the Harrow Health Authority and the North West Thames Regional Health Authority, establish the best timetable for an orderly MRC withdrawal from Northwick Park, which should allow the Health Authorities to make optimum use of the

opportunity to attract other specialities to the site and develop it as a centre of excellence for clinical services in the new environment created by the White Paper, Working for Patients [paras 33-35].

- The Finance Committee will analyse the running costs of the Centre, having regard to the opportunities which this initiative presents for savings in recurrent expenditure; will examine potential sources of funds from the private sector [para 32]; and will propose arrangements which safeguard the MRC's accountability.

- The Working Group on Governance and Management will propose a form of governance which allows the development of a dynamic scientific strategy for the new Centre.

- The Science Group (or "Chairmen's Group) will propose a broad outline of the Centre's scientific strategy* and identify potential programme leaders [paras 13-26] who will work up the programmes in more detail.

- The Industrial Group will establish links with leading industrialists (particularly in the pharmaceutical industry) and will, with their help, report on the industrial needs for research and training that the new Centre could aim to meet, and on the mechanisms that will be needed to involve companies in the new Centre's work.

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* work on this will extend beyond 31 May 1989

. The Building Project Team will, having regard to the cost limit noted at 1 above:

- estimate the capital expenditure required to purchase additional land, refurbish some of the existing accommodation and provide a building equipped to the standards judged necessary for modern research and teaching [paras 29-31];

- appraise alternative ways of establishing a centre to these specifications on the proposed site and compare their respective costs;

- offer a view on the margins of error involved in the calculations;

- analyse possible timetables for building work to meet the Spring 1994 deadline and the consequent financial year phasing of capital expenditure [para 28]; and

- examine the scope for acquiring sufficient adjacent land to permit the eventual fulfilment of the MRC's original proposal [para 27].

March 1989

PRIME MINISTER

NEW CLINICAL RESEARCH CENTRE

1. In this year's Science budget I allocated £2m to the Medical Research Council so that it could do some basic planning and preparatory work on its proposal for a new National Centre for Clinical Research and Training at Hammersmith.

2. I appreciate your concern about this initiative. It is a major capital investment - which MRC estimate will cost some £48.5 million at 1988 prices - on a central London site. The MRC are proposing to raise one fifth of the cost from the private sector.

3. This is not something we should enter into lightly and there is no question of committing another penny from the public purse until we have rigorously examined the results of the feasibility study whose terms of reference are now being worked out by the MRC in consultation with the Treasury and my Department.

4. In the meantime it is worth examining the thinking which has gone into the MRC's proposal. It starts from the proposition that clinical research in the UK is ailing. The strategy for reversing this trend is to harness basic science to clinical research in a way that will ensure the widest and fastest dissemination into clinical practice of the consequent advances. Unfortunately this cross-fertilisation can't be achieved at the Clinical Research Centre (CRC) because Northwick Park is a district general hospital and as such is distanced from the leading edge of clinical practice and without the direct lines of rapid communication and dissemination available to a teaching hospital.

5. In theory the MRC's strategy can be implemented in a number of ways. MRC's approach, developed in line with the conclusions of Sir Robin Nicholson's study in 1987/88, is to build on an existing centre of excellence. The Royal Postgraduate Medical School (RPMS) is unquestionably a centre of excellence and it has many years' experience of outstanding research, training and clinical service. The practice of medicine at Hammersmith is of the very highest quality, judged by international standards, and one consequence of this is that Hammersmith exports a clinician to a professorship somewhere else at an average rate of about one every three months. Working within a Special Health Authority, it pursues research-led objectives with the same person able to assess academic and clinical needs. It therefore already occupies a unique place in our system. But medical science is developing in such a way as to require closer cooperation between clinicians and other scientists. To maintain its position in the world league, the RPMS now needs a further infusion of basic science which can be drawn largely from the CRC. This amalgamation would produce an institution more powerful than the sum of its parts because it would:

i. bring together on one site in multidisciplinary groups and in a clinical research environment the top scientists, clinicians and teachers;

ii. increase the number of researchers who are as much at home in modern biology as they are in clinical research;

iii. enhance the cross-fertilisation of basic research and work with patients and speed up the clinical application of scientific advances;

iv. (and this is especially important) mould our future leaders in academic clinical medicine who will in their turn train our next generation of doctors and researchers who will then go on to disseminate the

new approach and establish centres of excellence throughout the UK.

6. The potential for making early advances simultaneously across such a wide front exists only in London where the RPMS can be combined with the CRC. We can't endow the RPMS's reputation upon a new centre built on a green field site. As no other centre rivals Hammersmith's reputation, it would take a long time for any other potential home to earn the respect which will attract the best scientists, clinicians, teachers and students. In any event, the conclusions of the option appraisal commissioned by Sir Robin Nicholson from Deloitte, Haskins and Sells was that both provincial and green field sites should be rejected on economic grounds - the capital investment required would be much greater than at Hammersmith.

7. Nor does dispersal to a number of different medical schools meet the bill. This kind of research requires increasingly expensive equipment and facilities. Dispersal would mean that we would lose the advantages of concentrating our efforts to bring together the multidisciplinary teams needed to carry forward biomedical research today. The most effective whole is one which ensures that the parts work most closely together.

8. I have looked long and hard at this. I have visited Hammersmith and Northwick Park and have discussed the proposal in depth with the MRC and NHS managers. I pressed them on cost and siting and have concluded that they have adopted the right strategy and have come forward with a sensible specific proposal. I now want to see the feasibility of the proposal tested.

9. Kenneth Clarke and I have discussed the position. Kenneth understands and shares the MRC's concern at the state of clinical research. He agrees that we need to ensure that we have a home-based international centre of excellence. He shares my view that basing this centre on the RPMS will capitalise on the School's international reputation and

offers the best prospect for re-establishing our leading position; with long-term benefits for the NHS.

10. The initiative is strongly supported by the ABRC and it was on their recommendation that I allocated the £2m for detailed planning and some advance work in 1989/90.

11. As I have already said, there is still work to be done before I get to the stage of seeking formal approval for the MRC proposal. But I thought it would be sensible now to set out my thinking on the fundamental issues involved.

12. I am sending copies of this letter to members of E(ST), Sir Robin Butler and John Fairclough.

KB

20 March 1989

DEPARTMENT OF EDUCATION AND SCIENCE

RESTRICTED

1

CABINET OFFICE

70 Whitehall London SW1A 2AS Telephone 01-270 0259.

From John W Fairclough FEng
Chief Scientific Adviser

WO39

Nicholas Bayne Esq CMG
FCO
King Charles Street
London SW1

1 March 1989

Dear Nicholas,

TIMETABLE OF FORTHCOMING DECISIONS

I wrote to the Chancellor of the Duchy of Lancaster on 30 June last year about ways of improving the planning of decisions on international collaboration in science and technology. I suggested that it would be of great help to Departments if they knew about decisions which other Departments were facing on S & T matters and about other international S & T issues which might be relevant to them. To help with this, I enclosed a timetable of forthcoming decisions which I had asked my staff to draw up in consultation with other Departments.

The timetable has received a general welcome. We have therefore brought it up to date following discussion in E(ST)(O)(IA). Three categories of events are now included: key forthcoming decisions (marked with an *); forthcoming events where policy decisions might be needed (marked with a +); and (for information only) items from the last list where key decisions have recently been taken.

I hope you and others will continue to find this timetable useful. Provided you do, we will keep it up to date and send round copies on a regular basis.

I am copying to other E(ST)(O) members.

Yours sincerely,

John

JOHN W FAIRCLOUGH

RESTRICTED

INTERNATIONAL SCIENCE AND TECHNOLOGY COLLABORATION
SUMMARY OF FORTHCOMING DECISIONS

A. MULTILATERAL AND BILATERAL

B. EUROPEAN COMMUNITY

(as at February 1989)

	lead Department (others)	key dates
A. MULTILATERAL AND BILATERAL		
Defence		
(i) NATO Frigate Replacement (NFR) * Project definition stage now agreed. Studies continue on the choice of weapon system. Decision expected in mid 1989. A decision on UK participation will be required at Ministerial level based upon advice from the Equipment Policy Committee.	MOD	Mid 1989
(ii) European Defence Industry Study * Action continues. At their meeting in November 1988, Ministers of the Independent European Programme Group nations endorsed proposals to work towards more open European defence market. Ministers will review progress when they meet in June 1989.	MOD	June 1989

(iii) Medium Surface to Air Missile * (Bloodhound/Hawk replacement) studies into the options for Bloodhound/Hawk replacement continue. Decision likely in 1989. A decision on UK procurement will be required at Ministerial level based upon advice from the Equipment Policy Committee.	MOD	1989
(iv) European Fighter Aircraft * Four nation programme (Germany/ Italy/Spain/UK). Development contract placed. Next planned submission to the Equipment Policy Committee is for Production Investment: scheduled to take place in 1991.	MOD	1991

Space

(i) European Space Agency

(a) **Columbus** * (Polar platform). Design configuration studies for the Polar Platform now in hand. Decisions on these and payload configuration are needed during the first quarter of 1989.	DTI	ESA Council March 198
(b) **Horizon 2000** At the December ESA Council the UK agreed to provide additional funding at 5% per annum compound up to 1992. It was further agreed that:	DTI/ DES	

- the contributions of new members would be contained within, and not be additional to, the funding baseline, and

- an independent review of the management and costs of the science programme has been put in hand, and will report in time to inform the next round of funding decisions (due 1990).		Mid to late 1989
(ii) Spectrum X (Russian Project) Mission due to fly late 1992. SERC/DES has approved funding for one (JET-X) out of four possible instrument payloads. Progress now dependent on grant of the necessary Export Licence which will be subject to COCOM considerations.	DTI/MOD	Early 198
(iii) Earth Observation - General * Initiatives on climate change and the global environment will precipitate a requirement for better data. Remote earth sensing will have key role to play, and ESA will be reconsidering its Earth Observation Programme.	DTI (SERC DOE NERC MOD - Met Office)	For consider-ation by ESA early 1989
Science		
(i) Japanese Human Frontier Science Programme (HFSP) * Japanese Cabinet backing agreed. Confirmation in DIET still needed, and is unlikely until end of March. Formal proposal is needed early 1989 if programme is to start by October 1989. Decision on UK participation will then need to be put to Ministers. Key issues include location of Secretariat (London is one of the possible locations) and organisational structure.	DES (MRC, other Councils)	Early 89 for organis-ation. Oc 89 for further particip-ation

(ii) CERN Negotiations almost complete on implementation of Abragam Review. New method of calculating contributions agreed. Decision to continue UK membership communicated to CERN Council on 15 December 1988. Need to continue to press for savings and wider international participation, but no major decisions now remain for UK.	DES (SERC)	Continuin pressure in 1989
(iii) Summit Bioethics Conference + The European Commission will host the sixth International Summit Conference on bioethics, in Spring 1989. The theme will be environmental. The UK has not yet hosted meetings, and may need to decide whether to host a Conference in 1990, or 1991 at the latest.	Cabinet Office (DHSS, MRC DOE, AFRC, DES, NERC, FCO, HO MAFF)	Spring 1989 for a 1990 conferenc Early 199 for a 199 conferenc
(iv) Neutron Sources (a) ISIS (UK spallation neutron source, RAL). Bilateral arrangements for overseas utilisation already signed with Netherlands and France, and agreed in principle with Sweden and Italy. Instrument provision agreed with Italy, Japan and FRG. Wider FRG participation desirable.	DES/SERC	discussio continuin through 1989 on FRG issue
(b) ILL (Institut Laue Langevin, Grenoble) * (UK/FRG/France) Option to reduce UK subscription when present treaty expires 1992. SERC review of support for all neutron sources to start Spring 1989. SERC already indicated informally intention to reduce UK ILL costs from 1/3 to 1/4 of total.	DES/SERC	1991/92
(v) Ocean Drilling Program (ODP) * Decision needed on UK membership beyond September 1990. Interdepartmental discussion on funding arrangements.	DES (NERC)	Spring-Summer 1989

Environment

i) International Ministerial Conference on Ozone Layer + - London. March 1989. Will include implications for the Third World of reduction in CFC use.	DOE	5-7 March 198
ii) International Task Force on North Sea + - inaugural meeting held March 1988. Next Quality Status Report to be prepared in 1989. The Third North Sea Conference to be held in the Hague in March 1990; will review progress on the agreements reached at the Second North Sea Conference last year.	DOE DOE	1989 1990
iii) World Economic Summit in Paris + - July 1989. Likely to have a major environmental component.	FCO (DOE)	14-16 July 1989
iv) Diplomatic Conference + to adopt UNEP Convention on International Transports of Hazardous Wastes, Basel.	DOE	March 1989
v) Review of Montreal protocol to Vienna Convention on Protection of Ozone Layer. + First meeting of Protocol parties Finland April 1989; second meeting London 1990.	DOE DOE	April 1989 April 199
vi) UNEP 14th Governing Council, + Nairobi	DOE (FCO, ODA)	May 1989
vii) UNEP/WMO Intergovernmental Panel on Climate Change: + Working Groups to report in 1990. UK chairing Group on scientific assessment, and member of Group on response strategies.	DOE	1990

viii) World Climate Conference (1990) +	DOE	1990
ix) The ECE Regional Conference in Bergen + in May 1990 to discuss the Brundtland Report and how best to take forward work on sustainable development and resource accounting.	DOE	1990
x) Ministerial meeting of Oslo/Paris Commission + in 1991. Waste disposal to sea.	DOE/ MAFF	1991
xi) UN Summit on Environment; + 20 years after Stockholm Conference. Venue to be agreed.	DOE	1992
Industrial Collaboration i) EUREKA * Medium Term Plan being developed to help provide continuity between successive Chair countries, and to give more clearly defined remit to Secretariat. Difficulties over agreeing priorities; UK wishes to exclude activities which are not EUREKA specific. Agreement needed at Ministerial Conference on 19 June 1989.	DTI	19 June 1989
ii) "Autoguide" traffic guidance: EUREKA assistance may be sought for pilot scheme probably in the London area. Work on pilot scheduled to start late 1989.	DTp	1989
Vehicle Noise * International Standards Organisation will circulate draft standard to national standards institutes for voting.	DTp	1990
Transport * Possible legislation on harmonised test procedures for pedestrian protection (via European Experimental Vehicle Committee)	DTp	1989

B. EUROPEAN COMMUNITY

Framework Programme		
Mid-Term Review of Framework Programme for R&D * Informal contacts with Commission and other Member States early 1989. Major proposal from Commission expected second quarter of 1989.	Cabinet Office	April-Dec 1989
The following programmes within the present EC Framework Programme have been proposed by the Commission. Negotiations will be conducted in the Research Working Group in early part of 1989 with a view to adoption of common positions probably in the first half of the year. Lead Departments only are indicated - others may have interests.		Jan-July 1989
Predictive Medicine	DHSS/MRC	
MONITOR (Forecasting and Evaluation)	DTI	
MAST (Marine S&T)	DES	
VALUE (Dissemination)	DTI	
DOSES (Statistical expert systems)	DTI	
Decommissioning	DEn	
TELEMAN (Robotic remote handling)	DEn	
STEP-EPOCH (Environmental protection, climatology, natural hazards, major technological hazards, cultural heritage).	DOE	
FLAIR (Food Linked Agro-Industrial Research)	MAFF (DTI, AFRC)	
Competitiveness of Agriculture	MAFF (AFRC)	
Radioactive waste management	DOE	
Energy	DEn	Dec 1989
i) Energy Demonstration Programme, * present Regulation runs out 31 Dec 1989; discussions on replacement programme just beginning. Likely to incorporate Hydrocarbon Scheme.		
ii) Technology Development: Hydrocarbon Sector * present regulation - 35 mecu p.a. - falls on December 1989; evaluation complete. A replacement programme expected. Discussions of a single programme incorporating both this and Energy	DEn	Dec 1989

Demonstration just beginning.

iii) Community Fusion Programme (CFP) * agreed to end March 1992. JET statutes agreed to end 1992. CFP Review due in 1989, and to report by mid 1990. But Commission may bring forward earlier proposal for revision in the context of the Mid-Term review.	DEn	April-Dec 1989
Education and Training Commission proposal for extension of COMMETT Discussion on content of COMMETT II may require evaluation of report on COMMETT (expected April 1989)	DES	April 1989
Technology Transfer * SPRINT: Negotiations started on much enlarged new Commission proposal (130 MECU). UK concerned about duplication with other Commission activities, and that much of the proposal is more appropriate for Structural Funds. 30 MECU justified in UK terms, but most Member States favour full 130 MECU. Agreement is likely in the first 3-6 months of 1989.	DTI	April - June 1989

* Forthcoming Decisions
+ Forthcoming Events

Cabinet Office
February 1989

10 DOWNING STREET

Paul.

John Fairclough speech (addressed by Richard Wilson but had to be cleared by No 10) Can you read & phone Robin Butler office or John Fairclough's office.

16/2.

Rob. I've passed No 2 comments noted by John Fairclough's office.

PAC 17/2

SPEECH TO RAWB: 20 FEBRUARY 1989

I am delighted to have been invited to be the first speaker at this conference on Europe in 1992. A conference such as this gives us an opportunity to share our own national perspectives on the place of science and technology in Europe in 1992 and beyond. If we can all understand better the place which science and technology has in our respective national policies, we should get a better feel for how international collaboration can develop both within Europe and beyond.

I am very glad therefore that our Chairman, Harry Beckers, has asked me to speak about how policies for science and technology are developed in the United Kingdom, what changes are afoot and what place we see for international co-operation.

In a couple of months I will have been three years in the Cabinet Office as Chief Scientific Adviser to the British Government. It really has been a very different sort of experience from the work and environment I was used to in IBM. The role is a mixture of daunting freedom on the one hand - an opportunity to speak up on the full range of science and technology issues for which different Departments are responsible - and a lack of specific budgetary responsibility on the other - I have no responsibility for any individual science and technology programme, no laboratories in which to test out my advice.

I mention this not to enlist your sympathy or attract your envy but because it illustrates the most important feature of the British Government's approach to science and technology - and indeed to many other areas of policy as well. That is that decisions - whether they concern basic research by the universities and Research Councils or applied research in support of government policy, regulation and procurement - should wherever possible be delegated down to those who have the knowledge and understanding to recognise scientific excellence on the one hand and to understand the contribution science and technology can make to improving the quality of life and international competitiveness on the other.

In 1992, assuming the present policy continues, we will have the 20th anniversary of the policy for the British Government's expenditure on applied R & D known as the Rothschild customer/contractor principle. As its name implies this requires a clear customer to commission R & D from a contractor. Hence there is no single Minister responsible for science and technology over all the different sectors - energy, agriculture, fundamental science and the rest. Science and technolgy, as it is in IBM and any other company, is seen as a means to an end not an end in itself, though of course we believe most strongly in supporting curiosity science conducted by the most able scientists. Science push and market pull are both important. The onus of responsibility for taking decisions on how much to spend and what to spend it on are for those who are responsible for the policies and objectives it is designed to serve. Different departments of state all have their own science and technology budgets and take decisions on them.

In total, United Kingdom Government R & D is around £5.5 billion a year. This compares well with our main Western partners. Within this total a growing proportion is being directed to basic and what we call long-term strategic research by the Universities and Research Councils. This is not "strategic" in any military sense, but in the sense that there are certain areas of research which by their very nature are pervasive and of wide application.

Let us look at the specific area of fundamental science. The United Kingdom Science Budget administered by our Research Councils will grow by no less than 16% between this financial year and next. The £825 million for the Science Budget in 1989-90 is distributed by the Secretary of State for Education and Science on the basis of advice from the Advisory Board for the Research Councils - he has always accepted their advice on the distribution. They in turn avoid detailed decisions on projects leaving these to be decided by the five separate Research Councils on the basis of programmes which the Advisory Board have approved. In addition to this £825 million, about £700 of the funds allocated

directly to the Universities is spent on research, much of it on equipment and other overheads for the ABRC money. The vast majority of British science is funded as a result of decisions taken by other scientific experts - the importance of the Peer Review mechanism - or, in the case of applied science, by those who are the customers for the research. Provided they can act as intelligent customers, they are in the best position to judge the contribution science and technology programmes can make to achieving the objectives for which they are responsible.

There are however two risks with pursuing this approach too single-mindedly. The existence of my post shows the Government is well aware of these dangers. First there is the problem of pre-empting resources. We all have a limited number of scientists. Demographic trends show the problem becoming more acute. How are priorities to be set to get the best out of these limited resources? Second there is the problem of duplication of effort or, to put it the other way, of getting the most out of our science and technology programmes. Work to develop technologies relevant to the defence industries for example are likely to be of enormous significance to a range of civil applications. How do we get different customers for research and different teams of scientists to share and collaborate and - a key point, this, for international competitiveness - to see the results of the research exploited for the widest benefit. In a recent White Paper the British Government announced a number of changes to strengthen the central machinery for deciding on science and technology policy. A new Advisory Council looking at the whole range of science and technology from basic science through to technology transfer was set up. The Prime Minister herself has chaired meetings of this council on two occasions. She also takes the lead directly in considering science and technology priorities with the departmental Ministers concerned.

As a result of all these changes, there is a new emphasis in the United Kingdom on establishing priorities. This means we are ready

to reduce expenditure, not just increase it, and some of the recent increases in our expenditure on more fundamental science have been funded by reductions in other areas, in particular research which we judge is more appropriate for the private sector to shoulder.

Science and technology is increasingly pervasive. It is serving an ever widening range of ends and goals - some of these, as in basic science, are broad goals - and are not identified with particular applications or markets. This strengthens the case for some degree of co-ordination of different departmental programmes. The greater the pervasiveness, the greater the risk of duplication and of failing to get the widest exploitation and application from the research. It seems to me that there is something about the way science and technology is itself evolving which is leading to greater pervasiveness. I do not think it is just a question of perceptions. So many of the interesting challenges and opportunities in science lie at the boundary between traditional academic disciplines. The challenge to be the first in the race for superconducting materials needs the experience of both the chemists and material scientists to experiment with new materials and of the physicists to understand why different materials are performing in different ways. As we learn more about the fine structure of the physical and living world the boundary between chemistry, physics and biology ceases to serve a useful purpose. They are dimensions created by man for our own convenience but nature does not recognise their existence. This has meant that in a country like the United Kingdom where much of the basic research goes on in Universities and is tied closely to particular teaching disciplines, we have needed to re-think the way in which this interdisciplinary research is carried out. We are not alone in this. The National Science Foundation in the United States has an ambitious programme of interdisciplinary reseach centres. We are embarking on a similar programme. Eight interdisciplinary research centres have been established already or are in the process of being established; Mr Baker the Secretary of State for Education and Science announced plans for another nine centres earlier this month. The intention is that these centres should be located in

Universities. They are not to be institutionalised so as to make make it much easier to change and adapt the centres to focus on areas of scientific excellence.

There is always a difficult balancing act between the need to concentrate resources and establish centres of excellence without at the same time creating a rigid structure which excludes the individual scientist. There is much to be said for critical mass but it can too easily lead to the establishment of rigid structures which soon outlive their usefulness. This is a challenge for all of us concerned with supporting long-term curiosity-driven science. We believe interdisciplinary research centres have an important part to play but on present plans they will still only account for about 2% of the Science Budget. We plan to review the success of those which have already been established before devoting more resources to them.

One of the key things for the centres is to build them around a scientist of recognised excellence. His task as Director of the centre is a difficult one. The management task which he has to undertake should be much more about selecting the key people to work with him and ensuring an atmosphere of communication and co-operation. Over-management will stultify the science. This is one of the key things we will need to look at in the review. The subjects on which these centres are focussing cover a wide range from superconductivity at Cambridge to transgenic animal biology at Edinburgh; from surface science at Liverpool University to molecular sciences at Oxford.

These are exciting times for scientists in the United Kingdom. The Prime Minister, herself a Fellow of the Society, spoke to the Royal Society last September and urged British scientists to do more to communicate the enthusiasm and the importance of their scientific work to the general public. Science like any other activity has to argue its case in a democracy. There is no point in scientists complaining that they are unloved or misunderstood if they do not go out to earn that admiration and explain the importance and

relevance of their scientific successes. I know it is not an easy matter. If the public is to understand science it needs to have a sufficient degree of scientific literacy itself. But there have been some notable scientific books published in the last few years which are aimed at the intelligent lay reader and have very successfully captured both imagination and good sales figures.

Of course one of the best ways of communicating success is to have highly visible commercial exploitation of scientific work. This is a difficult area in which to determine the respective responsibilities of Government and industry. Of course Government is critically involved through its responsibility for the patenting system and for a framework of protecting intellectual property. That is an international activity and our policy is to encourage the uptake of European rather than national patents.

Beyond that the Government has to have policies for the exploitation of the research which it has funded itself, including in Universities. There have been major changes in Britain in the last few years with much more responsibility being devolved down to the individual University and the individual Research worker. More recently the Government has welcomed the establishment of the Centre for the Exploitation of Science and Technology (CEST). This is primarily funded by industrial companies and financial institutions with some Government funding as well. Its aim is to bring science, industry, business investors and Government together to do four things. First, to monitor R&D developments worldwide.

Second to form judgements on what holds out the best promise of commercial exploitation. This means looking at social and demographic developments and society's changing needs as well as the technology to satisfy them. Third CEST is seeking better ways of linking scientists, manufacturers and commerce so that ideas are translated into saleable goods and services. Last this means encouraging industry, investors and scientists to stay in touch not only with each other but with the market.

As Chief Scientific Adviser I also advise on coordination of the Government's international scientific and technological relationships. There should be no doubt about the importance which the UK attaches to international cooperation in the scientific and technical field. Britain can never hope to do more than a small proportion of total world science. Our researchers therefore need to stay in touch with developments in other countries. But this does not mean that we believe in international collaboration for its own sake; it is the quality of the resulting science which matters. Nor that we are ready to be less tough with waste and inefficiency in international projects than we are prepared to be in the UK. That said, we have demonstrated our support for international collaboration over the years, most recently with the allocation of an extra £9.3 million for our CERN subscription in 1989-90. Our most important contribution, however, remains in the intellects and abilities of our scientists and researchers. This is as true of our particpation in the European Community's research programmes as elsewhere.

Let me then now turn to the future of research in the Community. Our Dutch hosts have already devoted some thought to the subject as is clear from their recent discussion paper "Towards a Science Policy for the 1990s". We in the UK have also begun to think about the impact of 1992 on research. Discussions have started in a number of fora but it would be premature to suggest that we have as yet reached any firm conclusions. We have however rather begun to focus on what we believe are some of the key questions.

Let me start with the basics. At the very heart of the programme for 1992 is the Single European Act which also lays the foundations for the European Community's own framework programme of research. The Single Act makes it plain that the crux is to support the research efforts of companies, research institutes and universities, both individually and cooperatively. Action by the Community must therefore complement and not undermine these efforts.

The single market agenda is of course largely focussed on trade and related issues, but there are some close links with R & D. The most obvious of these is the harmonisation of technical standards . Some research programmes such as RACE and ESPRIT have already contributed to the formulation of standards which will help European industry compete on the world stage. Others have the creation or administration of standards as a major goal. The Community Bureau of Reference here is the obvious example.

A second feature of the Single Market of importance to research is mobility - both of people and of resources. We expect young people whether at the under-graduate, post-graduate or post-doctoral level, as well as qualified professional people, to move around the Community much more freely in the future. How will this affect the doing of research? Will we see concentrations of expertise and specialisation in the various universities and institutes, or will we see a more general spread of talent? And what about the mobility of resources - both money and research facilities - will they be the main attraction or will they chase after the people and lower overheads?

Another important area is **that of regulation**. The conduct of scientific experiments will clearly be affected by the harmonisation of regulations on animal welfare, safety and so on. R & D will also be affected by - as well as contributing to - the harmonisation of technical standards for products.

We shall also see consequences for customers of research. In a freer, more competitive market will governments, for example, be able to turn to any research institute in Europe for guidance on questions of relevance to policy? Will private companies commission more of their research from outside institutes?

Finally, what sort of central direction of research policy will be required in the Community in the future? Clearly any extension of top down planning must be resisted as being quite at odds with the development of science policy in my own country and, I believe, in

other Member States of the Community. We should rather, as with the Single Market, be seeking to reduce barriers and make it easier for researchers to collaborate - and compete - across our national boundaries.

At this stage there are far more questions than answers to be given about the place of research in the Europe of 1992. Faced with such uncertainties there are a number of broad principles which I believe will continue to be valid and which should serve us in good stead for the future.

First, Government funded R & D, whether at the national or at the Community level, should be directed above all towards basic and strategic research or in support of Governments' policy, regulatory and procurement requirements.

Next, international collaborative research is of proven benefit in the right circumstances. Whether at the Community or more widely international level, collaboration is not, however, an end in itself. But properly selected, collaborative projects can offer real advantage - value added. So we need an environment in which such collaborations can flourish. This does not mean that they have to be invented and directed from the centre under all circumstances. Rather we need an environment which will facilitate flexible solutions to differing research problems and for key individuals to remain in contact with each other. And here the diversity of expertise in the Community should be regarded as one of our strengths.

My next principle is that it is essential for all concerned with collaborative research to feel directly responsible for the resources they will be using. Community funding for R & D ultimately comes from the taxpayer and we must ensure that only the most worthwhile projects are supported. So we must be selective. We must encourage companies to shoulder a substantial part of the burden.

Finally, let us not forget that as we consider action at the government or the Community level, the main research effort must continue to be shouldered by companies and the wider economic benefits which will result from the single market may help their research efforts far more than anything we do in terms of R & D policy.

It has been said:

"There is nothing more difficult to carry out, nor more doubtful to success, nor more dangerous to handle, than to initiate a new order of things.

For the former has enemies in all who profit by the old order, and only lukewarm defenders in all those who would profit by the new order.

This lukewarmness arises partly from fear of their adversaries, who have the law in their favour; and partly from the incredulity of mankind, who do not truly believe in anything new until they have had actual experience of it."

Who wrote that you may wonder? Schumpeter? Keynes? Friedman? Drucker? It was Machiavelli - in 1513. He knew a thing or two!

There are many changes and challenges ahead. I find it hard to believe that Professor van Beuren, whom we are here today to salute, will be ready to separate himself from them. Indeed, I do not really believe that he will. But whether his retirement is complete or not, I join others in thanking him for his many contributions over the years and wishing him all the very best for the years to come.

10 DOWNING STREET

LONDON SW1A 2AA

From the Principal Private Secretary

SIR ROBIN BUTLER

MEMBERSHIP OF ACOST

The Prime Minister has seen your minute of 9 February and is content that the Chairman of the Innovation Advisory Board, now Lord Chilver, should be an ex officio member of ACOST.

Andrew Turnbull

10 February 1989

OTP

Prime Minister
Agree?
AT
9/2

Ref. A089/396

MR TURNBULL

Membership of ACOST

Sir John Collyear, Chairman of the DTI Technology Requirements Board, has been one of two ex officio members of ACOST. The Technology Requirements Board has been replaced by the Innovation Advisory Board, chaired by Lord Chilver; and Sir Francis Tombs hopes that the Chairman of the Innovation Advisory Board can similarly be an ex officio member of ACOST.

2. I should be grateful if you would confirm that the Prime Minister has no objection to this or to my inviting Lord Chilver to serve on ACOST in this capacity. Lord Chilver would in any case come up for appointment to ACOST shortly as Chairman of the University Funding Council and Sir Francis Tombs would be content for him to serve in both capacities.

FER.B.

ROBIN BUTLER

9 February 1989

10 DOWNING STREET

LONDON SW1A 2AA

PERSONAL

The Rt Hon Lord Belstead
Lord Privy Seal and Leader of the
House of Lords
Whitehall
LONDON SW1A 2AI

9 February 1989

Dear Lord Belstead

At lunch in No.10 last week we were discussing potential Government supporters of its science policy.

I have thought about this further and taken a few soundings. Some names, ancient and modern, are attached. I don't know whether they will all be avid enthusiasts for what we are doing but at least they will understand the issues.

I hope this is of some help.

Yours sincerely, George Guise

GEORGE GUISE

bcc: Andrew Turnbull for information

	Age	Affiliation	Background
Lord Todd	82	Ind	1975-80 Chairman House of Lords Ctee on Science and Technology. 1980 President Society of Chemical Industry.
Lord Dainton	75	Ind	1972-73 President Chemical Society. 1969 Holder of the Davy Medal, Royal Society.
Lord Flowers	65	SD	1983 Former SDP spokesman on education and science.
Lord Caldecote	72	C	1981-84 Advisory Council for Applied R&D. 1976-84 Pro-Chancellor Inst. of Technology. Chairman 3i until 1987.
Lord Jellicoe	71	C	1965-70 Parliamentary and Scientific Committee.
Lord Butterworth	71	C	1981-85 Chairman Standing Committee on International Co-operation in Higher Education.
Lord Nelson	72	C	1984 Member House of Lords Select Committee Science and Technology.
Lord Halsburg	81	Ind	1963-66 President Parliamentary and Scientific Committee. 1972-77 Member of the Medical Research Council.
Lord Hailsham	82	C	Lord High Chancellor.
Lord Zuckerman	85	Ind	1973-76 President Parliamentary and Science Committee. Publications: 1980 Science Advisers, Scientific Advisers and Nuclear Weapons.

LASABJ

	Age	Affiliation	Background
Lord Rothschild	79		Numerous Government, Scientific and Industrial roles.
Lord Tedder	63	SD	Purdie Professor of Chemistry, University of St Andrews. Numerous scientific publications.
Lord Ashby	85	SD	Botanist. 1970-73 Chairman Royal Commission on Environmental Pollution.
Lord Miles	82	Ind	Actor, founder of the Mermaid Theatre Trust.
Baroness Warnock	65	Ind	1979-84 Member Royal Commission on Environmental Pollution. Author of books on ethics and education.
Lord Rayleigh	29		Chairman, Lord Rayleigh's Farms Inc. Director, Strutt and Parker Farms Ltd. Grandson of a famous radiation physicist who takes a lay interest in science.
Lord Vinson	58	C	Inventor. Chairman of Development Commission. Former Director of CPS. Sundry business directorships.
Lord Trafford	57	C	Consultant Physician, Brighton Health Authority. Chairman of Council, University of Sussex.
Lord Adrian	62	Ind	Professor of Cell Biology at Cambridge. Master of Pembroke College.
Lord Selborne	49	C	Chairman AFRC.
Lord Swann	69		Distinguished zoologist. Chancellor, University of York.
Lord Lewis	61		Professor of Chemistry at Cambridge (recently ennobled)

LASABJ

	Age	Affiliation	Background
Lord Nathan	67	Ind	Solicitor. Member of the Watt Committee on Energy. 1979 Member Royal Commission on Environmental Pollution. Hon. Treas. Cancer Research Campaign.
Lord Cranbrook	56	C	Zoologist. Former Member, Select Cttee on Science and Technology. 1981 Member of Royal Commission on Environmental Pollution.
Lord Blakenham	51	C	1983 Chairman of Pearson group. Member of the House of Lords Select Committee on Science and Technology.
Lord Sherfield	85		Chairman House of Lords Select Commitee on Science and Technology.
Lord Shackleton	78		Parliamentary and Scientific Committee. (Left wing and was hostile on Space Policy. Otherwise well known and knowledgable.)
Lord Renwick	54	C	1975 Director Technology Systems Ltd.
Lord Chilver	63		Civil Engineer. Chairman, Universities Funding Committee (from April 1989). Chairman E. China Clays plc (from February 1989). Numerous academic and business posts.

LASABJ

AST(88)10th Meeting
1 February 1989

COPY NO

ADVISORY COUNCIL ON SCIENCE AND TECHNOLOGY

MINUTES of a Meeting held
in Conference Room A,
Cabinet Office, 70 Whitehall on
WEDNESDAY 1 FEBRUARY 1989 at 3.00 p.m.

PRESENT

The Rt Hon Margaret Thatcher MP
The Prime Minister
(in the Chair)

Professor Thomas Blundell
Professor Gordon Edge
Mr Tony Gill
Sir Graham Hills
Professor Leonard Maunder
Professor Stanley Metcalfe
Dr David Smith
Professor Keith Peters
Professor Sir David Phillips
Sir George Porter
Professor John Robertson
Sir Charles Reece
Dr Alan Rudge
Sir Francis Tombs

IN ATTENDANCE

Mr John Fairclough — Cabinet Office

ALSO PRESENT

Professor Jack Baldwin — Oxford University
Professor Graeme Davies — Liverpool University
Mr Andrew Turnbull — Private Office
Professor Neville Richardson — Liverpool University
Professor Sir David Weatherall — Oxford University

SECRETARIAT

Dr C C Bradley
Mr P D Finch
Dr D J van Rest
Dr W M Howarth
Mr C R Searle

CONTENTS

1. CHAIRMAN'S INTRODUCTION

On taking the chair, THE PRIME MINISTER expressed her pleasure at meeting ACOST again and said how much she had been looking forward to it. She explained her concerns that the devotion of too much of the basic science budget to big projects would leave too little for individuals and that further new organizations should not be started without very good reasons.

2. THREE EXAMPLES OF INTERDISCIPLINARY RESEARCH

SIR DAVID PHILLIPS outlined the background and rationale for IRCs. He said that for 20 years Research Councils had been making large numbers of small grants to individuals, but that not all science had been well served by this approach as some tasks required larger teams. Various solutions had been considered such as the Research Institutes in Germany. The UK had decided that the best approach was to associate research centres with universities since the latter provided a ready source of expertise. This association would facilitate the release of researchers from teaching, and local management would encourage rapid acceptance of new ideas from research workers. A key feature of IRCs was that they provided an interface between basic/strategic research and the user community. It was recognised that IRCs were not appropriate for all research, and that a balance would have to be struck between funding of IRCs and small individual grants.

Presentations on the work of three IRCs were then given by Sir David Weatherall (Musical ~~Molecular~~ Science, Oxford); Professor Jack Baldwin (Molecular Science, Oxford); Professor Neville Richardson (Surface Science, Liverpool).

In addition to specific questions on the technical content of the presentations, general points on IRCs were made as follows:

i. IRCs had been successful in breaking down interdisciplinary barriers, and were proving attractive to both young researchers and to those (both British and

foreign) currently working overseas

ii. the flow of ideas was not unidirectional from physics and chemistry to biology. A reverse flow in areas such as the catalytic creation of penicillin and the development of neural networks was also a feature of interdisciplinary work

iii. the IRC concept had been pioneered in industry and there was evidence that such centres led to increases in productivity and exploitability of the research. Again, there were examples of a reverse flow of ideas between industry and academic research

iv. the industry/IRC links were not yet strong enough and needed to be developed, and these should not be exclusively large companies

v. adequate protection of intellectual property (IP) was essential. It was important that as far as possible resulting IP should be transferred to UK rather than overseas companies for exploitation

vi. IRCs are not a replacement for specialist centres.

THE PRIME MINISTER expressed concern that it should be necessary to set up a new mechanism to force scientific disciplines to work together and queried the implications for the future of university departments. She added that additional funds should not be necessary; the £5.9bn allocated for UK R & D was adequate and emphasis should be on its swift and effective allocation with a minimum of bureaucracy. She asked why, if IRCs are so successful, they had not been introduced before.

THE PRIME MINISTER also asked if the ~~funding split~~ boundaries between Research Councils was acceptable. SIR DAVID PHILLIPS said the ABRC was keeping the situation under review and would consider reallocation if appropriate, but he had reservations about the bureaucratic upheaval this restructuring would involve.

3. GLOBAL ENVIRONMENT RESEARCH

THE PRIME MINISTER invited SIR GEORGE PORTER to outline the work carried out by ACOST on global environment change. He described ACOST's involvement since its first meeting in 1987, leading to the commissioning of a study by NERC and the subsequent establishment of an ACOST Working Group to advise on further action. He said that the Working Group had concentrated on the true 'global' problems; that of stratospheric ozone depletion and the 'Greenhouse Effect' and went on to review their conclusions and the comments made by ACOST.

THE PRIME MINISTER welcomed both the ACOST Working Group Report and the NERC Report. She commented that:

i. global environment problems were largely associated with the increase in world population and the development of technology over the last 100 years

ii. Europe's contribution to the increase in global carbon dioxode levels was small and that of the UK even smaller. It was therefore vital that action was taken at an international level and the UK would continue to play a leading role

iii. projections of the consequences of a rise in sea level resulting from global warming indicated that much land would be lost to flooding. In response the Government's aid policy includes forestry schemes in tropical regions to achieve more efficient fixation of carbon dioxide

iv. it was the stability of CFC's which had made them so useful, but had created problems elsewhere. Nevertheless progress had been made in reducing the consumption of CFC's in Britain such that their use would soon be down by 50% and by 85% within 10 years. (She noted with pleasure that many consumer products were being promoted as being environmentally benign.) However, there remained political difficulties in

In conclusion THE PRIME MINISTER expressed the view that the basic science budget should be supporting more outstanding individuals.

She invited ACOST to arrange a presentation by some half-dozen scientists, working at the frontiers of knowledge, worthy of more support. She would be pleased to spend a day on this, and host lunch in No 10. She hoped that this could be arranged within the next three months.

THE COUNCIL

- took note with approval of the Prime Minister's suggestion.

She then thanked the presenters for a stimulating meeting and closed the meeting.

Cabinet Office
2 February 1989

PRIME MINISTER

31 January 1989

IRCs - THE USA POSITION

In view of tomorrow's ACOST discussion, you may be interested to see that the Americans are setting up groups similar to our IRCs. Note that the initial funding proposed was cut back by Congress while the performance of the initial centers are evaluated.

Note also that the research content of most of the proposed STCs is preponderantly basic and strategic science - although there are aberrations in the form of advanced cement-based materials and polymeric adhesives and composites! It may be that these are funded principally by industry which is what ought to happen.

GEORGE GUISE

NATIONAL SCIENCE FOUNDATION
NEWS

FOR RELEASE:

Jeffrey Norris
(202) 357-9498

December 5, 1988
2:00 PM EST
NSF PR 88-77

NSF ANNOUNCES 11 SCIENCE AND TECHNOLOGY CENTERS, TO BE FUNDED WITH UP TO $24.7 MILLION IN FY 1989

After an extensive merit review of 323 proposals, a presidential initiative to bolster U.S. scientific research reached a milestone today, as the National Science Foundation (NSF) named 11 Science and Technology Centers that it intends to support with up to approximately $24.7 million dollars during the first year.

Research teams will begin to make their visions reality at university-based Science and Technology Centers in California, Illinois, Michigan, New Jersey, New York, Oklahoma, Texas and Virginia.

The National Science Board, the policy-making body of NSF, approved recommendations to establish the Centers (named below), concluding a multi-tiered process during which about 1,000 reviewers from academia, industry, NSF and other government agencies and laboratories narrowed the field to the most exceptional proposals.

-more-

(Comments by George Gries)

NSF established the Science and Technology Centers (STCs) Research Program to promote basic research that can most effectively be accomplished through centers--complex research problems that are large scale, of long duration, and that may require special facilities or collaborative relationships.

In response to an NSF solicitation, applicants were required to shape their proposals around a unifying intellectual theme, to include a strong educational component, to incorporate mechanisms for stimulating the transfer of basic research knowledge to those interested in building upon it, and to establish linkages with government, industry, states or other institutions.

Commenting on the STCs, Mr. Erich Bloch, director of NSF, said:

"The Science and Technology Centers are unique because they link university researchers, in many cases from geographically separate academic institutions, with other researchers in industry and national labs, in long-term basic research projects. One very important benefit we hope to see from this is a much shorter time span between actual discovery and utilization. The fast transfer of knowledge is critical to our nation's ability to compete in the world market.

"The Centers will foster new knowledge and innovations in many fields, from cosmology, to biotechnology, to advanced computing, to superconductivity and other advanced materials."

Recommended awards for the first year range in size from $900,000 to more than $4 million. Awards will be negotiated by NSF and host institutions through cooperative agreements. NSF support after the first year of the five-year awards is dependent on available funds and on satisfactory progress by each Center.

In creating the STC Program, NSF followed guidelines set forth by the National Academy of Sciences. NSF will monitor progress at the STCs with a process similar to the one used successfully to evaluate NSF's 18 Engineering Research Centers. A comprehensive review after the third year will determine whether STCs will be funded for an additional five years. Ultimately, NSF could support successful STCs for 11 years.

Forty-eight proposals, deemed the most meritorious during earlier review stages, received site visits. A 23-member multidisciplinary review panel scrutinized the 48 finalists, and resolved that the research envisioned in the 11 proposals recommended by the director to the National Science Board "was of the highest quality, and could only be accomplished through the Center mode." The Board approved recommendations to establish the following 11 NSF Science and Technology Centers during the first year at up to the approximate level of funding listed:

University of California at Berkeley
Center for Particle Astrophysics
$1,825,000

Basic

More than 90 percent of the mass in the universe is invisible and detectable only through its gravitational effects on objects that radiate in the electromagnetic spectrum. Despite its overpowering role, the nature of this dark matter is unknown. Under the direction of Bernard Sadoulet, the University of California at Berkeley, in collaboration with the University of California at Irvine, the University of California at Santa Barbara, San Francisco State University, Stanford University and Lawrence Berkeley Laboratory, will establish a Center where researchers will search for the essence of the dark matter. This effort will connect particle physics, astrophysics and cosmology in a multidisciplinary approach to one of the most fundamental questions in science. Center researchers will devote major efforts to the development of sensitive cryogenic detectors to aid in the search.

University of California at Santa Barbara
Center for Quantized Electronic Structures
$2,100,000

Basic

Scientists at this Center will explore novel concepts for producing extremely small structures in a new generation of compound semiconductors made from gallium, arsenic and other materials. These explorations could one day lead to new very high speed integrated circuits and to tiny lasers for use in fiber-optic circuits, but first scientists must reach a basic understanding of how the movement of subatomic particles is controlled in these materials. A multidisciplinary team of researchers with expertise in surface chemistry, materials research, electrical engineering, applied physics and condensed matter physics will pursue this fundamental research under the direction of James L. Merz.

California Institute of Technology
Center for the Development of an Integrated Protein and
Nucleic Acid Biotechnology
$3,050,000

Strategic

Leroy Hood will direct a cooperative effort by Caltech and Jet Propulsion Laboratory scientists, who will improve upon and integrate the most advanced techniques in genetic engineering, protein chemistry and data analysis in order to develop new technology to speed research in protein and gene regulation. Their efforts should ultimately open up new possibilities for understanding, diagnosing and treating diseases at a molecular level. New technology will be in a form that can easily be transferred to biological scientists in academia and industry. Projects include development of a new and more sensitive method

for determining how the components of DNA and protein are ordered, and new methods for analysis of biological data bases that will allow scientists across the country to compare this sequence data on proteins and genes.

University of Illinois, Champaign-Urbana
Center for High-Temperature Superconductivity
$4,250,000

Basic & Strategic

At this Center, strong emphasis will be given to understanding the interactions that give rise to high-temperature superconductivity. Participating scientists will probe high-temperature superconductors to learn more about their structural and chemical properties, how they conduct, how to make them, and how to shape them into thin films and other usable forms. Researchers at three NSF-funded materials research laboratories at the University of Illinois, the University of Chicago and Northwestern University will collaborate with Department of Energy-supported scientists at Argonne National Laboratory. Center funds will more than double existing support for high-temperature superconductivity at the four laboratories. Miles V. Klein will direct the Center.

Michigan State University
Center in Microbial Ecology
$1,100,000

Strategic

Groundwater quality, hazardous waste disposal, plant pest control, recycling of organic material, and the products of biotechnology, fermentation and other industrial processes may all be improved through basic knowledge to be acquired by researchers studying microbes at the Michigan State Center. Microbiologists, soil scientists, molecular geneticists, chemists, engineers and mathematicians will work together to better understand the physiology and genetics of microbes, and how they are affected by their surroundings. This work will complement ongoing plans by the U.S. Environmental Protection Agency in this area. The Center will be directed by James M. Tiedje.

Northwestern University
Center for Advanced Cement-Based Materials
$1,750,000

Applied

The value of all cement-based structures in the United States is in the trillions of dollars, as is the estimated cost of repairing existing concrete structures over the next twenty years. Nonetheless, materials made with cement remain poorly understood. Researchers at Northwestern, including Center director Surendra P. Shah, in association with colleagues at the University of Illinois, the University of Michigan, Purdue University and the National Institute of Standards and Technology, will study properties and processes of cements and will establish comprehensive principles for designing cement-containing materials with improved properties.

University of Oklahoma
Center for Analysis and Prediction of Storms
$900,000

University of Oklahoma and National Oceanic and Atmospheric Administration scientists will together create better mathematical models for predicting tornadoes, flash floods and severe thunderstorms. Although weather prediction has rapidly advanced with the advent of supercomputer models and weather-radar bearing satellites, a gap remains in the scientific understanding of weather phenomena that arise on a regional scale too small to be accounted for by current techniques of data collection and analysis. These unpredicted phenomena generate feedbacks that can sometimes give rise to major large-scale events, such as the unanticipated highly-destructive tornadoes that struck Raleigh, North Carolina, in November. Through use of new ground-based radar and advanced parallel-processing supercomputers, modelers hope to develop and test new mathematical techniques to explain these so-called "mesoscale" phenomena that can give rise to damaging storms. Douglas K. Lilly will direct the Center.

strategic

Rice University
Center for Research on Parallel Computation
$4,100,000

Advanced supercomputing power is vital to long-term economic welfare and security, but higher performance now depends on parallel processing--breaking up computations into smaller problems that can more quickly be solved by computer subsystems processed in parallel. However, many older single processor programs must be restructured to take advantage of parallel systems. Furthermore, these systems can be difficult to test and debug. Researchers at Rice University, the California Institute of Technology, Argonne National Laboratory, and Los Alamos National Laboratory will use their expertise in computer architecture, programming systems, computational mathematics and scientific applications to make parallel-processing computers easier to use. The Center will be directed by Ken Kennedy of Rice.

strategic/ applied

University of Rochester
Center for Photoinduced Charge Transfer
$1,650,000

The University of Rochester, in collaboration with the Eastman Kodak Company and the Xerox Corporation, will investigate how light drives important chemical reactions, including naturally occurring biological processes such as photosynthesis, as well as photochemical processes that are important in photographic films, copiers, printers, data storage, and photovoltaic energy devices. These reactions all depend on the light-activated transfer of subatomic electrons from atom to atom, a process that might be manipulated to create desirable electronic effects in various states of matter. David G. Whitten will head the Center.

basic/ strategic

Rutgers University
Center for Discrete Mathematics and Theoretical Computer Science
$1,825,000

Basic & strategic

Rutgers, in cooperation with Princeton University, AT&T Bell Laboratories and Bell Communications Research, will establish a Center where mathematicians and theoretical computer scientists can not only share findings to advance their own disciplines, but where they may ultimately contribute to progress in telecommunications, transportation and computer design and manufacture. The Center director will be Daniel Gorenstein.

Virginia Polytechnic Institute and State University
Center for High-Performance Polymeric Adhesives and Composites
$2,124,000

Applied

The future of the aerospace, automotive and construction industries, among others, will depend heavily on improved adhesively-bonded, lightweight, composite polymers. Although high-performance adhesives and composites have been the focus of research in other technologically advanced countries, until now no U.S. university has supported such integrated investigations. These will range from the creation of new materials, to the study of mechanical and molecular behavior on a microscopic level within and between adhesives and composite layers, to the measurement and prediction of large-scale mechanical properties. The Center will be directed by James E. McGrath.

-end-

file

Duty Clerk
Miss Bowdery

30 January 1989

I would be grateful if you would substitute the attached annex to the briefing for ACOST meeting 1 February. I believe that the Prime Minister's copy is complete but that Mr Turnbull and Sir Robin Butler should have Annex F replaced.

I have enclosed two copies for No. 10.

Jane Hare.

Jane Hare - Secretary to Mr Fairclough

RESTRICTED

ADVISORY COUNCIL ON SCIENCE AND TECHNOLOGY

GLOBAL ENVIRONMENT RESEARCH

A REPORT BY A WORKING GROUP TO ACOST ON THE ROLE OF THE UK IN GLOBAL ENVIRONMENT RESEARCH PROGRAMMES

INTRODUCTION

1. Global environment change has been identified by governments world-wide as an issue which needs to be urgently addressed at the domestic and international level. The Prime Minister chose the occasion of her address to the Royal Society on 27 September 1988 to indicate her concern. Global environment change is an increasingly public subject. The national and international press carry articles almost daily warning of the consequences of the continued use of aerosol sprays, automobile emissions, destruction of rainforests, acid rain etc. Such articles, whether sensationalist or balanced, both reflect and reinforce the increased public awareness of the environment. Despite the uncertainties which surround predictions for environmental change we need to review existing policies and where appropriate take new initiatives.

2. ACOST's interest in this field goes back to September 1987 and a subsequent commissioning of a report on the global environment from the Natural Environment Research Council. ACOST reviewed this report on 8 November 1988 and set up a Working Group under Sir George Porter to advise it on what further steps should be taken. The membership of Working Group is given at Annex 1 of this Report.

3. The Working Group have addressed most of the major points made by NERC in their report and they formed the basis of the Group's

discussion. For information the Executive Summary and Summary of Recommendations of this NERC Report are attached as Annex 2.

GLOBAL ENVIRONMENT CHANGE

4. The NERC Report identified two main categories of environmental issues which could be termed 'global'. The first of these is perhaps more truly global in that it encompasses world wide changes in climate and in the composition of the atmosphere; the 'Greenhouse Effect' and depletion of the stratospheric ozone layer come into this category. The second is the issue of local environment changes which are repeated widely and hence have become a global issue, for example acid rain, deforestation, desertification, chemical fogs. The Working Group decided that although in many ways these are linked, in order to address the key issues in global environment, they should limit their enquiry to stratospheric ozone depletion and the greenhouse effect. The Group, while aware of common linkages between these two effects both in source and effect, concluded that they are distinctly different.

STRATOSPHERIC OZONE DEPLETION

5. The depletion of the ozone layer has been observed (particularly over the Antarctic the concentration of ozone between 14Km and 18Km was depleted by over 95% in 1987) and its sudden appearance in the last decade or so means that urgent action is required to prevent further depletion. The consequences of doing nothing could be widespread - the effect of UV rays unscreened by the ozone layer will seriously damage vegetation and human and other animal life.

6. The cause of the problem is well known; the Second Report of the UK Stratospheric Ozone Review Group highlighted the role of pollutants in the depletion of the stratospheric ozone layer. By far the most important of these are the chloroflurocarbon (CFC) gases. The problem of ozone depletion is understood in general terms but much of the detailed atmospheric chemistry is not. A practical solution to the

problem exists as far as man made pollutants are concerned. Although further research will be necessary, the Working Group doubted if future findings would seriously alter the required actions already identified. The Group considered that this problem was the first priority for the international community. The immediate measures being taken by the signatories of the Montreal Protocol to limit the emission of CFCs are welcomed but the scientific evidence indicates that they will be insufficent. The Working Group welcomed the Governments call for strengthening of the Protocol to cut emissions by at least 85% by the turn of the Century. They also welcomed the forthcoming international Conference to be hosted by the Government in March whose aim is to underline the importance of a world-wide commitment to reduce CFC's and in particular to pursuade lesser developed and newly industrialised countries to play a full part.

7. The UK market for Montreal Protocol CFC's is 62% for aerosols, 18% for foams, 12% for solvents and 8% for refrigerants. However, more important is the world market for CFC's, currently amounting to 960kte per annum, which is almost equally split between these four uses. Substitution of CFC's in most aerosols is possible using hydrocarbons such substitution in Europe may be achieved this year. A reduction in use for foams of about 50% might also be quickly achieved by replacement with HCFC 22 and reformulation (although total elimination will require the development of substitutes such as HCFCs 123 and 141b). The main use of CFC's for solvents is for flux removal from printed circuit boards. No alternative to CFC 113 has yet been found but its use could be reduced by better management/house keeping. CFC's are at present an essential requirement for refrigerators but alternative hydrofluorocarbons, in which chlorine is absent, eg HFC 134a, and hydrofluorochlorocarbons of shorter life are being developed (by ICI for example). These are being tested under the "program for Alternative Fluorocarbon Toxicity Testing" set up by 13 potential manufacturers and the results are expected in 1993. Considerable industrial investment in new plant will be required if sucessful with sufficient world capacity then taking a number of years to develop. Development of replacements for chillers (CFC 11) and display cabinets

(CFC 502) is several years behind.

8. The Working Group noted that the introduction of alternatives to CFC's would not be without considerable cost for each different application (possibly as much as a tenfold increase in the cost of refrigerant but perhaps not an unacceptable increase in the cost of a refrigerator unit). This would be a barrier to their introduction in lesser developed countries. Indeed alternative chemicals may only form part of the answer and consideration of alternative practices should not be excluded. Any subsidy of substitutes to discourage the use of CFC's in developing countries might be a heavy burden for the more advanced nations.

THE 'GREENHOUSE EFFECT'

9. In contrast the'Greenhouse Effect'is much less well defined both in terms of predicted effects and in its understanding. The number of variables are greater and the possible systems interactions more complex. Fortunately the potential implications for climatic changes are longer term. It is not clear what the overall impact will be on the UK; some predictions which do not go as far as to include consideration of an increase in sea level as a result of the melting of polar ice, suggest that some of these changes may be locally beneficial to the UK. However, the Group was concerned that we should not adopt an insular viewpoint as the ramifications of international impacts could be very significant (eg the changes resulting in extensions of desert areas of Africa, and those on the wheat growing areas in the United States which might have severe repercussions for the UK) and lead to an increase in political and social instability world wide. The need to improve our understanding of both the problem and processes involved is clear. What is far less clear at this stage is the action which should be taken. It was the Group's view that the international response is likely to be reactive rather than pro-active ie damage limitation/adaption.

INTERNATIONAL EFFORT

10. Problems associated with global environment change are, by definition, of international concern and will only be solved by international agreement and action. In this respect the Working Group welcomes the recent formation of, and UK involvement in, the UNEP/WMO Intergovernment Panel on Climate Change.

11. GER programmes are carried out by most developed nations. The USA was identified as the prime mover in all aspects of GER and the UK the major contributor to GER in Europe. The contribution which the UK, or for that matter any other one country, can make to the total GER effort is limited by capabilities and funds available. The Working Group felt unable to recommend either an increase or a decrease in the current level of UK Government expenditure (identified by NERC as £29 million in 1988 for true 'global' research excluding expenditure on satellites etc) at this stage. The Group accepted that the UK could not be world leaders in all fields and recommended that in order to maintain a significant role in GER international collaboration should continue to be encouraged wherever possible. In this respect the formation of, and UK involvement in, the UNEP Intergovernment Panel was supported by the Group.

12. It was noted that the present USSR input to GER was limited in spite of their potential to provide data from their fleet of approximately 400 research vessels. The Working Group considered that it might be an appropriate time to encourage greater involvement and input by the USSR.

RESEARCH PRIORITIES

13. For both fields (ozone layer depletion and greenhouse effect) the Working Group concluded that the highest priority was for monitoring and data collection proceeding hand in hand with the development of better models in order that satisfactory prediction data are available

and the necessary parameters are being monitored.

14. In relation to research supported by Government on the depletion of stratospheric ozone, the Group concluded that the main emphasis should be on basic science, that is re-enforcing the work currently underway on atmospheric chemistry. (In particular, for example, modelling of stratospheric ozone changes is greatly restricted by the need for more knowledge of the photochemical reactions of ClO and related compounds at low temperature and in heterogenous conditions of the polar stratospheric clouds.) Ozone research should include the effects on the total ozone column of tropospheric ozone formation resulting from NOX emissions.

15. The Working Group considered that it was for the private sector to conduct the required applied research and that the highest priority should continue to be given to the development of alternatives to existing CFC's.

16. In relation to the 'Greenhouse Effect' the Group considered that some of the major impacts would be on agriculture. It was noted that of those reports known to the Group none had highlighted the differing efficiencies of C3 and C4 plants with change in temperature regime and their respective potentials in a changed CO2 environment. The Group recommended that such information should be prepared as a supplement to the NERC Report to be considered by the new organisational structure indicated in paragraph 23.

17. The Group noted that whilst CO2 had been identified as the major 'greenhouse gas' others such as methane, tropospheric ozone and CFC's were significant and their rate of increase in the atmosphere more rapid. They recommended high priority should continue to be assigned to monitoring and that research managers should ensure that work is not over concentrated on CO2. However, they recommended that priority should be given to the improved understanding of CO2 fixation by plants. Other priority areas for 'Greenhouse' research

are the investigation of:

(i) atmospheric chemistry of 'greenhouse gases' interaction,
(ii) the significance of tropospheric ozone build up,
(iii) the physio-chemical take up of CO2 by oceans
(iv) the role of phytoplankton,
(v) distribution of vegetation types on land,
(vi) how plant adaptation might take place,
(vii) feedback mechanisms,

and more generally

(viii)how the global system might react.

18.The Group further recommended that effort should be devoted to the development of scenario modelling. In this respect they had in mind the development of predictive capabilities such that the effects of global temperature rises of 1, 2, 3, 4, degrees centigrade could be estimated (for example change in growing conditions, effects of rise in sea level due to melting of polar ice). Not only would this approach assist policy makers in the assessment of options but it would also highlight the potential commercial opportunities for UK industry. The potential environmental consequences of global warming for the UK could be illustrated by reference to those parts of the world where these conditions already exist. This might encourage UK industry to look more seriously at the opportunities for the UK in the light of such conditions being manifest elsewhere. Examples of such skills and technologies which are already well developed in the UK include water management, management of agricultural production change, control of pest organisms (agricultural and medical) and plant breeding eg for salt tolerance etc.

19. The development of scenario modelling will take some time and will by its very nature be prone to uncertainty. In the short term the Group therefore recommends that in order to establish which industrial sectors will be most affected by global warming the Centre for the Exploitation of Science and Technology (CEST), should be asked to prepare a report on the threats and opportunities for UK

industry.

20. The Group felt that in the time available they could not provide any authoritative advice on wider issues such as energy conservation, alternative sources of energy, nuclear power, aid policy etc. However, they would wish to see the debate on climate and environment change opened up at all levels to a wide range of disciplines.

FUNDING OF RESEARCH

21. The size of the UK effort is difficult to judge and the Group took note of the figures (£29m) given in the NERC report. They concluded that, contrary to the NERC view, GER was to be researched and funded in the private as well as the public sector. Private sector finance is particularly appropriate for applied, 'near market' research; for example important research on the possible substitutes for CFCs and on industrial applications was already being carried out by industry. As industry will reap the rewards of such applied research through profit on new products they should bear the costs of the necessary research.

COORDINATION

22. The Group felt that having read reports on research activities by DOE, Sir John Mason and others there is a lack of focus in our research in these fields and in our contributions to international programmes. The Group were aware of proposals to set up coordinating committees but were of the view that a more dynamic solution was required for this most important area. The Group had some sympathy for a US style 'task force' but where unable to see how this might be organised in the UK. As an alternative they recommend that a directorate should be set up to act as the lead agency for research in the UK.

23. There is a precedent for this type of organisation in the

arrangements recently made for UK research on the human genome organised under MRC. It is envisaged that the GER directorate would be responsible for overseeing the UK interface and coordination with the international GER effort and would have some executive powers. Since GER is very wide ranging from modelling to basic chemistry the Group proposed that as one possibility the directorate should be set up in NERC and should be accountable to Government through the Chairman of NERC. The directorate would include members from the Research Councils, the Royal Society, the Meteorological Office, other Government departments HEI's, and industry. Preferably it would have a finite life and would be reviewed after about 5 years.

24. At a lower level of priority the Group noted that in contrast to the ozone depletion problem there is no coordinating study group on the 'Greenhouse Effect' exists in Britain at present They considered that the Stratopheric Ozone Review Group had been effective in bringing researchers and administrators together and had produced a useful document on the 'state of the art'. They therefore recommended the formation of a similar group for the' Greenhouse Effect'. This should have a similar funding and organisation that is from DOE and the Meteorological Office.

25. Finally, in reviewing the recommendations of the NERC Study, the Group concluded that they should be passed to those charged with setting up the proposed directorate to act as a UK reference source. The review requested of CEST (paragraph 19) should also be forwarded to ACOST for further consideration.

SUMMARY

26. The recommendations of the Working Group were as follows:

(a) Government resources devoted to true GER in the UK should remain at or about their current level of £29M in the immediate future (para 11)

(b) highest S&T priority should be devoted to monitoring data collection and modelling (para 13)

(c) the main emphasis for scientific research should be on basic science i.e re-enforcing the current effort on stratospheric ozone photochemistry (para 13) and in respect of the 'Greenhouse Effect' (para 17) on:

(i) improved understanding of CO2 fixation by plants
(ii) atmospheric chemistry of 'greenhouse gases' interaction,
(iii) the significance of troposheric ozone build up,
(iv) the physico-chemical take up of CO2 by the oceans
(v) the role of phytoplankton,
(vi) distribution of vegetation types,
(vii) how plant adaptation might take place,
(viii) feedback mechanisms,

and more generally

(ix) how the global system might react

(d) a report on the potential for C3 and C4 plant at elevated temperature and CO2 levels should be prepared (para 16)

(e) effort should be devoted to the development of scenario modelling of the consequences of global environment change (para 18)

(f) CEST should be asked to prepare a report on the threats and opportunities for UK industry of global environment change (para 19)

(g) the private sector has a role to play in the conduct and funding of GER, particularly in relation to applied research of which the highest priority is research into possible substitutes for CFC's (para 21)

(h) a GER directorate should be set up under the auspices of

NERC (para 22 and 23)

(i) a working group for research into the 'Greenhouse Effect' should be set up along the lines of the Stratospheric Ozone Working Group (para 24)

(j) the NERC Report on GER commissioned by ACOST should be passed to those charged with setting up the proposed new GER directorate (para 25)

27. It is the view of the Working Group that ACOST need take no further action at this time other than to ensure that the recommendations, given at paragraph 26 above, are passed to the appropriate Government Departments for action. However, Council may also wish to consider giving the NERC permission to publish a suitably edited version of their Report.

28. In conclusion the Working Group, having had the benefit of the NERC GER Report and having discussed GER at a strategic level at its two meetings, invite Council to approve the recommendations given in this Report.

ANNEX 1 MEMBERSHIP OF THE WORKING GROUP

MEMBERS

Sir George Porter PRS (Chairman)	Royal Society
Professor Thomas Blundell FRS	Birkbeck College, University of London
Dr Dennis Oliver CBE FEng	Business Consultancy
Professor Sir David Phillips FRS	AFRC
Sir Charles Reece FRSC	ICI

IN ATTENDANCE

Mr John Fairclough FEng		Cabinet Office
Dr Clive Bradley		Cabinet Office
Mr Callum Searle	(Secretary)	Cabinet Office

ANNEX 2 EXTRACT FROM A REPORT TO ACOST BY NERC ON GLOBAL ENVIRONMENT RESEARCH, OCTOBER 1988

EXECUTIVE SUMMARY

1. The terms of reference are:-

   i) to describe the subject of global environmental research (GER);

   ii) to give measures of the importance of this research for UK environment, politics, defence, economy and society;

   iii) to describe the main UK agencies' interest and involvement in environmental research;

   iv) to describe the main international agencies involved in environmental research and the contacts between UK and international agencies;

   v) to describe the potential for further exploitation of environmental research in the UK.

2. Recently expressed concern about the global environment indicates that man may, as a consequence of his numbers and his demand for resources, be changing the balance of the global system, possibly irreversibly. Future prospects for the size of the human population, and the pressure in all countries to raise living standards imply that the demands on the global environment will intensify. It is clear that research now is urgent to understand fully the effects of man on the global environment, to predict their scale in terms of impact and timescale, in order that action to change some of man's practices is feasible within the democratic system.

3. Global environmental research falls into two categories. The first which is dealt with in this report, concerns research on processes which are global in scale and implication and which are likely to have an effect on a timescale of a year to a century. The second, not dealt with fully in this report, concerns research on local regional phenomena which are repeated worldwide so becoming an issue of global environmental concern.

4. Global environment research aims to describe and measure the sources and sinks of elements and substances which circulate within and between the global sub-systems of the Atmosphere, the Geosphere, the Biosphere and the Hydrosphere. This movement of elements and substances (the fluxes) is driven by the energy, hydrological and biogeochemical cycles and reveals that the natural global system is dynamic and variable although it may remain in stable equilibria over long periods of time. Man, by his activities, can alter the balance of the sinks and fluxes within and between the subsystems, and may destabilise the global system, possibly, irreversibly. GER aims to assess the natural variation in global sinks and fluxes, to assess the effects of man's activities on this variation and to develop methods of predicting future natural and man made variation in the environment.

5. Although environmental changes in the British Isles in the past have seldom been so severe or prolonged enough to dominate Government policy, unlike the situation which prevails elsewhere and particularly in the Third World, we are now faced with the prospect of a changing global environment from whose effects the UK is unlikely to be immune. An immediate aim of GER is to predict the consequences of changes in the global environment for the national environment. Prospective changing climate patterns and rising sea level as a result of global warming may affect the UK in a number of significant ways including: innundation of low lying land and the need to increase coastal defences; saline intrusion into freshwater resources; changes in agriculture; major changes in energy requirements and generation of electricity; changes in transport systems; changes in civil engineering and building practices and requirements.

6. Concern about the changing global environment will lead to increasing international regulatory pressure which will affect industry. Furthermore, industry needs to be informed, at the earliest opportunity of what environmental factors need to be taken into account as it is expensive for industry to adapt, late in the planning cycle to new environmental regulations for its technology. In the energy supply industry there is an immediate need to make a thorough examination of alternative energy sources in order to plan investment now for electricity production for the next 25-30 years. Also, it must be recognised that our economic interests are not confined to the British Isles and our standing in the world and our international industrial performance could well depend on our ability to contribute to GER. The

UK has developed a strong tradition in the sciences which underlie GER and the opportunity now exists to use this expertise to the national advantage. Moreover, opportunities are likely to arise for us to market internationally our environmental R&D expertise.

7. The possible changes resulting from a changing global environment are likely to occur on timescales comparable with the timescales of planning and implementation of major capital construction. A more precise definition of the effects of global change, based on predictive models is required if the correct political and investment decisions are to be made. This in itself is sufficient to justify research on impacts and more importantly, in the first instance, on the processes of environmental change.

8. The level of expenditure on GER in both the public and private sector is relatively low in terms of the national R&D budget and only represents a small fraction of the total Government-funded civil R&D investment. Of this, only about one tenth is devoted to studies of global processes themselves, most of the expenditure being related to local/regional research such as acid precipitation. Furthermore, the research effort in GER in the UK is somewhat uncoordinated.

9. GER needs to be pursued urgently and internationally since no one country can afford, or has access to the territory, needed for all the research that is required. Failure to participate in international initiatives will result ultimately in delayed access to the data necessary to conduct and understand GER. Furthermore, it is vital that we have our own independent assessment of the research and predictions which arise from international and other national programmes and which could well form the basis for international (especially European) environmental regulation.

10. The conclusions and recommendations for further action are to be found on pages 78-82 of the main report.

Section 8: Conclusions

84. Environmental change at the global level resulting from Man's activities can now be observed. The extension of deserts and widespread soil erosion can be blamed upon the destruction of forests and vegetation cover and forms of cultivation by man. The rise in carbon dioxide, methane, sulphur dioxide, nitrogen oxides, CFC's and other gases in the atmosphere can be attributed to combustion of fossil fuels by man and to the release of man made chemicals. There are predictions based on limited data put into relatively simple computer models which indicate that these activities may lead to global climate changes of temperature, precipitation and solar radiation. In turn global climate changes may lead to melting of the main ice masses, to rising sea level and land inundation, to saline infiltration of freshwater and the destruction of major centres of population.

85. The impact of these environmental changes on the UK environment on politics, the economy, defence and society can be perceived only impressionatically and sketchily but sufficiently to justify research on these impacts and more importantly in the first instance on environmental change.

86. GER should aim:

i to establish the natural variation in the global environment both temporally and geographically;

ii to establish the interaction of the natural variation with man's activities and so establish the variation in the global environment attributable to man;

iii to develop the capability of predicting natural and man-made variation;

iv to develop means of reducing, preferably eliminating, the undesirable aspects of man's activities.

87. GER will involve:

i long term earth observation of environmental phenomena from satellite, aircraft, ships, submersibles and land based craft and from instruments and robots;

ii on-site experimentation;

iii data capture, reduction, analysis, storage and interpretation;

iv computer and software development;

v modelling of global systems for the purpose of predicting future environments.

88. GER needs to be pursued urgently and internationally since no one country can afford, or has access to the territory, needed for all the research that is required. The UK, as a major trading nation, will be affected directly and indirectly by the environmental changes should they occur. The UK science community should therefore participate in GER in order to maintain the skill and the understanding of global research and to be able to advise objectively politicians, industrialists and the public on these issues.

89. GER is a multidisciplinary strategic activity which will need to be funded by government since it is either too speculative for industry or the results relate to matters such as defence, health, infrastructure, land conservation, international affairs and flood control which are the province of government.

90. GER is being pursued internationally largely through ICSU and WMO in which UK scientists are playing an active role. The Royal Society arranges a national committee for the WCP. The new IGBP under the auspices of ICSU is being planned. The UK has a national committee established by the Royal Society and UK scientists are closely involved in the planning phase of the programme. The UK should aim to make a significant practical contribution to the IGBP during the active phase.

91. GER is being pursued nationally. The principal agencies are:

i the NERC which supports relevant research in its institutes and in Universities. Its main areas of interest are atmospheric science, oceanography, hydrology, geology of palaeoclimate, climate impact on land, vegetation, animals and water supplies, and earth observation from satellites. It also supports a major polar programme with much of relevance on ice and climate. It is the lead agency for the UK involvement in the ocean drilling programme.

ii the Meteorological Office which carries out major research on atmospheric science, meteorology and weather/climate modelling of world class. It carries a major responsibility for involvement of the UK in the WCP.

iii the SERC which supports basic physics, chemistry, biology, mathematics and computer science necessary to support the more strategic research of NERC and the Met Office. It also supports some atmospheric science and a major programme of space instrumentation and data handling and analysis for earth observation.

92. There is no one major focus for GER nor is there an appropriate co-ordination mechanism for either the relevant activities in the public sector nor for the public-private sector interface. NERC would be willing to establish such a focus in conjunction with SERC and the Meteorological Office (if they are willing) provided sufficient resources can be found. The focus might take the form of a "Directorate" in which there are three main players but which will aim to encourage funding and participation from a wide variety of public and private sector organisations. Such a "Directorate" would require a Steering Committee drawn from the major funding bodies. The first task of the Committee would be to draw up a complete statement of relevant existing UK research and to identify major new areas for funding.

93. Expenditure on all categories of GER in the UK is estimated to be about £98m per year at present of which £89m comes from public funds and £9m is spent by industry. Of this only £29m is concerned with global process studies, most of which is funded by the public sector. This seems a small sum in relation to the likely consequences of environmental change for the UK.

94. In the short term (over the next year or so) the UK GER programme should be developed to include:

i) maintenance and extension of on-going time-series observations (eg stratospheric ozone, continuous plankton recorders, tide gauges, ecological, hydrological and meteorological data collection). This activity requires new instrumentation, some co-ordination of existing observations and more linkage to international networks especially GEMS.

ii) continued support for research in the Antarctic and the development of a complementary but smaller Arctic programme in view of the sensitivity of polar areas to environmental change [a programme of about £1m per year would be significant].

iii) development of major marine science programmes especially in research institutes and universities to allow UK involvement in the WOCE; to develop the BOFS as a contribution to JGOFS; to develop ocean modelling such as FRAM; and to develop ocean observing instruments such as AUTOSUB. [To maintain the NERC marine fleet and to develop these programmes NERC needs a capital injection of £12m to maintain and equip the research fleet plus an increase in recurrent expenditure of £3m per year].

iv) development of university centres for atmospheric sciences, geology of global change (palaeoclimate) and for climate change impact studies [NERC has indicated that these centres and research require about £3m per year to establish and run].

v) development of global atmospheric scale modelling linked to ocean models by the Meteorological Office and by NERC in the universities. [NERC has indicated a need for about £1m per year for this activity. The Meteorological Office requirements are not known].

vi) development of the satellite remote sensing and earth observation programme. This will require the launch of ERS-1 the development of a datacentre and a launch of ERS-2 followed by some form of involvement in the Polar Platform. Access to data from a range of

satellites and provision for new instruments will be needed. These activities are funded by the BNSC, SERC and NERC. It is doubtful if sufficient funds are available for this element of the GER programme.

vii) development of a number of studies on the impact of global environmental change on energy, defence, politics, society, and the economy [these should be funded jointly by ESRC and NERC and funds of the order of £½m will be needed].

viii) development of studies of the long-term impacts on crop and forest growth, wildlife, freshwater, water supplies and sea level. (NERC and AFRC would be involved and £1M per year would be appropriate now, rising as and when the climatic change effects become better defined).

95. In the longer term the GER programmes should be developed by the proposed Directorate who should be seeking particularly to identify other man made environmental effects apart from those attributable to CO_2 and the 'greenhouse' gases.

CONFIDENTIAL

10 DOWNING STREET
LONDON SW1A 2AA

From the Principal Private Secretary

MR. FAIRCLOUGH

MRC CLINICAL RESEARCH INITIATIVE

The Prime Minister has seen the note attached to your minute of 27 January. Having read it, she commented that it is no wonder that the MRC are short of money for basic research.

(ANDREW TURNBULL)
30 January 1989

CONFIDENTIAL

WO3

CONFIDENTIAL

MR TURNBULL

27 January 1989

cc Sir Robin Butler
Mr Wilson

No wonder they are short of money for basic research

ACOST MEETING: 1 FEBRUARY

I enclose a brief for the Prime Minister's use at her meeting with ACOST next Wednesday.

2. In your minute to me of 23 January you asked me to send you some background material on the MRC's Clinical Research Initiative. I attach a separate note on this.

JOHN W FAIRCLOUGH
Chief Scientific Adviser

MEDICAL RESEARCH COUNCIL CLINICAL RESEARCH INITIATIVE

Position as at 26 January 1989

Note by the DES

The Proposal

1. The Medical Research Council (MRC) has proposed a major new initiative to reverse the steady deterioration in the national condition in UK clinical research over recent years. Among the several partners on which UK clinical research depends - the MRC, the universities, the NHS, DoH, DES, the charities, and the pharmaceutical and biotechnological industries - the MRC has the major responsibility for the well being of UK publicly-funded clinical research. The initiative aims to remedy the two main defects: unacceptable delays in applying the considerable achievements in basic science to clinical medicine; and inadequate recruitment of talented doctors into clinical research.

2. MRC currently spends about £38M pa on clinical research. About a third goes to the two major centres - the Royal Postgraduate Medical School (RPMS) at Hammersmith, and the MRC's Clinical Research Centre (CRC) at Northwick Park. Twothirds goes to the teams outside these centres. The initiative is a major component of the Council's strategy for clinical research. Increasingly the attack on clinical problems needs to engage the basic science disciplines; conversely, new scientific understanding needs to be fed into the clinical disciplines. Numerous individual teams secure this relationship for particular diseases. The need now is to create a new national centre that will achieve this cross-fertilisation economically and on a larger scale; and will ensure that it is carried through into the

training of young clinicians and of the future cadres of top-rank clinical researchers.

3. For a number of reasons, some inherently structural, this synthesis and transmission has not been achieved by the present structure of two major centres. The Council wants better value for money. After long study the Council has proposed the creation of a single national centre of excellence, building on the existing strengths of the Royal Postgraduate Medical School and of the CRC, and a substantially strengthened force of basic scientists. The choice of Hammersmith, compared with Northwick Park, a green field site or some other location was based on a thorough option appraisal by management consultants overseen by a group under Sir Robin Nicholson. The decisive factors were the link with postgraduate teaching, in which the RPMS has an international reputation; the distinctive structural relationship it has with the NHS through its Special Health Authority; and its record in winning support for research from a variety of sources.

4. MRC expects the running costs of the new centre to be met from within existing allocations (their own, from the UFC, and from other sources), with some savings and much improved value for money. The initiative will require major capital investment, beyond the scale of what the Council can find from its present and planned allocations without unacceptable damage to other high priority medical research. As with other major Research Council restructurings, the Council, through the Advisory Board for the Research Councils (ABRC), has made a PES bid.

5. The capital cost of the scheme was initially put at about £100M. In the view of the ABRC and DES this was too large a bid. They asked the Council to reduce the cost by phasing; and to put forward a first phase that would be worthwhile in its own right, without prejudice to any possible subsequent development.

Accordingly the Council submitted a reduced proposal estimated to cost about £50M at 1988 prices, phased over 6 years. They have undertaken to find a fifth of this cost from private sources and from the disposal of other capital assets. This investment would provide about 13,000 sq m of new space equipped to modern standards for research and teaching, and some upgrading of existing facilities. The refurbished and enlarged premises would accommodate some 1,200 staff and 600 students - an increase of about 20% in the present complement at Hammersmith.

6. The ABRC strongly supports the initiative. It has recommended an allocation of £2M to the MRC in 1989/90 for a detailed feasibility study and some advance work. It will make a further recommendation in May on the allocations needed in later years, based on the costings in the feasibility study.

7. Detailed work needs to proceed, in parallel, over the coming months on the building specifications, the scientific and clinical programmes, and on arrangements for governance and management of the new centre. The MRC and its partners in the scheme have in place a strong planning structure to oversee these developments on which all of the parties are represented including the two Health Authorities - Hammersmith and North West Thames. There will be close consultation with the Harrow DHA over the consequences of the MRC's withdrawal from Northwick Park.

Implications for DoH, the NHS and Northwick Park

8. The proposal has the support of DoH. In the early years cost consequences for DoH and the NHS are small and containable. Any implications in the later stages would be considered within the longer term plans for the future development of the Hammersmith Hospital. The consequences for the services provided by the Health Authorities will be clarified by the more detailed planning to be set in hand in the coming months. The planning

organisation will provide the main means of securing co-ordination of research and health service strategies. The rundown of CRC at Northwick Park will be managed so as to minimise the impact on patient services. It will be monitored jointly by the RHA and the MRC, with the parent Departments. The aim will be to match the pace and extent of redeployment and the liberation of space to the rationalisation of facilities in North West London. The Harrow DHA and the RHA are examining how space released at Northwick Park might contribute to this rationalisation. (The modular design of CRC accommodation allows for conversion to hospital use.)

Present Policy Position

9. Mr Baker is currently considering the ABRC advice. Both he and the Parliamentary Under Secretary, Mr Robert Jackson, have had detailed briefings from the MRC and discussions with them, and separately have visited each site. Mr Baker and Mr Clarke have corresponded on the proposal and Mr Clarke has agreed that a centre of excellence at the RPMS will capitalise on the school's international reputation and offers the best prospect for re-establishing a leading UK position. He has stressed the need, fully accepted by the MRC, for the Council to work closely with the three Health Authorities mainly concerned so as to manage the pace of rundown of CRC to minimise impact on patient services. He has expressed his hope that the project will go ahead.

10. Mr Baker will shortly consider a submission offering advice on the timing and nature of an approach to the Prime Minister, the Chief Secretary, and other Ministerial colleagues.

Department of Education and Science
26 January 1989

PAUL GRAY FN 27 January 1989

ACADEMIC PRIZES

You may be interested to see the attached in view of our discussion about academic prizes last night.

GEORGE GUISE

Fuzzy computing felt to be the next step in Tokyo

Tokyo

JAPAN's Ministry of International Trade and Industry (MITI) has persuaded a vast consortium of Japanese companies to invest millions of dollars into establishing a new centre for research and development on fuzzy computing.

The decision to set up the facility, called the Laboratory for International Fuzzy Engineering Research (LIFE), was made at a meeting of MITI officials and industry representatives on 11 January. According to a report in the Nihon Keizai Shimbun (an economic newspaper), 42 companies — including Toshiba, Nippon Steel, Hitachi, and Toyota — will each contribute Y100 million ($800,000) to LIFE. The project, not run directly by MITI, will be chaired in alternating two-year shifts, beginning with Hitachi. The centre, scheduled to open in April in Kannai near Yokohama and expected to operate for six years, will be staffed by some 30 researchers drawn from industry and will conduct joint research with government national laboratories (for example, Tsukuba's Electrotechnical Laboratory) and universities (specifically, Tokyo Institute of Technology and Kyushu Institute of Technology). MITI also plans to collaborate with foreign universities and research asssociations in countries such as France, the United States and West Germany. Patent rights will be held by LIFE and licensed to non-members, but fuzzy algorithms will be made freely available.

Fuzzy computing is based on fuzzy set theory, first presented in 1965 by Professor L.A. Zadeh, a US mathematician at the University of California at Berkeley who is now chairman of the International Fuzzy Systems Association there. Whereas conventional digital computers operate on the binary system, fuzzy computers can form conclusions from imprecise data (such as 'faster' or 'not so hot'), treating such input as having a value somewhere in the continuum between zero and one. Proponents of fuzzy theory hold that these characterisitics will allow fuzzy computers to process information in a manner analogous to the brain.

Considerable research on fuzzy computing has already been carried out in Japan, and fuzzy programming on conventional computers is used to control train speed in a subway in Sendai, a city north of Tokyo. At Kumamoto University, Associate Professor Takeshi Yamakawa has developed a fuzzy microcomputer chip set in collaboration with Omron Tateisi Electronics Company. Of the two chips, the 'rule chip' draws inferences from indistinct data; the 'defuzzifier chip' converts inferred conclusions into analog numerical values. In September 1987, the US National Aeronautics and Space Administration (NASA) asked Yamakawa if it could use his technology in controlling attitude and docking in the space shuttle. Yamakawa is said to have agreed on condition that the chips be used solely in civilian applications. NASA is said to have complied. Sometime this spring — after NASA completes its evaluation — Yamakawa intends to commercialize the device.

"What we are interested in falls into three categories", says MITI spokesman Taizo Nishikawa, deputy director of the Electronics Policy Division at the Machinery and Information Industries Bureau, "fuzzy control, such as the Sendai system; fuzzy information processing; and fabrication of fuzzy hardware — for example, fuzzy chips — that will be used to evaluate our basic research in the first two categories."

"There is a very broad range of applications for fuzzy computing", continues Nishikawa. "Industrial applications include image processing, plant management, and robotic control. Social applications include medical diagnosis, weather forecasting and aeronautics control."

The scope of the industries from which member companies come is quite broad, as are their specific interests in fuzzy applications. In addition to the steel, electronics and automotive industries represented by the companies listed earlier, members include computer software houses, chemical companies, electric appliance and consumer electronics manufacturers, transportation companies, an electric power utility, and — very unusual for a MITI technology project — a Tokyo securities firm.

Stuart M. Dambrot & David Swinbank

This year's prize season gets under way

London

ROBERTO Poljak of the Pasteur Institute in Paris, Walter Schaffner of the University of Zurich and Gregory Winter of the Medical Research Council's Laboratory of Molecular Biology in Cambridge are to share the 1989 Louis Jeantet Prize in Medicine, awarded for outstanding biomedical research in Western Europe. All three are selected for their contributions to immunology, and each will receive about one-third of the £0.75 million prize, plus £30,000 pocket money.

Poljak is cited for his contributions to solving the three-dimensional structure of antibodies, and will use his prize money to improve the computing and graphics power available to his group, and for new area detectors for his X-ray diffraction equipment. He hopes to solve the structure of a lysozyme idiotope–anti-idiotope complex. Schaffner will invest in an automated cell-microinjection apparatus and a fluorescence-activated cell sorter, both to enable his group to study the relevance of DNA methylation to the expression of genes, particularly the antibody genes for which he is cited.

Winter is rewarded for work on engineering antibody molecules, and hopes finance a project he has been hoping undertake for some years — to design antibody molecule to bind specifically to antigen of known three-dimensional str ture. Winter has also won the 1990 E von Behring prize given by the Phili University of Marburg. He wins the £6,0 prize for his contributions to the molecu biology of the development of hum monoclonal antibodies.

The 1989 King Faisal Internatio Prizes, each worth £0.5 million, have just been announced. The medicine pri shared by Robert Edwards of the Univer of Cambridge and Luigi Mastroianni of University of Pennsylvania School Medicine for work that has made humar *vitro* fertilization possible. Theodor Hän who has recently moved from Stan University to Munich University, Ahmed Zewail of California Institute Technology, share the science prize (year physics) for their laser studies.

Peter Newm

Poljak (left), Schaffner and Winter: the immune system pays handsome dividends.

cc GR

Prime Minister
The points in paras 7 and 14 show you are getting through to the Fairclough you want on the way forward
AT 27/1

A note on the MRC's Clinical Research Initiative is at Flag A.

WO1 CONFIDENTIAL

PRIME MINISTER 27 January 1989

BRIEF FOR ACOST MEETING: 1 FEBRUARY 3.00 PM

ATTENDANCE

1. A list of those attending is at Annex A together with a seating plan to help you identify members. The three scientists giving presentations on their Research Centres - Sir David Weatherall and Professor Jack Baldwin from Oxford and Professor Neville Richardson from Liverpool University (plus the Vice Chancellor of Liverpool Graeme Davies) will be sitting behind the table to your right. They will leave after the discussion on the first agenda item.

ABSENTEES

2. Four ACOST members will be absent - Andrew Bain (Group Economic Adviser to the Midland Bank), Tony Harrison, (Chairman of Northern Engineering Industries), David McMurtry,(Chairman of Renishaw and Sir Peter Swinnerton-Dyer (Chairman of the University Grants Committee).

NEW ACOST MEMBERS

3. Two new ACOST members who have been appointed since your last meeting will be present. They are Professor Thomas Blundell, from Birkbeck College London and Professor John Robertson from the University of Edinburgh.

AGENDA

4. It was agreed at your meeting with Sir Francis Tombs that the Future Work of ACOST should not feature as a separate item on the agenda. Points on this wuld be left to emerge throughout the afternoon's discussion.

5. There are therefore only two substantive items on the agenda flagged at Annex B:-

Three Examples of Interdisciplinary Research;

Global Environment Research.

HANDLING

6. Sir Francis Tombs will start the meeting with a few words of introduction and will then invite you to take the chair.

GENERAL POINTS ON ACOST

7. You may like to begin with some opening remarks about developments since you last met ACOST on 11 April 1988:-

a) ACOST provided their annual advice last May on S&T priorities. They recommended a shift from near market R&D to support for basic and strategic science;

b) the Government followed this advice. The Chancellor announced in the Autumn Statement last November an extra £130m for civil science and technology in 1989/90. The main increase (£95m) was for the science budget where the Advisory Board for the Research Council advises on the distribution of funds; as a result the Science Budget for

1989/90 is 11% higher than that in 1988/89 in real terms. The Autumn Statement said that: "This substantial increase reflects the importance the Government attaches to basic and strategic science and its policy of redeploying resources to these areas from those near to the market which are properly the responsibility of industry.";

c) the Public Expenditure White Paper due for publication before the ACOST meeting (on Monday 30 January) will show an increase of £70 million for civil science and technology expenditure in 1990/91 over the amount shown in last year's White Paper. The total amounts for civil and defence R&D for the next three financial years are roughly constant in cash terms:- £5,514m, £5,440m and £5,430m - significantly more than the estimated outturn for 1988/89 of £5,140m;

d) reflecting the 'S' in their new title, ACOST should concentrate particularly on scientific priorities. Priorities should be built around excellent people, bureaucracy should be kept to a minimum and the system must cater for the support of small scale work;

e) ACOST also has a role to encourage industry to spend more on R&D and leave Government support for the long term work, far from the market.

ITEM 1: THREE EXAMPLES OF INTERDISCIPLINARY RESEARCH

8. The purpose of the presentation is for ACOST to explore the progress which has been made so far in establishing Inter-disciplinary Research Centres (IRCs) and to review the workings of the IRC arrangements. ACOST were asked specifically for advice on IRCs for last year's priorities advice.

Background on IRCs

9. The case for IRCs was first set out by the ABRC in its strategy advice in May 1987. The following six IRCs were started in 1988 and provision remains for two more. (The three which are to be presented at the ACOST meeting are highlighted):-

Superconductivity	- Cambridge (SERC)
Molecular Science	**- Oxford (SERC with MRC interest)**
Engineering Design	- Glasgow (SERC)
Surface Science	**- Liverpool (SERC)**
Semiconductor Materials	- Imperial College, London (SERC)
Molecular Medicine	**- Oxford (MRC)**

10. The ABRC recommended a further programme of IRCs in their advice on funds for 1989/90. The details of the PES settlement have now been agreed with the Chief Secretary. This includes provision for a further 9 IRCs but this is on the understanding that there is then a pause in the IRC programme and that ABRC conducts a thorough review of IRCs during 1989. The nine further IRCs approved are:-

Transgenic Animal Biology	-	Edinburgh (AFRC with MRC interest)
Microsocial change	-	Essex (ESRC)
Cell Biology	-	London (MRC)
Macromolecular interactions	-	Cambridge (MRC with AFRC and SERC interests)
Population Biology	-	London (NERC with AFRC and SERC interests).

There will also be 4 SERC centres, still to be selected from a short list. Some of these centres are called IRCs; others (eg the Institute of Molecular Medicine) are not. The establishment of

joint IRCs is helping coordination and cooperation between the Research Councils.

11. IRCs still consume only a small percentage of scientific expenditure. The present group of IRCs will acount for only about 1% of total (ABRC and UGC) scientific expenditure; the 17 present and planned will consume about 2% of the budget.

Handling of Presentation

12. The arrangements which Sir Francis Tombs has made are for Sir David Phillips to introduce the subject and for the three heads of the IRCs to make their presentations. You may like to suggest that general discussion be held over until after the three presentations and that questions during the presentations be confined to matters of fact.

13. The order of events is then:-

Sir David Phillips to introduce

Sir David Weatherall	-	Institute of Molecular Medicine, Oxford (see flag at Annex C)
Professor Jack Baldwin	-	IRC on Molecular Science, Oxford (see flag at Annex D)
Professor Neville Richardson	-	IRC on Surface Science, Liverpool (see flag at Annex E)

Professor Richardson's Vice Chancellor, Professor Graeme Davies, has asked to attend the meeting to answer points about the place of the IRC within the University.

DISCUSSION

14. Sir Francis Tombs would like to make some concluding remarks before the general discussion. We know that Professor Peters, Sir George Porter, Sir Graham Hills, Alan Rudge and David Smith would like to participate in the discussion. Questions which you might like to raise are:-

a) need for a special initiative Have not researchers across disciplines been collaborating without need for special mechanisms?

b) criteria for selecting IRCs How far is priority given to the quality of the scientists?

c) rules and regulations How much freedom does the Director of the Centre have to manage the operation?

d) lifespan What arrangements are there for ensuring IRCs do not develop a life of their own?

e) duplication How far do IRCs involve the provision of new buildings and equipment? Is there not a danger of duplicaton with existing facilities?

f) links with industry How do we ensure IRCs do not become centres for carrying out research which industry should be funding?

ITEM 2: GLOBAL ENVIRONMENT RESEARCH

15. This is on the agenda so that ACOST can tell you what it has been doing on this subject since September 1987.

BACKGROUND

16. ACOST's interest goes back to September 1987 when they agreed that there should be a review of global environmental research, particularly the role which the UK should play. In March 1988 the Natural Environment Research Council was commissioned to undertake such a review consulting widely both the public and private sectors. Their report was submitted to ACOST in October 1988. ACOST reviewed the report in November and set up a Working Group of ACOST members under Sir George Porter to advise it on what further steps should be taken. The other members of the working group have been Professor Blundell, Dr Oliver, Sir David Phillips and Sir Charles Reece.

17. The Working Group has now produced a report and its recommendations are due to be considered at the ACOST meeting earlier in the day on 1 February. The report is flagged at Annex F. The main recommendations are at paragraph 26. ACOST will have been asked in the morning:-

a) to consider the Working Group's recommendations and where suitable ensure they are passed to the appropriate Government Department;

b) to consider authorising NERC to publish a suitably edited version of their Report to ACOST.

18. The recommendations in the Working Group's report on improved coordination of UK research into the global environment (the possible formation of a dedicated Directorate in NERC and the formation of a working group) will have to be considered in the context of the work you asked me to carry out at your meeting with Ministers on 12 January.

HANDLING

19. Sir Francis Tombs would like an opportunity to open the discussion. Sir George Porter will then be ready to give an oral presentation on the conclusions of his working group.

DISCUSSION

20. You may like to enquire what action ACOST decided to take at its earlier meeting, if this has not already been made clear in the presentation. We understand that Professor Blundell, Sir Charles Reece, Dr Oliver and Sir David Phillips (the other members of the working group) would like to participate in the general discussion. You may like to pursue the following points:-

a) timescale of research There is a trade off between the length of time series data and the degree of confidence required from the projections. Certainty about a temperature rise within a broad range can be achieved more quickly, as can projections on global as opposed to regional impacts. You may like to explore this;

b) continuity of data Projections will depend on a continuing source of data from ground and satellite based observation. Looking from an international perspective, will sufficient data be available?

c) international and national efforts UK cannot contribute more than a small part of the total effort. How does ACOST see the balance?

d) coordination of UK effort In paragraph 23 of their Report, the ACOST Working Group say that one possibility

would be the creation of a Directorate in NERC. What other possibilities has ACOST considered?

NEXT MEETING

21. You suggested to Sir Francis that you would like to invite ACOST members to lunch for the next meeting and bring in a number of scientists to talk about their work. You may like to end the meeting with this suggestion. I am sure it would be warmly welcomed by ACOST members.

JOHN W FAIRCLOUGH
Chief Scientific Adviser

CC JG

ACOST MAIN MEETING ON 1st FEBRUARY 1989
3.00 pm

EXPECTED ATTENDANCE

MEMBERS

Sir Francis Tombs FEng (Chairman)	Chairman, Rolls-Royce plc
Mr Andrew Bain FRSE	Group Economic Adviser, Midland Bank plc
Prof Thomas Blundell FRS *	Dept Crystallography, Birkbeck College
Prof Gordon Edge	Chief Executive, Scientific Generics Ltd
Mr Anthony Gill BSc FEng	Chairman, Lucas Industries plc
Mr Terry Harrison FEng,BSc,FIMechE,FIMarE	Chairman, Northern Engineering Industries plc
Sir Graham Hills FRSC FRSE	Principal & Vice Chancellor, University of Strathclyde
Prof Leonard Maunder OBE FEng	Dept of Mechanical Engineering, University of Newcastle-upon-Tyne
Mr David McMurtry	Chairman, Renishaw plc
Prof Stan Metcalfe	Dept of Economics, Manchester University
Dr Dennis Oliver CBE FEng	Business Consultancy
Prof Sir David Phillips FRS	Chairman of the Advisory Board for the Research Councils
Prof Keith Peters FRCP	Regius Professor of Physic, Cambridge University Clinical School
Sir George Porter PRS	President of the Royal Society
Dr Charles Reece FRSC	Director of Research and Technology Imperial Chemical Industries plc
Prof John Robertson *	Dept Electrical Engineering, University of Edinburgh
Dr Alan Rudge OBE FEng FRSA	Director of Research and Technology British Telecom plc
Dr David Smith	Consultant
Prof Sir Peter Swinnerton-Dyer FRS	Chairman, University Grants Committee

* New Members

OTHERS

Mr John Fairclough	Chief Scientific Adviser
Prof Graeme Davies	Vice-Chancellor, Liverpool University
Prof Neville Richardson	Director, Surface Science IRC, Liverpool
Prof Jack E Baldwin	Director, Molecular Science IRC, Oxford U.
Prof Sir David Weatherall	Director, Molecular Medicine IRC, Radcliffe Hospital, Oxford

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Mr George Guise
Mr Paul Gray

27 January 1989

DvR1/Draft/ACOST/Chair-Brief/dAttendance-list.Main.1Feb89

TABLE PLAN

Entrance door

Projector Screen

Prof J E Baldwin

Prof Sir David Weatherall

ACOST Secretaries

Prof Stan Metcalfe

Sir Graham Hills

Sir Charles Reece

Prof N. Richardson

Prof Keith Peters

Prof John Robertson

Prof G Davies

Dr David Smith

Sir David Phillips

Prof Leonard Maunder

Prof Thomas Blundell

Dr Alan Rudge

Prof Gordon Edge

Mr G Guise

Sir George Porter

Mr Tony Gill

ACOST Sec

Paul Gray

John Fairclough

Prime Minister

Sir Francis Tombs

Dr Bradley

Throne

Main Meeting 1 Feb 89

[Rev A/ 1 Feb]

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AST(89)10th (Main) Meeting

COPY NO 37

1 February 1988

ADVISORY COUNCIL ON SCIENCE AND TECHNOLOGY

MEETING to be held in Conference Room A
Cabinet Office, 70 Whitehall
on WEDNESDAY 1 FEBRUARY 1989 at 3.00 pm

(Please note the change of time)

REVISED AGENDA

1. CHAIRMAN'S INTRODUCTION

2. THREE EXAMPLES OF INTERDISCIPLINARY RESEARCH

3. GLOBAL ENVIRONMENT RESEARCH
   Oral report on his Working Group by Sir George Porter

Signed Dr C C BRADLEY Dr W M HOWARTH
Mr P D FINCH Mr C R SEARLE
Dr D J van REST

Cabinet Office
27 January 1989

Note: Apologies and queries please to the Registry: 01-270 0105

CONFIDENTIAL

Institute of Molecular Medicine, University of Oxford

Subject Area

The Institute undertakes clinical research in association with the John Radcliffe Hospital, with a special emphasis on applying the modern techniques of molecular biology, immunology, and cell biology to such research. The work includes research on inherited diseases (muscular dystrophy, thalassaemia), disorders involving immune mechanisms (diabetes, asthenia gravis), infectious diseases (meningitis, HIV virus, and malaria) and cancer (cellular mechanisms involved in the development of tumours).

Funding

The Institute operates as a "Research Hotel", that is it provides space and facilities for groups of researchers whose work is related to its common theme. The accommodation consists of a refurbished existing building plus an extension which will be completed in March 1988. The capital cost of this accommodation plus initial equipment is £7.6m, of which MRC are providing £2.7m and the Imperial Cancer Research Fund £2.6m, with the remainder coming mainly from other medical charities. The running costs when fully operational will be £1.6m pa, of which the MRC will provide about £1m, the remainder coming from the ICRF and other medical charities.

Director

The director is Professor Sir David Weatherall FRS (55), Nuffield Professor of Clinical Medicine, University of Oxford. Sir David qualified in medicine at Liverpool University in 1956, spent two years in Liverpool hospitals, and then two years with the Royal Army Medical Corps in Singapore and Malaya. He worked in the USA in the early sixties as a Research Fellow at John Hopkins University. He returned to Liverpool as a lecturer in 1965, and was appointed Professor of Haematology in 1971. He moved to his present post in Oxford in 1974.

Other Staff

Other leading scientists who are undertaking work within the Institute are Professor E R Moxon, Department of Paediatrics; Professor A J McMichael, Department of Immunology; and Professor A L Harris, who will be moving to the Centre later this year from the Chair in Clinical Oncology at Newcastle University. When fully operational the Institute will have a core staff of about 50, plus an additional 20-30 staff on limited term contracts.

IRC on Molecular Sciences, University of Oxford

Subject Area

The Centre undertakes research into proteins, and their interactions with other molecules to control biological functions. Specific research areas under investigation are protein folding and specificity, blood clotting and fibrinolysis, immunology, signal transduction, viruses, and enzymes of secondary metabolism.

Funding

The initial period of funding is for six years, starting 1 October 1988. Over this period SERC are providing £6.3m; MRC £1.1m; and UGC £2.6m.

Director

The Director is Professor J E Baldwin FRS (50), Waynflete Professor of Organic Chemistry and Fellow of Magdalen College. Professor Baldwin was educated at Imperial College, London and held a lectureship at Imperial College before going to the USA in 1967 as an Assistant Professor, Pennsylvania State University. He was Professor of Chemistry at the Massachusetts Institute of Technology from 1972-78, before returning to the UK to take up his present post.

Other Staff

Other leading scientists associated with the Centre are Professor R J P Williams FRS, Department of Inorganic Chemistry; Professor Sir David Phillips FRS, Professor of Molecular Biophysics; Professor G K Radda FRS, Department of Biochemistry; and Professor G G Brownlee FRS, Professor of Chemical Pathology. A total of some 26 existing academic staff will contribute to the work of the Centre; and it will employ an additional 30 research assistants and technicians.

IRC on Surface Science, Liverpool University

Subject Area

The Centre will undertake a coordinated programme of experimental and theoretical research on the behaviour of surfaces of metals, oxides and semiconductors - including their geometric structure, electronic structure, lattice dynamics and the dynamics of their interaction with gaseous phases. The research will provide an improved basic understanding of surfaces, which might underpin future commercial applications, for example, in corrosion, adhesion, catalysis, and the manufacture of electronic devices.

Funding

The initial period of funding is for six years, starting 1 June 1988. Over this period SERC are providing £7.8m, and the UGC £2.6m.

Director

The Director is Professor N V Richardson (38), Department of Inorganic, Physical and Industrial Chemistry, University of Liverpool. Professor Richardson graduated from Oxford University with a DPhil in 1974, and was an SERC Research Fellow at Birmingham University from 1974-78. He spent 1978-79 at the Fritz Haber Institute in Berlin. He moved to Liverpool in 1979 as a lecturer, and was appointed to a personal chair in 1988 upon becoming Director of the IRC.

Other Staff

Other leading scientists associated with the Centre are Professor Colin Humphreys, Department of Metallurgy and Materials Science; Professor R W Joyner, Director of the Leverhulme Centre for Innovative Catalysis; and Dr P T Andrews, Department of Physics. Altogether some 20 existing academic staff of the University will contribute to the Centre; and it will employ an additional 32 research assistants and technicians.

ADVISORY COUNCIL ON SCIENCE AND TECHNOLOGY

GLOBAL ENVIRONMENT RESEARCH

WORKING GROUP REPORT TO ACOST ON THE ROLE OF THE UK IN GLOBAL ENVIRONMENT RESEARCH PROGRAMMES

Cabinet Office
24 January 1989

ADVISORY COUNCIL ON SCIENCE AND TECHNOLOGY

GLOBAL ENVIRONMENT RESEARCH

A REPORT BY A WORKING GROUP TO ACOST ON THE ROLE OF THE UK IN GLOBAL ENVIRONMENT RESEARCH PROGRAMMES

INTRODUCTION

1. Global environment change has been identified by governments world-wide as an issue which needs to be urgently addressed at the domestic and international level. The Prime Minister chose the occasion of her address to the Royal Society on 27 September 1988 to indicate her concern. Global environment change is an increasingly public subject. The national and international press carry articles almost daily warning of the consequences of the continued use of aerosol sprays, automobile emissions, destruction of rainforests, acid rain etc. Such articles, whether sensationalist or balanced, both reflect and reinforce the increased public awareness of the environment. Despite the uncertainties which surround predictions for environmental change we need to review existing policies and where appropriate take new initiatives.

2. ACOST's interest in this field goes back to September 1987 and a subsequent commissioning of a report on the global environment from the Natural Environment Research Council. ACOST reviewed this report on 8 November 1988 and set up a Working Group under Sir George Porter to advise it on what further steps should be taken. The membership of Working Group is given at Annex 1 of this Report.

3. The Working Group have addressed most of the major points made by NERC in their report and they formed the basis of the Group's

discussion. For information the Executive Summary and Summary of Recommendations of this NERC Report are attached as Annex 2.

GLOBAL ENVIRONMENT CHANGE

4. The NERC Report identified two main categories of environmental issues which could be termed 'global'. The first of these is perhaps more truly global in that it encompasses world wide changes in climate and in the composition of the atmosphere; the 'Greenhouse Effect' and depletion of the stratospheric ozone layer come into this category. The second is the issue of local environment changes which are repeated widely and hence have become a global issue, for example acid rain, deforestation, desertification, chemical fogs. The Working Group decided that although in many ways these are linked, in order to address the key issues in global environment, they should limit their enquiry to stratospheric ozone depletion and the greenhouse effect. The Group, while aware of common linkages between these two effects both in source and effect, concluded that they are distinctly different.

STRATOSPHERIC OZONE DEPLETION

5. The depletion of the ozone layer has been observed (particularly over the Antarctic the concentration of ozone between 14Km and 18Km was depleted by over 95% in 1987) and its sudden appearance in the last decade or so means that urgent action is required to prevent further depletion. The consequences of doing nothing could be widespread - the effect of UV rays unscreened by the ozone layer will seriously damage vegetation and human and other animal life.

6. The cause of the problem is well known; the Second Report of the UK Stratospheric Ozone Review Group highlighted the role of pollutants in the depletion of the stratospheric ozone layer. By far the most important of these are the chloroflurocarbon (CFC) gases. The problem of ozone depletion is understood in general terms but much of the detailed atmospheric chemistry is not. A practical solution to the

problem exists as far as man made pollutants are concerned. Although further research will be necessary, the Working Group doubted if future findings would seriously alter the required actions already identified. The Group considered that this problem was the first priority for the international community. The immediate measures being taken by the signatories of the Montreal Protocol to limit the emission of CFCs are welcomed but the scientific evidence indicates that they will be insufficent. The Working Group welcomed the Governments call for strengthening of the Protocol to cut emissions by at least 85% by the turn of the Century. They also welcomed the forthcoming international Conference to be hosted by the Government in March whose aim is to underline the importance of a world-wide commitment to reduce CFC's and in particular to pursuade lesser developed and newly industrialised countries to play a full part.

7. The UK market for Montreal Protocol CFC's is 62% for aerosols, 18% for foams, 12% for solvents and 8% for refrigerants. However, more important is the world market for CFC's, currently amounting to 960kte per annum, which is almost equally split between these four uses. Substitution of CFC's in most aerosols is possible using hydrocarbons such substitution in Europe may be achieved this year. A reduction in use for foams of about 50% might also be quickly achieved by replacement with HCFC 22 and reformulation (although total elimination will require the development of substitutes such as HCFCs 123 and 141b). The main use of CFC's for solvents is for flux removal from printed circuit boards. No alternative to CFC 113 has yet been found but its use could be reduced by better management/house keeping. CFC's are at present an essential requirement for refrigerators but alternative hydrofluorocarbons, in which chlorine is absent, eg HFC 134a, and hydrofluorochlorocarbons of shorter life are being developed (by ICI for example). These are being tested under the "program for Alternative Fluorocarbon Toxicity Testing" set up by 13 potential manufacturers and the results are expected in 1993. Considerable industrial investment in new plant will be required if sucessful with sufficient world capacity then taking a number of years to develop. Development of replacements for chillers (CFC 11) and display cabinets

(CFC 502) is several years behind.

8. The Working Group noted that the introduction of alternatives to CFC's would not be without considerable cost for each different application (possibly as much as a tenfold increase in the cost of refrigerant but perhaps not an unacceptable increase in the cost of a refrigerator unit). This would be a barrier to their introduction in lesser developed countries. Indeed alternative chemicals may only form part of the answer and consideration of alternative practices should not be excluded. Any subsidy of substitutes to discourage the use of CFC's in developing countries might be a heavy burden for the more advanced nations.

THE 'GREENHOUSE EFFECT'

9. In contrast the'Greenhouse Effect'is much less well defined both in terms of predicted effects and in its understanding. The number of variables are greater and the possible systems interactions more complex. Fortunately the potential implications for climatic changes are longer term. It is not clear what the overall impact will be on the UK; some predictions which do not go as far as to include consideration of an increase in sea level as a result of the melting of polar ice, suggest that some of these changes may be locally beneficial to the UK. However, the Group was concerned that we should not adopt an insular viewpoint as the ramifications of international impacts could be very significant (eg the changes resulting in extensions of desert areas of Africa, and those on the wheat growing areas in the United States which might have severe repercussions for the UK) and lead to an increase in political and social instability world wide. The need to improve our understanding of both the problem and processes involved is clear. What is far less clear at this stage is the action which should be taken. It was the Group's view that the international response is likely to be reactive rather than pro-active ie damage limitation/adaption.

INTERNATIONAL EFFORT

10. Problems associated with global environment change are, by definition, of international concern and will only be solved by international agreement and action. In this respect the Working Group welcomes the recent formation of, and UK involvement in, the UNEP/WMO Intergovernment Panel on Climate Change.

11. GER programmes are carried out by most developed nations. The USA was identified as the prime mover in all aspects of GER and the UK the major contributor to GER in Europe. The contribution which the UK, or for that matter any other one country, can make to the total GER effort is limited by capabilities and funds available. The Working Group felt unable to recommend either an increase or a decrease in the current level of UK Government expenditure (identified by NERC as £29 million in 1988 for true 'global' research excluding expenditure on satellites etc) at this stage. The Group accepted that the UK could not be world leaders in all fields and recommended that in order to maintain a significant role in GER international collaboration should continue to be encouraged wherever possible. In this respect the formation of, and UK involvement in, the UNEP Intergovernment Panel was supported by the Group.

12. It was noted that the present USSR input to GER was limited in spite of their potential to provide data from their fleet of approximately 400 research vessels. The Working Group considered that it might be an appropriate time to encourage greater involvement and input by the USSR.

RESEARCH PRIORITIES

13. For both fields (ozone layer depletion and greenhouse effect) the Working Group concluded that the highest priority was for monitoring and data collection proceeding hand in hand with the development of better models in order that satisfactory prediction data are available

and the necessary parameters are being monitored.

14. In relation to research supported by Government on the depletion of stratospheric ozone, the Group concluded that the main emphasis should be on basic science, that is re-enforcing the work currently underway on atmospheric chemistry. (In particular, for example, modelling of stratospheric ozone changes is greatly restricted by the need for more knowledge of the photochemical reactions of ClO and related compounds at low temperature and in heterogenous conditions of the polar stratospheric clouds.) Ozone research should include the effects on the total ozone column of tropospheric ozone formation resulting from NOX emissions.

15. The Working Group considered that it was for the private sector to conduct the required applied research and that the highest priority should continue to be given to the development of alternatives to existing CFC's.

16. In relation to the 'Greenhouse Effect' the Group considered that some of the major impacts would be on agriculture. It was noted that of those reports known to the Group none had highlighted the differing efficiencies of C3 and C4 plants with change in temperature regime and their respective potentials in a changed CO2 environment. The Group recommended that such information should be prepared as a supplement to the NERC Report to be considered by the new organisational structure indicated in paragraph 23.

17. The Group noted that whilst CO2 had been identified as the major 'greenhouse gas' others such as methane, tropospheric ozone and CFC's were significant and their rate of increase in the atmosphere more rapid. They recommended high priority should continue to be assigned to monitoring and that research managers should ensure that work is not over concentrated on CO2. However, they recommended that priority should be given to the improved understanding of CO2 fixation by plants. Other priority areas for 'Greenhouse' research

are the investigation of:

(i) atmospheric chemistry of 'greenhouse gases' interaction,
(ii) the significance of tropospheric ozone build up,
(iii) the physio-chemical take up of CO2 by oceans
(iv) the role of phytoplankton,
(v) distribution of vegetation types on land,
(vi) how plant adaptation might take place,
(vii) feedback mechanisms,

and more generally

(viii)how the global system might react.

18.The Group further recommended that effort should be devoted to the development of scenario modelling. In this respect they had in mind the development of predictive capabilities such that the effects of global temperature rises of 1, 2, 3, 4, degrees centigrade could be estimated (for example change in growing conditions, effects of rise in sea level due to melting of polar ice). Not only would this approach assist policy makers in the assessment of options but it would also highlight the potential commercial opportunities for UK industry. The potential environmental consequences of global warming for the UK could be illustrated by reference to those parts of the world where these conditions already exist. This might encourage UK industry to look more seriously at the opportunities for the UK in the light of such conditions being manifest elsewhere. Examples of such skills and technologies which are already well developed in the UK include water management, management of agricultural production change, control of pest organisms (agricultural and medical) and plant breeding eg for salt tolerance etc.

19. The development of scenario modelling will take some time and will by its very nature be prone to uncertainty. In the short term the Group therefore recommends that in order to establish which industrial sectors will be most affected by global warming the Centre for the Exploitation of Science and Technology (CEST), should be asked to prepare a report on the threats and opportunities for UK

industry.

20. The Group felt that in the time available they could not provide any authoritative advice on wider issues such as energy conservation, alternative sources of energy, nuclear power, aid policy etc. However, they would wish to see the debate on climate and environment change opened up at all levels to a wide range of disciplines.

FUNDING OF RESEARCH

21. The size of the UK effort is difficult to judge and the Group took note of the figures (£29m) given in the NERC report. They concluded that, contrary to the NERC view, GER was to be researched and funded in the private as well as the public sector. Private sector finance is particularly appropriate for applied, 'near market' research; for example important research on the possible substitutes for CFCs and on industrial applications was already being carried out by industry. As industry will reap the rewards of such applied research through profit on new products they should bear the costs of the necessary research.

COORDINATION

22. The Group felt that having read reports on research activities by DOE, Sir John Mason and others there is a lack of focus in our research in these fields and in our contributions to international programmes. The Group were aware of proposals to set up coordinating committees but were of the view that a more dynamic solution was required for this most important area. The Group had some sympathy for a US style 'task force' but where unable to see how this might be organised in the UK. As an alternative they recommend that a directorate should be set up to act as the lead agency for research in the UK.

23. There is a precedent for this type of organisation in the

arrangements recently made for UK research on the human genome organised under MRC. It is envisaged that the GER directorate would be responsible for overseeing the UK interface and coordination with the international GER effort and would have some executive powers. Since GER is very wide ranging from modelling to basic chemistry the Group proposed that as one possibility the directorate should be set up in NERC and should be accountable to Government through the Chairman of NERC. The directorate would include members from the Research Councils, the Royal Society, the Meteorological Office, other Government departments HEI's, and industry. Preferably it would have a finite life and would be reviewed after about 5 years.

24. At a lower level of priority the Group noted that in contrast to the ozone depletion problem there is no coordinating study group on the 'Greenhouse Effect' exists in Britain at present They considered that the Stratopheric Ozone Review Group had been effective in bringing researchers and administrators together and had produced a useful document on the 'state of the art'. They therefore recommended the formation of a similar group for the' Greenhouse Effect'. This should have a similar funding and organisation that is from DOE and the Meteorological Office.

25. Finally, in reviewing the recommendations of the NERC Study, the Group concluded that they should be passed to those charged with setting up the proposed directorate to act as a UK reference source. The review requested of CEST (paragraph 19) should also be forwarded to ACOST for further consideration.

SUMMARY

26. The recommendations of the Working Group were as follows:

(a) Government resources devoted to true GER in the UK should remain at or about their current level of £29M in the immediate future (para 11)

(b) highest S&T priority should be devoted to monitoring data collection and modelling (para 13)

(c) the main emphasis for scientific research should be on basic science i.e re-enforcing the current effort on stratospheric ozone photochemistry (para 13) and in respect of the 'Greenhouse Effect' (para 17) on:

(i) improved understanding of CO2 fixation by plants
(ii) atmospheric chemistry of 'greenhouse gases' interaction,
(iii) the significance of tropospheric ozone build up,
(iv) the physico-chemical take up of CO2 by the oceans
(v) the role of phytoplankton,
(vi) distribution of vegetation types,
(vii) how plant adaptation might take place,
(viii) feedback mechanisms,

and more generally

(ix) how the global system might react

(d) a report on the potential for C3 and C4 plant at elevated temperature and CO2 levels should be prepared (para 16)

(e) effort should be devoted to the development of scenario modelling of the consequences of global environment change (para 18)

(f) CEST should be asked to prepare a report on the threats and opportunities for UK industry of global environment change (para 19)

(g) the private sector has a role to play in the conduct and funding of GER, particularly in relation to applied research of which the highest priority is research into possible substitutes for CFC's (para 21)

(h) a GER directorate should be set up under the auspices of

NERC (para 22 and 23)

(i) a working group for research into the 'Greenhouse Effect' should be set up along the lines of the Stratospheric Ozone Working Group (para 24)

(j) the NERC Report on GER commissioned by ACOST should be passed to those charged with setting up the proposed new GER directorate (para 25)

27. It is the view of the Working Group that ACOST need take no further action at this time other than to ensure that the recommendations, given at paragraph 26 above, are passed to the appropriate Government Departments for action. However, Council may also wish to consider giving the NERC permission to publish a suitably edited version of their Report.

28. In conclusion the Working Group, having had the benefit of the NERC GER Report and having discussed GER at a strategic level at its two meetings, invite Council to approve the recommendations given in this Report.

ANNEX 1 MEMBERSHIP OF THE WORKING GROUP

MEMBERS

Sir George Porter PRS (Chairman)	Royal Society
Professor Thomas Blundell FRS	Birkbeck College, University of London
Dr Dennis Oliver CBE FEng	Business Consultancy
Professor Sir David Phillips FRS	AFRC
Sir Charles Reece FRSC	ICI

IN ATTENDANCE

Mr John Fairclough FEng		Cabinet Office
Dr Clive Bradley		Cabinet Office
Mr Callum Searle	(Secretary)	Cabinet Office

ANNEX 2 EXTRACT FROM A REPORT TO ACOST BY NERC ON GLOBAL ENVIRONMENT RESEARCH, OCTOBER 1988

EXECUTIVE SUMMARY

1. The terms of reference are:-

   i) to describe the subject of global environmental research (GER);

   ii) to give measures of the importance of this research for UK environment, politics, defence, economy and society;

   iii) to describe the main UK agencies' interest and involvement in environmental research;

   iv) to describe the main international agencies involved in environmental research and the contacts between UK and international agencies;

   v) to describe the potential for further exploitation of environmental research in the UK.

2. Recently expressed concern about the global environment indicates that man may, as a consequence of his numbers and his demand for resources, be changing the balance of the global system, possibly irreversibly. Future prospects for the size of the human population, and the pressure in all countries to raise living standards imply that the demands on the global environment will intensify. It is clear that research now is urgent to understand fully the effects of man on the global environment, to predict their scale in terms of impact and timescale, in order that action to change some of man's practices is feasible within the democratic system.

3. Global environmental research falls into two categories. The first which is dealt with in this report, concerns research on processes which are global in scale and implication and which are likely to have an effect on a timescale of a year to a century. The second, not dealt with fully in this report, concerns research on local regional phenomena which are repeated worldwide so becoming an issue of global environmental concern.

4. Global environment research aims to describe and measure the sources and sinks of elements and substances which circulate within and between the global sub-systems of the Atmosphere, the Geosphere, the Biosphere and the Hydrosphere. This movement of elements and substances (the fluxes) is driven by the energy, hydrological and biogeochemical cycles and reveals that the natural global system is dynamic and variable although it may remain in stable equilibria over long periods of time. Man, by his activities, can alter the balance of the sinks and fluxes within and between the subsystems, and may destabilise the global system, possibly, irreversibly. GER aims to assess the natural variation in global sinks and fluxes, to assess the effects of man's activities on this variation and to develop methods of predicting future natural and man made variation in the environment.

5. Although environmental changes in the British Isles in the past have seldom been so severe or prolonged enough to dominate Government policy, unlike the situation which prevails elsewhere and particularly in the Third World, we are now faced with the prospect of a changing global environment from whose effects the UK is unlikely to be immune. An immediate aim of GER is to predict the consequences of changes in the global environment for the national environment. Prospective changing climate patterns and rising sea level as a result of global warming may affect the UK in a number of significant ways including: innundation of low lying land and the need to increase coastal defences; saline intrusion into freshwater resources; changes in agriculture; major changes in energy requirements and generation of electricity; changes in transport systems; changes in civil engineering and building practices and requirements.

6. Concern about the changing global environment will lead to increasing international regulatory pressure which will affect industry. Furthermore, industry needs to be informed, at the earliest opportunity of what environmental factors need to be taken into account as it is expensive for industry to adapt, late in the planning cycle to new environmental regulations for its technology. In the energy supply industry there is an immediate need to make a thorough examination of alternative energy sources in order to plan investment now for electricity production for the next 25-30 years. Also, it must be recognised that our economic interests are not confined to the British Isles and our standing in the world and our international industrial performance could well depend on our ability to contribute to GER. The

UK has developed a strong tradition in the sciences which underlie GER and the opportunity now exists to use this expertise to the national advantage. Moreover, opportunities are likely to arise for us to market internationally our environmental R&D expertise.

7. The possible changes resulting from a changing global environment are likely to occur on timescales comparable with the timescales of planning and implementation of major capital construction. A more precise definition of the effects of global change, based on predictive models is required if the correct political and investment decisions are to be made. This in itself is sufficient to justify research on impacts and more importantly, in the first instance, on the processes of environmental change.

8. The level of expenditure on GER in both the public and private sector is relatively low in terms of the national R&D budget and only represents a small fraction of the total Government-funded civil R&D investment. Of this, only about one tenth is devoted to studies of global processes themselves, most of the expenditure being related to local/regional research such as acid precipitation. Furthermore, the research effort in GER in the UK is somewhat uncoordinated.

9. GER needs to be pursued urgently and internationally since no one country can afford, or has access to the territory, needed for all the research that is required. Failure to participate in international initiatives will result ultimately in delayed access to the data necessary to conduct and understand GER. Furthermore, it is vital that we have our own independent assessment of the research and predictions which arise from international and other national programmes and which could well form the basis for international (especially European) environmental regulation.

10. The conclusions and recommendations for further action are to be found on pages 78-82 of the main report.

Section 8: Conclusions

84. Environmental change at the global level resulting from Man's activities can now be observed. The extension of deserts and widespread soil erosion can be blamed upon the destruction of forests and vegetation cover and forms of cultivation by man. The rise in carbon dioxide, methane, sulphur dioxide, nitrogen oxides, CFC's and other gases in the atmosphere can be attributed to combustion of fossil fuels by man and to the release of man made chemicals. There are predictions based on limited data put into relatively simple computer models which indicate that these activities may lead to global climate changes of temperature, precipitation and solar radiation. In turn global climate changes may lead to melting of the main ice masses, to rising sea level and land inundation, to saline infiltration of freshwater and the destruction of major centres of population.

85. The impact of these environmental changes on the UK environment on politics, the economy, defence and society can be perceived only impressionatically and sketchily but sufficiently to justify research on these impacts and more importantly in the first instance on environmental change.

86. GER should aim:

i to establish the natural variation in the global environment both temporally and geographically;

ii to establish the interaction of the natural variation with man's activities and so establish the variation in the global environment attributable to man;

iii to develop the capability of predicting natural and man-made variation;

iv to develop means of reducing, preferably eliminating, the undesirable aspects of man's activities.

87. GER will involve:

i long term earth observation of environmental phenomena from satellite, aircraft, ships, submersibles and land based craft and from instruments and robots;

ii on-site experimentation;

iii data capture, reduction, analysis, storage and interpretation;

iv computer and software development;

v modelling of global systems for the purpose of predicting future environments.

88. GER needs to be pursued urgently and internationally since no one country can afford, or has access to the territory, needed for all the research that is required. The UK, as a major trading nation, will be affected directly and indirectly by the environmental changes should they occur. The UK science community should therefore participate in GER in order to maintain the skill and the understanding of global research and to be able to advise objectively politicians, industrialists and the public on these issues.

89. GER is a multidisciplinary strategic activity which will need to be funded by government since it is either too speculative for industry or the results relate to matters such as defence, health, infrastructure, land conservation, international affairs and flood control which are the province of government.

90. GER is being pursued internationally largely through ICSU and WMO in which UK scientists are playing an active role. The Royal Society arranges a national committee for the WCP. The new IGBP under the auspices of ICSU is being planned. The UK has a national committee established by the Royal Society and UK scientists are closely involved in the planning phase of the programme. The UK should aim to make a significant practical contribution to the IGBP during the active phase.

91. GER is being pursued nationally. The principal agencies are:

i the NERC which supports relevant research in its institutes and in Universities. Its main areas of interest are atmospheric science, oceanography, hydrology, geology of palaeoclimate, climate impact on land, vegetation, animals and water supplies, and earth observation from satellites. It also supports a major polar programme with much of relevance on ice and climate. It is the lead agency for the UK involvement in the ocean drilling programme.

ii the Meteorological Office which carries out major research on atmospheric science, meteorology and weather/climate modelling of world class. It carries a major responsibility for involvement of the UK in the WCP.

iii the SERC which supports basic physics, chemistry, biology, mathematics and computer science necessary to support the more strategic research of NERC and the Met Office. It also supports some atmospheric science and a major programme of space instrumentation and data handling and analysis for earth observation.

92. There is no one major focus for GER nor is there an appropriate co-ordination mechanism for either the relevant activities in the public sector nor for the public-private sector interface. NERC would be willing to establish such a focus in conjunction with SERC and the Meteorological Office (if they are willing) provided sufficient resources can be found. The focus might take the form of a "Directorate" in which there are three main players but which will aim to encourage funding and participation from a wide variety of public and private sector organisations. Such a "Directorate" would require a Steering Committee drawn from the major funding bodies. The first task of the Committee would be to draw up a complete statement of relevant existing UK research and to identify major new areas for funding.

93. Expenditure on all categories of GER in the UK is estimated to be about £98m per year at present of which £89m comes from public funds and £9m is spent by industry. Of this only £29m is concerned with global process studies, most of which is funded by the public sector. This seems a small sum in relation to the likely consequences of environmental change for the UK.

94. In the short term (over the next year or so) the UK GER programme should be developed to include:

i) maintenance and extension of on-going time-series observations (eg stratospheric ozone, continuous plankton recorders, tide gauges, ecological, hydrological and meteorological data collection). This activity requires new instrumentation, some co-ordination of existing observations and more linkage to international networks especially GEMS.

ii) continued support for research in the Antarctic and the development of a complementary but smaller Arctic programme in view of the sensitivity of polar areas to environmental change [a programme of about £½m per year would be significant].

iii) development of major marine science programmes especially in research institutes and universities to allow UK involvement in the WOCE; to develop the BOFS as a contribution to JGOFS; to develop ocean modelling such as FRAM; and to develop ocean observing instruments such as AUTOSUB. [To maintain the NERC marine fleet and to develop these programmes NERC needs a capital injection of £12m to maintain and equip the research fleet plus an increase in recurrent expenditure of £3m per year].

iv) development of university centres for atmospheric sciences, geology of global change (palaeoclimate) and for climate change impact studies [NERC has indicated that these centres and research require about £3m per year to establish and run].

v) development of global atmospheric scale modelling linked to ocean models by the Meteorological Office and by NERC in the universities. [NERC has indicated a need for about £1m per year for this activity. The Meteorological Office requirements are not known].

vi) development of the satellite remote sensing and earth observation programme. This will require the launch of ERS-1 the development of a datacentre and a launch of ERS-2 followed by some form of involvement in the Polar Platform. Access to data from a range of

satellites and provision for new instruments will be needed. These activities are funded by the BNSC, SERC and NERC. It is doubtful if sufficient funds are available for this element of the GER programme.

vii) development of a number of studies on the impact of global environmental change on energy, defence, politics, society, and the economy [these should be funded jointly by ESRC and NERC and funds of the order of £½m will be needed].

viii) development of studies of the long-term impacts on crop and forest growth, wildlife, freshwater, water supplies and sea level. (NERC and AFRC would be involved and £1M per year would be appropriate now, rising as and when the climatic change effects become better defined).

95. In the longer term the GER programmes should be developed by the proposed Directorate who should be seeking particularly to identify other man made environmental effects apart from those attributable to CO_2 and the 'greenhouse' gases.

10 DOWNING STREET

Prime Minister

The Foreign Secretary has been put off to 17.20 - to give you an extra 20 mins.

—

You probably need to move to Global Environment no later than 16.45.

—

AJT

EAMAMA SUBJECT & MASTER

NOTE FOR THE RECORD

PRIME MINISTER'S DISCUSSION WITH SIR FRANCIS TOMBS:
26 JANUARY 1989

The Prime Minister held a meeting on 26 January with Sir Francis Tombs for a preparatory discussion prior to her meeting with ACOST on 1 February. George Guise (Policy Unit), Sir Robin Butler and John Fairclough (Cabinet Office) were also present.

The main points discussed were:

The Prime Minister expressed concern that the present arrangements for allocating Government funding for science meant that all the money went to the 'big battalions' and not to smaller research groups, who were often the most promising areas for scientific advance. Sir Francis Tombs said it should be remembered that the Research Councils did give a large number of small grants. But he agreed that it would be sensible to look at how the structure of scientific funding has changed over time. He envisaged asking Sir Graham Hills to undertake this work within the ACOST framework. The Prime Minister welcomed this suggestion. She also stressed the importance of ensuring that funding went to the people most likely to make scientific breakthroughs rather than trying to define too closely areas of research which should be supported.

The Prime Minister also expressed concern about Inter-disciplinary Research Councils being too bureaucratic, and suffering from the traditional problems when new organisations were established. Sir Francis Tombs agreed that there were dangers, but he was determined to ensure that IRCs did not suffer from this weakness. He regarded this approach as a crucial means of bringing together academically-led small groups embracing a range of

different scientific disciplines; physicists, chemists, biologists, etc. The selection of teams to form IRCs had to be carefully monitored, and, once established, there should be maximum devolution of responsibilities to the teams, matched by regular reports. One advantage of IRCs was that, unlike the Research Councils, the mechanism avoided the need for large-scale peer review bodies. Sir Francis also said that he was no longer planning for 40 IRCs; the right approach was to develop the process gently. The Prime Minister said that she had been reassured 'a little' by what had been said.

The Prime Minister asked why industry was still not undertaking enough near-market and product research. Sir Francis responded that this activity had been cut back by the effect of the economic squeeze in the 1970s and the tradition of Government doing too much in these areas. He welcomed the salutary effect that could often follow when Government-funding was reduced. In the university world that had certainly been the case for Salford. The Prime Minister was concerned that there were inadequate mechanisms for ensuring that the £700 million of Government money for research in universities was properly directed. Sir Francis thought a clear division of Government funding for teaching and research purposes would help.

The Prime Minister asked why it was that the UK's record in receiving Nobel prizes was falling behind. In discussion it was suggested that former UK Nobel prize-winners were perhaps not as industrious as they might be in putting forward nominations for new UK candidates.

The Prime Minister asked whether enough Government-funded research was going into environmental issues. Sir Francis responded that quite a lot was included in the scientific work funded by the SRC. But an important issue here was to identify those aspects of environmental

research that the UK was best placed to pursue, and to fit these in with what other countries were doing; United Nations agencies might have a co-ordination role to play. The Prime Minister wondered if there would be advantage in talking to Mr Riley of the United States Environmental Protection Agency.

Sir Francis said that ACOST would welcome suggestions from the Prime Minister on issues and areas of work that she would like to be pursued. The Prime Minister said she would give it further thought, and Sir Robin Butler said that the Cabinet Office would provide periodic advice on this. The Prime Minister said that one current issue that would bear investigation was why we seemed to be entering a period of much greater difficulty over bacterial disease in food production and preparation.

There was also discussion of the arrangements for the ACOST meeting on 1 February. It was agreed that the Prime Minister would take the chair, and that the two main items for the agenda would be the three presentations on IRCs, followed by the global environment. The Prime Minister said she did not want to have the future ACOST work programme as a separate agenda item, but would wish to touch on this issue during discussion of the other items.

A copy of this note goes to George Guise (Policy Unit), and to Sir Robin Butler and Mr Fairclough (Cabinet Office).

PAUL GRAY
27 January 1989

CONFIDENTIAL

PRIME MINISTER

MEETING WITH SIR FRANCIS TOMBS AND JOHN FAIRCLOUGH

Following your discussion the other day with John Fairclough, you are having a discussion tomorrow with Francis Tombs and John Fairclough prior to next week's meeting of ACOST. George Guise and I will also be present.

John Fairclough has prepared a revised brief for you - attached at Flag A. You may also like to have to hand a copy of Francis Tombs's interview with the Financial Times published on Monday (Flag B) and George Guise's earlier note of 12 January (Flag C).

One point John Fairclough's note does not perhaps bring out, and which you may wish to get across to Francis Tombs, is the importance you attach to ACOST differing from ACARD, with particular emphasis on the 'S' in ACOST.

PRCG.

PAUL GRAY

25 January 1989

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WO997

MR TURNBULL

25 January 1989

ROLE OF ACOST

As agreed I attach a brief and speaking notes for the Prime Minister's meeting with Sir Francis Tombs tomorrow afternoon.

2. Could I also correct one point in your record of my discussion with the Prime Minister last Monday? What I meant to say on the dual support system for funding university research was not that it was undesirable per se but that there needed to be greater clarity of roles and responsibilities particularly with the plan to separate teaching and research.

3. I will let you have a background note on the MRC plans for Hammersmith shortly.

4. I am copying this minute to Sir Robin Butler.

JOHN W FAIRCLOUGH
Chief Scientific Adviser

CC B/P H

WO996 CONFIDENTIAL

PRIME MINISTER 25 January 1989

ACOST: MEETING WITH SIR FRANCIS TOMBS: 26 JANUARY

1. Following our discussion on the role of ACOST on Monday evening, you may find it helpful to have some speaking notes for use in your meeting with Sir Francis Tombs and some suggestions for handling the ACOST meeting on 1 February which you might like to discuss with him.

Speaking Notes

2. On the role and future work of ACOST:

i) you would like ACOST to have advice ready to offer on scientific matters, particularly longer term ones, when you and your colleagues were addressing related policy issues. The climatic change issue was a current example.

ii) in depth studies taking up to a year to produce a report would often not be appropriate for this. ACOST might consider changing its modus operandi, eg with round table conferences and just a brief report.

iii) ACOST would clearly need to be told when their advice on particular issues was needed. You would look to me to act as the link with them on this. (If this suggestion is acceptable to you, I will need to agree with you arrangements for putting it into effect.)

iv) ACOST should not feel restricted to doing work requested by Government. They should still have an independent remit and should be aiming to influence and inform a wider audience. (Although we did not have an opportunity to discuss this on Monday, you might like to consider recommending ACOST tackle two of the "wider" topics suggested in my minute of 20 January - how to encourage further

private sector investment in R&D: lessons to be learned from industries with a good record; and the future status and potential of the biological sciences in which we are particularly strong.)

3. As far as their advice on scientific research is concerned;

v) you were concerned that funding for science should go to the prominent scientists with the minimum of bureaucracy. You hoped that in their advice ACOST would not put the emphasis on structures at the expense of the quality of the scientists.

vi) you were looking forward to the presentations on IRCs to be given at the ACOST meeting but would want to be satisfied that these were not new organisations for their own sake and that underneath the new label there was good quality science being carried out in an economical way.

Handling of the Meeting with ACOST

4. You might like to agree with Sir Francis how the meeting is to be run. If you are content, he will suggest that you should chair the meeting and **I recommend you agree to this.**

5. There are no papers for the meeting. A normal business meeting is being held in the morning and the three items on the agenda for the afternoon are a series of oral presentations. I attach the proposed agenda. You have set aside from 2.30 to 4pm for the meeting. This is unlikely to leave time for the item on Global Environment. **I suggest you discuss with Sir Francis whether you are content with the agenda and whether you want to make time for a discussion of the Global Environment.**

If you wished we could stretch this to 4.30. - Yes.

PRCG.

6. ACOST members will want to participate in the discussion on each item after the presentations. **You may like to discuss with Sir Francis whether he suggests calling on specific members to speak.**

7. I will provide fuller briefing for the ACOST meeting in your weekend box. This will include a list of members attending and the seating plan. There will also be biographical notes on the presenters and on the laboratories from where they come.

JOHN W FAIRCLOUGH
Chief Scientific Adviser

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AST(89)10th (Main) Meeting
1 February 1988

COPY NO

ADVISORY COUNCIL ON SCIENCE AND TECHNOLOGY

MEETING to be held in Conference Room A
Cabinet Office, 70 Whitehall
on WEDNESDAY 1 FEBRUARY 1989 at 2.30 pm

AGENDA

(Subject to modification)

1. CHAIRMAN'S INTRODUCTION

2. THREE EXAMPLES OF INTERDISCIPLINARY RESEARCH

3. CURRENT & FUTURE WORK OF ACOST

4. GLOBAL ENVIRONMENT RESEARCH
   Oral report on his Working Group by Sir George Porter.

Signed Dr C C BRADLEY
Mr P D FINCH
Dr D J van REST
Dr W M HOWARTH
Mr C R SEARLE

Cabinet Office
24 January 1989

Note: Apologies and queries please to the Registry: 01-270 0105

CONFIDENTIAL

AT / PG This is an eloquent statement of what's wrong with Arcot (all T and no S).

For B/up + Tombi
Fenelon Falls

With Compliments
George R. J. Guise

Jan 23/

FINANCIAL TIMES

Monday January 23 198

THE MONDAY INTERVIEW

Engineering the future

David Fishlock talks to Sir Francis Tombs, chairman of Rolls-Royce

Sir Francis Tombs is arguably the best-known engineer in British business today, although not everyone knows he is an engineer.

He has presided over a conspicuous improvement in the fortunes of three international engineering companies during the 1980s, including Rolls-Royce, a name still synonymous with the best that engineering can offer.

As chairman of the Advisory Council on Science and Technology (Acost), he advises the Prime Minister on engineering. He also advises N.M. Rothschild, the merchant bank, on such projects as investment in the infamous Sinclair electric car. "I was not enthusiastic."

As chairman of the Engineering Council until last year, he was embroiled in the engineering industry's efforts to educate more and better professional engineers, and to change the widely-held public image of an engineer as someone in overalls.

Frank Tombs is a round, slightly rumpled man of 64, whose sartorial insouciance ensures that he is unlikely to be mistaken for a banker. His face also breaks easily into an engaging grin. Colleagues know when he is angry because he becomes uncharacteristically quiet.

Tombs brusquely rejects the fashionable term "company doctor" for his role in restoring to favour with the City, successively, the Weir group, Turner & Newall and Rolls-Royce. He prefers the term manager and says self-deprecatingly that the task required nothing more than "the application of logic to difficult situations."

That logic he learned training to be an engineer, starting with the General Electric Company in Birmingham during the Second World War, when evening classes at the Birmingham College of Technology alternated with spells at a first aid post. After the war he became a graduate trainee in electricity supply for Birmingham Corporation, learning both to run a power station and to control the grid.

By 1952 he was an operating efficiency engineer with the nationalised electricity industry. But GEC wooed him back, to its Erith turbine-generator factory in Kent as a trouble-shooter for its products. He rose to general manager, learning a lot from the young Arnold Weinstock, before finding his company sold off to Parsons in 1965. Lord Weinstock, he says, has since admitted to him that this sale was a big mistake.

Irritation with the ways of accountants led him in his mid-30s to read in his spare time for an external London degree in economics. This taught him enough to get accountants worried, he says.

But his engineering experience has taught him to examine evidence critically, and to make decisions on the basis of inadequate data. "Engineering develops the judgmental qualities." Those qualities are readily translated into the kind of commercial situation in which he has made his name. "When engineers are willing to do it, they can make very good managers," he believes.

In 1968 he landed the post of director of engineering with the South of Scotland Electricity Board – the first job he had applied for since starting his career. He became deputy chairman and then chairman by 1974. He came to public attention as the ever-amiable but unswerving opponent of the Central Electricity Generating Board's plans to introduce the US nuclear pressurised water reactor (PWR).

Tombs remains convinced that Britain should not be building big PWR power stations, even though he is chairman of a company which has built more than a score of PWR propulsion plants for the Royal Navy. He says he has no doubts about its safety as a sea-going engine, but does not accept that it will be as safe in a power station as the British reactor designs.

When offered the post of Rolls-Royce chairman, he warned Mr Norman Tebbit, then Industry Secretary responsible for the state-owned company, that he would continue to speak out against the Sizewell B PWR project. To its credit, says Tombs, the Government raised no objection.

This month, however, he has given his blessing to a scheme for Rolls-Royce to pursue a new design of PWR, in partnership with the UK Atomic Energy Authority and two US companies, as a prospective power-plant for small nuclear power stations.

The nuclear debate apart, Tombs broke free from electricity in 1981, just as he was reaching the pinnacle of his profession, by becoming president of the Institution of Electrical Engineers. Mr Tony Benn, then Energy Secretary, had brought him back to London, as chairman of the Electricity Council, lured, Tombs says, by a promise that he would head a unified industry incorporating the CEGB. But Benn – "an arch-procrastinator," according to Tombs – changed his mind.

Tombs challenged the new Thatcher Government to keep the promise instead, only to be told that it could hardly be seen to adopt a plan of Mr Benn's. So he resigned – without, he says, any idea what he might do next. In fact, the first invitation came on the day he announced his resignation. It was from Lord Rothschild, the bio-scientist, then chairman of the family merchant bank. Tombs is still on N.M. Rothschild's board and is chairman of its audit committee.

He was next approached to help the Weir group, then in dire straits. Tombs became its chairman from 1981 to 1983. Soon afterwards, he was approached about another company in desperate need of a rescue, which turned out to be Turner & Newall.

Tombs finds common factors in their distress. Each had taken its eye off the ball in attempts to diversify from a sound traditional business into areas it did not understand. With Weir, the attempted diversification was desalination, with T&N it was plastics and chemicals. Both firms became over-reliant on computers, asking too many questions and allowing the answers to drown in print-out. "All the real messages were lost."

"I'm lucky in having a very simple mind," Tombs grins.

Rolls-Royce he already knew as a director, from 1982, when he was head-hunted following the sudden death of Sir William Duncan in 1985. By now exasperated with the fickleness of political decision-making, he asked for – and got – an assurance that he was to prepare Rolls for a return to the private sector. "My only condition," he says.

Today, Weir, T&N and Rolls-Royce are all managed by engineers he has chosen. At Rolls-Royce it is Sir Ralph Robins, one who "always has his eye on the bottom line". As with the other groups, there are many temptations to diversify. Its big US rivals are already more diversified. Moreover, Rolls-Royce is spending about £180m of its own money on research and development – "and we might as well get any fringe benefits that are going," Tombs says.

However, one area of diversification has been abandoned for the time being, at least. Well-publicised takeover talks with Northern Engineering Industries, the power-plant group, ended late last year because of what Rolls called an unbridgeable gap in price.

Thirty years' experience as the dominant partner in Rolls-Royce and Associates, the defence consortium that has built 20 PWRs for the Royal Navy, does provide one opportunity for fringe benefits. Plans for the new "safe integral reactor" a 300 MW PWR, "may prove to be an interesting development of our existing nuclear interests. Time will tell."

The memorandum of understanding just signed between the company, the UK Atomic Energy Authority, and Combustion Engineering and Stone and Webster in the US, is an agreement to study the funding and market opportunities for this advanced engineering system for the next century, he says.

Nevertheless, he is determined Rolls-Royce will not take its eye off the ball, for he says he is confident its traditional aero-engine business offers immense opportunities for the future.

As chairman of Acost, comprising some of the nation's top technical talent, he has a unique view of the future. Tombs believes Britain is in better shape today than ever before in his own career, and that the quality of its management has never been higher. Its industrial management is now admired worldwide, he says, by Americans especially. "I'm not conscious that much is holding back Britain at the moment."

If there is one restraint, it is awareness of the importance of investing in research and development, he says. He cites Rolls-Royce, crucially dependent on R&D, as an example of how naive City analysis can be.

Last year the company's investment in R&D was unusually high, and this was criticised as bad, he says. This year it returned to more normal levels and, says Tombs, this was also criticised as bad. "In both cases they should have been more concerned with what the money was being spent on," he says.

Launch aid from government for a major new project is another misunderstood investment, he says. Although he has little love for politicians, he still believes government should be prepared to help a company like Rolls-Royce to keep Britain at the forefront of engineering with launch aid for high-technology ventures. He is currently seeking £100m to help launch a new civil aero-engine.

'When engineers are willing to do it, they can make very good managers'

PERSONAL FILE

1924 Born
1939 Joined GEC
1974-77 Chairman, South of Scotland Electricity Board
1977-80 Chairman, Electricity Council
1978 Knighted
1981-83 Chairman, Weir group
1982 Chairman, Turner & Newall
1985 Chairman, Rolls-Royce
1987 Chairman, Advisory Council for Research and Development

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SAMALS

bc George
Gorse

10 DOWNING STREET

LONDON SW1A 2AA

From the Principal Private Secretary

SUBJECT CC MASTER.

MR FAIRCLOUGH
CABINET OFFICE

ROLE OF ACOST

The Prime Minister discussed with you the role of ACOST in preparation for the meeting with Sir Francis Tombs and with ACOST itself. She expressed a number of concerns:

i. She was worried about the emphasis on new structures and new organisations which tended to take on a life of their own. It was essential to look first at the resources available in terms of people.

ii. It was essential not to overlook the potential contribution of small research teams. In this context she referred to Professor Lovelock's Schumacher lecture.

iii. The peer review process for selecting research projects was too bureaucratic. It was better to give a prominent scientist responsibility for a budget and let him select his own researchers.

iv. There was a danger that IRCs would become organisations in their own right, seeking premises and equipment. This was a recipe for bureaucracy and duplication.

v. There was a danger that IRCs would reduce the incentive for industry to take responsibility for its own research.

In response, you made the following points:

i. You recognised the importance of not allowing IRCs to become bureaucracies. Properly established, they could achieve precisely what the Prime Minister wanted, ie allowing team leaders flexibility in choosing the avenues of research they wanted to pursue and in recruiting their own researchers.

ii. It was important to resist the tendency to identify areas of science where the United Kingdom was weak and then to propose IRCs in an effort to make that good. The result would be to promote science in precisely the areas where the country lacked the scientific resources.

iii. The structure of the Research Councils needed to be re-thought. You had in mind only two - medical science and natural science. (The Prime Minister suggested putting agriculture and environment together.)

iv. You wanted to put the MOD research establishments into agencies. The danger that this would confirm them as permanent organisations could be countered by making them compete with outside organisations for MOD research contracts.

v. A dual system for funding university research was undesirable.

vi. It was important to steer ACOST away from producing large review-type reports which took six to nine months to produce. It would be better to get them to produce advice to Ministers on individual issues in a much shorter time-scale.

The Prime Minister again expressed her concern about reorganising the MRC at a cost of £80 million. You agreed to provide me with the background on this. She also asked how it came about that the United Kingdom had opposed the ESR-2 satellite project when its purpose was to gather information about the global climate, which was something the Government very much favoured. You explained that the purpose of this project was to bridge the gap between the ESR-1 and the Polar Platform. It was not clear that a further satellite was necessary. There were also other ways, eg oceanographic surveys, of collecting the necessary data.

We agreed that you would re-work your minute of 20 January into a brief and speaking note for the Prime Minister to use in her discussion with Sir Francis Tombs. This would need to include advice on the handling of the ACOST meeting. You agreed to get this to me by lunchtime on Wednesday.

I am copying this minute to Sir Robin Butler.

AT

ANDREW TURNBULL
23 January 1989

PRIME MINISTER

ACOST: MEETING WITH JOHN FAIRCLOUGH

The object of the meeting is to communicate directly to John Fairclough your views on the role of ACOST so that he in turn can pass the message through in his dealings with it. The meeting will be followed by that with Sir Francis Tombs on Wednesday and with ACOST itself on 1 February.

John Fairclough's note indicates that he is now thinking much more on the lines you want:

- he recognises that ACOST must not simply be ACARD under another name (para. 1). It can do this by giving more emphasis to science rather than confining itself to technology;

- he recognises the need to emphasise people rather than structures and not to overlook small research teams (para. 2(a)).

My only reservation is his para. 2(e). If "educating industry" means getting across the message that near market research is for them to finance then fine, but the reference to "assessing industrial strengths and weaknesses" must not revert to an attempt to identify industrial weaknesses.

The suggestion at para. 2(d) that Sir Francis Tombs should make a presentation to the Ministers on E(ST) is worth exploring but it should be made clear that Sir Francis is not being invited to sit in on the Ministerial discussions.

The suggested agenda for the ACOST meeting is an ambitious one. It is essential that sufficient time is left for the discussion of the future work of ACOST. This will mean that the individual presentations under item 1 will need to be strictly controlled. I understand the need for brevity has been impressed upon individual speakers.

AT

(ANDREW TURNBULL)
20 January 1989
DCAARZ

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PRIME MINISTER 20 January 1989

THE WORK OF ACOST: Meetings 23 and 26 January and 1 February

We are to meet on Monday 23 January to prepare for the discussion you are to have with Sir Francis Tombe on 26 January and the ACOST meeting on 1 February. A note on the proposed agenda and membership is at Annex A. The meeting with Sir Francis will give you an opportunity to discuss ACOST's role and its transition from ACARD. You promised in your letter of 12 August to suggest subjects for ACOST to study.

2. My understanding is that the points you may wish to make are:

a. for its confidential advice on scientific priorities ACOST should do more to identify good quality scientists and places where good quality work is going on and less to try and spot scientific winners. It should guard against recommending structures regardless of the quality of the work and should ensure room is left for small research;

b. it should also try to identify future issues such as climate change where an understanding of the science is important for policy, leaving any consequential questions of organisation and co-ordination to Government;

c. all its work should have an international perspective. Advice on important good quality work being undertaken overseas and ways of tapping into it could help avoid wasteful duplication;

d. you would strengthen the links with ACOST. You would ask me to brief ACOST on S & T issues being addressed by Ministers and would request specific advice from ACOST where appropriate. When ACOST provided advice, you might invite Sir Francis to make a presentation of it to Ministers and give Ministers a chance to question him;

e. for its published work, ACOST should aim to educate industry, not just Government. They should assess industrial strengths and weaknesses and provide better information for taking decisions on R & D. The following themes were suggested in my minute of 11 November; two or three of these could be examined in round-table discussion followed by a brief paper rather than an extensive report;

- Guidelines for the UK's involvement in international research
- How to encourage further private investment in R & D: lessons to be learned from industries with a good record
- Public understanding and acceptability of science and technology
- Biological science and technology
- New opportunities in manufacturing: the management of technology

3. I would also welcome an opportunity at our meeting on Monday to review two outstanding E(ST) issues - the Strategy for the Science Base (the response which the Government is due to give the ABRC report) and the organisation of Civil Research Establishments, where I am working with Peter Kemp to develop an internal market for Next Steps Research Agencies with competitive tendering and as level a playing field as possible.

4. I am copying this minute to Sir Robin Butler.

JOHN W FAIRCLOUGH
Chief Scientific Adviser

ANNEX A

Suggested Agenda for ACOST Meeting on 1 February

REVIEW OF RECENT INTERDISCIPLINARY RESEARCH INITIATIVES (1 hour)

- introduction from Sir David Phillips
- Sir David Weatherall - Molecular Medicine IRC Oxford
- Professor Jack Baldwin - Molecular Science IRC Oxford
- Professor Neville Richardson - Surface Science IRC Liverpool University
- close by Sir Francis Tombs followed by open discussion with members

FUTURE WORK OF ACOST (half an hour)

- short presentations from Chairmen of various working groups
- this provides an opportunity for you to say what you want ACOST to do

GLOBAL ENVIRONMENT (half an hour - if time permits)

- introduction from Sir Francis Tombs on ACARD/ACOST work since 1987
- presentation from Sir George Porter on his sub-Committee's work.

Membership of ACOST

Sir Francis Tombs F Eng (Chairman)	Chairman, Rolls-Royce plc
Mr Andrew Bain FRSE	Group Economic Adviser, Midland Bank plc
*Prof Thomas Blundell FRS	Dept of Crystallography, Birkbeck College, University of London
Prof Gordon Edge	Chief Executive, Scientific Generics Ltd
Mr Tony Gill BSc FEng	Chairman, Lucas Industries plc
Mr Terry Harrison	Chairman, Northern Engineering Industries plc
Sir Graham Hills FRSC FRSE	Principal & Vice Chancellor, University of Strathclyde
Prof Leonard Maunder OBE FEng	Dept of Mechanical Engineering, University of Newcastle-Upon-Tyne
Mr David McMurtry	Chairman, Renishaw plc
Prof Stan Metcalfe	Dept of Economics, Manchester University
Dr Dennis Oliver CBE FEng	Consultant
Prof Sir David Phillips FRS	Chairman of the Advisory Board for the Research Councils
Prof Keith Peters FRCP	Regius Professor of Physic, University of Cambridge
Sir George Porter FRS	President of the Royal Society
Sir Charles Reece FRSC	Director of Resarch and Technology, Imperial Chemical Industries plc
*Prof John Robertson	Department of Electrical Engineering, University of Edinburgh
Dr Alan Rudge OBE FEng FRSA	Director of Research and Technology, British Telecom plc
Dr David Smith	Consultant
Prof Sir Peter Swinnerton-Dyer FRS	Chairman, University Grants Committee

* joined since you last met ACOST

10 DOWNING STREET
LONDON SW1A 2AA

From the Private Secretary

MR. WOOLLEY
Cabinet Office

EVIDENCE TO THE HOUSE OF LORDS SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY ON 19 JANUARY

Thank you for your minute of 16 January enclosing briefing for the appearance by Sir Francis Tombs and Mr. Fairclough before the Select Committee. The Prime Minister is content with this briefing.

PAUL GRAY

17 January 1989

10 DOWNING STREET

LONDON SW1A 2AA

From the Principal Private Secretary

SIR ROBIN BUTLER

ACOST

The Prime Minister has seen your minute of 13 January. She found your summary of what the Government is trying to achieve through ACOST helpful though she did not necessarily subscribe to all the points made in it.

Against the point that significant savings are being made through the move out of near-market research she has commented that the savings in the energy field relate to very long term rather than near-market research. Against the point that some of the savings are being used to increase basic science, she commented that this was because what is called basic science has sometimes been applied science. Against the reference to IRCs she said she was doubtful about new structures. Finally, she has commented at paragraph 5, that some funds should be clearly set aside for "small" original researchers.

She has agreed that it would be useful to see Mr. Fairclough before the meetings with Sir Francis Tombs and ACOST in order to go over her objectives with him. I will now try and set up a meeting.

ANDREW TURNBULL

16 January 1989

Prime Minister

The material at A and B seems suitably cautious. Content with this briefing for the Tombs/Fairclough hearing?

RRC6 16/1

Ref. A089/129

MR GRAY

Evidence to the House of Lords Select Committee on Science and Technology on 19 January

You will recall that it was agreed last September that the evidence which Sir Francis Tombs gave to Select Committees in his capacity as Chairman of ACOST should be considered by you in advance. I therefore attach the list of questions which the House of Lords Select Committee on Science and Technology have indicated that they will wish to put to Sir Francis Tombs and to Mr Fairclough at their joint appearance before the Committee on 19 January, together with draft briefs for Mr Fairclough (Flag A) and Sir Francis Tombs (Flag B) to respond to them. The briefs have been cleared with Sir Robin Butler.

2. I should be grateful to know that you are content for these briefs to form the basis of Mr Fairclough's and Sir Francis Tombs' evidence.

Trevor Woolley

T A WOOLLEY

16 January 1989

SCIENCE AND TECHNOLOGY COMMITTEE
COMMITTEE OFFICE
HOUSE OF LORDS
LONDON SW1A 0PW
switchboard 01-219 3000
direct line 01-219 3218

10th January, 1989

Dear John

The Select Committee are looking forward to your evidence on Thursday, 19th January, at 11 a.m. The meeting will be in Committee Room 4b.

I enclose a list of possible questions for the meeting. They are directed to both you and Sir Francis Tombs indiscriminately. Lord Sherfield will encourage you to decide between yourselves who should make the running on individual questions. Some are obviously designed for only one of the two witnesses. On others the views of both of you would be appreciated. I hope this arrangement is acceptable.

As usual I can give no guarantee that the questions will actually follow the paper but I hope it will give useful guidance.

It is uncertain what action the Committee will wish to take by way of a report. At present the most likely outcome seems to be the publication of your evidence, together with that of Sir David Phillips and CEST, who follow you, with only limited comment by the Committee. A full-scale report is not anticipated.

If, following the meeting, there is any of your evidence which you prefer not to remain on the record, you will be given the opportunity to "side-line" it.

I am writing a similar letter to Sir Francis Tombs.

Yours ever
Clerk

P. D. G. HAYTER
Principal Clerk of Committees

John Fairclough, Esq.,
Chief Scientific Adviser,
Cabinet Office,
70 Whitehall,
LONDON. SW1A 2AS.

SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY

POSSIBLE QUESTIONS FOR SIR FRANCIS TOMBS AND JOHN FAIRCLOUGH

~~Tuesday~~ Thursday, 19th January 1989

1. What are the key details of the Chancellor's Autumn Statement for Civil R & D? In particular, how much of the money added to the Science Budget is new, and how much is transferred from other Departmental budgets supporting civil R & D?

2. Can we expect the next Public Expenditure Survey to show further evidence of the strengthened central consideration of science and technology priorities?

3. What is ACOST's method of working? Is it visible enough? How often has it met with the Prime Minister?

4. What is ACOST currently engaged on?

5. Will ACOST, following the example of the Japanese CST, try to elucidate the strategic goals for science and technology which Government, industry and academia wish to pursue?

6. What do you hope that CEST will achieve?

7. How much does the Cabinet Office contribute to CEST and why?

8. What is the trend in industrial spending on R & D, and how can it be encouraged to grow faster?

9. Ministers have occasionally misquoted the Select Committee, claiming that we said " The main responsibility for funding R & D rests with industry" whereas we actually said "The main responsibility for funding D rests with industry". Is the difference now accepted?

10. For civil R & D what consequences flow from the Prime Minister's statement to the Royal Society that "the health of the economy and the health of the environment are totally dependent on each other"?

11. Will the withdrawal of Government funding from near market research result in more funding of that research which, under the customer/contractor principle, Departments commission as proxy customer for the general public?

12. What advice do you give to Departments about the payment of an average 10% surcharge on Government commissioned research?

13. What are your views about the future of the Government's research establishments? Does the Government need them?

14. What emphasis in Government is being put on the evaluation of R & D, following the Assessment Office's discussions with all bodies involved in the public funding of R & D?

15. What changes in the Annual Review of Government Funded R & D are you contemplating?

16. How reliable are international statistics of R & D spending as a basis for comparison between countries?

17. Are you in favour of a rapid expansion of Interdisciplinary Research Centres? What main criteria should they meet?

18. Can the ABRC without executive power provide the strong management and decisions about priorities which the Research Councils need?

19. We see that the Chief Scientific Adviser's terms of reference (in Annex A of Cm 185) require him to "influence positively the economic contribution from Government spending on science and technology". What does this mean in practice?

DRAFT

BRIEF FOR JOHN FAIRCLOUGH'S EVIDENCE TO HOUSE OF LORDS SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY ON 19 JANUARY 1989.

1. **Q: What are the key details of the Chancellor's Autumn Statement for Civil R & D? In particular, how much of the money added to the Science Budget is new, and how much is transferred from other Departmental budgets supporting civil R & D?**

A: The Chancellor announced in his Autumn Statement that the balance of public support for science and technology would be altered within an increased total. Overall an extra £130 million has been added to planned spending on civil science and technology in 1989-90. This is all new money for science and technology. The main increase in allocation is for the DES's Science Budget - where the Advisory Board for the Research Councils advises on the distribution of the funds. The Science Budget increase is £95 million in 1989-90 which brings the total to 16% over the resources for 1988-89. This substantial increase reflects the importance the Government attaches to basic and strategic science and its policy of redeploying resources to these areas from those near to the market which are properly the responsibility of industry.

IF PRESSED: I regret I cannot provide further details on the settlements in the Autumn Statement; your Lordship may wish to address such questions to the Ministers concerned.

Supplementary Q: What information will the Public Expenditure White Paper provide on science and technology?

A: As with last year's Public Expenditure White Paper, this will provide information on the plans for 1990/1 and 1991/2 as well as giving greater details of individual Departmental plans for 1989/90.

Supplementary Q: Would the substantial increase in the Science Budget have been achieved without the strengthened central structure for

science and technology?

A: You will appreciate the long standing convention that I cannot comment on the structures for Ministerial decision taking. However the outcome in the recent Survey shows the Government's commitment to funding work of high scientific priority.

Supplementary Q: How does the 16% increase in the Science Budget announced in the Autumn Statement for 1988-89 to 1989-90 compare with previous plans?

A: Previous plans were for a 4% increase between 1988-89 and 1989-90.

Supplementary Q: How big an uplift has been given to the Science Budget by the Autumn Statement?

A: The new figure for 1989-90 is 13% higher than the planning figure set in the previous Public Expenditure Survey.

Supplementary Q: Have the civil science and technology totals for later years, ie after 1989-90, also been increased?

A: Provision for 1990-91 is £70 million higher than in the last White Paper (which of course did not cover 1991-92).

Supplementary Q: Does the provision rise over time?

A: Provision for civil science and technology in 1989-90 is £210 million higher than in 1988-89.

[You should be aware: The White Paper, which will be published shortly, will show total civil S & T declining even in cash terms after 1989-90. The figures for the three years from 1989-90 are £2,969 million, £2,930 million and £2,870 million. Excluding launch aid the figures would be broadly level in cash terms.]

Supplementary Q: Does this mean that the policy of withdrawing from

near market R&D has been abandoned and no such reductions have been made?

A: Within the totals there are a number of increases and decreases including the restructuring of energy and agriculture provision announced on 27 October and 1 November 1988 respectively.

Supplementary Q: Are the figures you have quoted in current prices? Will not much of the increase be eaten up by the faster rate of inflation now expected?

A: The figures are in cash terms and take account of the forecast of inflation published in the Autumn Statement. The increases are very substantial compared with any possible changes in inflationary expectations. The Science Budget figure for 1989-90 represents a real increase of 11% over 1988-89.

IF PRESSED: The planning figures for 1990-91 and 1991-92 will be subject to review in the Public Expenditure Survey in the normal way.

[Defensive briefing to be provided by DEn on decisions on fusion and fast reactor funding.]

2. Q: Can we expect the next Public Expenditure Survey to show further evidence of the strengthened central consideration of science and technology priorities?

A: You will appreciate the long standing convention that I cannot comment on the structures for Ministerial decision taking. However the outcome in the recent Survey shows the Government's commitment to funding work of high scientific priority. I am sure there will be plenty of speculation about the outcome of next year's Survey but we shall all, including myself, have to wait and see.

[Note that no details can be given on the Cabinet Committee Structure.]

[Sir Francis Tombs to answer in relation to ACOST's role in advising on priorities.]

3. **Q: What is ACOST's method of working? Is it visible enough? How often has it met with the Prime Minister?**

A: [Sir Francis Tombs to answer]

Supplementary Q: Are there problems in reconciling your position as Chief Scientific Adviser with membership of ACOST?

A: I am in fact an assessor on ACOST rather than a member. This enables me to fulfil the remit defined for me in the White Paper of acting as a link between ACOST and the Government.

IF PRESSED: Although the White Paper said I would be a member I have concluded with Sir Francis Tombs that the present arrangement is more appropriate.

4. **Q: What is ACOST currently engaged on?**

A: [Sir Francis tombs to answer]

5. **Q: Will ACOST, following the example of the Japanese CST, try to elucidate the strategic goals for science and technology which Government, industry and academia wish to pursue?**

A: [Sir Francis Tombs to answer]

6. **Q: What do you hope that CEST will achieve?**

A: [Sir Francis Tombs will answer as CEST arose from ACARD]

7. **Q: How much does the Cabinet Office contribute to CEST and why?**

A: The major part of the £1million which the Government is contributing to CEST over five years is provided equally by the Departments of Trade and Industry, and Education and Science. The Cabinet Office is contributing £200,000 in order to enable ACOST to participate in CEST activities on a similar basis to founder member companies.

[Sir Francis Tombs to answer]

8. **Q: What is the trend in industrial spending on R & D, and how can it be encouraged to grow faster?**

A: Between 1981 and 1986 expenditure on R&D performed by industry increased by some 13% in real terms. [Over this period the percentage of expenditure on R&D performed by industry and funded by them increased but in 1986 it was still less than 2/3, the remainder coming from government and overseas sources. This compares unfavourably with most of our industrial competitors.] **[To be checked]** Industry must take primary responsibility for funding the R&D which it itself performs. As the DTI White Paper on Enterprise made clear last year the Government's role is to create an economic climate which encourages firms to spend on R&D. Industry profitablility in 1987 was the best since 1969. Businesses are therefore better placed to invest in future commercial success, including innovation and the exploitation of science and technology, than they have been for years.

[Sir Francis Tombs to answer in respect of ACOST views.]

Supplementary Q: Despite the recent increases in industrial spending on R & D the UK performance still compares unafavourably with other nations. Should the Government provide further tax incentives for industrial R & D or require companies to disclose their R & D expenditure?

A: The Government's view of tax incentives for R & D was set out in the 1987 White Paper on Civil R & D, namely that the average cost-effectiveness of such incentives is low. On disclosure the Government welcomes the recent decision by the 6 members of the Consultative Committee of Accountancy Bodies to approve a new accounting standard on the treatment of expenditure on R & D. The new standard will require all public limited companies and very large private companies to disclose their expenditure on R & D in their annual report and accounts.

9. **Q: Ministers have occasionally misquoted the Select Committee, claiming that we said "The main responsibility for funding R & D rests with industry" whereas we actually said "The main responsibility for funding D rests with industry". Is the difference now accepted?**

A: The Government agrees with the Select Committee that the main responsibility for funding D rests with industry. The Prime Minister confirmed this in her recent speech to the Royal Society when she said that "the commercial development of scientific principles should mainly be the task of industry" - this of course includes both D and R with a commercial application. As a corollary she also said that "the nation as a whole must support the discovery of basic scientific knowledge through Government finance."

10. **Q:For civil R & D what consequences flow from the Prime Minister's statement to the Royal Society that "the health of the economy and the health of the environment are totally dependent on each other"?**

A: Civil R & D has an important role to play in understanding the causes of environmental changes, assessing their impacts on society and the economy, and in helping to identify appropriate responses so that we can minimise the adverse effects of these changes. In many cases such R&D will most effectively be pursued at the international level. Environmental

research will benefit from some of the additional resources for science announced in the Autumn Statement.

[Sir Francis Tombs to answer in respect of ACOST views.]

Supplementary Q: Will this lead to additional expenditure on civil R & D?

A: The pattern of expenditure will inevitably change as priorities change over time. However what impact this will have on total expenditure on civil R & D will depend upon the outcome of future Public Expenditure Surveys.

11. **Q:Will the withdrawal of Government funding from near market research result in more funding of that research which, under the customer/contractor principle, Departments commission as proxy customer for the general public?**

A:Departments will each determine, in the context of the Public Expenditure Survey, what R & D they require to support them in meeting their overall objectives. In some areas - development of policy, procurement and statutory duties - the Departments are true customers of R & D although acting ultimately for the general public. The Department of Education and Science - through the UGC and the Research Councils - are also acting on behalf of the general public in their support of basic science and the Secretary of State announced last November that the substantial increase in the Science Budget reflected both the importance the Government attaches to basic and strategic policy and the Government's policy of redeploying resources to these areas from those near to the market.

Supplementary Q: What is the definition of near market R & D?

A: In her Royal Society speech the Prime Minister used the description "the commercial development of scientific principles".

12. Q:What advice do you give to Departments about the payment of an average 10 per cent surcharge on Government commissioned research?

A:I have not given any advice to Departments about the payment of a surcharge on Government commissioned research. Indeed Lord Rothschild recommended that arrangements should be left to departmental controllers of R & D, not centrally defined or controlled. Departments have therefore evolved different arrangements with their research contractors.

[Sir Francis Tombs to add that ACOST has not given any advice to Departments on this either.]

13. Q:What are your views about the future of the Government's research establishments? Does the Government need them?

A:I can only speak in general terms. The future of individual Government Research Establishments is of course a matter for the particular Ministers concerned. However, technological issues are pervasive - impacting upon all areas of national life. Government needs a reliable source of expert scientific research and technical advice to inform its policy making and procurement decisions. The Research Establishments are well placed to act as a source of such advice and to provide a supply of staff for headquarters functions where relevant technical insight is required. Further, particular Departments have duties placed upon them by statute which require access to scientific research and service facilities which for reasons of national security or impartiality cannot readily be provided by external sources.

[Sir Francis Tombs to answer]

Supplementary Q: Why cannot most, if not all, of the activities currently undertaken by Government Research Establishments be undertaken by the private sector?

A: There will always be a core of activities which, for reasons of national security and/or the need to maintain impartiality, Government

will judge need to be undertaken in-house. However, wherever possible Government already seeks to contract-out the supply of research and development, and scientific and techical support services to the private sector.

Supplementary Q: Should the Government Research Establishments be set up as Next Step Agencies with a view to eventual privatisation?

A: Decisions on privatisation of particular Research Establishments are matters for the responsible Ministers. The question of whether particular Establishments should be set up as Next Steps Agencies is a separate issue related to obtaining better value for money from facilities that already exist.

Supplementary Q: Will all Government Research Establishments become Next Steps Agencies?

A: That is a question for individual Ministers. However, as all Government activities are currently being reviewed to establish their suitability for being conducted under Agency arrangements this encompasses the Research Establishments. Indeed, I understand that some Departments (MOD, DTI, DOE) have already declared some or all of their research establishments as agency candidates.

14. **Q:What emphasis in Government is being put on the evaluation of R&D, following the Assessment Office's discussions with all bodies involved in the public funding of R&D?**

A:There is no doubt that Departments are putting more effort into the evaluation of R&D and this is due in part to the work of the Assessment Office. The Assessment Office spent its first year taking part in the existing range of assessment activities undertaken by Departments. It has prepared confidential reports commenting on the strengths and weaknesses of these arrangements and making recommendations for improvements. Its task in the second year is to work with Departments in implementing jointly agreed improvements. Its role is to encourage and spread best

practice, and it has provided a forum for information exchange between Departments. It is also engaged in training activities, contributing to courses arranged by the Civil Service College or by the individual Departments. It is also planning to publish a handbook on guidelines for R&D assessment.

Supplementary Q: Does this apply to all bodies in public funding of R&D? What about Research Councils and Universities?

A: The Assessment Office has concentrated first on the major R&D spending Departments. It has also looked at assessment procedures in the Research Councils and Universities but has not yet formulated specific recommendations. It is also engaged in observing the existing assessment activities of the smaller R&D spending Departments - DH, DOE and DTp.

Supplementary Q: Are Departments devoting the 1% to assessment recommended in our earlier report?

A: In offering recommendations for the future, the Assessment Office has taken account of the amount of resource going into assessment as well as the way it is organised. The way in which the total effort is brought together - the decision taking before work commences, in management and monitoring, and its evaluation afterwards - is as important as the amount of resource involved.

Supplementary Q: What are the main recommendations for Departments from the Assessment Office?

A: The detailed points are of course confidential. The Assessment Office needs to have a relationship of trust with Departments. It does not have an external audit function. In general the Assessment Office has found all Departments contribute substantial effort to R&D assessment but all have some gaps. There are weaknesses in ex post evaluation in some Departments, and in ex ante appraisal of programmes in others.

15. **Q:What changes in the Annual Review of Government Funded R&D are you contemplating?**

A:The Chancellor of the Exchequer put forward proposals last May in the White Paper on Financial Reporting to Parliament for restructuring the Autumn Statement and Public Expenditure White Paper (PEWP). The 1989 PEWP will be published as usual early this year but its role will be principally to spell out the details of individual departmental programmes. The individual chapters will be published in separate volumes. This will provide a stepping stone to the eventual production of departmental reports, which will replace the PEWP. As proposals for these departmental reports are further developed I shall consider whether it would be appropriate to make significant changes in the format and/or content of the Annual Review of Government Funded R&D. It is too early, however, to indicate what the changes may be. I should though welcome any proposals for changes which your Lordships may wish to provide.

[Sir Francis Tombs to give ACOST views]

Supplementary Q: Are there any changes envisaged before the new format of the PEWP emerges?

A: the Annual Review will, from 1989, be providing complete coverage of the expenditure on science and techology detailed in the 1989 Public Expenditure White Paper. In past years the Annual Review has concentrated on the R&D part.

16. **Q:How reliable are international statistics of R&D spending as a basis for comparison between countries?**

A: The most widely quoted and reliable statistics for international comparisons of R & D activity are undoubtedly those produced by the OECD. Unlike EC statistics, which record only budgeted R & D expenditure, the bulk of OECD data is actual expenditure reported by member countries and may be revised as more accurate figures become available. Inevitably OECD

figures for the most interesting recent years are sometimes provisional and may not be comprehensive. Though all the R & D statistics collected by member countries and reported to the OECD are broadly in accordance with the agreed criteria, national practices do vary to some extent. These differences are generally small and have little affect on the main statistics commonly used, but care does need to be exercised particularly in making more detailed international comparisons. The OECD and member countries are conscious of the need to improve the statistics and will be updating over the next year or so the definitions of research expenditure that the OECD use.

[Sir Francis Tombs to answer in relation to ACOST International Committee]

Supplementary Q: Can the OECD statistics be used to make satisfactory comparisons of both total expenditure and that on specific categories?

A: While comparisons of total expenditure are more reliable than those of the finer subdivisions, it is extremely difficult to ensure the comparisons are truly of like with like. Misleading conclusions may therefore result.

17. **Q:Are you in favour of a rapid expansion of Interdisciplinary Research Centres? What main criteria should they meet?**

A:The rate of expansion of Interdisciplinary Research Centres and the main criteria which they should meet are the responsibility of the Secretary of State for Education and Science advised by the Advisory Board for the Research Councils. Your Lordships will wish to discuss IRCs with Sir David Phillips next week. However, I can say that I welcome the important start that has been made in establishing IRCs - eight have been established or are in the process of being established.

IF PRESSED: As a member of the ABRC I am, of course, involved in their advisory process for IRCs but I regret I am unable to comment on the advice which I provide.

[Sir Francis Tombs to give ACOST views]

Supplementary Q: Is your position as a member of the ABRC compatible with your being a civil servant?

A: Appointments to the ABRC are a matter for the Secretary of State for Education and Science. I was invited to be a member in my capacity as Chief Scientific Adviser, as was my predecessor.

18. **Q:Can the ABRC without executive power provide the strong management and decisions about priorities which the Research Councils need?**

A:An advisory body can be powerful where its advice is accepted, particularly of course where this involves the power of the purse. The ABRC's advice has been regularly accepted by the Secretary of State for Education and Science. I am well aware of the increasing pressure for change in the role of the ABRC. However I hope you will understand if I suggest this is a question which your Lordship should explore with Sir David Phillips.

[Sir Francis Tombs to answer.]

19. **Q:We see that the Chief Scientific Adviser's terms of reference (in Annex A of Cmd 185) require him to "influence positively the economic contribution from Government spending on science and technology". What does this mean in practice?**

A:This means in practice that in advising the Prime Minister and Ministers my broad objective is to increase the contribution of Government funded R&D to the efficiency, competitiveness and innovative capacity of the economy. I do not interpret this remit in a narrow short-term sense as this would imply a bias against basic science where economic rewards cannot be judged by immediate results. As the Prime Minister commented to

the Royal Society the value of Faraday's work today must be higher than the capitalisation of all the shares on the Stock Exchange.

DRAFT BRIEF FOR SIR FRANCIS TOMBS' EVIDENCE TO HOUSE OF LORDS SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY ON 19 JANUARY 1989

1. Q: **What are the key details of the Chancellor's Autumn Statement for Civil R & D; In particular, how much of the money added to the Science Budget is new, and how much is transferred from other Departmental budgets supporting civil R & D?**

   A: (For CSA)

2. Q: **Can we expect the next Public Expenditure Survey to show futher evidence of the strengthened central consideration of science and technology priorities?**

   A: ACOST provides an annual advice to the Government on national priorities for science and technology. This covers policy issues as well as specific scientific and technological fields which the Council considers to be of importance to the UK's economic future well-being. The advice is given in confidence to the Prime Minister and I cannot divulge details to you but I understand that the ACOST advice on priorities is taken into account in Departmental expenditure provisions as stated by the White Paper on Civil Research and Development (Cm 185).

   Supplementary Q: What evidence have you that this advice has had effect on Government policy?

   A: I am satisfied that ACOST advice has been considered appropriately.

3. Q: **What is ACOST's method of working? Is is visible enough? How often has it met with the Prime Minister?**

   A: ACOST has evolved from ACARD by increasing the number of members with scientific interests and constituencies. The present Council has 18 members (excluding the Chairman) of which 9 are academics 6 are industrialists, 2 are independents but with industrial background and

one is an economist. The relationsip with other advisory councils and boards is achieved through ex-officio membership of ACOST from the University Grants Committee, the Advisory Board for the Research Councils and also by the presence of assessors at Council meetings.

The Council meets 6 or 7 times a year. There are 4 standing committees and one working group. The Prime Minister has attended one meeting and is expected to attend another in February. The Council is well known both nationally and internationally. Some of our reports are published, for example those on Sizewell and the UK opto-electronics industry and others will follow.

Supplementary Q: What effects outside government have the reports had?

A: They have stimulated discussion and reassessment. For example ACARD's report on Exploitable Areas of Science led to the formation of CEST. Also there is a reorientation in the optoelectronics industry following our analysis of the industry and its technological capabilities. Similarly reports on the software industry and on the medical equipment industry have provoked a reconsideration of the UK position in these important industries.

4. Q: **What is ACOST currently engaged on?**

A: Our current interests are a review of national priorities, international cooperation, manpower and training, emerging technologies, barriers to growth and global environment. We have Committees and Working Groups studying these subjects.

Supplementary Q: What is happening to the Defence R & D Report?

A: The report was completed and approved by ACOST a few weeks ago. It is being considered by the Government and we are awaiting their response.

5.Q: **Will ACOST, following the example of the Japanese CST, try to elucidate the strategic goals for science and technology which Government, industry and academia wish to pursue?**

A: ACOST has a different role to the Council for Science and Technology of Japan. I understand the CST is chaired by the Prime Minister of Japan and has 4 Cabinet Ministers as members as well as independent members. The usual consensus gathering in Japanese government means that when reports reach the council they have already been considered by Government Ministers.

In contrast, ACOST has a more independent role. Much of its work is on its own initiative. ACOST's reports, while often covering similar topics to those of the CST, usually provideadvice to the Prime Minister before there is consideration by government departments. We do of course find it helpful to have views from Departmental assessors on Council and its Committees and take these into account in framing our advice. Our work is concerned with the elucidation of national priorities and ACOST is contributing to the national debate on policies and technical areas for the future.

6. Q: **What do you hope that CEST will achieve?**

A: CEST was set up as a consequence of the findings of ACARD in its report Exploitable Areas of Science. The budget is something like £5.5m over 5 years and £1m is from Government (of which £200,000 over 5 years will come from the Cabinet Office). The aim is to identify markets and areas of industrial technology and science which present new or improved opportunities for British industry. I hope that CEST will provide the

link between research and exploitation by identifyng new markets and providing its 'customers' with new opportunities. An essential part of this will be the integration of basic science in the universities and polytechnics and industrial development. We have too often been accused of squandering the brilliant ideas of our original thinkers. I expect CEST, in a modest way to begin with, will change that.

Supplementary A: Organisations like CEST have been around in many countries for many years. Why will CEST be special?

A: Because it is over 80% funded by the private sector with the private sector interests predominant on its Council and a commitment to improving the situation which we all feel has gone on far too long; also CEST will widen the debate and consensus in Britain on which direction we should take in the future.

7. Q: **How much does the Cabinet office contribute to CEST and why?**

A: The Cabinet Office contribution to CEST enables ACOST to play an important role in the Centre's activities. I am a member of the Council and can see the benefits of a close connection between ACOST's studies and the implementation of some of their findings through CEST. We have asked CEST to look at some aspects of space exploitation and I expect there will be other opportunities to link them with us effectively.

8. Q: **What is the trend in industrial spending on R & D, and how can it be encouraged to grow faster?**

A: The trend in increasing industrial commitment to R & D is very welcome and meets ACOST's wishes. Growth will increase with further improvement in industrial performance, particularly in full competition between companies within and outside the UK.

Supplementary Q: Are companies being encouraged to publish their expenditure on R & D?

A: The six members of the Consultative Committee of Accountancy Bodies have approved a recommendation that all public limited companies and very large private companies should publish a statement on R & D expenditure in their annual report and accounts. ACOST welcomes this but would like to see how it works in practice.

9. Q: **Ministers have occasionally misquoted the Select Committee, claiming that we said "The main responsibility for funding R & D rests with industry" whereas we actually said "The main responsibility for funding D rests with industry". Is the difference now accepted?**

A: (For CSA).

10.Q: **For civil R & D what consequences flow from the Prime Minster's statement to the Royal Society that "the health of the economy and the health of the environment are totally dependent on each other".**

A: ACOST is currently studying the implications of environmental changes. These are both a threat and an opportunity for British industry, for example the development of substitutes for pollutants and new equipment, as well as devising new infrastructure systems and agriculture. We believe that in research the British role has to be an international one. ACOST's views are being formulated but are not yet finalised.

11.Q: **Will the withdrawal of government funding from near market research result in more funding of that research which, under the customer/contractor principle, Departments commission as proxy custmer for the general public?**

A: (For CSA).

12.Q: **What advice do you give to Departments about the payment of an average 10 per cent surcharge on Government commissioned research?**

A: ACOST has not discussed this topic and therefore I have no comment.

13.Q: **What are your views about the future of the Government's research establishments? Does the Government need them?**

A: ACOST has considered from time to time in its studies the role of government research establishments, most recently in the report on Defence R & D. However I cannot comment on this any further as their management is the Government's responsibility. I believe that there are aspects of government such as standards and safety, which require it to have its own research facilities.

14.Q: **What emphasis in government is being put on the evaluation of R & D, following the Assessment Office's discussions with all bodies involved in the public funding of R & D?**

A: (For CSA).

15.Q: **What changes in the Annual Review of Government Funded R & D are you contemplating?**

A: ACOST will review government funded R & D as part of its priorities deliberations. For this it relies on the Annual Review and may make suggestions for changes in it. This is still under discussion and I cannot tell you how far we have progressed.

16.Q: **How reliable are international statistics of R & D spending as a basis for comparison between countries?**

A: ACOST does not itself gather statistics on R & D but makes use of those provided by the government, OECD and other agencies. In my view comparisons of like with like are extremely difficult and this may result in misleading conclusions.

17.Q: **Are you in favour of a rapid expansion of Interdisciplinary Research Centres? What main criteria should they meet?**

A: ACOST has supported the principle of the IRCs and has reviewed progress in one of them. Whether or not the rate of setting up IRCs should be increased is a matter for the ABRC, the Research Councils and the DES, but it is important that decisions take account fully of their need and potential role as centres of excellence with close involvement of industry.

18.Q: **Can the ABRC without executive power provide the strong management and decisions abour priorities which the Research Councils need?**

A: I am a member of ABRC and support the enquiry by Mr Richard Morris on boundary problems between RCs and how this may affect ABRC. Until we have seen and considered this fully I cannot comment on any changes which may or may not be appropriate in the role of ABRC.

Prime Minister (1)

(i) Agree to see John Fairclough before meetings with Tombs and ACOST. He is only Chief Scientist we have got for time being and if he is to be effective he needs to know, from you, how you think.

(ii) Agree Sir Robin's view on way forward to ACOST?

Yes

AT 13/1

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PRIME MINISTER

More anon

ACOST

It may be helpful if I set down the points I made this morning. Since I have done so without consulting John Fairclough, please allow for the fact that I am not expert on these matters.

2. The Government - you, John Fairclough and ACOST - are struggling to make a big change in the Government's R and D priorities; and by past standards big changes are being made -

An important decision has been made to take the Government out of near market research and significant savings are being made from DTI, agriculture and energy; a cap has also been placed on defence;

The savings on energy research are different ie longer long rather than near market.

some of the savings are being used to increase basic science; [this is because what is called basic science has sometimes been applied science

at the applied end, more research is being established in IRCs to bring research and industry more closely together and to make research more purposeful; One doubtful about new structures.

ACOST has identified some key areas which it has recommended for research, viz advanced materials (polymers, ceramics, high temperature superconductivity, surfaces and interfaces); biotechnology (the human genome);

FRBARD

communication and control (optoelectronics and millimetre waves). It has recommended some of these as suitable for IRCs but these recommendations are not mandatory.

3. ACOST are also closing reports on other aspects of science - barriers to growth, European framework programme, informal scientific collaboration, Eureka - and is proposing others.

4. The question is: how does this differ from what you want ACOST to do? I think that they are trying to a) identify priorities; b) help in getting a shift in the pattern of Government funding; c) offer advice on key scientific issues of the day. They are not, in my view, 'picking winners' in the sense of super-imposing their views on those of the scientists and enforcing their views by the allocation of funds: they are recommending priorities and encouraging industry and research to come closer together with a more deliberate aim.

5. Perhaps one point which you will want to put to John Fairclough is that you would like advice on where the good teams are so that the Government can back the teams, not the projects. And another point which I detect is that you want the process to be less bureaucratic than it appears to be - less Committees and paper, more action. And some sum clearly set aside for "small" original research.

6. At all events, in my view, both John Fairclough and ACOST want very much to help in the direction you want to go - and big changes are being made. I should like to suggest that you see John Fairclough and talk through all this with him - he is certainly eager to have your guidance - as a preparation for the talk you are to have with him and Francis Tombs.

Patrick Turner
for
ROBIN BUTLER

13 January 1989

Approved by the Cabinet Secretary and signed in his absence

ERBARD

PRIME MINISTER

12 January 1989

ACOST

At our meeting earlier this week, you expressed your concerns about Government policy on science and in particular on the role of ACOST. You were also worried that, by championing basic science and totally renouncing near market research, Government may further harm the nation's competitiveness. My belief is that we have already done harm to British innovation by removing much of the R&D burden from industry since the war. That which is not paid for, or earned, is rarely valued and the poor status of engineers today is in part because industry has not had to pay for and nurture them in order to stay ahead in the market place.

Meanwhile, the engineers and would be technical innovators have formed cabals whose prime purpose is to get money out of Government for technical research. They drew more sympathy from organisations like the DTI and the DES than from their own industrial masters on the boards of companies like Vickers and GEC. That is why it is now considered automatic for Government to finance the domestic development of new weaponry, notwithstanding the availability of a proven foreign alternative. We have just seen this with the ultimate MOD recommendation on tanks as indeed we saw it with Nimrod. Vickers were not prepared to invest £80m of their own development funds in order to secure a £2bn Government order!

This philosophy has led to the Alvey programmes, to Inmos , and to the billions of pounds that have gone on industrial support over the past decades. Unless the managements of our businesses face the raw, real forces of competition, and

accept that they cannot win without developing and paying for technical research themselves, Britain will continue to underperform.

It is a vicious circle. The more Government featherbeds technical research, the less top management will value it and the lower our innovative standing will be. Those in ACOST and ABRC and the endless quangos who lobby Government for technical support will continue to present this as evidence that more money is needed. The cure has been exacerbating the illness!

It is healthy that Government has now turned from this policy. Nevertheless, sufficient lobbyists remain in key roles, including the Chairman and much of the membership of ACOST, that I do not think you need fear that we shall throw the baby out with the bath water. There will continue to be enormous pressure, originating in industry for technical expenditure by HMG. As before, it will be voiced through organisations like ACOST, ABRC and the DTI.

Among the basic science community your standing is extremely high. You are regarded as an ally against the forces of bureaucracy and centralisation which the Financial Times' article points out. In your discussion with Sir Robin Butler, and subsequently with John Fairclough and Sir Francis Tombs prior to the ACOST meeting on 1 February, all you need do is indicate to them that you expect ACOST to give advice on issues relating to basic science, including measures of value for money, and to remind it that its brief is not exclusively technology and "making Britain internationally competitive".

Over time the membership of ACOST should include more young successful scientists from basic fields as well as economists and technocrats. It might even be appropriate to have more "working" members of ACOST drawn from a younger

group to augment the executive work currently being done by economists and non-scientists in the Cabinet Office.
You need not be too severe on IRCs because your doubts were clearly expressed at the May E(ST). But you should emphasise that structures do not produce results - only people can do that. Furthermore the principle that the more market orientated the work of the IRC the greater should be the proportion of industrial funding, must be hammered home.

We have all fallen into a logical type confusion about 'picking winners'. What we should foreswear is the picking of winners by ranking the potential economic benefit of basic work such as thermonuclear fusion. We shall always have to pick individuals and decide how their efforts can best be financed. It is this kind of individual winner that you need to see rather than the detailed work of project teams at ACOST.

GEORGE GUISE

SW2AQK

IN CONFIDENCE

NOTE FOR THE RECORD

ACOST

The Prime Minister had a discussion with George Guise (Policy Unit) this afternoon about the work programme for ACOST. The papers available were John Fairclough's minute to the Prime Minister of 11 November together with Policy Unit comments.

The Prime Minister expressed concern that the ACOST machinery was not working as she wished. She saw its main role as providing advice to Government on broad priorities for science and technology but she was concerned from the recent papers that it was reverting to the practice of trying to pick winners.

After a brief discussion, the Prime Minister said that she wished to give further thought as to how best to handle the ACOST meeting she would be chairing on 1 February and the briefing meeting prior to that. It was noted that the diary currently provided for a joint briefing meeting with Sir Francis Tombs and John Fairclough about a week before the ACOST meeting. But the Prime Minister also wished to have an early word with Sir Robin Butler about her concerns in this area, and then to consider the possibility of a separate discussion with John Fairclough in advance of the combined Tombs/Fairclough meeting presently planned.

PRCC.

(PAUL GRAY)
10 January 1988

cc AT

IN CONFIDENCE

10 DOWNING STREET

PRIME MINISTER

You saw this file over the weekend, but you may just want to glance at George Guise's further note at Flag C.

RLCG
9/1

cc BJ/JP

CONFIDENTIAL

PRIME MINISTER

ACOST - DISCUSSION WITH GEORGE GUISE

You will recall that you were to have attended a meeting of ACOST on 14 December. This was cancelled because of the expected Gorbachev visit. The ACOST meeting is now rescheduled for 1 February.

As preparation for the original scheduled December meeting John Fairclough sent you a minute on 11 November (Flag A) setting out his ideas for future ACOST activity. George Guise (Flag B) commented critically on the Fairclough proposals in his minute of 15 November. You commented that "ACOST isn't working" and said you wanted to have a talk to George Guise in advance of a pre-ACOST discussion with Francis Tombs and John Fairclough.

The meeting with George Guise takes place next Tuesday, 10 January. Over the weekend you may like to refresh your memory of the earlier papers. In addition, you may like to glance at George's further minute and attachments dated 1 January (at Flag C).

You will want to talk through the issues with George and decide on your strategy for handling the ACOST meeting and your pre-ACOST discussions with Tombs and Fairclough. At the moment we have a joint session with Tombs and Fairclough scheduled for 26 January; you will want to consider whether also to respond to John Fairclough's request for a separate meeting with you first.

PAUL GRAY
6 January 1988
KK1AJF

* Prime Minister
I have one reservation on George's otherwise excellent note. On page 5 he implies that agencies should be set up only where privatisation is the ultimate goal. My understanding of Next Steps is that it is principally a way of managing better what, for the foreseeable future, will remain in Government. George's approach would stop the movement to agencies in its tracks.

AT 6/1

CONFIDENTIAL

GGGuise

PAUL GRAY

1 January 1989

MEETING WITH THE PRIME MINISTER ON 10 JANUARY

In addition to my previously submitted note on ACOST dated 15 November, you might show the PM two attached papers.

The Times article is polemical but it does illustrate how the centralisation and exploitability instincts of organisations like the ABRC and, by implication, ACOST contrast with the PM's own beliefs.

The second is a private note from Kumah Bhattacharyya warning against the drive for IRCs, particularly in combination with a SERC of the present size and engineering bias. It is ironical that a leading engineering academic should make the point so forcibly. Indeed, it has always been his philosophy that the funding of engineering should come predominantly from industry. The success of his department at Warwick in attracting non government funding illustrates this.

GEORGE GUISE

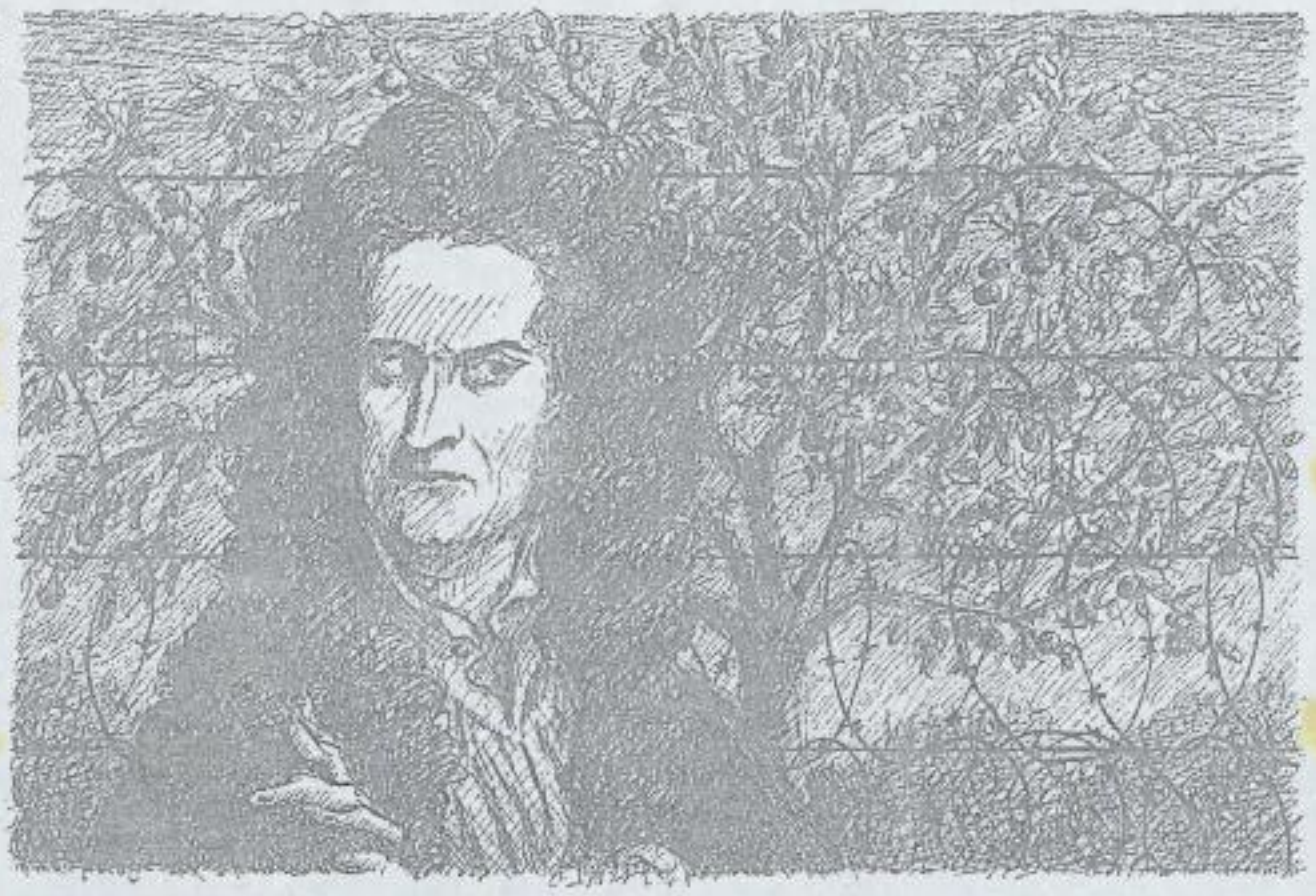
CONFIDENTIAL

Michael Prowse on the debate over Britain's priorities in scientific research

Why bigger may not be better

"We should support those teams, however small, which can demonstrate the intellectual flair and leadership which is driven by intense curiosity and dedication."

Margaret Thatcher at the Royal Society September 1988



The Prime Minister's professed support for small-scale, curiosity-driven research must be provoking hollow laughter in Britain's scientific community. Just about every policy initiative launched in recent years has favoured big teams, "exploitable" science and "directed" research projects.

Indeed, the big is beautiful mentality is arguably as well established in British science today as it was in industry in the late 1960s. So is the notion that committees of wise men can sensibly determine priorities. Anyone who doubts this need look no further than A Strategy for the Science Base – the key policy document published by the Advisory Board for the Research Councils in 1987.

The following sentences are typical of the flavour of this technocratic report:

- "There is a lack of purposeful direction, nationally, in the redeployment of research effort, both between and within institutions."
- "We need to make the transition from a widely-distributed university research base to a system in which fewer centres are equipped to world class standards."
- "Standing back, the development of selectivity and more directive management can be seen as the inevitable response to the challenge of managing science."

The Advisory Board has not had all its wishes granted. Mr Kenneth Baker, the Education Secretary, has fought shy of formally segregating universities into three classes: R (capable of substantial research); T (capable of teaching and "scholarship" only); and X (capable of limited research). But virtually everything else seems to be going through.

The report called for the establishment of big interdisciplinary research centres (IRCs), independent of the universities and thus more susceptible to "positive" management by officials via the research councils. These were intended to bring UK research in specified fields of exploitable science up to "world class" standards. The first, on warm superconductivity, has just been opened in Cambridge. Many more are planned.

The goal of increasing the proportion of directed research is also being achieved by a shift in research council funding from support for small projects (often involving only a few talented individuals) to programme grants for large research groups. These are "inherently more susceptible to strategic articulation" and "easier to monitor and review." A parallel shift from funding research through university block grants to funding via research councils is another means of tightening central control.

A Strategy for the Science Base called for greater emphasis on "exploitability" and greater involvement of businessmen in setting scientific priorities. The Centre for the Exploitation of Science and Technology has accordingly been launched. It is not, of course, supposed to pick winners, but it apparently hopes to identify opportunities for IRCs. One of the businessmen who helped raise industrial finance for the centre even expressed his hope that it would play the role of Japan's Ministry of International Trade and Industry.

Industrialists are exerting influence in other ways. They are heavily represented on the new Universities Funding Council. This will impose much tighter controls on academics than the existing University Grants Committee. Businessmen also sit on the Advisory Council on Science and Technology (Acost), the key central committee set up to establish priorities for British science.

While not calling for a restructuring of the five main research councils, the report did rehearse arguments for rationalisation and "more executive authority at the centre." Plans are now afoot to create a single large Biological Research Council by merging two small councils concerned with agriculture and food, and the environment.

Some would go further still. Sir David Phillips, the Oxford molecular biophysicist who chairs the Advisory Board for the Research Councils (and who, with Mr John Fairclough of the Cabinet Office, was the driving force behind the new science policy), would like to merge all five councils. A National Science Foundation, along US lines, is "very much a runner in the longer term," he says.

Above all, the 1987 strategy document called for concentration of university research efforts. The R, T, X formula may be technically dead, but the proposals for the rationalisation of physics and chemistry departments are very much alive. Review bodies established by the University Grants Committee last month called for the closure of many small departments.

Neither Sir Sam Edwards, chairman of the physics review, nor Professor F.G.A. Stone, chairman of the chemistry review, saw much merit in Mrs Thatcher's concept of supporting creative teams, "however small". According to Sir Sam, mergers are "inevitable and advantageous." Physics "would emerge stronger from concentrating staff and students into fewer universities" and the UK would be better able to provide a "range of internationally competitive research."

Both these reviews concluded, mysteriously, that departments must contain at least 20 staff and 200 students to be viable, figures apparently plucked from the air; certainly no detailed attempt has been made to justify them. Six of the 15 top university departments in terms of research earnings are inefficiently small by this artificial criterion.

The rationale for concentrating scientific resources and establishing tighter control at the centre runs roughly as follows. Britain is a small country and cannot afford to spend much on science. Yet both the number of opportunities for research and the cost of doing "frontier" science are escalating rapidly. Therefore the UK must be selective in the science it supports and strive where possible to spread equipment costs over large numbers of researchers.

Mr Ben Martin of the Science Policy Research Unit in Sussex strongly supports the thrust of present policies. "I suspect the answer is that we don't need 50 physics departments," he says. "Either you impoverish everybody or you let some have the equipment to do frontier physics."

"Britain," he says, "must adopt a more selective approach to research." He points out that Sweden recognised the need to concentrate its resources more than a decade ago and has been successfully identifying scientific priorities ever since. Even the US, despite its vast science budget, is having to make hard choices. Thus the UK's future lies in swallowing its pride and locating fields of research where "we have clear comparative advantages in terms of industrial applications." In Britain this means chemicals and pharmaceuticals.

But some scientists and economists are sceptical of this conventional wisdom. Professor Denis Noble, Oxford physiologist and founder of the pressure group Save British Science, says the "big is beautiful" argument is "only a quarter true but has been made into a whole truth." He accepts that some scientific research requires "quite massive funding" but argues that "it is a total over-reaction to this problem to try to close 20-odd departments." He points out that separate research groups can share facilities (and thus reap economies of scale) without merging and losing their independence.

He maintains it is impossible to predict where excellence will emerge. "Nobody would have expected Dundee to have one of the best biochemistry departments in the country. Yet it has been transformed by the efforts of a single creative individual."

Dr David Edgerton of the Centre for the History of Science, Technology and Medicine at Manchester takes an even stronger line. He argues that the twin policies of selectivity and centralisation are evidence of a "naive technocratic" bias on the part of a government which professes to believe in markets and freedom.

In a recent paper, written jointly with Dr Kirsty Hughes, he argues that the supporters of A Strategy for the Science Base are "seeking to smuggle in a 1960s-type modernisation" and want to "organise the nation's science for battle with the science of other nations." But the promotion of national champions in science fails to recognise that "it is firms not nations that compete with each other."

Nobody has provided any sort of empirical justification for concentrating resources or merging facilities, he says, pointing out that there is a lot of woolly thinking about costs. "What does it mean to say costs are rising," he asks. "Is it cost per innovation? Does it mean that fixed and variable costs costs have gone up, but the value of research output has also gone up? If so, then the costs are being recouped."

In any case, he argues, if there is an accelerating growth of scientific opportunities, it is not obvious that concentration of resources is the sensible strategy. Thus, if previously there were 2,000 paths and UK research followed 200, now, with 10,000 paths, it may not be possible to follow 1,000. "It would seem perverse, though, to cut the number of paths to 100 in response to the increased diversity."

Dr Donald Braben, head of venture research at BP, is an equally passionate advocate of diversity. "Current proposals for rationalisation will have a corrosive effect, and may inflict lasting damage," he warns. "The more you concentrate, focus and select," he says, "the less flexibility you have and the more you're playing the game by unfair international rules."

Britain, he says, is choosing to specialise in exactly the same fields of research as everybody else. But this is a recipe for failure. The UK's investment in, say, biotechnology, is likely to be a factor of 20 less than that of the US. "It is like an arm-wrestler challenging a sumo wrestler. We may be naturally creative, but to rely on us being 20 times as ingenious as the Americans is a bit silly."

Dr Braben advocates a quite different approach. Instead of trying so hard to achieve "world class" standards in fields in which all countries are already competing, the UK should do more to encourage genuinely original research. The trouble for the Government is that central committees, financial memoranda, and "purposeful" direction of large tightly-managed teams are unlikely to create an environment in which genuine creativity can flower.

Dr Braben's venture research unit at BP backs fundamental scientific research. But he does not worry about exploitability *per se*; in fact he distrusts scientists who waffle on about likely industrial applications. The lesson of history, he says, is that good science always has industrial applications, but you cannot predict when or how.

The first question he asks scientists seeking BP support is: "If you faced no constraints and complete freedom, what would you be doing that you are not doing now?" He then encourages them to follow their instincts. A bigger contrast with current government policy would be hard to imagine.

Sir David Phillips at the Advisory Board rejects the charge that Britain is adopting a 1960s "national champions" approach to science. Selectivity and tighter management, on the contrary, represent an overdue response to the problems posed by past policies, which wrongly let "a thousand flowers bloom."

But even he appears to have some qualms about the present drive to rationalise. While supporting the general principle of specialisation, he admits to "hesitations" about the closure of small departments planned by the UGC. He points out, somewhat ruefully, that he was trained in Wales in a small department with five lecturers and one professor – in other words in a department roughly a quarter the new minimum size.

Nobody is suggesting that all science can be small-scale and curiosity-driven. The question is whether the pendulum is now in danger of swinging too far in the opposite direction. In her Royal Society speech, Mrs Thatcher said the value of Michael Faraday's work today must be higher than the capitalisation of all the shares on the Stock Market. But was it the result of a technocratic strategy for the science base?

FROM Professor S.K. Bhattacharyya - Department of Eng.
University of Warwick

TO Mr. G. Guise

DATE 28th November, 1988

PRIVATE AND CONFIDENTIAL

I apologise for the delay.

Please find enclosed some more pointers on Research Councils which I am sure you will find interesting. I am off to Hong Kong to make a presentation to the Management Association and I will be back at the weekend. If you need any clarification please let me know.

Mrs M. Black
.....
PROFESSOR S.K. BHATTACHARYYA

pp

SOME POINTERS ON SERC

1. Under Labour Governments in the 1970's, SERC (then SRC) was encouraged to redirect its research and postgraduate training towards near-market engineering. SERC was seen as one arm of an intervention policy to support industry with public money.

2. The Government and economic climate have since changed. Companies are now profitable and can pay for the near-market R & D and the staff development that they need. SERC however clings to its old ways and supports much mundane, low-risk applied research.

3. The situation is compounded by the new Interdisciplinary Research Centres (IRCs) being established by SERC. In the initial stages, academics will be deflected from research into organisational and bureaucratic issues. Later, competing growth points in smaller departments will be starved of funds and so new ideas will be stifled. Finally, as individual IRCs weaken, SERC will show its usual procrastination in cutting out dead wood. The IRCs will simply breed disgruntled researchers for the future.

4. There is a strong possibility that the research element of the block grant for the universities, currently provided by the UGC (and in the future from UFC) will be administered by the Research Council on the basis of Council-funded contracts. If this is allowed to happen then they will have the total monopoly and will regulate university research. Is it right that such a large proportion of universities modus operandi depends on often rudderless councils?

5. This will have the effect of the universities being totally beholden to the Councils.

What will be the motivation for carrying out joint research with industry if the large proportion of block grant is based on Research Council funding? HMG should reconsider its strategy of giving so much authority to the Councils, especially in engineering. If there is no other alternative I would much rather see the dual support remain with the UGC with equal weighting given to industrially-funded research.

6. Engineering research (and postgraduate training) should be removed from SERC, into a separate Agency.

7. This will be opposed by SERC on the grounds that engineering is a logical extension of basic science, and funding for the two must be united. The example of the continuum of research in materials is often quoted.

8. However, where does the continuum stop? By SERC's argument it runs from basic research into applied science, into engineering, and into product development. The truth is that engineering near the point of application must be judged by different criteria from science. For example, return on investment is crucial and this is why company commitments in hard cash are more revealing than peer review in engineering.

9. Thus research and training in engineering should be funded by an Agency with the following features:

i. Close to DTI and under its influence.

ii. Giving equal weight to industrial and public funds.

iii. Policy-making staffed by fixed-term secondees from industry and commerce instead of tenured civil servants.

iv. With the remit to manage areas of research and seek a return on investment.

nbpm

CABINET OFFICE

70 Whitehall London SW1A 2AS Telephone 01-270 0259

From John W Fairclough FEng
Chief Scientific Adviser

W0964 CONFIDENTIAL

J M M Vereker Esq
Dept of Education & Science
Elizabeth House
York Road
London SE1

23 December 1988

Dear John,

INTERNATIONAL R&D PROGRAMMES

flap

I am writing about the arrangements for carrying out the exercise which the Prime Minister has asked me to put in hand, as recorded in Paul Gray's minute to me of 14 December.

I see the aim of the exercise as being to identify good practice for the UK's collaboration in international R&D projects, as well as pointing up specific areas for improvement in the management of existing projects. The exercise would be confined to looking at the UK end of the participation. I would not envisage direct contact with international partners or organisations. The end product of the exercise would be twofold: first a suggested check list of issues to bear in mind when negotiating future international R&D agreements; and second a report on the individual projects examined with any specific recommendations for improvement. As the Chief Secretary suggested in his letter of 1 December, it would be for individual Departments to consider these recommendations and make proposals to E(ST) colleagues on what action they planned to take to implement them. I would propose clearing both these reports through E(ST)(O).

I suggest the study focuses on international scientific research facilities where the cost to HMG exceeds £1m a year. I would include three categories of international collaboration: -

a. facilities operated and managed by an International Organisation to which the UK pays an annual subscription.

b. facilities operated by several countries as part of a bi- or multi-lateral agreement.

c. facilities in the UK or abroad run by one country but where a significant part of the cost is recovered by international usage.

The study would aim to address four questions:-

a. our scientific objectives and the rationale for taking the international collaborative route.

b. the terms of the UK's participation in them.

c. the arrangements for monitoring and reviewing the project, including the way the UK reviews its future participation.

d. such indicators of the efficient management of the project as can be drawn from discussions with the UK participant, eg levels of utilization, resources devoted to administration etc.

I have set out in the attached Annex an illustrative list of projects we would suggest including in this exercise. You will see that this is not confined to facilities funded by the Research Councils, as I believe it would be instructive to compare them with other research facilities such as the European Centre for Medium Range Weather Forecasts, the Joint European Torus and the European Transonic Windtunnel. I would also suggest looking for lessons from our participation in ESA. Where arrangements are in hand for an international review of the management of the programme, as they are in the case of ESA Science and JET, our study should confine itself to looking at the terms of the UK's participation.

I would expect the study to last two months and to start early in the New Year. The team will be led by Dr J N Wingfield. You and other Departments will be very welcome to nominate someone to take part in the meetings with the participating bodies for which you are responsible. In the meantime I would be very grateful for any comments you and other E(ST)(O) Members have on the approach I have outlined above, the criteria for coverage of the exercise and the illustrative list of candidates in the Annex.

I am copying this to other members of E(ST)(O).

Yours sincerely,

John

JOHN W FAIRCLOUGH

ANNEX

INTERNATIONAL PROJECTS TO BE COVERED IN STUDY

European Molecular Biology Laboratory
European Synchrotron Radiation Facility
Institute Laue Langevin
ISIS
Australian Telescopes
Northern Hemisphere Telescopes
NERC Research Vessels
Ocean Drilling Programme
European Transonic Windtunnel
European Space Agency Projects
ROSAT
Joint European Torus
European Centre for Medium Range Weather Forecasts

SCIENCE + TECH : Budget
PT 8

Prime Minister 2

THE TIMES
19.12.88

George Guise asked me to show you this.

ARB 19/12.

BIG SCIENCE

Two decisions have put the United Kingdom back in to the "big league" of scientific nations. After much hesitation, the Government has committed itself to continue subscribing to the Centre Europeen de Recherche Nucleaire (Cern). After similar delays, it has also signed up with the partners in the European Space Agency (ESA) for the Horizon 2000 space project.

Participation in these two joint enterprises does not mean that the Government has entirely shed its reputation for carelessness towards Britain's research capabilities. But it is a good sign — one whose importance is not confined to physicists or astronomers. It provides an opportunity to put national space and science policy back on course.

The low point was reached earlier this year when Mr Kenneth Clarke, then the Trade and Industry minister responsible, proved so unnecessarily abrasive and negative in international negotiations with Britain's scientific partners. His successor, Mr Tony Newton, is blessed not only with an auspicious name in this field; he has the calmer style that was required too.

The Government was right to insist on a thorough efficiency audit at Cern. It has scored important points and injected a necessary note of cost consciousness into the ESA. But that phase is now over. Ministers should plan ahead in a more positive frame of mind.

In recent years the Government has successfully given the impression that it cared little for scientists or their work. Ill-considered rhetoric and lack of imagination have obscured the considerable investment still made annually in big, basic science projects.

Science policy has had three main positive elements. The Government wants the "consumers" of research, private business, to underwrite more of its costs. It has sought to apply to research the firm criteria of economy, efficiency and effectiveness. It has refused to accept that expenditure on science be immune from external scrutiny by accountants.

But it has been reluctant itself to "pick winners", despite the attempt by both the Advisory Board for the Research Councils and the University Grants Committee to push policy in the direction of concentrating available resources in a strictly limited number of specialisms and laboratories. Applied to participation in international programmes in space and for advancing pure knowledge in particle physics these principles have led to procrastination and — for a while — the possibility of withdrawal altogether.

Take Cern first. To compete in the same league as the accelerator recently agreed by the Reagan Administration for Texas requires the pooling of resources from several European countries. Even then it means devoting a significant fraction of each national science budget to particle physics. The Government found itself dithering over the expense when the real question was one of principle: should Britain, still with some of the finest nuclear physicists in the world, remain a top player in the science business?

To accuse Cern of inefficiencies was easy (and entirely justified). But to try to avoid a decision on grounds of office politics in Lausanne and Geneva was wrong.

Britain, in European partnership, is to continue to probe for the basic truths about the matter that makes up our world. The Government and its agents in the Science and Engineering Research Council must now live with the consequences of having, in effect, picked a winner. These consequences could include painful economies elsewhere in the budget.

Now consider the ESA. Mr Clarke's continual refrain was: why should we get embroiled in expensive French visions of extra-terrestrial *gloire*? The case for European collaboration on rocketry was made with terrible force the day that Challenger exploded and the only launch vehicles available for scientific and commercial satellites were Russian, Chinese or Ariane.

The case for a British place in space science can be made on several grounds, the existing investment in astronomy which would gradually go to waste, the abandonment of all the potential benefits (most inevitably still unknown) of the last frontier; not least there was the potentially deadening effect on young minds here if British capability in space were to be denied. Having made the decision to go forward, the ESA was the only means open.

But why, Mr Clarke said more than once, does not British business pay? The answer to that is a compound of time horizons, corporate strategy and, perhaps above all, the fact that in no other country (especially the United States) has private capital done more than provide for the exploitation of technologies developed by government agencies.

That phase is now, thankfully, past. Britain has signed up for the ESA's "Horizon 2000" project, having secured an external scrutiny of the accounts. With that decision the Government has given a necessary and valuable focus to scientific research. Britain is a little nearer now to a science policy fit for an enterprising society, still proud to devote significant national resources to the advance and exploitation of physical knowledge.

CONFIDENTIAL

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8Rw

10 DOWNING STREET
LONDON SW1A 2AA

From the Private Secretary

MR. FAIRCLOUGH

INTERNATIONAL R&D PROGRAMMES

The Prime Minister has seen the Chief Secretary's letter of 1 December to the Secretary of State for Education and Science about CERN, in which he suggested an Assessment Office exercise to identify other international projects with scope for savings.

The Prime Minister would like such an exercise to be carried out, including a study of the management of large international research facilities and the terms of participation. She would be grateful if the arrangements could now be put in hand.

I am copying this minute to the Private Secretaries to members of E(ST) and to Sir Robin Butler.

Paul G.

(PAUL GRAY)
14 December 1988

CONFIDENTIAL

CONFIDENTIAL

FILE
SRW

10 DOWNING STREET
LONDON SW1A 2AA

From the Private Secretary

MR. WOOLLEY

EVIDENCE TO HOUSE OF LORDS SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY

Thank you for your minute of 12 December which the Prime Minister has seen.

She is content for Mr. Fairclough to accept the Committee's invitation to appear, on the basis that he would only be able to answer on matters within his area of responsibility. She welcomes the proposal to brief the Clerk on the limitations which would apply to the range of evidence, but has commented that it will be difficult to ensure that the evidence can be kept strictly within those limits.

I am copying this letter to Nick Gibbons (Lord Privy Seal's Office) and John Fairclough (Chief Scientific Adviser).

Regs.

(PAUL GRAY)
14 December 1988

CONFIDENTIAL

Yes - but I doubt whether Prime Minister
his evidence could
Ref. A088/3591 keep strictly Content for John Fairclough
to attend on the basis proposed?
(Lord Privy Seal supports
MR GRAY within the the proposed line). PRCC
proposed limits put 12/12

Evidence to House of Lords' Select Committee on Science and Technology

Mr Fairclough has been invited to appear alongside Sir Francis Tombs before the House of Lords' Select Committee on Science and Technology on 19 January. Sir Francis Tombs has accepted his invitation to attend.

2. The Memorandum of Guidance for officials appearing before Select Committees states that 'Normally the Cabinet Office and other similar co-ordinating offices will not be required to give evidence to a Committee'. However, a precedent has been set by Mr Fairclough's appearance before the Committee in July 1986. It would be very difficult for him to refuse to attend on this occasion.

3. Sir Robin Butler therefore recommends that Mr Fairclough should accept the Committee's invitation to appear, but that in responding to the Clerk, he should make clear that he would only be able to answer on matters within his area of responsibility.

4. The purpose of the meeting will be to discuss the development of the Government's science policy since the publication of CM 185 on Civil Research and Development. The Committee has indicated that it will wish to cover:

- the new budgetary arrangements for Science and Technology announced in the Autumn Statement;

- Near-market research;

TAWALU

- the workings of the Advisory Committee on Science and Technology (ACOST);

- the Research Councils and the role of the Advisory Board for the Research Councils (ABRC);

- the Centre for the Exploitation for Science and Technology (CEST)

- the Annual Review of Government-funded research and development.

A number of the topics which the Committee has indicated it wishes to pursue fall clearly outside the responsibilities of the Chief Scientific Adviser and the Cabinet Office, including in particular the budgetary arrangements for Science and Technology announced in the Autumn Statement (a matter for the Treasury) and the Research Councils and the role of the ABRC (DES). There are also subjects which may lead the questioning into areas of specific departmental responsibility - for instance CEST and near-market research (a matter of particular sensitivity to MAFF).

5. If the Prime Minister agrees with Sir Robin Butler's conclusion that Mr Fairclough cannot refuse the invitation to give evidence, we will brief the Clerk in detail on the limitations which would apply to the range of evidence which Mr Fairclough would be able to provide; and to clear the briefs prepared for Sir Francis Tombs and Mr Fairclough with you as envisaged in Mr Wilson's minute to you of 5 September.

6. Sir Robin would be grateful to know that the Prime Minister would be content to agree to Mr Fairclough's appearance before the Select Committee on this basis.

TAWALU

7. I am copying this minute to the Private Secretary to the Lord Privy Seal and to John Fairclough here.

Trevor Woolley

T A WOOLLEY

12 December 1988

cc PO

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
WHITEHALL PLACE, LONDON SW1A 2HH

From the Minister

The Rt Hon Kenneth Baker MP
Secretary of State for Education & Science
Department of Education and Science
Elizabeth House
York Road
London SE1 7PH

12 December 1988

MBAM
RRCB
12/12

Dear Secretary of State

CERN: UK'S FUTURE MEMBERSHIP

Thank you for copying to me your minutes of 24 November and 9 December to the Prime Minister, reporting on the negotiations which have taken place over the past year and which, on some aspects, will continue. I agree with your proposal that, on the basis which you have set out, we should now take the decision to remain in membership of CERN for the foreseeable future, though I also support strongly your views that we must keep up the pressure to achieve the further economies and maximise income from other sources.

I am copying this letter to other members of E(ST), to Sir Robin Butler, and to the Chief Scientific Adviser.

Yours sincerely,

S J Lambert

pp JOHN MacGREGOR
Approved by the Minister and signed in her absence

SCIENE & TECHNOLOGY

Science Budget pr. 7

17.XII 1988

CONFIDENTIAL

fcs SEW

bc: PG

10 DOWNING STREET
LONDON SW1A 2AA

From the Private Secretary

12 December 1988

Dear Tom,

CERN: UK'S FUTURE MEMBERSHIP

The Prime Minister was grateful for your Secretary of State's minute of 9 December. She would be grateful if the targets and parameters for further economies and better value for money could be regularly monitored by our CERN representatives and periodically reported back.

I am copying this letter to the Private Secretaries to members of E(ST) and John Fairclough (Chief Scientific Adviser).

Yours,
Paul

(PAUL GRAY)

Tom Jeffery, Esq.,
Department of Education and Science.

CONFIDENTIAL

DTS

PRIME MINISTER

CERN

You agreed (reluctantly) that the UK should announce at the December Council meeting its intention to remain in membership of CERN. But you asked for a further report before that Council on the expected level of further economies (see my letter at Flag A).

Kenneth Baker's minute of 9 December (Flag B) is in response to that remit. He does now give some further quantification of targets for savings other than those arising from the new method of calculating the new contribution rate.

George Guise's minute of 9 December (Flag C) broadly supports Mr. Baker's approach, but suggests that the targets and parameters set out in his minute should be regularly monitored by our CERN representative and periodically reported back to Government.

Content to agree Kenneth Baker's minute on that basis?

PR16.

PAUL GRAY
9 December 1988

KKlAIQ

????

Prime Minister
You queried that international R+D programmes would be covered by a Cabinet Office study.
This gives reassurance. Do you want Cab. Office to do a study as the Chief Secretary proposed?
PRCG 12/12

CONFIDENTIAL

Qd. 0345
File Ref: ST 140/2

FROM: VIVIAN BROWN
DATE: 9 DECEMBER 1988

MR GRAY

cc Mr Fairclough
Mr Wilson

Yes please MR

INTERNATIONAL R&D PROGRAMMES

In his letter to Mr Baker of 1 December about CERN, the Chief Secretary proposed a review of international R&D programmes. You asked for a list so that the Prime Minister could consider the proposal.

INTERNATIONAL SCIENCE PROGRAMMES/ FACILITIES

2. **Medical**

European Molecular Biology Laboratory (Heidelberg)
- UK contribution £3m pa (MRC)

International Agency for Research on Cancer (Lyon)
- UK contribution £0.3m (MRC)

Marine

Ocean Drilling Programme (coordinated by National Science Foundation in US)
- UK contribution £2m pa (NERC)

Physics (Other than CERN)

Neutron Source in Grenoble (Institut Laue Langevin)

- UK contribution £9m pa. Membership after 1992 to be reviewed next year. (SERC)

European Synchrotron Radiation Facility (to be constructed in 1990)

- UK contribution £3.5m rising to £5m pa (SERC)

Astronomy

Optical Telescopes in Australia

- UK contribution - capital £5m, annual revenue £2m (SERC)

Space Science

ESA Programme (UK contribution £20m pa, now due to rise). The programme is to be reviewed by 1990, as a condition of the UK's agreement to the increase in the programme. (mainly SERC)

UK SCIENTIFIC FACILITIES

The programmes above are overseas led projects to which the UK contributes. There are also UK led projects to which other countries contribute eg the Northern Hemisphere astronomy facilities at La Palma and Hawaii (capital costs £40m, annual revenue costs to UK £7m). There is also the ISIS spallation neutron source on which the Chief Scientific Adviser minuted the Prime Minister in September. (SERC)

INDUSTRIAL COLLABORATIVE PROGRAMMES

3. **European Transonic Windtunnel**

- to be constructed at Cologne. Capital cost to UK £35m (DTI)

SCI + TECH : Budget 82

Space Technology

In addition to the Space Science projects, the UK contributes about £60m a year to various technology projects managed by the European Space Agency. (DTI)

EUREKA

Projects agreed directly between European companies with minimum international bureaucracy. Differing levels of Government support - UK contribution likely to rise above £20m pa. (DTI)

Community Framework Programme

The work of the mid term review has already commenced; the Commission are expected to produce proposals in June 1989.

ENERGY

4. **Fusion and Fast Reactor**

These have just been reviewed by E(ST). The Commission are to undertake a mid term review of JET.

MAJOR DEVELOPMENT PROJECTS

5. There is a significant R&D element in projects such as Airbus and various defence projects (EFA, Nato Frigate etc). But the issues are rather different and the management of Airbus has been reviewed recently.

INTERNATIONAL CO-ORDINATION

6. There are also many areas of UK research which are co-ordinated in various ways through international organisations, eg much of the research on climatic change.

CONCLUSIONS

7. The main area that might be considered for review is that of the management of large international research facilities and the terms of participation. There are unlikely to be universal rules and the lessons from CERN may not be applicable to other projects; the scope for altering existing projects may also be limited. Nevertheless there may be benefits from examining existing international projects and using that experience to draw up a check list of useful points to follow when negotiating the UK's participation in future international research.

VIVIAN BROWN

CONFIDENTIAL

PRIME MINISTER

CERN: UK'S FUTURE MEMBERSHIP

1. I welcome your agreement that we should announce our intention to remain in membership of CERN at next week's Council meeting.

2. The early reductions in the underlying CERN budget are less than at one stage we hoped. But, as I indicated in my last minute and detail further below, there are prospective savings of over 10% in CERN's budget, amounting to about 85MSf (£32M) per annum, to be achieved progressively over the next 5 years, with additional benefit to be achieved from greater non-member income for CERN and the introduction of greater flexibility through a core plus options arrangement for any further projects at CERN.

3. I share your view that the UK must keep up the pressure at CERN to achieve these further economies in their operating budget and to maximise income from other sources. In our statement for the CERN Council, we shall be emphasising our intention to do so, and particularly press for the need for specific targets to be set.

4. The importance of, and the substantial savings from, the new method of calculating the contribution rate should not be underestimated. From 1990 onwards the subscription will be about £44M, while in 1987/88 and 1988/89 the subscription was £55.8M and £54.3M respectively. In addition, SERC will no longer be faced with the possibility of large increases in its subscription, simply because of a

fall in the value of the pound against the Swiss franc. This has been a major problem for SERC in the planning of its overall programme each year. While contributions from Member States in Swiss francs have been maintained constant in real terms (based on very low Swiss inflation) since 1980, there have been years where the cost of our subscription has increased very substantially, on one occasion by over £10m.

5. From the Abragam report, we know that a reduction of well over 20% in CERN's budget would be necessary to reach the £8m cut in the cost of the UK's subscription Kendrew suggested. If carried out immediately, such a reduction would require the termination of all programmes except LEP and the operation of that facility for only half the available time. The four major experiments would also have to be reduced to three (not necessarily the three in which UK scientists are participating). Other Member States have supported our drive for greater management efficiency so long as the quality of CERN's science is maintained. The smaller countries, particularly the Scandinavians who have been very helpful to us this year, set considerable store by their involvement in the smaller programmes at CERN as well as on the potential of the LEP programme. Quite apart from the loss of these smaller programmes, failing to capitalize on the major new LEP facility, by running it at well below capacity, would be bad value for money.

6. Nevertheless reductions in the cost of CERN can be achieved through improved efficiency, control of the pace of future developments and widening the resource base, as follows:-

i. Staff Numbers

We have already achieved agreement to the large cut in the numbers of staff on indefinite contracts I described in my earlier minute: this includes the loss of 200 posts by 1990. This will continue until

1996, by which time 500 posts will have been lost - about 15% of the total. The speed of reduction is governed by the cost of terminating contracts, and savings of some 30MSf per annum will feed through into the budget once the costs of the scheme are covered by the gross savings.

ii. Pay and Conditions

A major review of personnel policy, including these two important elements, is well under way at CERN and an interim report was made to the October meeting of Council. The matter is due to be discussed again early next year and the UK will be pressing - with others - for stringency in the new arrangements that will apply. In practice, pay at CERN has in several recent years been cut in real terms. Overall budgetary savings of 20MSf per annum could be reached.

iii. Improved Budgetary and Project Control

Although the management and supervision of the LEP project has been exemplary in terms of keeping within budget and to timetable, there are still perceived weaknesses in detailed aspects of overall budget and project control as compared with normal practice in the UK scientific community. Management consultants are advising on the presentation of the CERN budget to provide Member States with proper information on which to determine its views on future expenditure. The SERC has also been working closely with CERN management to introduce improved project control systems. Our constructive approach is winning support for our proposals. The target here might be 15MSf per annum.

iv. Wider Membership

The key question here is the form of any new relationship between CERN and scientists in the

United States. This may be an important opportunity for achieving improved scientific partnership and rationalising expensive facilities between Europe and the US. As Geoffrey Howe reported, there is now much uncertainty about the future of their planned Superconducting Super Collider (SSC) project. Our hope must be that this will not proceed so that, instead, they will co-operate with CERN in future development - probably of a Large Hadron Collider (LHC) which can be constructed within the LEP tunnel and hence capitalize on the existing infrastructure investment. This could lead to savings to the UK, through wider contributions to the general CERN overheads, as well as to the capital and running costs of new or replacement facilities at CERN. CERN Management generally recognises that Member States will not contemplate any significant increase in the overall CERN budget and that new modes of funding will need to be found for this and any other new project. The Working Group examining this area is due to report in the first half of the coming year. The extent to which CERN is able to obtain funding from non-members such as the US and Japan will to a large extent depend on the nature and timing of decisions on the proposed SSC. This will not be one of the earliest decisions for President-elect Bush, but we should bear in mind that a political intervention with him at the Economic Summit in Paris in July could be helpful.

v. Host Country Premiums

We have made clear our view that there should be increases in the level of special contribution made by the host States (particularly Switzerland). We have accordingly supported the FRG's leading role in this area. We shall particularly wish to pursue an interesting new suggestion by the Director-General

designate that the substantial pension fund deficit be offset by transfer of the CERN site from the Swiss and French Governments to CERN itself as an asset of the pension fund. This capital injection would lead to recurrent savings over at least the next 15 years. We shall also press the FRG to maintain the momentum regarding other suggestions whereby the host countries would meet costs the CERN budget would otherwise have paid. A target here is for obvious reasons very difficult to offer - perhaps 20MSf per annum from the budget should be our objective in the first instance.

vi. Core Plus Options

During the negotiations over the past year we have explored very fully the scope for splitting the present CERN activities into a core activity with optional programmes. Some progress has been made but, as Abragam pointed out, the main CERN facilities are constructed - as a cost saving measure - using the earlier accelerators as input to later ones. This makes any major increase in optional activities difficult. However, before agreeing to any new facility or activity at CERN, such as the LHC, the UK will press for the introduction of a core plus optional programme.

7. I am sending copies of this letter to Members of E(ST), to Sir Robin Butler and to the Chief Scientific Adviser.

KB

KB

9 DECEMBER 1988

DEPARTMENT OF EDUCATION AND SCIENCE

PRIME MINISTER 9 December 1988

CERN - ANALYSIS OF BAKER'S MINUTE

Last year we identified three targets whose pursuit would increase the UK value for money from its CERN subscription:

(i) A better basis for calculating the UK subscription. This has been achieved with only Italy dragging its heels on timing - it does not oppose the basic principle of using current net national income relativities and exchange rates. This will mean cash savings to the British science budget of the order of £10 million per annum. This is real money, not bookkeeping cosmetics!

(ii) Improved financial and administrative arrangements at CERN itself. Baker's Paragraph 6 shows how this may be achieved without impairing the science programme itself. Cumulative annual savings of 65 million Swiss francs by the mid-90s are indicated without high front-end costs for redundancy and restructuring. This is a better prognosis than many nationalised industries showed some years back when the price of ultimate efficiency was always enormous front-end money.

These figures do however demonstrate how much financial laxity has developed over the years at CERN. Our team should be encouraged to pursue these targets and, if possible, exceed them. The total CERN budget for 1988/89 is about 800 million Swiss francs, about half of which

are personnel costs, so the proposals represent about 16% reduction.

(iii) Making others pay more. There are some good proposals here. One is to press the United States to postpone its domestic SSC project in favour of collaboration on a future hadron collider (LHC) at CERN. This makes scientific sense because the LHC will partially cover the energy bands where some of the anticipated new phenomena, such as Higgs particle production and supersymmetry, are expected. This would then give the Americans greater confidence to build, perhaps in the mid-90s, an even greater SSC based on more secure theoretical foundations. This argument appeals to those American scientists who are not blinded by the chauvinistic feeling that CERN has already left the US playing second fiddle! It will however require political pressure as Baker's minute suggests.

Such proposals and those involving higher contributions from Japan and Russia as well as the host countries must be pursued. CERN management is generally timid about pressing too hard for fear that it will lose its reputation for accessibility to all top ranking scientists. Our representatives should fight this battle hard at the CERN Council so that fellow members become increasingly persuaded that it is stupid not prestigious, to have non-members using CERN facilities without paying their share.

CONCLUSIONS

There has been some quantifiable financial success at the CERN Council. More important, is the change in attitude at CERN where value for money is increasingly recognised as comparable in importance with the scientific work achieved. Without the practical testwork at institutions such as CERN, our understanding of the physical basis of reality will simply cease to advance. It is a measure of how enormously successful the theoreticians have been that such huge temperatures and energies are now required in order to point the direction of further advance. The high cost of experimental particle physics is therefore not a malady but a consequence of achievement. It does however underline the importance of wringing every last drop of science from each pound, dollar or Swiss franc!

It would have been absurd to achieve the Abragam reductions by running LEP for half the time or cutting out one of the experiments. That would have been the easy way to get there, by doing less work. It is far preferable to maintain a programme dedicated to the original scientific goals while spending less.

RECOMMENDATION

We should continue in CERN for the time being without in any way reducing the pressure for continued improvement of efficiency. The parameters mentioned in Paragraph 6 of Baker's minute should be regularly monitored by our CERN representatives and periodically reported back to Government so that progress against these targets is continually assessed.

Andrew Dunlop

for GEORGE R GUISE

cst.ps/11jml.12

CONFIDENTIAL

Prime Minister
Would you like Cabinet Office to carry out the exercise at X?

PR CC 6/12

Treasury Chambers, Parliament Street, SW1P 3AG

We have already had a go at European Space Agency. What did we learn? Anything? Flag not

The Rt Hon Kenneth Baker MP
Secretary of State for Education and Science
Elizabeth House
York Road,
London
SE1

Dear Ken,

1st December 1988

CERN: UK'S FUTURE MEMBERSHIP

Eat Hap

I have seen your minute to the Prime Minister of 24 November, John Fairclough's comments on it, and Paul Gray's response of 29 November detailing the Prime Minister's views.

I agree that the improvements in the management of CERN, and the change in the method of calculating contributions are creditable achievements following the effort that you and Robert Jackson have put in to this, and I welcome them. I hope we can maintain the progress that has been made on implementing the Abragam proposals, and in pressing for wider international participation in CERN.

I am happy for the British delegation to make a statement along the lines proposed in your letter, so long as the legal position of one year's notice to withdraw remains.

The cost of continuing membership provided for in the recent PES settlement for Science is based on the new method of calculating contributions. Any additional costs due to late implementation, will need to be met from within the settlement which we agreed..

X I was interested to see what John Fairclough had to say about the lessons to be learned from the success of our efforts at CERN. I would like to build on these lessons by proposing an Assessment Office exercise, to identify other international projects with scope for savings. Departments could then examine the Assessment Office proposals and report their reaction back to E(ST).

I am copying this letter to the Prime Minister, other members of E(ST), to Sir Robin Butler and to John Fairclough.

Yours Ever, John

JOHN MAJOR

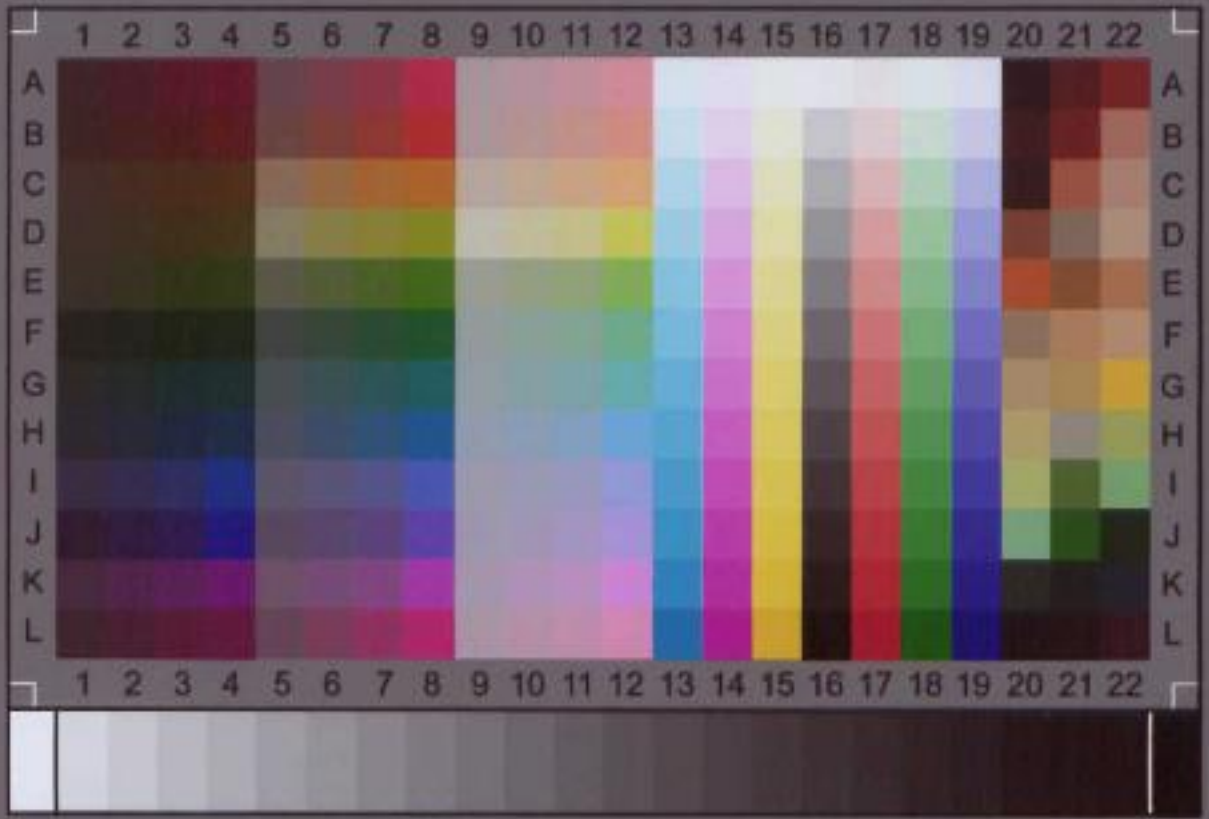
SCIENCE + TECH: Budget

PART 7 ends:-

MoD to PG 29.11.88

PART _____ begins:-

CST to SS/EDS 1.12.88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