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Ref. A086/3447

Prime Minister

PRIME MINISTER

Content to sign the attached?

Government Response to Advice from the Advisory Council for
Applied Research and Development (ACARD)

Attached for your approval is the proposed Government response to ACARD's advice on the 1986 Annual Review of Government Funded R & D.

2. When you discussed ACARD's advice with Sir Francis Tombs, Chairman of ACARD, on 25 July, you told him that you were glad to hear that John Fairclough would be co-ordinating a general Government response. Attached is a draft letter which you may like to send to Sir Francis.

3. The response has been cleared with all those Ministers with a significant involvement with R & D.

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ROBERT ARMSTRONG

12 December 1986

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DRAFT LETTER FROM THE PRIME MINISTER TO
SIR FRANCIS TOMBS, CHAIRMAN, ADVISORY COUNCIL
FOR APPLIED RESEARCH AND DEVELOPMENT

At our meeting on 25 July we discussed ACARD's comments on the 1986 Annual Review of Government Funded R & D, and I said I shared ACARD's anxiety to improve the wealth-creating potential of Government R & D expenditure, to improve the scope for technology transfer (particularly on defence contracts) and to encourage industry to invest more in R & D.

Acard's comments have been an important contribution to the Government's thinking on how to secure these objectives. I am sending --- you the formal Government response to ACARD herewith.

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GOVERNMENT RESPONSE TO ADVICE FROM THE ADVISORY COUNCIL FOR APPLIED
RESEARCH AND DEVELOPMENT (ACARD) ON THE 1986 ANNUAL REVIEW OF
GOVERNMENT FUNDED R & D

1. The Government are grateful to ACARD for undertaking this annual exercise. There is much in the ACARD commentary with which the Government readily agree, notably the emphasis given to the importance of evaluation of R & D programmes, to the importance of technology transfer and to the need for technologies developed for defence to be applied in the civil sector.
2. In terms of the context and emphasis of the ACARD comments, however, the Government make two general observations. The first is that, while they welcome ACARD's endorsement of the need to assess the wealth-creation potential of publicly funded R & D programmes, this should not be interpreted too narrowly to refer only to the interests of industry. Apart from other forms of economic benefit, publicly funded R & D also has wider socio-economic benefits which are not dealt with in ACARD's comments. This particularly applies to medical, environmental and social research. The second observation is that the commercial exploitation of technology is first and foremost the responsibility of industrial and commercial firms. Our shared concern about levels of R & D spending in the UK, and the comparative international disadvantage that may arise, must start from the willingness and ability of firms themselves to undertake, fund and exploit R & D for their own benefit.
3. In the more specific comments which follow, the numbers in brackets indicate the appropriate paragraphs in ACARD's comments.

Issues Arising From Comments on Earlier Annual Reviews

4. ACARD are aware that their earlier advice in 1984 & 1985 contributed to the decision to establish new Ministerial and official machinery which has as its main task the development of policies which will enhance the contribution of R & D expenditure, both public and private, to improving the efficiency, competitiveness and innovative capacity of the United Kingdom economy. ACARD have been invited to assist in this work and will be kept informed as it proceeds.

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5. The Government acknowledge that there may not always have been clear lines of co-ordination between Departments with a shared interest in R & D projects (1.4). ACARD recommend that a central fund of £250,000 per annum be established for enabling and primary investigations on R & D matters of wide interest. The Government have made available to ACARD the sum of £75,000 per annum to commission research papers and to assist in preparation of reports. Some provision is likely also to be made for the new Cabinet Office Science and Technology Assessment Office. Additional central expenditure would need to be considered against a statement of what is to be achieved, by when and how this achievement is to be measured.

6. The Government are exploring ways of encouraging private sector R & D (1.5), and welcome ACARD's assistance. The Government place considerable stress on the need for greater private sector commitment to the funding and exploitation of R & D. With inflation brought down and significant improvements achieved in company profitability, liquidity and capacity utilisation, the commercial environment should now be more conducive to all forms of investment in future commercial success, including innovation and the exploitation of R & D than it has been for many years. The Government consider that the key to the contribution which civil R & D makes to the economy is not so much the level of public spending itself as the priority given by the private sector to R & D expenditure, which they hope will increase as the business climate continues to improve.

7. The Government are examining the level of public spending on civil R & D - by Government Departments, Research Councils and universities - in this year's and future public expenditure surveys (PES). Among the factors which the Government are taking into account are :

- the level of funding needed to support the most important research priorities;
- the scope for increasing the effectiveness of existing R & D budgets through better targetting and tighter management and control;
- the scope for improving commercial exploitation of R & D by closer collaboration with industry;

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-the scope for further rationalisation in the deployment of R & D resources.

These issues have begun to be addressed in relation to the Department of Education and Science (DES) funded Science Base in the PES advice from the Advisory Board for the Research Councils (ABRC) to the Secretary of State for Education and Science, and in the papers ABRC and ACARD prepared earlier in 1986 for the Ministerial Group on R & D. The ABRC, for its part, is now taking this work forward in a new strategy document which it hopes to complete in early 1987.

8. In general the Government support the ACARD view that technologies developed for defence must also be applied as fully as possible in the civil sector (1.6). The Ministry of Defence (MOD) are developing a wide range of measures designed to increase co-operation with industry, support joint programmes with the civil sector and enhance commercial spin-off. Examples include the appointment of industrialists to Research Establishment boards; the National Electronics Research Initiatives centred on the Royal Signals and Radar Research Establishment (RSRE) and funded by MOD, the Department of Trade and Industry (DTI) and industry; the setting up of Defence Technology Enterprises Ltd; and joint funding of research grants by MOD, DES and Research Councils. Most of these activities are collaborative, involving the private sector.

9. It has been agreed that ACARD will take a more detailed look at the Defence R & D programme and the Secretary of State for Defence, in welcoming ACARD's intentions to conduct such a study, set out the main elements of the MOD's approach (copy attached). ACARD are invited in particular to offer comments on action by the private sector defence industry to enhance exploitation of defence technology for civil application.

THE 1986 ANNUAL REVIEW

Distribution and Trends in Expenditure

10. The Government share ACARD's concern with the level of civil R & D expenditure in the UK, but consider that the source of funding, the way it is carried out and the extent to which the private sector's commitment is engaged

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are as important as the level of funding(2.1). In particular, public support of civil R & D for economic growth and productivity is unlikely to be effective if industry is not adequately engaged. The 1986 Annual Review indicates that UK **public** funding of civil R & D was higher as a percentage of GDP in 1983 than in the USA ,Italy and Japan, and France has since cut back on its public spending on civil R & D. It is **private** industrial funding that was lower on the same measure than in the USA, Japan and Germany.

11. The Government reviews the level and balance of its R & D expenditure each year taking account of the requirements of Departmental programmes and the cost-effectiveness with which public funds have been used. In the first half of the 1980s, DTI expenditure on innovation support increased significantly in real terms. As the Annual Review points out, the last year has seen a consolidation of DTI policies based upon their fundamental review of innovation support in 1985. The outcome has been a change of emphasis, with a greater proportion of support being made available for collaborative research, advisory services and schemes for encouraging and disseminating best practice and improving key skills. In other words, there is a shift to technology diffusion and transfer which ACARD recognise should be a major issue for Government funded R & D (3.11).

**Effectiveness of Government R & D Expenditure
R & D Evaluation**

12. ACARD's comments on the importance of effective evaluation of Government R & D are welcomed. As is the recognition that evaluation of research programmes is complex and difficult. A considerable amount of the funding of Research Councils which relates to basic and strategic research is of a nature which cannot be subjected to evaluation with anywhere near the total rigour suggested by ACARD. But nevertheless it is agreed that greater efforts need to be made on this to ensure research is effectively targetted and executed (3.2). Evaluation need not be costly in relation to its benefits eg DTI currently devote 0.3% of their programme spend to evaluation of R & D. The Government also support ACARD's perception of evaluation results being used to inform choice between

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competing programmes. The establishment of a Science and Technology Assessment Office, reporting to the Chief Scientific Adviser, Cabinet Office, indicates the importance attached to evaluation (3.6). The Assessment Office (AO) has started work on its remit to develop evaluation methodologies, gather consistent information on, and make analyses of, the inputs and outputs from Departmental, Research Council and University Grants Committee (UGC) support for R & D and evaluate the contribution made by each to the efficiency, competitiveness and innovative capacity of the UK economy. The AO will advise Ministers, their officials, and the bodies for which they are responsible on the shape, content and conduct of their R & D programmes, with the objective of achieving a more effective contribution to the development of the UK economy. The work of the AO will improve the information base for determining relative priorities between R & D programmes.

13. Annual reassessment is carried out for Departmental R & D programmes in the normal process of research formulation. As a specific example of improvements which can be made, the Department of the Environment (DOE) are to add a specific evaluation process of the effectiveness with which research sub-programmes are targetted to meet policy objectives and, where appropriate, the extent to which they can be orientated to stimulate industrial competitiveness (3.4).

14. The AO is in the process of offering all Departments guidance on the way their R & D assessment work should be structured. Some common features can be expected to apply across all programmes; if an impartial assessment is to be obtained as efficiently as possible and greatest benefit is to be derived from the lessons of the past, an independent assessment function will be required properly linked into Department's systems for allocating R & D funds.

15. Where programmes involve cooperation between Departments, the Government agree with ACARD that mechanisms must exist to ensure that objectives are clearly agreed so that effective evaluation can be made by those contributing. Departments already cooperate on various areas of joint interest eg DTI/MOD and the Science and Engineering Research Council (SERC) for the Alvey Programme, and fuller cooperation has been agreed in other cases eg the Department of Energy (DEn) and DOE are setting up a Concordat on radioactive waste management. This Concordat covers all radioactive waste management R & D undertaken by the UK Atomic Energy Authority (UKAEA). Its aim is:

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a. to provide a coherent national strategy for R & D into nuclear waste management

b. to clarify the nuclear waste management R & D needs and their financing

c. to establish administrative arrangements whereby agreement can be reached on a) and b) above, and to this end it requires

d. both Departments to publish an annual statement of R & D objectives in this field

and e. the evaluation of projects. The AEA will prepare an annual report on the previous year's R & D.

Co-operation in environmental R & D is addressed in para 23.

Technology Transfer

16. The Government are in complete agreement with ACARD that technology transfer is of crucial importance in obtaining maximum benefit from R & D expenditure (3.7). In reflection of this importance DTI have focussed an increasing share of their R & D support on a wide range of technology transfer activities and measures to encourage best practice; MOD set up Defence Technology Enterprises Ltd; DEn seek to fund Research, Development and Demonstration (R D & D) jointly with industry such as in the Energy Efficiency Demonstration Scheme and the Offshore Supplies Office work; the Ministry of Agriculture, Fisheries and Food's (MAFF) Agricultural Development and Advisory Service (ADAS) has as its primary objective the translation and dissemination of research results into improvements in agricultural practice and efficiency; DES are encouraging universities to exploit their own research discoveries, and together with the Treasury, are reviewing Research Councils' incentives to exploit their work; the Department of Transport are looking at the same issues relation to the Transport and Road Research Laboratory: the Medical Research Council, together with the then National Enterprise Board set up Celltech, and have also set up a Centre for Collaborative Research (eventually to be self-funding) to promote the transfer of discoveries to industry and the health

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service; and the Natural Environment Research Council (NERC) are taking positive actions to interest the industrial and public service users of NERC research results in technology transfer for resource development and environmental management. Under the Energy Efficiency Demonstration Scheme, for example, savings in energy costs of about £200 million per annum have been stimulated since the scheme started in 1978 on the basis of grants to firms of up to 25% of the cost of installing novel technology which will cut energy costs.

17. As an important new initiative the Link Programme is being developed across all Departments with substantial R & D spending. The objectives of the Programme are: to accelerate the application of advances made in basic science and technology to products, processes and services of value to the economy; to bring about a real increase in industry's own expenditure on R & D; to forge more effective links between industry, institutions of higher education (HEIs) and other publicly funded research institutions; and to influence the programmes of Government Departments, HEIs and other publicly funded research institutions in the direction of greater relevance to industrial and commercial needs. The main features of the Programme will include: a number of programmes pursued normally for at least 3-5 years and funded at least 50 per cent by industry (including nationalised industry); programme proposals could arise from Departments, the Science Base or industry; the execution of projects within programmes should normally involve industry and the Science Base - projects may also involve Government Research Establishments; the Programme will include all Government Departments that spend substantial amounts of money on R & D; public expenditure on the Programme will be built up by the gradual re-shaping of planned expenditure to be consistent with Link Programme purposes and principles; and the achievement of the target level of total expenditure will be critically dependent on industry's willingness to find matching funds. The objective is that by 1991 the scheme should have stimulated up to £400 million a year of research funded jointly by industry and Government. As the Programme develops ACARD's Exploitable Areas of Science initiative should help to identify priority areas of technical and commercial promise.

18. Technology transfer is a diverse activity as the ACARD comments imply (3.8), and the Government agree with the need to encompass all the aspects noted if the topic is to be covered comprehensively. DTI, as well as various other Departments and Research Councils, are involved already in significant

activity under all the headings mentioned eg 'club' projects, support of Research Associations, involvement in the Teaching Company Scheme and assessment of technology transfer activities.

19. The Government are largely in agreement with ACARD's suggestion that both internal and external applications for R & D funding should make reference to the technology transfer potential of the work (3.9); and fully in accord with ACARD's view that Government must give emphasis to the transfer of new technologies into manufacturing industry, to improve international competitiveness.

20. In general it is not realistic for Departments to expect direct financial returns from the technology transfer activities that they support (3.10) for a variety of reasons, but chiefly because these are very wide-spread in their benefits to industry and because of the administrative difficulties of assessing and collecting repayment from a very wide range of beneficiaries, often many years after the event. The Government are considering what scope exists for providing more incentive to Research Establishments (REs) to attempt specific exploitation of their knowhow or inventions through repayment or licensing, and for reducing barriers to the commercial exploitation of REs' expertise and research results.

21. ACARD's suggestion that a senior member of each Department should have responsibility for technology transfer is fully supported by the Government and practised by Departments in terms of **general** responsibility. As well as having this central focus in each Department, technology transfer must also be the working ethos of all project directors and managers. For example, as recommended by ACARD the Director General of ADAS is at a senior level in MAFF - a role which is combined with the position of Chief Scientific Adviser, thus underlining the efforts made to ensure that research and the advisory service are fully integrated to the benefit of the UK economy.

Comments on Specific Sectors: Environment

22. The Government agree in principle with ACARD's underlying premises that adequate and robust data should be generated in advance of policy decisions; that research on topics at Departmental boundaries should not be overlooked;

that the control of environmental hazards can be extremely expensive; and that appropriate environmental research may produce considerable financial savings (4.3 and 4.4). This acceptance in principle should not, however, obscure the fact that it will not always be practicable to meet all information needs in advance. Moreover, an increasing number of environmental policy decisions have in recent years been taken at the European Community rather than the national level and this adds a significant complicating factor.

23. ACARD consider there is a lack of inter-Departmental co-ordination on environmental R & D and considerable overlap in Departmental activity and their R & D (4.5 and 4.6). Co-ordination within a research area impinging on several interests is never easy. The Government believe ACARD may have underestimated the progress that has been made recently in reinforcing various longer-established interdepartmental links. Particular examples are the DEn/DOE Concordat on radioactive waste management; the new mechanism in place between DOE, MAFF and the Department of Agriculture and Fisheries for Scotland, involving Research Councils, for co-ordinating research activities; the NERC/Agriculture and Food Research Council agreement on co-ordinated programmes; and the new Co-ordinating Committee for Marine Science and Technology. Such efforts on co-ordination can be expected to reduce inadvertent overlap in research programmes, but a degree of overlap is inevitable and proper: for example it is imperative that Government-sponsored research on environmental pollution be seen to be independent of the Departments sponsoring the industries whose activities may cause pollution.

24. What the Government propose is a strengthening of information exchange systems between Departments and others concerned with environmental matters. DOE would seek to get those commissioning environmental research to exchange programme information - where this does not already happen - in order to produce an overview of what work is being done and where. Information would be made available at two levels; at one level for Ministers and those concerned with strategic scientific and research decisions; and at another level of detail for experts and those who must translate research needs into research activity. ACARD may wish to invite Departments to report on progress.

Construction

25. The Government agree with ACARD that the construction industry needs to be

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stimulated both to do more R & D and to apply new technology more effectively (4.11). However it is not proven that the most effective way of achieving this would be through additional expenditure by the DOE on construction R & D (4.10). A variety of possible initiatives are being considered by the Government to improve the performance of the construction industry. These possibilities include: a Construction Technology Board as recommended by NEDO primarily to improve technology transfer (4.12); an initiative to improve education and training systems; an industry technology advisory service; the development and application of robots; and more effective insistence by public sector customers on the procurement of quality assured products and the development of quality assurance systems for design and construction work (on which the Property Services Agency, PSA, is already leading the way).

26. Even though PSA is the largest single client of the UK construction industry, the Agency only accounts for around 5 per cent of the industry's output; thus public purchasing initiatives have to be carefully devised to be effective (4.13). With PSA in the lead, some other public clients are now demanding quality assured products, contractors and consultants. A growth in quality assurance schemes would lead to improved performance by the industry with a faster adoption of best practice embodying current technology as well as improved international competitiveness.

Transport

27. With a view to enhancing the contribution of its R & D programmes to wealth creation the Department of Transport (DTp) have been examining with 15 selected firms (from the industries for which they are a major customer ie construction and provision of traffic control and communication systems) the scope for closer collaboration with the Transport and Road Research Laboratory (TRRL) (4.16). Evaluation of this exercise is not complete but the main factual results show a demand for joint working and the use of TRRL staff as consultants. The scope for meeting this demand is being explored. DTp have achieved improving value for money over many years in the construction and maintenance of trunk roads and motorways, but will continue to explore options, including procurement policy, which might lead to further improvement. In executing and following up their research DTp seek to collaborate with both consultants and contractors to ensure that technical innovations and other changes in highway specifications do take account of export potential as well

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as domestic needs.

28. The Government are not aware on what evidence ACARD have based their view that R & D expenditure by British Rail and London Regional Transport is 'woefully inadequate' (4.18). Nor do they share the view that the merging of the R & D grant into the total grant will seriously affect the level of their R & D. The change was made because the Government considered that autonomy in research procurement as in other purchasing policies would improve the cost-effectiveness of that expenditure by linking it closer to the needs of their businesses. DTp have successfully encouraged British Rail to have an increasing amount of its design and development carried out by manufacturers.

29. ACARD's concern over the R & D spend of British Shipbuilders is noted (4.19), but it would be hard to justify a higher level in the present state of the industry.

30. DTp consults and advises widely both with industry and with the higher education sector on all aspects of research relating to national transport policy. But because many of the issues stand largely separate from each other, the Government does not consider that the establishment of a Transport Research Coordination Board would be a cost effective way of addressing them (4.20). Those aspects of transport research related to building and civil engineering would be covered by the proposed Construction Technology Board.

Energy

31. ACARD's opinion that the scale of expenditure on UK reactor programmes is too high compared with the levels of other civil R & D spend is noted (4.23). The current level of expenditure on thermal and fast reactor programmes is the result of collective Ministerial examination and decisions. It also takes account of commitments to international collaboration and the partial transfer to the electricity generating boards of responsibility for financing thermal reactor research. The electricity supply industry is increasing its financial contribution to fast reactor R & D. Much of the rest of the thermal reactor programme is directed towards nuclear safety. Ministers have chosen to fund a safety research programme independently of the reactor operators.

32. ACARD consider (4.24) that there should be a high potential for technology

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transfer from energy industry R & D to other civil fields. The UKAEA have gone some way down this road already, eg the non-nuclear programmes at AEA Harwell and elsewhere (to which DTI contributes about £8 million/annum support). In addition, there may be potential for further spin-off from more specialized nuclear establishments.

Defence

33. MOD and DTI are already involved in initiatives designed to transfer technology at an early stage from the defence to the civil field (eg the aircraft programmes at Farnborough and Pyestock and the programme of the National Electronics Research Initiative, and are actively seeking other joint programmes to achieve the same objective (4.26). Government is currently considering further measures to increase benefits to civil industry and the economy from defence R & D and procurement and the implications of greater international collaboration for these topics. These measures include wider industrial representation on Research Establishment (RE) management boards, sharper incentives for REs to promote industrial applications, a case study of spin-off from defence contracts, better means of encouraging industry to exploit MOD-funded R & D programmes, and a pilot scheme for back-to-back defence and civil development contracts.

34. The need to respond to customers' requirements in a competitive market is crucial to industrial performance, and provides a strong encouragement for investment, for industrial R & D and for the most efficient use of all resources. Government policy is to make the greatest possible use of competitive tendering in meeting the needs of the armed forces, with a view to securing these benefits for the UK economy and improving value for money for the taxpayer. The Government consider that in the application of this competition policy, 'off-the-shelf' procurement from overseas must remain among the options (4.27).

Improvements to the Annual Review

35. New arrangements have been agreed between the Cabinet Office and the DTI for the preparation of future Annual Reviews. These include the appointment of co-ordinators by each Department who will be responsible for all aspects of each Department's response. The co-ordinators should ensure an effective correlation between each Department's text and tables (5.2).

IND Pac: Support Innovation, P63

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For the purpose of this report, the term "innovation" is defined as a new idea, product, or process that has not been previously used or known.



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