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ADVISORY COUNCIL FOR APPLIED RESEARCH AND DEVELOPMENT

70 Whitehall, London SW1A 2AS Telephone: 01-233 7140

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

17 July 1986

Dear Prime Minister,

The Advisory Council for Applied Research and Development has considered the 1986 Review of Government Funded R & D and their comments are enclosed.

I welcome the opportunity which I will have this year to discuss these comments with you.

The comments made by ACARD in 1984 and 1985 emphasised the need for the maximum contribution towards wealth creation to be gained from the full range of Government funded R & D programmes ACARD is very pleased to learn that Ministers are giving serious consideration to this matter and that the establishment of the Science and Technology Assessment Office reporting to your Chief Scientific Adviser, will strengthen their ability to assess the economic return to R & D. We hope that this process will lead to a reallocation of expenditure to maximise this return.

ACARD's principal comments on the 1986 Review concern the decline in civil R & D expenditure whilst that for defence continues to rise, (this concern applies particularly to DTI, DOE and DTp as sponsors and customers for industry); the lack of effective cooperation between Departments; the need to increase technology transfer activity and to make better use of the procurement `muscle' of Departments to improve our international competitiveness.

ACARD believes that a modest central fund would enable primary investigations of R & D matters to be undertaken in order to stimulate more cross-departmental work. This is one of the aims of studies undertaken by ACARD and we would hope to underpin these on occasions with more detailed work.

I look forward to discussing these issues and others contained within the attached comments with you when we meet on 25 July.

Yours sincerely

Francis Tombs

SIR FRANCIS TOMBS

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cc: Scientific Secretariat, CO

10 DOWNING STREET

THE PRIME MINISTER

21 July 1986

Dear Sir Francis.

Thank you for sending me the comments by the Advisory Council for Applied Research and Development, on the 1986 Annual Review of Government Funded R & D.

I look forward to discussing some of the issues raised by the Council when we meet on 25 July.

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Yours sincerely

Margaret Thatcher

Sir Francis Tombs.

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COMMENTS ON THE 1986 ANNUAL REVIEW OF GOVERNMENT FUNDED R&D BY THE ADVISORY COUNCIL FOR APPLIED RESEARCH AND DEVELOPMENT

Introduction

In our comments on the 1986 Annual Review, Section 1 considers issues arising from our 1984 and 1985 Comments; in Section 2 we look at some expenditure patterns revealed by the statistics; we then consider some issues affecting the effectiveness of that expenditure; in Section 4 we comment on environment, construction, and transport R&D, with shorter comments on energy and defence R&D; Section 5 is a brief comment on how the Annual Review itself could be improved. Our conclusions are summarised at the end.

1 Issues arising from Comments on earlier Annual Reviews

1.1 This is the fourth successive year in which the Annual Review of Government funded R&D has been produced and ACARD has submitted its Comments to Government.

1.2 We are glad to be told that Government has now set up Ministerial and official machinery to assess R&D priorities across Government, and that the wealth creation potential of programmes is to be taken into account in this.

1.3 **We look forward to receiving evidence to show that these initiatives are achieving R&D programmes with an enhanced capability of contributing to our economic wealth.**

1.4 **We continue to be concerned that initiation and control mechanisms for large programmes of interest to more than one Department are inadequate - both in organisation and in funding.** (Exceptions are the Alvey programme and the British National Space Centre). **We recommend that a central fund of £250,000 per annum be established for enabling and primary investigations on R&D matters of wide interest.**

1.5 In our Comments on the 1985 Annual Review we questioned the statement in Cmnd 8591 `that the R&D expenditure as a proportion of GDP is sufficient'. We have not received any evidence that Government has considered whether its contribution to total UK civil R&D is adequate. We welcome Government intentions to encourage private sector R&D and we will be offering advice separately on this. We would urge Government to consider whether the potential contribution of civil R&D to the economy justifies giving it a higher priority in competing claims for public expenditure.

1.6 We welcome recent moves to improve spin-off and diffusion of technology from defence research. It is too early to judge the success of these initiatives but we question whether the scale of the effort is yet significant. We are told that the contribution from the export of defence technology is in excess of some £2 billion per annum and we recognise the contribution made by defence R&D to this. But technologies developed for defence must also be applied in the civil sector if the investment is to bring the fullest returns.

The 1986 Annual Review

2 Distribution and Trends in Expenditure

2.1 Table A.2 shows that the total Government R&D expenditure will decrease in 1988/89 by 2.9% from 1984/85. In this period, expenditure on defence R&D increases by 2.9%, for total civil R&D it decreases by 8.8% and for civil Departments there is a sharp decline of 17.3%. Expenditure by DTI declines over this period by 38%: from £346.7m to £215.5m, although the latter figure does not include any provision for new launch aid allocations. We are most concerned that Government expenditure on civil R&D is declining whilst that for defence continues to rise. The decline in civil R&D investment is contrary to our recommendations in previous years, and places the UK at a disadvantage in relation to our industrial competitors; we urge Government to take steps to ensure that the decline is halted and reversed. This applies

particularly to those Departments with a sponsoring role for industry or who are its major customers such as DTI, DOE and DTp.

3. Effectiveness of Government R&D Expenditure

3.1 We made brief comment last year on the evaluation of R&D programmes and on technology transfer. These topics are of central importance and this year we have looked in some depth at the methods being employed by Departments. Government R&D programmes are disparate and have a wide range of underlying aims. With such a wide range of aims it is impossible to formulate simple criteria against which the effectiveness of all R&D programmes can be assessed. Nevertheless, to ensure that limited Government funds are used to best effect, difficult choices will have to be made between competing programmes. Evaluation procedures for R&D programmes must play a necessary part in making these choices; and there must be mechanisms for wider exploitation of technologies developed as a result of publicly sponsored R&D. Evaluation must seek to be objective, results oriented, and to have common aims; among these must be an assessment of technology transfer possibilities.

R&D Evaluation

3.2 **The evaluation of R&D programmes is complex, difficult and costly, but its application will lead to great benefits: clearer definitions of the objectives and timescales of programmes, better progress control, closer risk and success assessment; and not least, better information to guide choices between contending programmes.**

3.3 Effective evaluation must have several constituent stages:

(a) The pre-project or `ex-ante' stage: when the project's objectives are set and the risk/benefit trade-off is assessed. Also to set timetables against which progress and achievement is to be judged.

(b) The continuous evaluation stage: to monitor progress against the objectives and time tables as set. Early recognition of project failure is an important aim here; as is a recognition of possible unexpected benefits.

(c) The final or `ex-post' evaluation to establish whether the programme objectives have been met; and to assess scientific technical, and economic achievements of the programme, including technology transfer.

3.4 Methods of evaluation currently used by Departments vary widely. Most Departments are using methods which are applied only retrospectively rather than combining ex-post with continuous evaluation. Many of the techniques in use are applied in an ad hoc and unco-ordinated way, and do not constitute a complete process of evaluation. For many Departments it is unclear where the responsibility for setting the procedures and conducting the evaluation lies.

3.5 **Where programmes involve co-operation between Departments, mechanisms must exist to ensure that objectives are clearly agreed so that effective evaluation can be made by the contributing Departments. We see little evidence of these mechanisms.**

3.6. **Departments and Government as a whole must use evaluation as part of the process of setting priorities for UK research. We recommend that Departments should give more attention to their evaluation procedures and ensure that they are applied.** Otherwise, Government R&D cannot be managed to best effect.

Technology transfer

3.7 **Technology transfer is of crucial importance in obtaining maximum benefit from R&D expenditure. All Departments should recognise this, and project formulations should always indicate who is intended to benefit from the work**

and how the results are to be transferred. DTI already reports some progress in this regard.

3.8 The interpretation by Departments of what constitutes technology transfer appears rather narrow and variable. Effective technology transfer will differ between programmes and Departments but it should encompass the following aspects:

(i) Communication and the promotion of the use of research results and new technologies both within Government and to industry, including groups who may need stimulation to see the relevance of results to their own field.

(ii) The examination of results to determine whether they have a potential in other application fields.

(iii) The interchange and transfer of people between Departments, and between Departments and industry. The benefits of this are twofold: staff movement is an effective means of transferring knowledge and it encourages researchers to involve themselves in the exploitation of their work.

(iv) The use of external organisations (such as the British Technology Group(BTG)) specialising in technology transfer.

(v) The monitoring of international R&D work so that technologies developed elsewhere may be recognised and transferred to the UK; and that opportunities for the sale of UK technology can be identified.

(vi) Machinery to assess the financial returns from Departments' technology transfer activities.

3.9 **Departments should require both internal and external applications for R&D funding to make a reference to the technology transfer potential of the**

work. Government must give emphasis to technology transfer into manufacturing, to stimulate advanced production methods which will raise the `added value' of products, and will lead to enhanced international competitiveness.

3.10 It should be considered how Departments that achieve effective technology transfer might benefit from their success by being credited with income arising from their R&D work.

3.11 **Technology transfer must become a major issue for Government R&D. We recommend that responsibility for technology transfer should be assigned to a senior member of each Department.**

4 Comments on Specific Sectors

4.1 We have selected environmental, construction and transport R&D for comment this year because **the management of the natural environment and an effective transport infrastructure have a wide economic importance and a direct impact on wealth creation, and because the level of R&D spending in these sectors by Government is fragmented and low compared with eg MAFF, DEn/AEA.**

4.2 The major proportion of Government R&D on environmental matters is through DOE and NERC, but several other bodies (eg HSC, MRC, MAFF) are sponsoring research which they classify as environmental. DOE and DTp are the principal bodies sponsoring R&D for the built environment.

Environment

4.3 The effects of agriculture, industry, transport, building and leisure activities on the environment are matters of wide importance and public concern. For many environmental problems the data are weak, and this makes it difficult to provide quantified arguments on risks and benefits. As a result decisions are often taken without enough facts. A central objective of environmental R&D must therefore be to generate adequate and robust data in advance of policy decisions. Departments (and DOE in particular) should ensure

that their R&D anticipates needs rather than only reacting to them, and that research on topics at the boundaries between Departments is not overlooked.

4.4 The control of environmental hazards can be extremely expensive. If environmental research can establish that the threat from a hazard is in fact limited or non-existent, the resulting financial saving may be considerable.

4.5 Many Departments are sponsoring R&D with an environmental component. But we have difficulty in discerning any direction of Government thinking on environmental matters, as the Departments concerned report their environmental research activities so differently. We perceive a lack of inter-Departmental co-ordination on environmental R&D. Where Departmental programmes have common aims it is wrong for them to be formulated and carried out in isolation.

4.6 There is moreover considerable overlap in Departmental activity and in their R&D. For example MAFF undertakes R&D to prevent flooding and waterlogging of urban and agricultural land and to maintain sea defences; whereas DOE's programmes are in support of the freshwater environment, the Water Authorities, and the rural environment. Nuclear waste management and acid deposition also involve many Departments, corporations and sections of industry and appear insufficiently co-ordinated.

4.7 **We question whether there is an adequate policy for R&D on environmental matters involving several Departments. We consider that the direction and effectiveness of such projects could be improved by setting up `national programmes' with well defined objectives.** Nuclear waste management research would seem a possible example.

Construction

4.8 The construction industry, broadly comprising building and civil engineering (including materials and components), contributes some 10% of GDP,

with R&D at only 0.7%* of construction turnover. In terms of international comparisons, UK Government support for construction R&D lags behind France, Germany and the US but is probably ahead of Japan. DOE's total support is only about £16.5m per year (which also covers relevant work on radioactive waste, housing and water supply). Much of the construction research in DTp (£9m) also makes an indirect contribution to the industry. About £1.5m goes to the industry from the DTI under the SFI scheme. Private sector R&D (£80m per year) is mainly carried out by individual manufacturing firms.

4.9 The DOE is the sponsoring Department for the construction industry, and is also through the PSA, a substantial customer. The policy which guides DOE R&D on construction is:

i. to do mainly what is needed for Government's own purposes.

ii. to leave it to the construction industry itself to do the research necesssary to maintain competitiveness, preferably in partnership arrangements.

iii. not to do what is the responsibility of local authorities

iv. not to do basic environmental research, which is left to SERC, NERC, ESRC etc

4.10 **DOE emphasis is therefore not to do research that other bodies `ought to do'. We believe this is inadequate. As the sponsoring body for the construction industry the Department should either perform or sponsor wealth creating research not adequately initiated by others.**

*Figures taken from the National Economic Development Office (NEDO) report: `Strategy for Construction R&D'

4.11 The conclusions of the NEDO report `Strategy for Construction R&D' taken together with the information in the Annual Review appear to show that DOE has not assigned enough priority and resources to construction R&D to help the industry to maintain its international competitiveness. **We consider that more resources should be allocated by DOE to encourage construction R&D, and the diffusion of technologies throughout the industry.**

4.12 The NEDO report recommends that a Construction Research Board should be established to co-ordinate private and public R&D. We agree with this, and we feel that DTp should be involved in this Board.

4.13 A theme of the recent ACARD study on the UK medical equipment industry is that public sector procurement practices do not encourage the production of advanced internationally competitive equipment. This applies equally to the construction industries. **As DOE (through the PSA) and other Government Departments are major customers of the construction industries, public purchasing policies should be modified to ensure more stimulus for technological advances which would enhance the international competitiveness of these industries.**

Transport

4.14 Both DTp and DTI support transport R&D. DTI sponsors R&D for the vehicle supply industry at about £12.0m per annum, maritime technology and shipbuilding £5.0m p.a and predominantly aerospace at £183.0m p.a. DTp expenditure in 1985/6 on R&D was: support for procurement £8.7m, support for statutory duties £7.9m and support of policy £8.2m, R&D for improvement of technology has been phased out in 1985/86 and DTp expenditure under this heading is now zero.

4.15 DTp's research programme is thus mainly oriented towards policy support, the framing of standards and the maintenance of technical efficiency.

4.16 **As the largest customer for civil engineering (notably highways and bridges) we would expect the Department to be particulary concerned with the health of these industries, for which the NEDO report cited earlier expressed concern. We consider that DTp as a major public customer should take a wider view of its responsibilities, and its R&D programmes should incude more - not less - direct support for the transport industries, to make them more competitive.**

4.17 The main contractor for road transport research is the Transport and Road Research Laboratory (TRRL), which spends about half of DTp's total R&D funds internally. This laboratory mainly supports the Department's policy responsibilities. This may be too narrow for the health of the industry which provides the transport infrastructure. It is regrettable that there has been no recent annual report issued by TRRL (its last report was published in 1979).

4.18 Although some transport related industries undertake high levels of R&D (e.g. aerospace) others appear to be niggardly e.g. R&D spending by British Rail (BR) and London Regional Transport (LRT) is woefully inadequate. Up to recently, this was jointly funded between BR/LRT and DTp, but these arrangements were terminated in 1985-86, with the R&D grant being merged into the total grant they get from the Department. This leaves BR and LRT to decide on their own allocations betweeen R&D and other forms of investment and expenditure. Such a change in the arrangements could seriously affect the level of R&D which is already low.

4.19 We also note that the R&D spend of British Shipbuilders has fallen over the last year to £2.7m which at 1.14% of turnover seems completely insufficient to maintain the industry.

4.20 Efficient transport systems are crucial to the effectiveness of all industries. The multiplicity of Government bodies and nationalised industries involved with transport research makes a co-ordinated policy almost impossible.

We consider that the case for a Transport Research Co-ordination Board (analogous to the Construction Research Board proposed by NEDO), should be explored.

Energy

4.21 The Advisory Council in Applied R&D for Fuel and Power (ACORD) is now considering a major appraisal of all the energy technologies that might be deployed in the UK. We believe that this would provide a useful foundation for the Council to examine energy R&D in its Comments on the 1987 Annual Review, and we therefore make only limited comment this year.

4.22 In 1985/86, UKAEA spent close on £380m on nuclear energy research, although half of this was recovered from "receipts" which the Annual Review does not break down by source or sector. Of the nett reported expenditure, £18m was for thermal reactors, £96m for the fast reactor.

4.23 **It is important for the UK to retain nuclear energy expertise, but we believe that the scale of expenditure on the reactor programmes is too high especially when contrasted with that of DTI which sponsors R&D for the whole of UK industry.**

4.24 Given the scale of expenditure on energy R&D, there should be high potential for technology transfer which can assist developments in industries not directly concerned with power generation. This should be given an adequate priority by all those benefiting from these funds.

Defence

4.25 In view of the importance of defence R&D within the total we consider it appropriate to return to this topic next year. We therefore make only limited comment this year.

4.26 **The impact of defence R&D on UK industry is considerable, yet it has often been difficult for technologies developed primarily for defence purposes to be transferred to benefit civil applications. Methods should be explored for incorporating the interest of the civil sector into suitable defence R&D programmes sufficiently early to facilitate the transfer of technologies.**

4.27 When equipment is bought at fixed-price terms, there is a fraction of the price paid, whether from UK or overseas sources, which must be attributed to R&D. For high technology equipment this fraction may be considerable. The figures given in the Annual Review may therefore underestimate the total expenditure on defence R&D. **We consider that the purchase of 'off-the-shelf' equipment from overseas will inevitably enhance the R&D capability of our international competitors and this applies not only to defence.**

5. Improvements to the Annual Review

5.1 The lack of detail in the Annual Review makes it difficult to provide an opinion on particular aspects of Departmental programmes. We shall consider whether in future years Departments should provide us with more programme background to aid in preparing these Comments.

5.2 It seems to us that in some Departmental submissions the text and tables in part II are inadequately correlated. The text often fails to refer to the levels of current expenditure, the trends or advance reasons for them. **We consider that the value of the Annual Review (both to ACARD and to Government) would be enhanced if Departments were to ensure full correlation between their text and tables.**

6. Principal Conclusions and Recommendations

6.1 We continue to be concerned that initiation and control mechanisms for large projects of interest to more than one Department are inadequate - both in organisation and in funding. We recommend that a central fund of £250,000 per annum be established for enabling and primary investigations on R&D matters of wide interest. (1.4)

6.2 Where programmes involve co-operation between Departments, mechanisms must exist to ensure that objectives are clearly agreed so that effective evaluation can be made by the contributing Departments. We see little evidence of these mechanisms. This applies particularly to environmental R&D. (3.5) (4.7)

6.3 We are most concerned that Government expenditure on civil R&D is declining whilst that for defence continues to rise. The decline in civil R&D investment is contrary to our recommendations in previous years and places the UK at a disadvantage in relation to our industrial competitors; we urge Government to take steps to ensure that the decline is halted and reversed. This applies particularly to those Departments with a sponsoring role for industry or who are its major customers such as DTI, DOE and DTp. (2.1)

6.4 Departments and Government as a whole must use evaluation as part of the process of setting priorities for UK research. We recommend that Departments should give more attention to their evaluation procedures and ensure that they are applied. (3.6)

6.5 Government must give emphasis to technology transfer into manufacturing, to simulate advanced production methods which will raise the `added value' of products; public purchasing policies should be modified to ensure more stimulus for technological advances. These actions will lead to enhanced international competitiveness. (3.9) (4.13)

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6.6 The management of the natural environment and an effective transport infrastructure have a wide economic importance and a direct impact on wealth creation, but the level of R&D spending in these sectors by Government is fragmented and low compared with eg MAFF, DEn/AEA. (4.1)

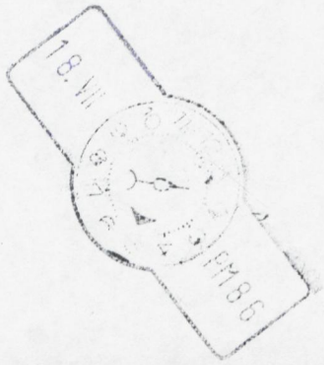
6.7 As the sponsoring body for the construction industry the Department of the Environment should either perform or sponsor wealth creating research not adequately initiated by others. (4.10)

6.8 We consider that DTp as a major public customer should take a wider view of its responsibilities, and its R&D programmes should include more - not less - direct support for the transport industries, to make them more competitive. (4.16)

6.9 It is important for the UK to retain nuclear energy expertise, but we believe that the scale of expenditure on the reactor programmes is too high especially when contrasted with that of DTI which sponsors R&D for the whole of UK industry. (4.23)

6.10 Methods should be explored for incorporating the interest of the civil sector into suitable defence R&D programmes sufficiently early to facilitate the transfer of technologies. Technologies developed for defence must also be applied in the civil sector if the investment is to bring the fullest returns. (4.26 and 1.6)

6.11 We consider that the value of the Annual Review (both to ACARD and to Government) would be enhanced if Departments were to ensure full correlation, between their text and tables. (5.2)



Qn 0368

MR MARK ADDISON
10 Downing Street

9 July 1986

cc Dr Burdett
Mr Jones

Sir Francis Tombs, the Chairman of the Advisory Council for Applied Research and Development will shortly be sending to the Prime Minister a copy of the the Council's comments on the 1986 Annual Review of Government Funded R & D. We are delaying his letter until the Annual Review itself can be sent to the Prime Minister and this will not be before 17 July. I suggest that a brief letter to Sir Francis along the lines of the attached draft is all that is required in reply at this stage.

For your information and reference, a draft copy of these coments is enclosed. It is not anticipated that the final comments will differ from this draft.

Mr Fairclough will be forwarding, in due course, a summary of the main points in the Review and a short background brief to cover the points Sir Francis will raise when he meets with the Prime Minister on 25 July.

CATHY CUNNINGHAM

Enc.

ACARD 6 / 86

Press Notice

ADVISORY COUNCIL FOR APPLIED RESEARCH AND DEVELOPMENT
70 Whitehall London SW1A 2AS

16 JUNE 1986

UK CAN INCREASE ITS COMPETITIVENESS BY USING MORE SOFTWARE, SAYS ACARD REPORT

The UK can increase its competitiveness by using more software says a report "Software - A vital key to UK competitiveness"* published today by the Advisory Council for Applied Research and Development (ACARD).

The report says that world wide, the manufacturing and service industries are increasing their competitiveness by applying software more widely. To apply software effectively, the UK industries require a better understanding of the nature and power of software; this understanding can only be achieved through increased in-service education and training.

The world market for IT products is large and growing rapidly. Major industrial nations are vigorously developing, promoting, and exploiting IT. Software is a key strategic element in the fierce economic competition between such nations.

ACARD's attention was drawn to the possibility that the UK might be failing to develop and apply software sufficiently rapidly and widely in all industries. A related possibility was that the UK was failing to win its expected share of the world market for software.

The report recommends forming an expert body to be called STARTING (Software Technology and Applications Review Team of Industry and Government), to monitor the implementation of the recommendations and their effectiveness in achieving the targets set. STARTING's main function would be to hold an annual, large scale, formal review meeting to consider a performance report of software users, appliers and suppliers.

*HMSO ISBN 0 11 630829 X £6.00

The main recommendations for Industry are:

* In-service training initiative for all users, appliers and suppliers.

* Increased application of software to increase the competitiveness of the manufacturing and service industries.

* Marketing initiative for UK software products and services.

The main recommendation for government is for inter-departmental cooperation on:

* Public purchasing to exercise demand side leadership.

* Technology transfer acceleration.

* Better R&D planning to avoid discontinuities in policy and funding.

* In-service training initiative for government employees.

Welcoming the launch of the report, Sir Francis Tombs, Chairman of ACARD said that he was pleased that the Prime Minister had agreed to publication of the report which ACARD hoped would stimulate public discussion of this key issue and lead to effective action.

Issued on behalf of ACARD by
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Notes for Editors

The ACARD Working Group was set up in January 1985 with the following membership:

Mr J Coplin (Chairman)	Director of Design, Rolls Royce Ltd
Miss S Bond	Royal Signals and Radar Establishment, Ministry of Defence
Mr D Collens	Technical Director, Software Sciences Ltd
Mrs J Connell	General Manager, F International Ltd
Prof C A R Hoare	Programming Research Group, Oxford University
Mr G W Holmes	Deputy Chairman, Systems Designers plc
Lt Col P Ost	Procurement Executive, Ministry of Defence
Mr D Robson	Controller, Software Support Services, National Westminster Bank plc
Dr M F Smith	Head of R&D, ISTEL Ltd
Mr J Whalley	Technical Manager, British Aerospace, Manchester
Dr C Whitby-Strevens	Microcomputer Support Manager, Inmos Ltd
Dr R W Witty	Deputy Director (Software Engineering), Alvey Programme

The Working Group's report was considered in February 1986 by ACARD, who endorsed its conclusions and recommendations. It is now published, with the approval of Government, to draw attention to the importance of software, to the concerns arising from the findings and to facilitate wider discussion of the Working Group's Recommendations.

The Advisory Council for Applied Research and Development (ACARD) advises the Government on applied research, design and development and the application of research and technology, together with the co-ordination of these activities with basic research. Its current chairman is Sir Francis Tombs, and the other members of the Council include senior industrialists, chairmen and technical directors of major companies, distinguished academics and other leaders in the field.

The formal terms of reference of the Council are -

"To advise the Government and publish reports as necessary on -

i. applied research, design, and development in the United Kingdom;

ii. the application of research and technology, developed in the United Kingdom and elsewhere, for the benefit of both the public and private sectors in accordance with national economic needs;

iii. the co-ordination, in collaboration with the Advisory Board for Research Councils, of these activities, with research supported through the Department of Education and Science;

iv. the role of the United Kingdom in international collaboration in the fields of applied research, design and development related to technology."