PREM 19/481

MT

PART 2

Confidential Filing

ACARD.

GOVERNMENT MACHINERY

Part 1: May 1979
Part 2: Aug 1980

Referred to	Date	Referred to	Date	Referred to	Date	Referred to	Date
~~3.11.80~~							
~~22.12.80~~							
~~3.2.81~~							
~~4.2.81~~							
~~23.2.81~~							
~~6.4.81~~							
~~26.5.81~~							
~~21.9.81~~							
~~22.10.81~~							
~~11.10.81~~							
14-12-81							

PREM 19/481

PART 2 ends:-

WR to D. Wright 14/12/81

PART 3 begins:-

ACARD to RTA 18/1/82

APPOINTMENTS IN CONFIDENCE jfh

MR WRIGHT

Advisory Council for Applied Research and Development (ACARD)

The Prime Minister has seen Sir Robert Armstrong's minute of 11 December, reference A06901.

She has asked whether it is really necessary to suggest to Dr. Spinks that he should resign the Chairmanship of ACARD at this stage. She realises the problems that his illness has caused, but she feels it would be heartless to ask him to resign. She would much prefer to leave things as they are.

WR

14 December 1981

Prime Minister,

No - surely we can wait... We cannot do such a heartless thing to Dr. Spinks. WR

Content to proceed as at A?

11/12

Ref. A06901

PRIME MINISTER

Advisory Council for Applied Research and Development (ACARD)

In my minute of 21 September (Ref. A05591) I told you that the Chairman of ACARD, Dr Alfred Spinks, was mortally ill, and would not be able to resume his duties; and that for the time being Sir Henry Chilver, the Deputy Chairman of ACARD, would act as Chairman. We have now completed the review of ACARD's usefulness, and you have agreed that it should continue in being. We have the report of the House of Lords Sub-Committee of the Committee on Science and Technology. They recommend that ACARD should continue; indeed, they would like it to evolve into a Council for Science and Technology. They have not recommended - as some thought they might - that ACARD should have a Ministerial Chairman; they propose an independent part-time Chairman.

2. Dr Nicholson, the Chief Scientist (CPRS), thinks that the time has come to recognise that the present situation is unsatisfactory, and to move to a definite appointment of a new Chairman in place of Dr Spinks. Mr Ibbs, who is an old friend and colleague of Dr Spinks, has volunteered to undertake the difficult task of suggesting to Dr Spinks that he should resign the Chairmanship of ACARD on the grounds of ill health. Sir Henry Chilver undoubtedly has what it takes to be Chairman of ACARD; and, if the Government decided to accept the House of Lords Sub-Comittee's recommendation that ACARD should evolve into a Council for Science and Technology with an independent part-time Chairman, he would be a perfectly appropriate Chairman for that.

A

3. We, therefore, recommend that Mr Ibbs should now be asked to suggest to Dr Spinks that he should resign the Chairmanship of ACARD, and that we should appoint Sir Henry Chilver as Chairman for a period of two years from 1 January 1982 to 31 December 1983.

RA

ROBERT ARMSTRONG

11 December 1981

10 DOWNING STREET

From the Private Secretary

cc CPRS
CSD

Govt Mach

MR WRIGHT

Advisory Council for Applied Research and Development

The Prime Minister was grateful for Sir Robert Armstrong's minute of 22 October (Ref. A05770). She agrees that ACARD should continue in being. She notes that any suggestions for increasing the effectiveness of ACARD, including those of the relevant Lords Sub-committee, will be taken into account.

However, the Prime Minister sees no need for another review in two years' time to confirm that there is still a need for such a body and that it is operating effectively.

I am copying this minute to Jeremy Colman (Sir Ian Bancroft's Office) and Gerry Spence (Central Policy Review Staff).

26 October 1981

Prime Minister 1

Ref: A05770

Agree to the recommendation in paragraph 4 overleaf?

RESTRICTED

PRIME MINISTER

Let it continue. I see no need for another review in 2 years time. 23/11

Advisory Council for Applied Research and Development (ACARD)

In my minute of 21st September I told you that the review of the future of ACARD which you asked us to carry out in the autumn of this year was in hand and that I was likely to recommend that ACARD was a useful body and should continue.

2. The review has now been completed and a report is attached. All the Departments concerned with the work of ACARD (Industry, Education and Science, Energy, Environment and Defence) and the CPRS endorse the view that a body such as ACARD is needed and that it operates cheaply and effectively. We have a number of ideas for further improving its effectiveness, for example by broadening the membership to include technologists holding executive positions in industry in addition to directors of research. The success of ACARD undoubtedly depends very much on its chairman and on the official support we provide. As I said in my minute of 21st September we believe that the acting Chairman, Sir Henry Chilver, would be a worthy successor to Dr. Spinks, and that the new Chief Scientist in the CPRS will be well qualified to stimulate and steer the work of ACARD into fruitful areas.

3. As it happens, a Sub-Committee of the House of Lords Select Committee on Science and Technology will be reporting towards the end of the year on the subject of Science and Government. We have reason to expect that the Sub-Committee will support the activities of ACARD and endorse the need for such a body. It is possible that they might favour some merger between ACARD and the Advisory Board for the Research Councils (ABRC). All Departments agree, however, with the recommendation in the penultimate paragraph of our Report that the ABRC, which has the task of advising on the allocation of resources to the research councils and on pure research matters, should be kept separate from ACARD and that effective liaison should be maintained by the existing arrangements for overlapping membership. It does not seem worthwhile to delay completion of the review until the Sub-committee have reported; we should

keep uncertainty and delay to a minimum, if we want ACARD to continue effectively, and we need to go ahead as soon as possible with the recruitment of new members.

4. I therefore recommend that ACARD should continue, but that there should be another review in two years' time to confirm that there is still a need for such a body and that it is operating effectively. Meanwhile we shall take account of any suggestions which may emerge for increasing further the effectiveness of ACARD including any relevant recommendations from the Lords Sub-committee.

5. I am sending copies of this minute to Sir Ian Bancroft and to Mr. Ibbs.

RA

Robert Armstrong

22nd October 1981

REVIEW OF THE ADVISORY COUNCIL FOR APPLIED RESEARCH AND DEVELOPMENT

GENERAL BACKGROUND

ACARD was established in 1976 and met for the first time in January 1977. The decision to set up the Council was announced in a memorandum (No 25) to the Select Committee on Science and Technology (Science Sub-Committee) by the then Lord Privy Seal. The then Government had concluded that, among improvements in the co-ordination of policies towards science and technology there should be a forum of external advice to central Government on applied R and D and technology, playing a similar role to that being undertaken in the field of scientific research and training by the Advisory Board for the Research Councils (ABRC). Unlike the ABRC, ACARD was to concentrate mainly on the industrial application of science and technology rather than on pure science. It was also to take into account private sector R and D as well as that financed by Government and the Council's membership was to be drawn largely from people with experience relevant to the development of technology and industry.

2. When the current administration came into office in 1979 the Prime Minister agreed, following a review by Sir Leo Pliatzky, that ACARD should continue in existence for another two years and should then be reviewed. The Prime Minister asked Sir Robert Armstrong to report on ACARD's performance in the autumn of 1981. At the same time Dr Spinks was appointed as the new Chairman. It was decided not to appoint a Ministerial Chairman (the Prime Minister had not given any other Minister a co-ordinating role in scientific matters parallel to that of the Lord Privy Seal in the previous administration).

3. Notes giving current membership, terms of reference and a list of published reports to date are attached (Annexes 1 and 2). The Head and Chief Scientist of the Central Policy Review Staff act as assessors to the Council as do Chief Scientists of the Departments of Energy, Industry, the Environment and the Ministry of Defence. The Chief Scientists attend the Council's meetings. The Council's Secretariat (two Principal Scientific Officers) is provided by the Cabinet Office.

4. The full Council meets half a day four times a year, but much of its work is carried out in small working groups. The membership of such groups is drawn partly from the Council and partly from non-members who can make a special contribution to

the subject under review. Typically a working group meets monthly for six to twelve months and will seek both written and oral evidence to aid its enquiry. The subjects for working group investigations have until recently been chosen by the Council itself although the most recent report ("Exploiting Invention") was requested by the Prime Minister. ACARD reports are submitted to the Prime Minister with a request for permission to publish. This has never been refused.

COSTS

5. The costs of ACARD are met from Cabinet Office vote. ACARD members are unpaid but their expenses are reimbursed. In 1980/81 these amounted, for Council and Working Group members, to about £3,000. The cost of supporting staff (1½ Principal Scientific Officers, 1/10th Assistant Secretary and CPRS support of 1/5th Under Secretary and 1/3rd Adviser) in the same year and also borne on Cabinet Office vote, amounted to about £63,000.

REVIEW

6. The activities of ACARD have been reviewed in accordance with the standard analysis proposed by the Civil Service Department for the review of advisory bodies and there has been consultation with the Departments mainly concerned with ACARD's work (Industry, Education and Science, Energy, Environment and Defence). The conclusions are summarised in the following paragraphs.

Is there a continuing need for outside advice in the field of applied R & D?

7. ACARD provides a forum for discussion of applied R and D and technology by those in industry concerned directly with their application and Chief Scientists concerned with Departmental R and D policies. ACARD has concentrated on advising the Government on new and developing technologies (eg microelectronics, biotechnology, inflrmation technology) and broader subjects (eg innovation and technological change) which cut across Departmental boundaries and are of relevance to many industrial sectors. ACARD thus provides part of the machinery for co-ordinating the separate R and D activities and policies of Departments and relating these to the needs of industry. For the future ACARD proposes to strengthen its relationship with Departments by entering into a dialogue with them on policy and priorities for R and D and technology, and intends to develop closer links with industry. At the same time it will continue to carry out in depth studies of new or developing technologies and broader studies on the impact of technology and technological policy. The need for

outside advice in this area has, if anything, increased since the last review, with the growing public awareness that the United Kingdom's future economic success depends on moving ideas swiftly and effectively from the laboratory to the market place.

Is there a need to maintain a special formal body for this purpose or could the need be met equally well by informal, ad hoc methods?

8. Advice could be taken from those in industry and elsewhere on an ad hoc basis but it is not clear that this would be any cheaper (see para 5) or more effective than the current arrangements. There is an additional advantage in having a publicly visible body providing advice to Government on science and technology and involving people from outside Government. This is particularly important with a decentralised system of support for R and D. ACARD has become increasingly well known publicly over the past three years through publication of its reports and the growing number of those in industry and the universities who have had direct contact with ACARD's work through membership of the Council or its working groups, or by providing advice in its studies, or through feedback and discussion of its reports. Abolition of ACARD would probably lead to considerable outside criticism on the grounds that Government was discounting the importance of science and technology. (A sub-Committee of the House of Lords Select Committee on Science and Technology is currently considering Science and Government including the need for a possible strengthening of the machinery for co-ordination at the centre; and the House of Commons Education Science and Arts Committee is also currently considering science policy.)

Is ACARD doing a good job, judged by its terms of reference and the practical usefulness of its advice?

9. ACARD's main output has been the publication of nine reports (listed in Annex 2). The reports make recommendations directed to Government, industry and others on how the benefits of scientific and technological developments can be maximised. The effectiveness of the reports can be judged in two main ways - the extent to which the recommendations have been put into effect by the Government and other bodies to which they were directed, and the extent to which the reports have raised general public awareness of important technological issues.

10. A quantitative assessment of the responses to ACARD's reports is given in Annex 3. In most cases the Prime Minister has asked the Departments concerned to prepare a response to the report and both the report and the Government's response have been published. Many of the recommendations have been put into effect. In some cases

action would probably have resulted anyway (eg the establishment of Celltech) although ACARD probably helped to accelerate the process; in others ACARD could claim to be the instigator (eg the appointment by the Science and Engineering Research Council of a Director for Biotechnology).

11. The ACARD reports have also been well received by the media and the public with a sale in each case of 2,000 to 5,000 copies. Their success can be attributed partly to their content and timeliness and partly to the format of the reports and their concise and readable style. The treatment given to the reports not only in the scientific and technical press but also in national newspapers such as The Times and the Financial Times has undoubtedly increased public awareness of important technological issues and of ACARD's role.

12. In addition to publishing reports, ACARD is also developing a useful dialogue with Ministers and Departments over their R and D strategies; Sir Keith Joseph attended the Council in his capacity as Secretary of State for Industry and Mr Shelton, Parliamentary Under Secretary of State at the DES attended the October meeting.

13. ACARD has interpreted its terms of reference fairly broadly but has generally worked within them. It has not done any specific studies on international collaboration (item 4 of its terms of reference) but has considered international aspects in several reports. ACARD is aware that it has not studied these specifically but returns to them from time to time; so far a suitable topic for detailed study has not emerged.

Should changes be made to the composition and operation of ACARD which would streamline its work or reduce costs?

14. ACARD has a rolling membership with about one third replaced each year. This allows adjustments to be made in its composition according to the sort of study it is likely to wish to carry out. There has been no suggestion that ACARD should be either substantially larger or smaller: it is probably about right. ACARD meets four times a year for half a day and this seems adequate – although whole day meetings have been held on occasions. Much of its work is done through working groups and ACARD also has a steering group comprising the Chairman, Deputy Chairman, Chief Scientist, CPRS and working group chairmen, which when necessary meets between Council meetings.

Is there scope for amalgamating ACARD with another body?

15. ACARD could be amalgamated with the ABRC but there is little to be said for it. The ABRC has the task of advising on the allocation of resources to the Research Councils and advising on pure research matters. Its functions are thus distinct from, albeit complementary to, those of ACARD. There is a need for liaison between the two bodies but the existing arrangement of overlapping membership is adequate to meet this need.

CONCLUSION

16. All Departments concerned with ACARD's work are agreed:

i. that there is a continuing need for outside advice to the Government on how applied research and development can best be deployed in both the public and private sectors;

ii. that a formal publicly visible body such as ACARD is the best means of providing this advice;

iii. that ACARD has made useful recommendations which have been implemented, and has raised public awareness of important technological issues;

iv. that there are no changes in its composition or operation which would further reduce its costs, which are small;

v. that it would not be appropriate to amalgamate ACARD with the ABRC or any other body.

It is therefore recommended that ACARD should continue, with a further review in two years' time.

CABINET OFFICE

The Advisory Council for Applied Research and Development (ACARD) was established in 1976 with the following terms of reference -

'To advise Ministers and to publish reports as necessary on -

i. applied R and D in the United Kingdom and its deployment in both the public and private sectors in accordance with national needs;

ii. the articulation of this R and D with scientific research supported through the Department of Education and Science;

iii. the future development and application of technology;

iv. the role of the United Kingdom in international collaboration in the field of applied R and D.'

The members of the Council (August 1981)* are -

Dr A Spinks CBE FRS (Chairman)	formerly Director of Research, ICI Ltd
Sir Henry Chilver F Eng (Deputy Chairman)	Vice-Chancellor, Cranfield Institute of Technology
Viscount Caldecote	Chairman, Delta Group plc
Sir Kenneth Corfield	Chairman and Chief Executive Standard Telephones and Cables Ltd
Dr D L Georgala	Head of Laboratory, Unilever Research
Professor W B Heginbotham OBE	Director-General, Production Engineering Research Association
Mr C S King CBE	Deputy Chairman BL Technology Ltd
Dr B C Lindley	Director of Research, Dunlop Ltd
Sir Alec Merrison FRS	Vice-Chancellor, University of Bristol, Chairman of the Advisory Board for the Research Councils
Mr A M Muir Wood F Eng FRS	Senior Partner, Sir William Halcrow & Partners
Mr D H Roberts	Research Director, GEC Ltd
Dr L Rotherham CBE F Eng FRS	formerly Vice-Chancellor, University of Bath
Mr J L van der Post F Eng	Chief Executive, Water Research Centre

* The 2 union members of the Council recently resigned (due to pressure of work)

ADVISORY COUNCIL FOR APPLIED RESEARCH AND DEVELOPMENT
70 Whitehall, London SW1A 2AS Telephone: 01-233 6139

The Advisory Council for Applied Research and Development (ACARD) was established in 1976 with the following terms of reference:

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iii. the future development and application of technology;

iv. the role of the United Kingdom in international collaboration in the field of applied R and D.'

The Council's published reports, available from Her Majesty's Stationery Office, are:

The Applications of Semiconductor Technology (1978) £0.85 — ISBN 0 11 630807 9

Industrial Innovation (1979) £1.00 — ISBN 0 11 630808 7

Joining and Assembly: The Impact of Robots and Automation (1979) £1.75 — ISBN 0 11 630810 9

Technological Change: Threats and Opportunities for the United Kingdom (1980) £1.75 — ISBN 0 11 630812 5

Computer Aided Design and Manufacture (1980) £2.25 — ISBN 0 11 630814 7

R and D for Public Purchasing (1980) £2.50 — ISBN 0 11 630815 X

Biotechnology (1980) £3.00 — ISBN 0 11 630816 8

Information Technology (1980) £3.30 — ISBN 0 11 630818 4

Exploiting Invention (1981) available free from ACARD

ACARD REPORT TITLE	PUBLISHED	GOVERNMENT RESPONSE	NUMBER ISSUED (March 1981)	COMMENTS ON RESPONSE TO REPORT
The Application of Semi-conductor Technology	September 1978	No specific document	4995	Report published under the previous administration. There was no formal or published response to the report but the reports recommendations were almost completely accepted and implemented through the various initiatives on microelectronics announced at the December 1978 NEDC meeting.
Industrial Innovation	February 1979	No specific document	4338	Report published at the end of the previous administration. Partial response by the then Lord Privy Seal in the course of a House of Lords debate on report in March 1979. No specific response from the present administration but many of the reports recommendations on small firms have been implemented in subsequent Budgets and other proposals (eg Royal Award for Innovation) have been taken up.
Joining and Assembly: The Impact of Robots and Automation	November 1979	April 1980	2745	The Government's response was mixed. It accepted th reports analysis of the importance of the subject bu disagreed on some of the initiatives proposed for Government. Government support for robotics has though since been increased substantially and a robotics awareness campaign has been started.
Technological change: Threats and opportunities for the United Kingdom	January 1980	February 1981	3780	Cool reception from Government. There has been litt action as a result of the report (apart from the appointment of Japanese consultants to aid technolog transfer).
Computer Aided Design and Manufacture	February 1980	February 1981	2560	The Government accepted the majority of the reports recommendations.

R & D for Public Purchasing	March 1980	June 1981	1298	Government endorsed the main thesis of the report and accepted almost all of the recommendations (which contributed to the development of policy on public purchasing).
Biotechnology	April 1980	March 1981	2742	Government responded in the form of a White Paper, highlighting the importance of the subject and accepting the majority of the recommendations. The White Paper had a cool reception but most of the recommendations have been implemented. Major developments: Celltech established; SERC Director of Biotechnology; new Government and Research Council Coordinating machinery.
Information Technology	September 1980	October 1981	2755	Most of the recommendations have been accepted by the Government and are being implemented. Major developments: appointment of Minister for Information Technology; creation of Cabinet Office Unit; formation of IT Division in DOI; appointment of advisers to PM.
Exploiting Invention	May 1981	Imminent	c500	Commissioned by the Prime Minister and published at her suggestion. Government response awaited. Generally favourable reception.

APPOINTMENTS IN CONFIDENCE

10 DOWNING STREET

From the Principal Private Secretary

SIR ROBERT ARMSTRONG
CABINET OFFICE

Advisory Council for Applied Research and Development (ACARD)

The Prime Minister has seen your minute A05591 of 21 September 1981 and she is content with the interim arrangements for the Chairmanship of ACARD which you are making because of the illness of Dr. Spinks.

23 September 1981

010

Ref: A05591

APPOINTMENTS - IN CONFIDENCE

PRIME MINISTER

Advisory Council for Applied Research and Development (ACARD)

I am very sorry to have to report that the Chairman of ACARD, Dr. Alfred Spinks, is seriously, indeed mortally, ill. There is no prospect of his being able to resume his duties.

2. When you agreed, after Sir Leo Pliatzky's review of quangos, that ACARD should continue, you asked that its usefulness and continuance should be reviewed after two years. That review is now proceeding and I will report the results in due course. I think it likely that I shall recommend that it is useful and should continue.

3. The question of appointing a new Chairman does not arise at the moment, and I would not want to raise it with you formally until we have completed the review. We are asking Sir Henry Chilver (Vice-Chancellor of Cranfield Institute of Technology), who is the Deputy Chairman of ACARD, to act as its Chairman during Dr. Spinks's incapacity. We are being careful to do this in a manner which in no way implies that he will be invited to take Dr. Spinks's place in due course; but he is in fact the strongest candidate to succeed Dr. Spinks as Chairman, on the assumption that ACARD continues in being, and he is bound to realise that his claims to succeed will be strengthened by his serving as acting Chairman in the meantime. I believe that he would in fact make a good Chairman. I understand that he has ideas for making ACARD more effective, and I believe, with him in the chair, and with a new Chief Scientist in the CPRS (on which I am minuting you separately), we should have a good opportunity for increasing ACARD's effectiveness.

RIA

Robert Armstrong

21st September 1981

APPOINTMENTS - IN CONFIDENCE

Dr. A. Spinks
Chairman
of
ACARD

9 Arncliffe
22 Greville Place
London, N.W.6
01-624 5331

Woodcote
Torkington Road
Wilmslow
Cheshire
Wilmslow (0625) 522316

PS

PS

September 1st 1981

PS

My Dear Prime Minister,

I am writing to thank you for your letter, and good wishes to my husband.

Sadly the long term outlook for him is very bleak, but all that is possible is being done to help him, and he is at home again.

Yours sincerely,

Patricia Spinks.

CF

10 DOWNING STREET

PRIME MINISTER

John Ashworth tells me that Dr Alfred Spinks, Chairman of ACARD, is seriously ill in Manchester Infirmary, suffering from a brain tumour. Would you be willing to send a letter of sympathy on the lines of the attached?

CRFSR

25 August, 1981

Title Govt March RH

10 DOWNING STREET

THE PRIME MINISTER

26 August 1981

Personal.

My dear Dr. Spinks

John Ashworth told me you were unwell, and I just wanted to write to say how sorry I am, and to wish you a speedy recovery.

I would also like to say how much I appreciate the work you have done as Chairman of ACARD. It is always horrid to be ill, and I hope you will soon be back in action.

All good wishes,

Yours sincerely

Margaret Thatcher

Dr A. Spinks

TJP

cc Press GOV Mach
na.
WR 7/5

MR PATTISON

RESPONSES TO ACARD REPORTS

You will wish to be aware of the attached replies of the Chairman of ACARD to the Government's responses to three ACARD reports: 24/4/81 — 'Technological Change', 'Computer Aided Design and Manufacture' — 16/4/81 and 'Biotechnology' (Science & Technology Jan 80). Of the three, the reply on 'Biotechnology' is the most vigorous and reflects a fairly general unhappiness in industry and the universities with the White Paper. The other two replies are more modest in tone.

R H ARAM

R H ARAM

Cabinet Office
6 May 1981

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c.c. R. Courtney.

ADVISORY COUNCIL FOR APPLIED RESEARCH AND DEVELOPMENT

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

29 April, 1981.

Dear Sir Keith

Response to ACARD Report: "Technological Change: Threats and Opportunities for the U.K."

You wrote to me on the 12 February with the Government's response to this ACARD report. The Council considered the response at its meeting on 12 March and invited me to reflect its views in a letter to you.

Both the response and your covering letter indicated a preference for ACARD to examine closely focussed, clearly defined topics. The Council noted this and agreed that most of its reports should concern such topics. It did not consider, however, that broader topics could or should be excluded. One function of ACARD is to comment on the implications of technological development for government policies and this necessarily involves the Council in some consideration of broad issues. I might perhaps add that the sales of this particular report have been considerably larger than those of some of our specialised reports, indicating substantial public interest in the general subject of technological change and its implications. I believe that the Council should continue to promote increased public awareness of such issues, and hope that you will support this.

The Government response suggested that ACARD had called for a major expansion of Government involvement in industry. The Council considered this to be a misunderstanding of the report's main theme. Our position was aptly summed up by the Prime Minister in a Parliamentary answer to Mr. Ian Mills on 14 January when she referred to Government developing with industry a framework in which industry can take R and D (and other) decisions. Recent NEDO reports have identified industries with growth potential and others where decline seems inevitable. The CBI have recently published a report that suggests comparable priorities. Such studies could facilitate the creation by Government and industry of a coherent basis for the development of technological strategies. The Council would look upon this as constructive and helpful intervention and would welcome further development of it.

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The response rightly pointed out the crucial part played by adequate profit in enabling industry to cope with technological change. It did not, however, refer to the long-lead times usually needed to establish significant change. Without appropriate investment now, industry will not be ready to take advantage of the opportunities opened up when the world economic climate improves. ACARD therefore welcomes the extra assistance for industry to which the response referred and urges that this should be given priority in the Government's spending programme since future industrial success will be founded on developments now taking place in new technologies. ACARD reports "Biotechnology" and "Information Technology" have discussed such opportunities in more detail. In this connection, the Council noted with some concern the apparent weakening of industrial support for Research Associations as a consequence of the recession.

I might add that long-lead times are a feature of higher education also, and that at the ACARD meeting considerable concern was expressed at the Government's slow response to the Finniston Report, and its policies on overseas students' fees, both of which are adversely affecting the ability of universities and other institutions of higher education to produce the skilled scientists and engineers required in the future.

It was, of course, never the intention of ACARD to suggest that service industries should deliberately take on more staff and thereby become uncompetitive. But we believe that employment growth in the future will be concentrated in the service sector: therefore, special attention needs to be paid to the development of that sector. The Council was pleased to note the support given to the development of the computer service industry. We hope that similar support will be available in other service activities, so that Government support schemes do not concentrate exclusively or excessively on manufacturing, critically important as that obviously is.

Finally, the Council was disappointed that the Govemment did not give adequate consideration to the proposal for tax incentives to encourage large firms to make available to small firms inventions that they themselves cannot use. With its limited resources, ACARD is not equipped to examine the detailed working-out of such an idea and it does seem an inadequate response on the part of Government for the proposal to be dismissed because no practical suggestions for its implementation were included in the Report. There is, I feel a parallel between this and the ACARD suggestion

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in "Industrial Innovation" for a loan guarantee system for small firms which, despite administrative difficulties, has now been implemented by the Government.

Kind regards,

Yours sincerely

Alfred Spinks

Dr. A. Spinks.

The Rt. Hon. Sir Keith Joseph, MP.,
Department of Industry,
Ashdown House,
123 Victoria Street,
London, SW1E 6RB.

RESTRICTED c.c. R. Courtney

ADVISORY COUNCIL FOR APPLIED RESEARCH AND DEVELOPMENT
70 Whitehall, London SW1A 2AS Telephone: 01-233

16 April, 1981.

Dear Sir Keith,

On 29 January you kindly sent me a departmental response to the Advisory Council's Report on Computer Aided Design and Manufacture. The paper has been considered by members of the Council's original Working Group and discussed at the March meeting of ACARD.

The Working Group and the Council were pleased to note the number of their recommendations that have been accepted by Government. It is regrettable that a different impression was given by several press reports that focussed on recommendations that were not accepted.

We do not think that continuing dialogue at this time between the Department of Industry and the Council is necessary or likely to be productive. ACARD would prefer to return to the topic in about a year's time to review progress in the context of its recommendations and the Government's response. Therefore, we do not expect a further response to the detailed points set out in the rest of this letter, but they may interest Departments concerned.

1) Our Working Group was unable to obtain much information on Government activities during its studies. ACARD therefore believes that, in the light of the comment that Government is itself a user of CAD/CAM, Departments should do more, subject only to the limits of security, to make their activities and their successes with CAD/CAM known to appropriate parts of British Industry.

2) ACARD had not expected that, at this time of financial stringency, there could be a physical move of the CAD Centre and the National Engineering Laboratory to one location. It has been glad to learn that a single Director of the two organisations has been appointed. The Government response leaves the Council with the impression, however, that this Director could promote more coordination of the two establishments' activities, for example, dissemination of information, and training.

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ADVISORY COUNCIL FOR APPLIED RESEARCH AND DEVELOPMENT
70 Whitehall, London SW1A 2AS Telephone: 01-233

3) ACARD welcomes information being made available through the Scientific Counsellors in Embassies on activities in other countries. It was particularly pleased to learn of the excellent flow of information on electronics coming back from the Scientific Counsellor in Tokyo who was appointed about a year ago. Earlier, I had been, personally, impressed by discussions at our scientific offices in Tokyo and Washington.

4) Some parts of the Government response are centred on the activity of the Mechanical Engineering and Machine Tools Requirements Board and the Computer Aided Engineering Panel of the Department of Industry. Members of ACARD are concerned that interest in computer aided design and computer aided manufacture extends outside the interests of this Board. The electronics industry for example is an extensive user of these techniques and also has a role to play in the supply of CAD/CAM equipment and software.

5) The Council has noted that the Department of Industry believes that the encouragement of the use of CAD/CAM equipment through leasing is a matter entirely for the commercial suppliers of equipment and that there are no plans to provide financial support for this purpose.

It was reported in The Times on 11 February that the Government has decided to assist the introduction of more robots in industry by paying 25% of the cost of new processes that adopt robots as prime constituents. We believe that it is also possible under the Product and Process Development Scheme for prototypes of new equipment, such as that for CAD/CAM, produced by British manufacturers to be placed on trial with British users. The introduction of CAD/CAM into industry is, we believe, as urgent and important as the introduction of robots and the Council therefore assumes that financial support under such schemes could be made available for CAD/CAM.

6) The Council thinks that there may have been a misunderstanding about Recommendation 8, on which in any case a response is awaited from the National Economic Development Council. ACARD did not have in mind that British manufacturers should at this time attempt to compete with the American manufacturers

ADVISORY COUNCIL FOR APPLIED RESEARCH AND DEVELOPMENT
70 Whitehall, London SW1A 2AS Telephone: 01-233

of large turnkey systems, but believed that the need for smaller cheaper systems, for use in small companies and in education, could provide an opportunity for a British company.

Comments in the response on software development in universities and public sector research establishments are not, we believe, relevant to this proposal. The comment that as many as thirty projects are being supported by NRDC and that a further twenty-five projects are under assessment suggests that there may be proliferations to the point where individual projects are hardly substantial or perhaps worthwhile. The response to Recommendation 11, that there are at least forty organisations currently offering 'various CAD services', raises the same question.

Dr. Duncan Davies was present at the meeting of ACARD at which all these points were discussed and we are sure that the Department of Industry will give them further consideration. As I suggested at the beginning of this letter, an immediate response would not really be profitable. I propose that ACARD should consider, in a year or so's time, whether it should review progress on this topic.

Dr. A. Spinks.

The Rt. Hon. Sir Keith Joseph, MP.,
Department of Industry,
Ashdown House,
123 Victoria Street,
LONDON, SW1E 6RB.

10 DOWNING STREET

From the Private Secretary

16 April 1981

ACARD PAPER ON PROBLEMS OF INVENTORS

Before we go ahead with arrangements to publish the revised version of this report, I should be grateful if you could remind me where we stand on the question of a draft reply to the recommendations. I wrote to you about this when we received the initial version of the paper on 22 December last.

M. A. PATTISON

Mrs. Cecily Morgan,
Department of Industry.

Ref. A04294

MR PATTISON

Advisory Council for Applied Research and Development

Your minute of 4 February gave the Prime Minister's approval to the new appointments to ACARD proposed in Sir Robert Armstrong's minute of 3 February (A04157). Sir Robert wrote to the nominees for the new posts, and all have accepted.

2. It would now be timely to make the changes in membership public. As last year, this might best be done by means of an inspired Written Parliamentary Question to the Prime Minister, together with a Press Release. I attach drafts.

D J WRIGHT

20 February 1981

DRAFT PQ ON ACARD MEMBERSHIP

To ask the Prime Minister if she will list the membership of the Advisory Council for Applied Research and Development (ACARD).

I have appointed four new members to ACARD.

The membership is now:

Dr A Spinks CBE (Chairman)	formerly Director of Research, ICI Limited
Sir Henry Chilver (Deputy Chairman)	Vice-Chancellor, Cranfield Institute of Technology
*Viscount Caldecote	Chairman, The Delta Metal Company Ltd
*Sir Kenneth Corfield	Chairman and Chief Executive, Standard Telephones and Cables Ltd
Dr D L Georgala	Head of Laboratory, Unilever Research
Professor W B Heginbotham OBE	Director-General, Production Engineering Research Association
*Mr C S King CBE	Deputy Chairman, BL Technology Ltd
Dr B C Lindley	Director of Research, Dunlop Ltd
Mr J Lyons	General Secretary Engineers' and Managers' Association
Sir Alec Merrison	Vice-Chancellor, University of Bristol Chairman of the Advisory Board for the Research Councils
Mr A M Muir Wood	Senior Partner, Sir William Halcrow & Partners
*Mr D H Roberts	Research Director, GEC Ltd

Dr L Rotherham CBE	Formerly Vice-Chancellor, University of Bath
Mr J L van der Post	Chief Executive, Water Research Centre
Mr G H Wright	Regional Secretary for Wales, Transport & General Workers' Union

*New members

DRAFT PRESS RELEASE

NEW APPOINTMENTS TO ACARD

The Prime Minister today announced changes in the membership of the Advisory Council for Applied Research and Development (ACARD).

In answer to a Parliamentary Question from [ELDON GRIFFITHS] the Prime Minister said: [Text of Answer]

Note for Editors

The Advisory Council for Applied Research and Development was established in 1976 with the following terms of reference:

"To advise Ministers and to publish reports as necessary on -

1. Applied R & D in the United Kingdom and its deployment in both the public and private sectors in accordance with national needs;

2. The articulation of this R & D with scientific research supported through the Department of Education and Science;

3. The future development and application of technology;

4. The role of the United Kingdom in international collaboration in the field of applied R & D."

The retiring members on the Council are:

Sir John Atwell CBE	Chairman, Scottish Offshore Partnership
Sir Robert Clayton CBE	Technical Director, GEC Ltd
Mr D Downs CBE	Chairman and Managing Director, Ricardo Consulting Engineers Ltd
Sir Ieuan Maddock CB	Formerly Chief Scientist, Department of Industry

The Council has published 8 reports:

The Applications of Semi-Conductor Technology (1978)

Industrial Innovation (1979)

Joining and Assembly: The Impact of Robots and Automation (1979)

Technological Change: Threats and Opportunities for the United Kingdom (1980)

Computer Aided Design and Manufacture (1980)

R and D for Public Purchasing (1980)

Biotechnology (1980)

Information Technology (1980)

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13/2.

DEPARTMENT OF INDUSTRY
ASHDOWN HOUSE
123 VICTORIA STREET
LONDON SW1E 6RB
TELEPHONE DIRECT LINE 01-212 3301
SWITCHBOARD 01-212 7676

Secretary of State for Industry

12 February 1981

Dr A Spinks CBE FRS
Chairman
Advisory Council on Applied Research
and Development
Cabinet Office
70 Whitehall
London SW1

Dear Dr Spinks.

You will be aware that the Prime Minister asked me to co-ordinate our response to your Council's report on "Technological Change: Threats and Opportunities for the United Kingdom".

I enclose the response. I regret that it has been delayed although this is partly attributable to the broad nature of the subject. I have already put to you my own preference for the Council to address itself to more closely defined topics - and have mentioned this again in the response. I believe this should be an important consideration in planning AGARD's investigations and I look forward to reading future reports.

I intend to draw attention to the Government's response through a reply to a written Parliamentary Question in the next few days, when copies of the response paper will be placed in the libraries of the House.

I am sending copies of this letter and the response paper to the Prime Minister and colleagues whose Departments have been involved in its preparation.

Yours sincerely, Keith Joseph

ACARD REPORT ON TECHNOLOGICAL CHANGE: THREATS AND OPPORTUNITIES FOR THE UNITED KINGDOM

Government Response

Introduction

1 The report of the Advisory Council for Applied Research and Development on "Technological Change: Threats and Opportunities for the United Kingdom" was published in January 1980.

2 ACARD have made eight principal recommendations, one of which encompasses four separate recommendations on small firms. The majority of the recommendations are aimed specifically at Government, and the Report also includes seven points of a more general nature which for the purposes of this response have been treated as recommendations.

3 Technological Change is an immensely wide and diffuse subject on which conclusions are likely to remain at a fairly high level of generalisation; and the more recent ACARD reports on Biotechnology and Information Technology show that concentration on a closely defined topic is likely to produce more clearly focussed recommendations.

Economic Climate

4 Many of the ACARD recommendations call for greater direct Government involvement in the promotion of technological change. It is perhaps a pity that the Report omits reference to Government schemes designed to stimulate awareness and adoption of new or under-used technologies; for example the Microprocessor Applications Project, Microelectronics Industry Support Programme,

the Product and Process Development Scheme. However, the Government is convinced that the greatest contribution it can make to technological change is to create an economic climate favourable to enterprise and growth; and an important element in this, as ACARD suggests (para 2.4), is the avoidance of unnecessary changes in fiscal and economic policy. These are the primary objectives of this Government's policy. A firmer monetary policy and cuts in public expenditure are designed to secure the progressive reductions in inflation and interest rates, which are now under way. A start has been made on switching the burden of taxation from direct to indirect taxes, and on reducing excessive rates of income tax, in order to improve rewards and incentives. A variety of measures have been taken to improve the working of the market - among them the abolition of controls on foreign exchange movements, dividends and prices, changes in employment legislation and housing policy. Administrative burdens on firms are being reviewed and eased. A number of measures have been adopted, and others are under consideration, for helping small firms; an important source of innovation and new employment.

5 Industry has generally welcomed these changes as offering the best prospect for financial stability and a revival of enterprise. A determination to stick to these policies, rather than the major expansion of Government involvement in industry that seems to be envisaged in some of the ACARD recommendations, is most likely to give industry the confidence to adopt new technology. When inflation and interest rates have come down, the fiscal and economic climate will by then already be found to have become more encouraging.

6 Although not discussed in the Report, adequate real profit levels are the critical influence on the ability of companies to cope with technological change. It is therefore extremely worrying that the real level of profitability, particularly in manufacturing industry, has been on a downward trend for many years, and more recently has reached damagingly low levels.

R & D Performance

7 Compared with leading OECD countries, the UK's performance over the last 15-20 years has been poor in areas such as productivity, value added per man and trade in finished manufactures. The result has been slower growth and relative economic decline. ACARD rightly identified research and development carried out by industry for its own commercial purposes as one of the most important elements in innovation leading to a strong economy. Here the UK's record is dramatically different from that of its competitors, with industrial funding of R & D falling by 10 per cent in constant price terms over the period 1967-75 whilst that in other leading OECD countries rose by an average of 30-40 per cent.

8 R & D focussed on the innovation of products and processes is increasingly important in determining industry's future performance. The Government will continue to invest in development when the private sector would probably not go ahead without help and when the results are likely to be to the public good. In recognition of this, the Government announced in November that it would be making additional funds available to support industrial

R & D expenditure which would probably not go ahead without support from public funds. The Science and Technology Act will be used for this purpose, and particular priority will be given to development projects likely to lead to marketable products.

New Industries and Services

9 Many of the new industries and services to which ACARD refers (paras 3.1 to 3.11) have already attracted the support of the Department of Energy and the Department of Industry's Research Requirements Boards at the R & D stage. In choosing projects to support, the Boards give priority to areas where industries based on new technologies might be generated and to research and development projects that can be carried through to commercial fruition. Examples include electric vehicle technology, composite materials, and process plant control and instrumentation. At the post-R & D stage, assistance is available under the Industry Act and through the NEB in partnership with private enterprise to encourage the setting up of new technology-based companies: (recent examples being the support for the robot manufacturing company Unimation in establishing production facilities in the UK, and the NEB private sector investment in Celltech).

10 ACARD suggest (para 4.11) that many of those displaced by increased productivity should be employed in service industries, thus improving the standard of many services. They cite in support of their view the proportions of the Japanese and UK national labour forces employed in manufacturing and service industries. However, the Government doubts whether a complete picture can be drawn from simple analogies based on the experience

of countries whose economic and social developments are historically different from our own. It is customer demand, rather than the availability of surplus labour, that is likely to determine improvements in services; and the scope for such improvements to generate substantial employment is limited both by competition and the application of new service sector technology. Overmanning would be highly damaging in those service industries subject to international competition; and any significant increase in costs in the tradeable goods sector is likely to lead to price rises.

11 The Government does however recognise the importance of service sector industries. Such industries commonly flow naturally from the technologies to which they relate and whose needs they serve; and if the climate is right and the time ripe they should not need government help to make them flourish. But in some areas, and notably in the development of software systems and the like, some support can help to stimulate and accelerate activity in rapidly-evolving fields. Thus, under existing support schemes, Department of Industry assistance to the computer services industry, directed mainly towards the development of software and systems, has amounted to approximately £1¼ million per year over the past three years. In view of the acknowledged importance to the UK of computer skills, the Department of Industry, within its overall budget, will ensure that the Software Products Scheme and the Product and Process Development Scheme continue to receive priority.

Small Firms

12 The Government agree that small firms can and do play an important part in the development and application of technological change. However, it does not agree with ACARD (para 5.2) that a major new study, along the lines of the Birch Report, of the role of small firms is necessary in addition to work already in hand in the Departments of Industry and Employment. We think we know the conditions which have been hostile to small firms. The Government's purpose in improving the economic climate is to encourage the birthrate of new firms (as well as the growth of existing firms) including high technology firms, while removing such non-market obstacles to survival as excessive taxation and form-filling over which the Government has influence.

13 The main thrust of Government assistance to small firms must continue to come through fiscal measures and by creation of a climate favouring enterprise (as discussed in para 4 above). But worthwhile assistance for small firms is already available from the taxpayer. Examples include the Microprocessor Application Project, where over half the companies assisted have a turnover of less than £2m, and the Manpower Services Commission Training Opportunities Scheme (TOPS). TOPS has recognised the importance of the small firm in job generation by the Development and expansion of the New Enterprises Programmes and Small Business Courses.

14 ACARD suggest (para 4.5) that large companies with R & D results which they do not intend to exploit commercially should be encouraged "perhaps through fiscal measures" to set up or seek

out small firms better able to utilise such results. They (ACARD) do not, however, offer any practical suggestions as to how this might be done. There is evidence of increasing interest and awareness on the part of large firms of their social role in helping to create new employment where they themselves have been the main creators of redundancies, but little of this activity has so far been in the R & D field.

15 General business advice and technical counselling is already available from a number of sources, such as the Department of Industry's Small Firms Service, through CoSIRA in rural areas and through the SDA, WDA and LEDU in Scotland, Wales and Northern Ireland respectively. However, the Government will continue to examine what further help can be given to small firms, including the possibility of a scheme to encourage more small companies to take up Research Association membership.

Technology Transfer

16 The Government concur with the ACARD comments on the importance of the transfer of technology into the UK. As well as lagging behind other industrial economies in its spending on industrial R & D, the UK's technological payments to, and receipts from, other industrialised countries are also lower than those of our major competitors. The National Research Development Corporation (NRDC) is already assisting innovation in industry in this country. To assist with the transfer of technology, the NRDC has engaged

consultants in the USA to seek out new products or processes which have been successful there, but which have not yet been launched in Europe. The NRDC will then seek an option to exploit the innovation while a suitable UK manufacturer is sought to take on the licence. The Government do not believe therefore, that a new agency is necessary for the purpose of assisting the transfer of technology into the UK (para 6.8). The task with the transfer of technology is to encourage UK industry, as their foreign competitors are, to a large extent, apparently so encouraged to make more use of the opportunities for them in this direction - and we see the change of economic climate as serving this purpose too.

17 While the Government accept the recommendation (para 6.9) that staffing policies in both technical and commercial sections of major overseas posts should be reviewed to see whether more engineers should be appointed to them, any increase in this aspect of embassy work could only be undertaken at the expense of other, perhaps equally important, work in the post. The Government is determined to reduce the size of the Civil Service, and any cuts must be shared between the Home and Diplomatic Service.

18 The Department of Industry is however planning to make some funds available for special studies to be undertaken in Japan of technological developments there and especially on opportunities for joint ventures and licensing agreements. These studies are likely to be undertaken by locally employed consultants, who will complement the work of the existing Science and Technology Counsellor.

Overseas Projects

19 The reference in the ACARD Report (para 4.3) to large export orders, and the recommendation that the machinery for tendering for large overseas projects be examined, appear to be peripheral to the subject of the Report and remote from the terms of reference ACARD had set themselves. Concern was expressed about this subject for a number of years, and in response the Department of Trade established in 1972 the Overseas Projects Board which represented both the public and private sectors concerned with overseas projects. Much progress has since been made in establishing a closer relationship between these two sectors. OPG was involved in many successful tenders for valuable overseas projects. In 1980 the work of OPG was taken over by the new Projects and Export Policy Division, which is part of the Department of Trade but also provides a common service to the Department of Industry.

Public Purchasing

20 The Department of Industry is taking the lead in initiating measures to increase the enlightened use of public sector purchasing to improve the performance and competitiveness of United Kingdom industry, both at home and abroad. ACARD's comment (para 4.14) on the use of the public sector's purchasing power to improve our competitiveness in overseas trade is under separate consideration in the light of the Council's further report on R & D in public purchasing.

Training and Education

21 ACARD consider the impact of technological change on education and training in paragraphs 5.4-5.8 of the report. The Government fully shares ACARD's view that technological change has considerable implications for the organisation of education and training (5.4). Government policy on industrial training was outlined by the Secretary of State for Employment on 26 November. There is a need for greater flexibility in training arrangements to meet the changing demands of industry, and in particular, a need for wider opportunities for the training and re-training of adults. Deficiencies in training at technician level must be remedied if the best use is to be made of new technology in modernising the economy (see para 5.5). The Manpower Services Commission has recently been asked to come forward with a scheme of distance learning - an "Open Tech" - in conjunction with existing technical colleges and colleges of further education. More generally, the Department of Employment are considering with the MSC and those concerned in industry and education, proposals which would enable progress to be made on all these training issues. The Government hopes that papers for consultation will be published in the next few months. The specific suggestions in para 5.6 of the ACARD report for increasing the public sector's responsibility and for an earnings related "training benefit" will need to be considered in this context. The Government also recognise the need to improve the supply of graduates in fast growing branches of technology (including electronics, computer science and information technology). The Government is proposing to recommend the setting up of a new

engineering body under Royal Charter following the recommendations of the Finniston Committee Report. This body will make a contribution to the development of engineering courses and the Government is considering what other action needs to be taken.

Sectoral Activity: EDCs and SWPs Requirements Boards and Research Associations

22 Two specific recommendations by ACARD concern the involvement of the National Economic Development Council and its tripartite sectoral Committees (para 6.5). It is already part of the remit of EDCs and SWPs to consider technological change as part of their work to improve the performance of their industries. They were asked to give particular emphasis to this work in 1979. A number have identified needs and opportunities for technological change and made recommendations to management and unions in their industries. However, in competitive conditions the job of developing technological strategies - which presumably should be one element in corporate strategies - is a matter for individual companies. The role of EDCs and SWPs is therefore less to draw up strategies for their industries than to influence the strategies of individual companies. This process of influence can be difficult, particularly in highly fragmented industries.

23 The reference to the involvement of Requirements Boards and the Research Associations with the development of technology strategies perhaps takes insufficient account of present efforts and past experience. The Requirements Boards have devoted considerable effort to establish priorities for the allocation of funds

that they control and have sought close links with the EDCs and SWPs. However, the EDCs and SWPs cover less than 50% of the output of UK manufacturing, and it is therefore necessary to supplement these links with wider discussions. The Government's influence on Research Associations is now largely through the contracts that it places with them, although there are frequent policy discussions between officials and RA management. In recent years the Research Councils have taken more account of what industry wants and are willing to finance by research contracts. The Department of Industry has encouraged them in this approach and has links with a number of programmes.

24 The ACARD recommendation (para 6.5) on the interfaces between EDCs/SWPs and industrial sectors touches on an area where action is already in hand. The Steering Brief issued by the NEDC to EDCs and SWPs early in 1979 asked the sectoral groups to investigate the application of advanced technologies, including microelectronics, in their own and customer industries. A number of maker/user groups have been established between EDCs and SWPs bringing together traditional suppliers of manufacturing machinery and those of advance control systems and information technologies. These joint groups have identified specific supply problems and technological gaps in development and production. Their work has also underlined the importance of formulating acceptable national and international standards to combat problems of incompatibility of equipment. While the Government will encourage EDCs/SWPs to continue with some aspects of this work, it is not the proper function of the sectoral groups to

become more deeply involved in detailed R & D considerations. Nor does the Government believe that individual company representatives would welcome such a move.

Key Materials

25 The Government agree with the ACARD comment (para 3.7) on the availability of key materials. An announcement was made in Parliament on 19 May that industry was to be consulted on the prospects for the supply of essential minerals and the desirability of measures to improve continuity and security of supplies. The Government are now considering the results of these consultations. A proposed European Community R & D Programme on substitution is being supported by the UK.

Conclusion

26 The Government welcomes the public attention that this ACARD Report has brought to the area of technological change, and will keep under review those recommendations where further action may be needed. But it cannot accept that a much greater degree of Government involvement in promoting technological change is the best way of improving industry's performance. Experience in this country and elsewhere has shown that the creation of a climate favourable to enterprise and risk-taking remains the principal contribution that the Government can make to technological change.

Department of Industry

February 1981

10 DOWNING STREET

THE PRIME MINISTER

6 February 1981

Dear Sir Robert,

I understand that you are retiring from the Advisory Council for Applied Research and Development. I should like to thank you for the great deal of time that you have given to the Council since its formation in particular in connection with its reports on the applications of semiconductor technology, computer-aided design and manufacture, and information technology. These reports have contributed greatly to the Council's success and have, I know, been read with much interest in Government and industry.

Yours sincerely

Margaret Thatcher

Sir Robert Clayton, C.B.E., F.Eng.

cc CO

10 DOWNING STREET

THE PRIME MINISTER

6 February 1981

Dear Sir Ieuan,

I understand that you are retiring from the Advisory Council for Applied Research and Development. I should like to thank you for the time that you have given to the Council and in particular for your contribution to its reports on semiconductor technology and technological change. These reports have, I know, been read with great interest in Government and industry.

Yours sincerely

Margaret Thatcher

Sir Ieuan Maddock, C.B., F.Eng., F.R.S.

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10 DOWNING STREET

THE PRIME MINISTER

6 February 1981

Dear Mr. Downs,

I understand that you are retiring from the Advisory Council for Applied Research and Development. I should like to thank you for the time that you have given to the Council since its formation and in particular for your leadership of the working Group on R and D for Public Purchasing. This Group's report has, I know, been read with great interest in Government and industry.

Yours sincerely,

Margaret Thatcher

D. Downs, Esq., C.B.E., F.Eng.

LB

10 DOWNING STREET

THE PRIME MINISTER

6 February 1981

Dear Sir John.

I understand that you are retiring from the Advisory Council for Applied Research and Development. I should like to thank you for the time that you have given to the Council since its formation and in particular for your contribution to its report on technological change. This report has, I know, been read with great interest in Government and industry.

Yours sincerely,

Margaret Thatcher

Sir John Atwell, C.B.E., F.Eng.

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Sir Mack

10 DOWNING STREET

om the Private Secretary

MR. WRIGHT
CABINET OFFICE

The Prime Minister has seen Sir Robert Armstrong's minute (ref: A04157) about membership of ACARD.

She has agreed his proposals, and will therefore be writing to the retiring members.

I should be grateful if Sir Robert Armstrong would now approach the four nominees for membership.

(Cabinet Office dealing with this, nothing more for No. 10 to do - David Wright 6/2/81)

M. A. PATTISON

4 February 1981

KRR

Prime Minister

Agree these 4 new appointments?

Yes

If so, I shall have the consequent 'farewell' letters typed up for you.

MTP 3/2

Ref. A04157

PRIME MINISTER

Membership of ACARD

At the end of 1979, you agreed that there should be a regular rotation in the membership of ACARD in order to bring new blood into the Council. Accordingly, five new members were appointed early in 1980 and the term of office of three others was extended by a year. The appointments of these three (Sir John Atwell, Sir Robert Clayton and Mr. D. Downs) have now expired, as has that of Sir Ieuan Maddock (who joined the Council in June 1977). I have consulted colleagues over possible replacements and have particularly borne in mind your wish to see more representation from the information technology area on the Council. As a result I propose that we should invite the following to serve:

- Lord Caldecote, Chairman, Delta Group Ltd.
- Sir Kenneth Corfield, Chief Executive, STC Ltd.
- Mr. C.S. King, Deputy Chairman, BL Advanced Technology Ltd.
- Mr. D.H. Roberts, Research Director, GEC Ltd.

2. If you are content with the above four names, I shall write accordingly.

3. I think it would be appropriate if, as last year, the retiring members were to receive a personal note from you. I attach drafts.

RCA

ROBERT ARMSTRONG

3rd February, 1981

DRAFT LETTER FROM THE PRIME MINISTER TO D. DOWNS, ESQ., CBE F Eng, CHAIRMAN AND MANAGING DIRECTOR, RICARDO CONSULTING ENGINEERS LTD., BRIDGE WORKS, SHOREHAM-BY-SEA, WEST SUSSEX BN4 5FG

I understand that you are retiring from the Advisory Council for Applied Research and Development. I should like to thank you for the time that you have given to the Council since its formation and in particular for your leadership of the Working Group on R and D for Public Purchasing. This Group's report has, I know, been read with great interest in Government and industry.

DRAFT LETTER FROM THE PRIME MINISTER TO SIR ROBERT CLAYTON, CBE F Eng, TECHNICAL DIRECTOR, GEC LTD., HIRST RESEARCH CENTRE, EAST LANE, WEMBLEY HA9 7PP

I understand that you are retiring from the Advisory Council for Applied Research and Development. I should like to thank you for the great deal of time that you have given to the Council since its formation in particular in connection with its reports on the applications of semiconductor technology, computer-aided design and manufacture, and information technology. These reports have contributed greatly to the Council's success and have, I know, been read with much interest in Government and industry.

DRAFT LETTER FROM THE PRIME MINISTER TO SIR IEUAN MADDOCK, CB F Eng FRS, SECRETARY, BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, FORTRESS HOUSE, SAVILE ROW, W1X 1AB

I understand that you are retiring from the Advisory Council for Applied Research and Development. I should like to thank you for the time that you have given to the Council and in particular for your contribution to its reports on semiconductor technology and technological change. These reports have, I know, been read with great interest in Government and industry.

DRAFT LETTER FROM THE PRIME MINISTER TO SIR JOHN ATWELL, CBE F Eng, SCOTTISH OFFSHORE PARTNERSHIP, CHARING CROSS TOWER, GLASGOW G2 4PP

I understand that you are retiring from the Advisory Council for Applied Research and Development. I should like to thank you for the time that you have given to the Council since its formation and in particular for your contribution to its report on technological change. This report has, I know, been read with great interest in Government and industry.

JH

DEPARTMENT OF INDUSTRY
ASHDOWN HOUSE
123 VICTORIA STREET
LONDON SW1E 6RB
TELEPHONE DIRECT LINE 01-212 3301
SWITCHBOARD 01-212 7676

Secretary of State for Industry

29 January 1981

The Rt Hon Geoffrey Howe QC MP
Chancellor of the Exchequer
HM Treasury
Treasury Chambers
Parliament Street
London SW1P 3AG

Dear Geoffrey.

ACARD REPORT ON TECHNOLOGICAL CHANGE

You wrote to me on 9 January suggesting some amendments to the draft Government response to this ACARD report to take account of the additional funds recently made available for supporting industrial R&D spending. Your letter was subsequently copied to the Prime Minister and colleagues as before.

2 I agree that we should include a reference to this support and I accept your suggestion for amendments to the final paragraph of the draft response, and the small addition in paragraph 5. However, in paragraph 8, I am reluctant to lose the reference to the Government's investment in development for the public good and I would like to suggest that the second sentence of the paragraph remains unchanged, and that your amendment forms a new third sentence. I believe the two sentences are complementary and can see advantages in dealing with the changes in this way. As I said in my minute to the Prime Minister on 16 December, the Government's response to this report has already been seriously delayed and I believe that we should make every effort to despatch the response as soon as possible. Unless I hear to the contrary by 4 February, I propose to send the response to the Chairman of ACARD in its revised form and to draw attention to it by means of a Parliamentary Question, as agreed.

3 I am sending copies of this letter, together with a copy of the revised draft response (with the amendments sidelined) to the Prime Minister and colleagues as before.

Yours ever, Keith

ACARD REPORT ON TECHNOLOGICAL CHANGE

Draft Response to ACARD

Introduction

1 The report of the Advisory Council for Applied Research and Development on "Technological Change: Threats and Opportunities for the United Kingdom" was published in January 1980.

2 ACARD have made eight principal recommendations, one of which encompasses four separate recommendations on small firms. The majority of the recommendations are aimed specifically at Government, and the Report also includes seven points of a more general nature which for the purposes of this response have been treated as recommendations.

3 Technological Change is an immensely wide and diffuse subject on which conclusions are likely to remain at a fairly high level of generalisation; and the more recent ACARD reports on Biotechnology and Information Technology show that concentration on a closely defined topic is likely to produce more clearly focussed recommendations.

Economic Climate

4 Many of the ACARD recommendations call for greater direct Government involvement in the promotion of technological change. It is perhaps a pity that the Report omits reference to Government schemes designed to stimulate awareness and adoption of new or under-used technologies; for example the Microprocessor Applications Project, Microelectronics Industry Support Programme,

the Product and Process Development Scheme. However, the Government is convinced that the greatest contribution it can make to technological change is to create an economic climate favourable to enterprise and growth; and an important element in this, as ACARD suggests (para 2.4), is the avoidance of unnecessary changes in fiscal and economic policy. These are the primary objectives of this Government's policy. A firmer monetary policy and cuts in public expenditure are designed to secure the progressive reductions in inflation and interest rates, which are now under way. A start has been made on switching the burden of taxation from direct to indirect taxes, and on reducing excessive rates of income tax, in order to improve rewards and incentives. A variety of measures have been taken to improve the working of the market - among them the abolition of controls on foreign exchange movements, dividends and prices, changes in employment legislation and housing policy. Administrative burdens on firms are being reviewed and eased. A number of measures have been adopted, and others are under consideration, for helping small firms; an important source of innovation and new employment.

5 Industry has generally welcomed these changes as offering the best prospect for financial stability and a revival of enterprise. A determination to stick to these policies, rather than the major expansion of Government involvement in industry that seems to be envisaged in some of the ACARD recommendations, is most likely to give industry the confidence to adopt new technology. When inflation and interest rates have come down, the fiscal and economic climate will by then already be found to have become more encouraging.

6 Although not discussed in the Report, adequate real profit levels are the critical influence on the ability of companies to cope with technological change. It is therefore extremely worrying that the real level of profitability, particularly in manufacturing industry, has been on a downward trend for many years, and more recently has reached damagingly low levels.

R & D Performance

7 Compared with leading OECD countries, the UK's performance over the last 15-20 years has been poor in areas such as productivity, value added per man and trade in finished manufactures. The result has been slower growth and relative economic decline. ACARD rightly identified research and development carried out by industry for its own commercial purposes as one of the most important elements in innovation leading to a strong economy. Here the UK's record is dramatically different from that of its competitors, with industrial funding of R & D falling by 10 per cent in constant price terms over the period 1967-75 whilst that in other leading OECD countries rose by an average of 30-40 per cent.

8 R & D focussed on the innovation of products and processes is increasingly important in determining industry's future performance. The Government will continue to invest in development when the private sector would probably not go ahead without help and when the results are likely to be to the public good. In recognition of this, the Government announced in November that it would be making additional funds available to support industrial

R & D expenditure which would probably not go ahead without support from public funds. The Science and Technology Act will be used for this purpose, and particular priority will be given to development projects likely to lead to marketable products.

New Industries and Services

9 Many of the new industries and services to which ACARD refers (paras 3.1 to 3.11) have already attracted the support of the Department of Energy and the Department of Industry's Research Requirements Boards at the R & D stage. In choosing projects to support, the Boards give priority to areas where industries based on new technologies might be generated and to research and development projects that can be carried through to commercial fruition. Examples include electric vehicle technology, composite materials, and process plant control and instrumentation. At the post-R & D stage, assistance is available under the Industry Act and through the NEB in partnership with private enterprise to encourage the setting up of new technology-based companies: (recent examples being the support for the robot manufacturing company Unimation in establishing production facilities in the UK, and the NEB private sector investment in Celltech).

10 ACARD suggest (para 4.11) that many of those displaced by increased productivity should be employed in service industries, thus improving the standard of many services. They cite in support of their view the proportions of the Japanese and UK national labour forces employed in manufacturing and service industries. However, the Government doubts whether a complete picture can be drawn from simple analogies based on the experience

of countries whose economic and social developments are historically different from our own. It is customer demand, rather than the availability of surplus labour, that is likely to determine improvements in services; and the scope for such improvements to generate substantial employment is limited both by competition and the application of new service sector technology. Overmanning would be highly damaging in those service industries subject to international competition; and any significant increase in costs in the tradeable goods sector is likely to lead to price rises.

11 The Government does however recognise the importance of service sector industries. Such industries commonly flow naturally from the technologies to which they relate and whose needs they serve; and if the climate is right and the time ripe they should not need government help to make them flourish. But in some areas, and notably in the development of software systems and the like, some support can help to stimulate and accelerate activity in rapidly-evolving fields. Thus, under existing support schemes, Department of Industry assistance to the computer services industry, directed mainly towards the development of software and systems, has amounted to approximately £1¼ million per year over the past three years. In view of the acknowledged importance to the UK of computer skills, the Department of Industry, within its overall budget, will ensure that the Software Products Scheme and the Product and Process Development Scheme continue to receive priority.

Small Firms

12 The Government agree that small firms can and do play an important part in the development and application of technological change. However, it does not agree with ACARD (para 5.2) that a major new study, along the lines of the Birch Report, of the role of small firms is necessary in addition to work already in hand in the Departments of Industry and Employment. We think we know the conditions which have been hostile to small firms. The Government's purpose in improving the economic climate is to encourage the birthrate of new firms (as well as the growth of existing firms) including high technology firms, while removing such non-market obstacles to survival as excessive taxation and form-filling over which the Government has influence.

13 The main thrust of Government assistance to small firms must continue to come through fiscal measures and by creation of a climate favouring enterprise (as discussed in para 4 above). But worthwhile assistance for small firms is already available from the taxpayer. Examples include the Microprocessor Application Project, where over half the companies assisted have a turnover of less than £2m, and the Manpower Services Commission Training Opportunities Scheme (TOPS). TOPS has recognised the importance of the small firm in job generation by the Development and expansion of the New Enterprises Programmes and Small Business Courses.

14 ACARD suggest (para 4.5) that large companies with R & D results which they do not intend to exploit commercially should be encouraged "perhaps through fiscal measures" to set up or seek

out small firms better able to utilise such results. They (ACARD) do not, however, offer any practical suggestions as to how this might be done. There is evidence of increasing interest and awareness on the part of large firms of their social role in helping to create new employment where they themselves have been the main creators of redundancies, but little of this activity has so far been in the R & D field.

15 General business advice and technical counselling is already available from a number of sources, such as the Department of Industry's Small Firms Service, through CoSIRA in rural areas and through the SDA and WDA in Scotland and Wales respectively. However, the Government will continue to examine what further help can be given to small firms, including the possibility of a scheme to encourage more small companies to take up Research Association membership.

Technology Transfer

16 The Government concur with the ACARD comments on the importance of the transfer of technology into the UK. As well as lagging behind other industrial economies in its spending on industrial R & D, the UK's technological payments to, and receipts from, other industrialised countries are also lower than those of our major competitors. The National Research Development Corporation (NRDC) is already assisting innovation in industry in this country. To assist with the transfer of technology, the NRDC has engaged

consultants in the USA to seek out new products or processes which have been successful there, but which have not yet been launched in Europe. The NRDC will then seek an option to exploit the innovation while a suitable UK manufacturer is sought to take on the licence. The Government do not believe therefore, that a new agency is necessary for the purpose of assisting the transfer of technology into the UK (para 6.8). The task with the transfer of technology is to encourage UK industry, as their foreign competitors are, to a large extent, apparently so encouraged to make more use of the opportunities for them in this direction - and we see the change of economic climate as serving this purpose too.

17 While the Government accept the recommendation (para 6.9) that staffing policies in both technical and commercial sections of major overseas posts should be reviewed to see whether more engineers should be appointed to them, any increase in this aspect of embassy work could only be undertaken at the expense of other, perhaps equally important, work in the post. The Government is determined to reduce the size of the Civil Service, and any cuts must be shared between the Home and Diplomatic Service.

18 The Department of Industry is however planning to make some funds available for special studies to be undertaken in Japan of technological developments there and especially on opportunities for joint ventures and licensing agreements. These studies are likely to be undertaken by locally employed consultants, who will complement the work of the existing Science and Technology Counsellor.

Overseas Projects

19 The reference in the ACARD Report (para 4.3) to large export orders, and the recommendation that the machinery for tendering for large overseas projects be examined, appear to be peripheral to the subject of the Report and remote from the terms of reference ACARD had set themselves. Concern was expressed about this subject for a number of years, and in response the Department of Trade established in 1972 the Overseas Projects Board which represented both the public and private sectors concerned with overseas projects. Much progress has since been made in establishing a closer relationship between these two sectors. OPG was involved in many successful tenders for valuable overseas projects. In 1980 the work of OPG was taken over by the new Projects and Export Policy Division, which is part of the Department of Trade but also provides a common service to the Department of Industry.

Public Purchasing

20 The Department of Industry is taking the lead in initiating measures to increase the enlightened use of public sector purchasing to improve the performance and competitiveness of United Kingdom industry, both at home and abroad. ACARD's comment (para 4.14) on the use of the public sector's purchasing power to improve our competitiveness in overseas trade is under separate consideration in the light of the Council's further report on R & D in public purchasing.

Training and Education

21 ACARD consider the impact of technological change on education and training in paragraphs 5.4-5.8 of the report. The Government fully shares ACARD's view that technological change has considerable implications for the organisation of education and training (5.4). Government policy on industrial training was outlined by the Secretary of State for Employment on 26 November. There is a need for greater flexibility in training arrangements to meet the changing demands of industry, and in particular, a need for wider opportunities for the training and re-training of adults. Deficiencies in training at technical level must be remedied if the best use is to be made of new technology in modernising the economy (see para 5.5). The Manpower Services Commission has recently been asked to come forward with a scheme of distance learning - an "Open Tech" - in conjunction with existing technical colleges and colleges of further education. More generally, the Department of Employment are considering with the MSC and those concerned in industry and education, proposals which would enable progress to be made on all these training issues. The Government expect to publish these proposals in the New Year. The specific suggestions in para 5.6 of the ACARD report for increasing the public sector's responsibility and for an earnings related "training benefit" will need to be considered in this context. The Government also recognise the need to improve the supply of graduates in fast growing branches of technology (including electronics, computer science and information technology). The Government is proposing to recommend the setting up of a new

engineering body under Royal Charter following the recommendations of the Finniston Committee Report. This body will make a contribution to the development of engineering courses and the Government is considering what other action needs to be taken.

Sectoral Activity: EDCs and SWPs Requirements Boards and Research Associations

22 . Two specific recommendations by ACARD concern the involvement of the National Economic Development Council and its tripartite sectoral Committees (para 6.5). It is already part of the remit of EDCs and SWPs to consider technological change as part of their work to improve the performance of their industries. They were asked to give particular emphasis to this work in 1979. A number have identified needs and opportunities for technological change and made recommendations to management and unions in their industries. However, in competitive conditions the job of developing technological strategies - which presumably should be one element in corporate strategies - is a matter for individual companies. The role of EDCs and SWPs is therefore less to draw up strategies for their industries than to influence the strategies of individual companies. This process of influence can be difficult, particularly in highly fragmented industries.

23 The reference to the involvement of Requirements Boards and the Research Associations with the development of technology strategies perhaps takes insufficient account of present efforts and past experience. The Requirements Boards have devoted considerable effort to establish priorities for the allocation of funds

that they control and have sought close links with the EDCs and SWPs. However, the EDCs and SWPs cover less than 50% of the output of UK manufacturing, and it is therefore necessary to supplement these links with wider discussions. The Government's influence on Research Associations is now largely through the contracts that it places with them, although there are frequent policy discussions between officials and RA management. In recent years the Research Councils have taken more account of what industry wants and are willing to finance by research contracts. The Department of Industry has encouraged them in this approach and has links with a number of programmes.

24 The ACARD recommendation (para 6.5) on the interfaces between EDCs/SWPs and industrial sectors touches on an area where action is already in hand. The Steering Brief issued by the NEDC to EDCs and SWPs early in 1979 asked the sectoral groups to investigate the application of advanced technologies, including microelectronics, in their own and customer industries. A number of maker/user groups have been established between EDCs and SWPs bringing together traditional suppliers of manufacturing machinery and those of advance control systems and information technologies. These joint groups have identified specific supply problems and technological gaps in development and production. Their work has also underlined the importance of formulating acceptable national and international standards to combat problems of incompatibility of equipment. While the Government will encourage EDCs/SWPs to continue with some aspects of this work, it is not the proper function of the sectoral groups to

become more deeply involved in detailed R & D considerations. Nor does the Government believe that individual company representatives would welcome such a move.

Key Materials

25 The Government agree with the ACARD comment (para 3.7) on the availability of key materials. An announcement was made in Parliament on 19 May that industry was to be consulted on the prospects for the supply of essential minerals and the desirability of measures to improve continuity and security of supplies. The Government are now considering the results of these consultations. A proposed European Community R & D Programme on substitution is being supported by the UK.

Conclusion

26 The Government welcomes the public attention that this ACARD Report has brought to the area of technological change, and will keep under review those recommendations where further action may be needed. But it cannot accept that a much greater degree of Government involvement in promoting technological change is the best way of improving industry's performance. Experience in this country and elsewhere has shown that the creation of a climate favourable to enterprise and risk-taking remains the principal contribution that the Government can make to technological change.

Department of Industry

January 1981

Cork Hoch

NBPM

MAD 20/1

Treasury Chambers, Parliament Street, SW1P 3AG
01-233 3000

19 January 1981

M.A. Pattison Esq.
10 Downing Street
LONDON
SW1

Dear Mike,

ACARD REPORT ON TECHNOLOGICAL CHANGE

You wrote to Catherine Bell on 22 December to say that the Prime Minister was content with the draft Government response attached to your Secretary of State's minute of 16 December.

The Prime Minister may be interested to see a copy of the Chancellor's letter of 9 January to the Secretary of State for Industry which proposes a few changes to the draft response.

I am sending copies of this letter to recipients of copies of your letter of 22 December.

Yours ever

Peter

P.S. JENKINS
Private Secretary

cc CST
FST
Sir D Wass
Mr Ryrie
Mr Middleton
Mr Dixon
Mr Lovell
Mr Unwin
Mr Patterson
Mr Ridley
Mr Gordon
Mr Andren

3/5/58/02

1Pcs

Treasury Chambers, Parliament Street, SW1P 3AG
01-233 3000

9 January 1981

The Rt. Hon. Sir Keith Joseph Bt MP
Secretary of State for Industry

Dear Keith

ACARD REPORT ON TECHNOLOGICAL CHANGE

On reading the draft Government response to the ACARD report on "Technological Change: Threats and Opportunities for the United Kingdom" attached to your minute of 16 December to the Prime Minister I noticed that you had made no mention of our decision to provide additional funds for supporting industrial R and D Spending. I suggest it is worth a mention. If you agree, you might cover this by amending the second sentence of paragraph 8 to read as follows:

> "In recognition of this the Government announced in November that it would be making additional funds available to support industrial R and D expenditure which would probably not go ahead without support from public funds".

I also feel the last two sentences of the final paragraph look a little odd when we have just announced increased public support for R and D and we propose saying in the Government response to the ACARD report on Computer Aided Design and Manufacture that "Government support for R and D is important at the early stages of innovation where the risk is greatest and where companies may under-invest due to poor profits and low liquidity". Perhaps these sentences could be amended to read as follows:

> "But it cannot accept that a much greater degree of Government involvement in promoting technological change is the best way of improving industry's performance. Experience in this country and elsewhere has shown that the creation of a climate favourable to enterprise and risk taking remains the principle contribution governments can make to promoting technological change."

/Finally,

306/1

Finally, in view of the strong criticism we have been facing in recent months from certain parts of industry, it might be as well to say "industry has generally welcomed these changes as offering the best prospect for financial stability and a revival of enterprise" in the first sentence of paragraph 5.

GEOFFREY HOWE

cc HMT
MOD
D/EMP
DES
DOE
DHSS
D/TRNS
CO

HS

10 DOWNING STREET

From the Private Secretary

22 December 1980

The Prime Minister has seen the Secretary of State for Industry's minute of 17 December, with which he enclosed a revised draft Government response to the ACARD Report on Computer Aided Design and Manufacture.

She is grateful for the work which has gone into the revision which she considers a considerable improvement. She is therefore content that the reply should now be issued, in the form proposed by your Secretary of State. She has noted that it would be released to the press.

I am sending copies of this letter to John Wiggins (H.M. Treasury), Brian Norbury (Ministry of Defence), Richard Dykes (Department of Employment, Peter Shaw (Department of Education and Science), David Edmonds (Department of the Environment), Don Brereton (Department of Health and Social Security), Tony Mayer (Department of Transport) and David Wright (Cabinet Office).

M. A. PATTISON

Mrs. Catherine Bell,
Department of Industry.

cc HMT DHSS HS
MOD D/T
D/EMP D/N
DOE DES
FCO MAFF
SO D/TRNS
WO LPO
NIO PGO
MS/CSD
CO

10 DOWNING STREET

From the Private Secretary

22 December 1980

The Prime Minister has seen the Secretary of State for Industry's minute of 16 December about the ACARD Report on Technological Change: Threats and Opportunities for the United Kingdom.

She is grateful for the work which has been put into the preparation of the draft Government response forwarded by your Secretary of State. She is content that this should now be issued through the arrangements proposed in the minute.

I am sending copies of this letter to John Wiggins (H.M. Treasury), Brian Norbury (Ministry of Defence), Richard Dykes (Department of Employment), David Edmonds (Department of the Environment), Roderic Lyne (Foreign and Commonwealth Office), Godfrey Robson (Scottish Office), John Craig (Welsh Office), Mike Hopkins (Northern Ireland Office), Don Brereton (Department of Health and Social Security), Stuart Hampson (Department of Trade), Julian West (Department of Energy), Peter Shaw (Department of Education and Science), Kate Timms (Ministry of Agriculture, Fisheries and Food), Tony Mayer (Department of Transport), Jim Buckley (Lord President's Office), Richard Prescott (Paymaster General's Office), Geoffrey Green (Civil Service Department) and David Wright (Cabinet Office).

M. A. PATTISON

Mrs. Catherine Bell,
Department of Industry.

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10 DOWNING STREET

PRIME MINISTER

You asked Keith Joseph to reconsider the Government response to ACARD's Report on Computer Aided Design and Manufacture, with the aim of making it a more acceptable, livelier and less bureaucratic document.

I attach his suggested revised version, together with a copy of the original. The document is considerably improved in tone.

Content that this response should now be issued in the form suggested by Sir Keith in his covering minute.?

19 December 1980

1

10 DOWNING STREET

PRIME MINISTER

Here is another of the three ACARD Reports which have reached us this week.

This one is of less interest than the other two, because it covers a very broad subject. ACARD has since been asked to focus its work on more specific subjects.

The response is not particularly informative but it is readable. You may think that this is an adequate response to a Report which is too broad-ranging to be of much influence.

Content for the Secretary of State to publish in the form proposed in his covering minute?

Yes no

MAD

19 December 1980

JU

PRIME MINISTER

You asked this Department to reconsider the tone and flavour of the Government response to the ACARD Report on Computer Aided Design and Manufacture. A revised response has been prepared and those concerned in any changes have been consulted. I attach the original and the revised response with the passages that have been amended and the amended versions sidelined in each case. The response has been restructured so that each recommendation is accompanied by a government response. This itself has made the presentation clearer. Moreover the tone of each response is now firmer and less qualified.

2 I suggest that the form of the reply remains as a paper under my covering letter to the chairman of ACARD, Dr Spinks. The paper would also be released to the Press.

3 I am copying this minute to the Chancellor of the Exchequer, the Secretaries of State for Defence, Employment, Education and Science, Environment, Health and Social Security, the Minister of Transport and Sir Robert Armstrong.

K J

17 December 1980

Department of Industry
Ashdown House
123 Victoria Street

Revised version

GOVERNMENT RESPONSE TO THE ACARD REPORT ON COMPUTER AIDED DESIGN AND MANUFACTURE

The Government welcomes this report from the Advisory Council for Applied Research and Development which focuses attention to an important area of technology and the benefits that are already being gained from its application. It agrees with ACARD that the rapid adoption of advanced technology by manufacturing industry, at a rate at least comparable with our overseas competitors, is an essential element in the restoration and maintenance of the competitivity of UK industry.

The main responsibility for taking advantage of the opportunities offered by these techniques must rest with industry which can best judge where the economic benefits lie. The Government accepts, within the limits it must set for public expenditure, that it has a role in improving awareness of the technology and in assisting research, development and demonstration as well as education and training. Government support for R&D is important at the early stages of innovation where the risk is greatest and where companies may under-invest due to poor profits and low liquidity.

The Government is itself a user of CAD/CAM, in, for example, the defence manufacturing and civil engineering fields and there is scope for promoting the development of the technology through its own requirements. Its more general interest in improving industrial awareness, in supporting R&D and in providing services, lies mainly with the Department of Industry. The DoI accords high priority to CAD/CAM activities and expects to devote an increasing proportion of its science and technology budget to this topic over the next few years. It has taken steps in response to ACARD's recommendations to improve the co-ordination of its activities, both as a customer for R&D work and as an R&D contractor, without however creating an Institute of Computer Aided Engineering.

It has established closer links with the Science Research Council, the other major funder of research in the area. DoI is improving its own knowledge of developments overseas and is seeking more effective ways of disseminating information to industry.

The Government sets out, in the following pages, its response to the individual ACARD recommendations. ACARD's report is also directed at industry, the educational sector, the professional institutions and the unions. The Government hopes they will also respond to the spirit of this report.

Recommendation 1 (Paragraph 7.4)

> We recommend that the Department of Industry should take responsibility for producing and disseminating (through courses and seminars) information on typical costs of installation and on the training needed for using CAD/CAM systems effectively. Case histories of successful installations showing how pitfalls can be avoided should be included.
>
> As with the current microelectronics awareness programme, all levels of management need to be informed of CAD/CAM. The Department should seek the assistance of professional institutions in this task.

The Government accepts this recommendation. The National Engineering Laboratory (NEL) currently disseminates information on the cost of installation of CAD/CAM equipment and runs seminars for industry and others to promote awareness. The main thrust is on training and giving practical experience in using CAD/CAM systems. 17 three-day courses, attended by over 200 people, mostly from industry, have taken place over the past 5 years. The Computer Aided Design Centre (CADC) runs courses to instruct operators in the use of software under licence from CADC. It also acts as a "clearing-house" through its Computer Aided Engineering Support Unit, which assesses useful software packages and registers them in a library. Relevant work being done in the research establishments of the Department of Environment and Transport could also be included in any information dissemination programme. The DoI is actively considering other schemes to improve awareness: they include further demonstration projects and the support of units where potential users could examine the capability of the technology by using it to solve their own real design and manufacturing problems.

ACARD made a comparison with the DoI's successful microelectronics awareness programme. The Department is considering the lessons which can be drawn from this and the way they might be applied to

promoting awareness of CAD/CAM, taking into account the somewhat different composition of the audience to be addressed and the scale of the investment which users would need to make.

ACARD suggested that a specific budget of £1.5 million over 3 years should be provided for the promotion of CAD/CAM awareness. The DoI is giving high priority to the support of CAD/CAM activities within its science and technology budget and these activities include the transfer of technology and the promotion of awareness. It therefore expects that the proportion of the budget spent on all aspects of the technology will increase over the next few years and that, within the planned expenditure, it will be possible to make adequate provision for awareness.

The ACARD report has stimulated a number of public discussions of CAD/CAM organised by the professional institutions. DoI has participated in these discussions and it will continue to encourage these institutions to promote the technology.

Recommendation 2 (paragraph 7.4)

> We also recommend that in order to keep its advice up-to-date the Department of Industry should maintain close watch on developments overseas, if necessary by retaining specialist consultants for the task.

Government accepts the ACARD recommendation that the Department of Industry should maintain a close watch on developments overseas. The Department already has very close links with the Science Counsellors in five Embassies (Bonn, Paris, Washington, Tokyo and Moscow) and it has a network of sources of information elsewhere. CAD/CAM has been identified as a priority area and we have received valuable reports from the Embassies. Staff constraints limit the amount of coverage which the Embassies can provide, and we are exploring the use of locally engaged consultants, particularly in Japan, to increase the flow of information. The staff of the Government's laboratories also maintain a close watch on progress in other countries through their participation in conferences and exhibitions. Collection of information is, however, only part of the problem: it must be disseminated as effectively as possible. DoI is continually trying to improve this aspect.

Recommendation 3 (paragraph 7.5)

> We therefore recommend that the Government should sponsor able young people to work for a period overseas to learn about and participate in developments in CAD/CAM. We suggest that this might be conveniently arranged through awards by the Fellowship of Engineering and an initial budget of about £100,000 annually might be appropriate.

The type of support suggested by this recommendation has broad application in all areas of Science and Engineering and would be most effective if aimed at people with industrial experience. Discussions have been held between the Science Research Council (SRC), the Fellowship of Engineering (FOE) and the Department of Industry (DOI). These indicate that initially an existing SRC scheme of industrial visiting fellowships could provide the sort of support ACARD has in mind. It has been agreed that the FOE will endeavour to find good candidates, suitable topics and interested firms. The first few cases cound be funded by the SRC under existing budgetary arrangements. If however, demand for awards under this scheme were to grow as a result of any FOE initiative, the situation and future funding arrangements would need to be reviewed.

In addition, the Engineering Industry Training Board operates a Manufacturing Management Fellowship Scheme for trainee managers under which a number of young people pay short visits overseas to study, among other things, the impact of technology such as CAD/CAM.

Recommendation 4 (paragraph 7.6)

> We recommend that the Department of Industry should arrange for the advisory and bureau services already provided by the National Engineering Laboratory and the work on software development of the Computer Aided Design Centre to be co-ordinated so that they form a single organisation (or institute) for Computer Aided Engineering, with a single Director responsible to a Board of Management whose non-executive Chairman and at least half its non-executive members should be drawn from industry. The work of the new Institute should include:-
>
> (i) evaluation of available CAD/CAM systems through close links with user companies;
>
> (ii) provision of advice on the economics and technical suitability of systems;
>
> (iii) supporting government departments with advice on CAD/CAM matters such as investment in R&D, educational requirements and standards.

Recommendation 5 (paragraph 7.9)

> We recommend that eventually the Institute should be located on one or more sites nearer the main manufacturing centres of the United Kingdom.

The DoI agrees with ACARD that there is a need to increase collaboration between NEL and CADC. It has already taken steps to achieve this by appointing the former Director of CADC as Director of NEL with responsibility for both laboratories. An important task of the new management is to increase the range and accessibility of the services provided for industry. The two laboratories draw part of their support from the DoI's Requirements Boards one of which, the Mechanical Engineering and Machine Tools Requirements Board (MEMTRB) is advised in this area by the Computer Aided Engineering Panel (CAE). Industry and SRC are represented on both the Board and the Panel. The DoI does not believe that it would be useful to interpose a further layer of management through the setting up of a Board of Management.

ACARD suggested that the co-ordination should extend to the creation of a "Computer Aided Engineering Institute" which would embrace the advisory and bureau services of NEL and the software development at CADC. However, in the case of NEL the advisory and bureau services are very closely integrated with the research and development work on, for example, automated small batch production, robotics and fan and pump design. DoI believes that it would be undesirable to separate these activities. The new management arrangements will ensure effective co-ordination of the work of the two establishments which will be able to cover all the items which ACARD recommended as work for the new Institute. The Department, therefore, does not propose to set up a separate "Computer Aided Engineering Institute".

Careful consideration has been given to ACARD's proposal that the DoI's CAD/CAM activities should be re-located on a new site. However, the Government does not accept that either Cambridge or East Kilbride are excessively difficult of access. Clearly some users would benefit if the laboratories were located elsewhere, but not all would benefit equally from any particular location. CADC has recently moved to a new permanent building in Cambridge. Having considered the cost involved, the good links which the laboratories have with universities and industry in their areas and the dislocation that would be caused by a geographical move, the Government has concluded that the laboratories should continue in their present locations.

Recommendation 6 (paragraph 7.11)

> We recommend in addition that the Government should consider how it might further assist companies, particularly those of small or medium size, to adopt appropriate CAD/CAM systems, for example:-
>
> a) supporting demonstration systems in user companies in exchange for availability of information on performance; this would allow companies to gain practical experience on their own problems of draughting and manufacture.
>
> b) initial leasing of equipment to companies until they have sufficient experience to show whether purchase is justified.

The Government has indicated that it attaches particular importance to the role of smaller companies in the economy. A number of schemes encourage their technological development . For example, the Manufacturing Advisory Service (MAS) provides consultancy on modern manufacturing methods for companies with less than 1000 employees. 25 MAS projects involving CAD/CAM applications have been completed and a further 11 are in progress. Companies of all sizes can submit proposals for financial aid to DoI's Reqearch Requirements Boards. The involvement of Boards through demonstration projects, such as that at Baker Perkins, is a successful way of promoting the development of the technology. The Product and Process Development Scheme also encourages the launching of new or significantly improved products and processes. Annex 1 gives some examples of the projects currently supported by the various DoI schemes. In addition, the resources of the Government's research laboratories are available on a repayment basis to industry for specific tasks. Industrial collaboration is also encouraged in their activities.

The Teaching Company Scheme, jointly funded by DoI and SRC, is a further route for encouragement of the use of CAD/CAM in industry. The scheme, which consists of projects undertaken jointly by a manufacturing company and a neighbouring university or polytechnic, currently has 30 projects, about one-quarter of them involving computer aided engineering. In several cases, CAD turnkey systems have been installed in the firm or academic establishment and can be used both for the firms' own problems and also for demonstration to other firms and students.

In addition to the schemes in the public sector, there is considerable activity by the private sector in increasing awareness and promoting sales of equipment.

DoI has given careful consideration to ACARD's proposal for a scheme of equipment leasing. DoI believes, however, that the encouragement of the use of CAD/CAM equipment through leasing is a matter entirely for the commercial suppliers of equipment. There are no plans to provide financial support for this purpose.

Recommendation 7 (paragraph 7.13)

> We recommend that Department should consider how they can promote economic applications of CAD/CAM through their purchases, and those of the public sector organisations for which they are responsible.

The Government accepts this recommendation. The Government believes it has an important role to play in stimulating innovation and technical developments through the use of public sector purchasing and the recommendation is, therefore, fully consistent with current policy. The Government is urging the nationalised industries, as far as it is consistent with their overall objectives, to give due consideration in their purchasing to the need to promote new technology and the interests of UK manufacturers.

Recommendation 8 (paragraph 7.14)

> We recommend that the National Economic Development Council, through relevant Sector Working Parties and Economic Development Committees, should consider how these market opportunities can best be tackled.

The National Economic Development Council will reply separately to ACARD on this recommendation.

The Government hopes that UK industry will increasingly be able to supply CAD/CAM equipment to the large potential markets which will develop as application increases; the market for large turnkey systems is at present dominated by American manufacturers. It is important that the UK supply industry should be sufficiently closely associated with any new Government initiatives for it to benefit from resulting stimulation. The sooner industry is aware of these initiatives the better it can respond. A British company is developing a competitive system in partnership with the taxpayer. Other less comprehensive systems, mainly for draughting, are available from several UK firms. Much software development is carried out in the Universities and public sector research establishments. Where appropriate these can be marketed either by the originator or through the NRDC companies Compeda and Genesys. NRDC has been providing development finance for joint ventures and engaging in technology transfer from public sector organisations for some time. Currently some 30 projects on CAD/CAM are supported by NRDC with an authorised investment of almost £7 million; a further 25 projects are under assessment. The National Enterprise Board has been involved in discussions on the development of a CAD/CAM system with a view to producing a new UK initiative in this area.

Recommendation 9 (paragraph 7.15)

> We recommend that the Department of Industry should undertake a study of Linked Business Systems to review the present state of availability of such systems and their application outside high technology and large companies. It should decide whether results of any work in high technology industry in this country could profitably be transferred to or adapted for more general use in different sectors of industry and it should identify any work on standards, languages or interfaces which needs to be done to make intelligible, practical systems available.

DoI has no plans for a formal study at present but several aspects of the topic are under discussion and MEMTRB is involved with industry in developing a Linked Engineering Business System. The Computer Aided Engineering Panel places particular emphasis on the importance of Linked Business Systems and in its assessment of projects takes account of how they could be joined together in an integrated system with compatible interfaces. MEMTRB is also examining more generally the need for work on standard languages and interfaces. In addition the British Standards Institute has an ongoing activity in this area. The need for standards and new software tools are two of the subjects of a study by DoI and the Electronic Engineering Association (EEA). One of the benefits of this study should be to help the UK supply industry by providing relevant information.

Recommendation 10 (paragraph 7.16)

> We recommend that the Department of Industry should take the lead in improving co-ordination (if necessary by creating new machinery for the purpose) involving the SRC, Research Associations, sectors of industry liable to use CAD/CAM, and organisations supplying equipment and software, as well as their own and other government establishments concerned. This work would take in the activities of the current CAE Panel and in it the proposed Institute would play a major role. The effort for this co-ordination would not be large and should not, we think, require extra staff.

The arrangements for improved co-ordination of the "contractor" side of DoI activities have been set out in response to Recommendation 4. Improvements have also been made in the co-ordination of "customer" activities in the Department. A new Committee has been set up to bring together the various interests in this topic within DoI and SRC: it will also take account of other activities. The MEMTRB is at present advised by the CAE Panel and by the Automated Small Batch Production (ASP) Committee. Ways of improving the links between CAEP and ASP are being considered (although it should be noted that effective co-ordination is already achieved by their having the same Chairman). Both Committees will retain their advisory roles in respect of the corresponding SRC programmes.

Recommendation 11 (paragraph 7.17)

> We recommend, therefore, that the Department of Industry, probably through the new Institute, should promote the use of CAD bureaux, user clubs for groups of users of the same systems (in which they could exchange experience) and clubs for the exchange of experience on common applications software.

DoI's enquiries indicate that there are at least 40 organisations currently offering various CAD services and some suppliers of CAD/CAM equipment provide advice on a user club basis. A number of Research Associations such as those for Production Engineering and the Machine Tool Industry are also active in the field. DoI's efforts will, therefore, be directed towards making the existing services better known.

Recommendation 12 (paragraph 7.20)

We recommend that:-

a) more emphasis should be given to computing principles in schools;

b) undergraduate engineering courses should include use of CAD systems for drawing and design, as a logical extension of manual methods;

c) courses should be established for the re-education and retraining of existing staff (draughtsmen, designers, engineers, managers) and these should include practical experience with CAD/CAM systems;

d) universities should prepare post-graduate courses on programming to train students in writing major software programs and modifying existing software;

e) increased awareness of CAD/CAM should be encouraged, for example by discussions between managements and employees and by meeting promoted by the professional engineering institutions.

Recommendation 13 (paragraph 7.23)

We recommend that, in addition to the educationan and training measures set out in the previous section, those offering education in management should include in their courses considerationof the need and opportunity for structural changes that can come with introduction of CAD/CAM, and the means whereby such changes can be managed without unnecessary friction.

The whole area of engineering education is being examined by the Government following the report by the Finniston Committee. More specifically there has been considerable debate about the place of computing in the school curriculum. The National Development Programme in Microelectronics for Schools and Colleges recently announced by the Department of Education and Science will give further attention to this issue. In the case of computer studies and CAD itself progress is limited by the availability of hardware

and of trained teachers. Staff and equipment shortages are also a barrier to the expansion of effort in CAD/CAM in the higher education system. However, the universities and polytechnics are planning, with SRC help, to launch five new MSc courses in computer aided circuit design. In the context of employment-oriented continuing education there may be some scope for removing administrative restrictions and financial disincentives which appear in some cases to prevent institutions of higher and further education from providing courses of the type suggested and which industry and commerce would wish to use and be willing to pay for. DES is considering the implications of the recommendation that universities should prepare post-graduate courses on programming to train students capable of writing major software programs and modifying existing software. Design engineering skills are one of the Manpower Services Commission's (MSC) priority training areas and the MSC will be exploring with the Industry Training Boards the question of updating training in CAD.

DEPARTMENT OF INDUSTRY PROGRAMMES IN SUPPORT OF CAD/CAM

The Department spends about £3 million per annum in support of CAD/CAM.

The major programme items are as follows:-

1 Computer aids for process plant design, manufacture and operation at CADC funded through CMRB.

2 Development of a British CAD/CAM system funded by MEMTRB and through the Pre Production Order Scheme.

3 Development and co-ordination of software for CAD of computers, funded through the Product and Process Development Scheme.

4 Integrated circuit design at RSRE funded by CSERB.

The following are funded by MEMTRB:-

5 Computer Aided Engineering at PERA

6 CAD system (demonstration project).

7 CAD/NC machining for tool making (demonstration project).

8 CAD for die, mould and pattern making at Cambridge University.

9 CAM system for sheet metal duct work.

10 Flexible Manufacturing System (demonstration system).

11 Computer Aided Draughting and Design System.

12 Automated Draughting.

13 Computer Aided Technology in the Mechanical Engineering Industry at CADC.

14 Advanced Numerical Stress and Structural Testing at NEL.

15 Computer Aided Manufacture at NEL.

16 Technology transfer at NEL and CADC.

Secretary
Dr. Davies
Dr. Catterall
Dr. Copestake
Mr. Goodman
not to copy this corner

PRIME MINISTER

The Advisory Council for Applied Research and Development (ACARD) published its report on 'Computer Aided Design and Manufacture' in February 1980 and you invited me to co-ordinate the Government response. I suggest that, with your approval, the reply should take the form of the attached paper, under a covering letter from me to the Chairman of ACARD, Dr Spinks. The text has been agreed at Ministerial level with the Departments of Defence, Employment, Environment, Transport, Health and Social Security, Education and Science, the Treasury and has been seen by Sir Robert Armstrong. The paper would also be released to the press.

2 A summary of the recommendations of the ACARD Report and the Government's responses to them is provided for easy reference as Annex 2 to the paper.

3 I am copying this minute to the Secretaries of State for Defence, Employment, Environment, Health and Social Security, Education and Science, the Minister of Transport, the Chancellor of the Exchequer and Sir Robert Armstrong.

KJ

K J
27 October 1980

Department of Industry
Ashdown House
123 Victoria Street

RESPONSE TO THE ACARD REPORT ON COMPUTER AIDED DESIGN AND MANUFACTURE

1 The report of the Advisory Council for Applied Research and Development (ACARD) on Computer Aided Design and Manufacture (CAD/CAM) was published on 6 February 1980. The Department of Industry was invited to co-ordinate the Government response and this reply incorporates views and comments from several Departments, and from the Science Research Council (SRC). Annex 2 summarises each of the ACARD recommendations and the relevant Government response.

2 For the purposes of this response CAD/CAM is taken to include the use of computers in design, manufacture and testing as well as the extension to estimating, production planning and stock control involved in Linked Engineering Business Systems.

3 The Government welcomes this report from the Advisory Council drawing attention to an important area of technology and to the benefits that are already being experienced by UK industry from its application. It supports the Council's view of the economic advantage that could be derived from wider adoption of the technology and it believes that important elements in securing that adoption are, that the economic conditions under which industry operates should be improved and that there should be increased awareness of the potential of the technology. The adoption of advanced technologies such as CAD/CAM at a rate comparable to our major industrial competitors is essential for the future of British Industry. The Government notes that comments in this report to the effect that although other countries are at present in advance of the UK the position is not irretrievable and it is therefore important that efforts should be made by all to secure the advantages of these techniques. The main responsibility

marked to become pages 1 and 2 in the revised version

clearly rests with industry but the Government accepts that for the present it has a role to improve awareness and to provide encouragement and support to help to accelerate the pace of application, within the limited resources available for public expenditure. Support for R&D via the tax-payer is important when private investors have difficulty in assessing the benefits of new techniques and are likely to underinvest in the state-of-the-art research from the point of view of society in general. Research aimed both at advancing the technology and demonstrating its benefits is therefore an area where Government can play a valuable role. A list of projects supported by the Department of Industry is at Annex 1; it includes work in the Department's own laboratories and in industry. Some of the industrial projects are "demonstration projects" in which access is provided to potential users of similar systems who can see them in operation.

Merge 1 and 2

4 The Government endorses ACARD's view (paragraph 7.6) that the DoI Research Establishments (the National Engineering Laboratory, NEL, at East Kilbride and the Computer Aided Design Centre, CADC, at Cambridge) should play a significant role in providing advice on CAD/CAM to industry. However, it does not feel that the creation of a new institute would significantly aid the process. Steps have already been taken to improve co-ordination between the two establishments by appointing the Director of CADC as Director of NEL and giving him overall responsibility for both organisations. An important task of the new management will be to examine ways of improving the range and accessibility of the services provided to industry. It is also felt that the costs of relocation to a new site would not be justified.

Becomes Response to Recs. 4 and 5 in revised version.

5 The two laboratories draw part of their financial support from the DoI Requirements Boards and part from outside sources, including

repayment work from industry. In the case of CADC the amount of industrial repayment work is now 37 per cent of the cost of the Centre and it is hoped to increase this in the future.

6 The Mechanical Engineering and Machine Tool Requirement Board (MEMTRB), the largest DoI customer in this field, is currently advised by the Computer Aided Engineering Committee and by the Automated Small Batch Production (ASP) Panel. In response to the ACARD recommendation (paragraph 7.16) that the co-ordination of research should be improved the effectiveness of the links between these two bodies is being considered. This committee structure will retain its present advisory role in respect of corresponsing Science Research Council programmes. More generally, co-ordinating machinery has been established across the broad range of the Department's (and Science Research Council's) activities in the field of CAD/CAM.

Response to Rec. 10

7 Paragraphs 4 and 6 above outline the proposals for improving co-ordination on both the customer and contractor sides of the customer-contractor relationship. Industry is represented on the customer side through the Requirement Boards and on their advisory committees, as it is on appropriate SRC Committees. Co-ordination is being improved in respect of DoI's other activities involving the supply industry, which is discussed in paragraph 12 below.

8 Government accepts the suggestion (paragraph 7.4) that DoI should take responsibility for producing and disseminating information and for promoting awareness of CAD/CAM. NEL already disseminates information on the cost of installation of CAD/CAM equipment and has run seminars for industry and others on CAD/CAM. The main thrust is on training and giving practical experience of using CAD/CAM systems. Seventeen three day courses have taken place over the past five years

and the majority of the participants have been from industry. CADC runs courses to instruct operators in the use of software under licence from CADC. It also acts as a "clearing house" through its Computer Aided Engineering Support Unit which assesses useful software packages and registers them in a library. Relevant work being done, for example, at the Research Establishments of the Departments of Environment and Transport could be included in any information dissemination exercise. ACARD made a comparison with the DoI's successful microelectronics awareness scheme (paragraph 7.4); However, the composition of the audience to be addressed is somewhat different, in the case of CAD/CAM, as is the scale of investment which may be involved in many cases. The Department is currently examining the need for further awareness activities in the CAD/CAM area.

9 Government accepts the ACARD recommendation (paragraph 7.4) that the Department of Industry should maintain a close watch on developments overseas. The Department already has very close links with the Science Counsellors in five Embassies (Bonn, Paris, Washington, Tokyo and Moscow) and it has a network of sources of information elsewhere. Reports on the development of CAD/CAM and its applications are included in the despatches from these posts. Arrangements are in hand to increase the flow of information from Japan by the use of local consultants. NEL and CADC also monitor developments overseas and the possibility of disseminating this information more widely is being examined.

Response to Rec 3.

10 The Department of Industry has had discussions with the Fellowship of Engineering arising out of the ACARD suggestion (paragraph 7.5) that the Government should sponsor young people to work for a period overseas to learn about and participate in CAD/CAM developments. This recommendation clearly has broad application to

other areas of technology and it will be studied carefully. We believe that for a scheme to be most effective it should be aimed at people with industrial experience. Some schemes already exist within the Science Research Council which could provide the sort of support ACARD has in mind. The discussions with the Fellowship of Engineering and the SRC about how these existing schemes could be better used and about whether additional funds are necessary will continue. In addition the Engineering Industry Training Board operates a Manufacturing Management Fellowship Scheme for trainee managers under which a number of young people pay short visits overseas to study, among other things, the impact of technology such as CAD/CAM.

Reply to Rec 3

11 The Government accepts the recommendation (paragraph 7.11) that it should consider how it might further assist companies, particularly those of small or medium size, to adopt appropriate CAD/CAM systems. The Council will be aware of the particular importance that the Government attaches to the role that smaller companies play in the economy. It already has a number of schemes specifically directed towards their assistance. For example the Manufacturing Advisory Service (MAS) provides consultancy on modern manufacturing methods to companies with less than 1000 employees. Twenty five projects on CAD/CAM are already complete and a further eleven are in progress. The assistance to industry through demonstration projects, such as that at Baker Perkins, is a successful way of promoting the development of the technology. The Teaching Company Scheme jointly funded by DoI and SRC is also a route for the encouragement of the use of CAD/CAM in industry. There are currently 33 projects and about a quarter of them involve computer aided engineering. In these, Associates, closely connected with a nearby university or polytechnic

work with the partner firm. In several cases CAD turnkey systems have been installed in the firm or university and can be used for the firm's own problems and also for demonstration to other firms and students. The resources of the Government research laboratories are available on a repayment basis to industry for specific tasks and industrial collaboration is encouraged. Companies can also submit proposals to the Requirements Boards and apply for support under the Product and Process Development Schemes. In collaboration with Universities and Polytechnics they can apply for support from the SRC under its Co-operative Grants Scheme. Many commercial organisations offer bureau services and there are thus many ways in which industry can obtain advice, both from the private and public sectors. The Government believes that encouragement of the use of CAD/CAM systems through the initial leasing of equipment is a matter for the commercial suppliers to consider. It has no plans to provide financial support for this purpose.

12 Government is aware of the importance to be attached to the supply of CAD/CAM equipment by UK manufacturers in view of the large potential market as the pace of application increases; the market for large turnkey systems is at present dominated by American manufacturers. It is important that the UK supply industry should be sufficiently closely associated with any new Government initiatives for it to benefit from resulting stimulation. The sooner industry is aware of these initiatives the better it can respond. A British company is developing a competitive system in partnership with the taxpayer. Other less comprehensive systems, mainly for drafting, are available from several UK firms. Much software development is carried out in the Universities and public sector research establishments. Where appropriate these can be marketed either by the originator or through the NRDC companies Compeda and Genesys. NRDC has been

providing development finance for joint ventures and engaging in technology transfer from public sector organisations for some time. Currently some 30 projects on CAD/CAM are supported by NRDC with an authorised investment of almost £7 million; a further 25 projects are under assessment. The need for standards and new software tools are two of the subjects of a study by DoI and the Electronic Engineering Association (EEA). One of the benefits of this study should be to help the supply industry by providing relevant information. The National Enterprise Board has been involved in discussions on the development of a CAD/CAM system with a view to producing a new UK initiative in this area.

Response to Rec 9

13 The report recommends (paragraph 7.15) that DoI should study Linked Business Systems. Although there are no plans for a formal study at present MEMTRB are involved with industry in developing Linked Engineering Business Systems. The practical experience gained in this way will be very valuable.

14 The Government accepts the recommendation (paragraph 7.13) that Departments should consider how they can promote applications of CAD/CAM through their own purchases. The Government believes that it has an important role to play in stimulating innovation and technical developments through the use of public purchasing throughout the whole of the public sector. For example, it is urging the nationalised industries, as far as it is consistent with their overall objectives, similarly to have regard in their purchasing to the need to promote new technology and the interests of UK manufacturers. The potential of this approach for encouraging the wider use of CAD/CAM will be examined.

15 ACARD suggest (paragraph 7.17) that DoI should promote the use of CAD bureaux and user clubs. The DoI will explore the question of user clubs possibly at a Research Association or a Government Research Establishment. Its enquiries so far indicate that there are at least forty organisations currently offering various CAD services and some manufacturers of CAD/CAM equipment provide advice on a user club basis. A number of Research Associations such as PERA and MTIRA are also active in the field. The need for further effort therefore requires careful consideration and it may be best for the DoI to concentrate its effort on making the existing services better known.

Response to Rec. 11

16 The Council made a number of recommendations (paragraph 7.20) concerned with education in CAD/CAM techniques. The whole area of engineering education is being examined by the Government following the report by the Finniston Committee. More specifically there has been considerable debate about the place of computing in the school curriculum. The National Development Programme in Microelectronics for Schools and Colleges recently announced by the Department of Education and Science will give further attention to this issue. In the case of computer studies and CAD itself progress is limited by the availability of hardware and of trained teachers. Staff and equipment shortages are also a barrier to the expansion of effort in CAD/CAM in the higher education system. However, the universities and polytechnics are planning, with SRC help, to launch 5 new MSc courses in computer aided circuit design. In the context of employment-oriented continuing education there may be some scope for removing administrative restrictions and financial disincentives which appear in some cases to prevent institutions of higher and further education from providing courses of the type suggested and

which industry and commerce would wish to use and be willing to pay for. DES is considering the implications of the recommendation that universities should prepare post graduate courses on programming to train students capable of writing major software programmes and modifying existing software. Design engineering skills are one of the Manpower Services Commission's (MSC) priority training areas and the MSC will be exploring with the Industry Training Boards the question of updating training in CAD.

17 In conclusion the Government welcomes the attention that this ACARD report has focused on CAD/CAM. The Government is already involved in many of the activities recommended by ACARD. It is taking steps to improve further the co-ordination of its activities and it will continue to keep under review those recommendations made by the Council which require further action.

DEPARTMENT OF INDUSTRY PROGRAMMES IN SUPPORT OF CAD/CAM

The Department spends about £3 million per annum in support of CAD/CAM.

The major programme items areas follows:-

1 Computer aids for process plant design, manufacture and operation at CADC funded through CMRB.

2 Development of a British CAD/CAM system funded by MEMTRB and through the Pre Production Order Scheme.

3 Development and co-ordination of software for CAD of computers, funded through the Product and Process Development Scheme.

4 Integrated circuit design at RSRE funded by CSERB.

The following are funded by MEMTRB:-

5 Computer Aided Engineering at PERA

6 CAD system (demonstration project).

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9 CAM system for sheet metal duct work.

10 Flexible Manufacturing System (demonstration system).

11 Computer Aided Draughting and Design System.

12 Automated Draughting.

13 Computer Aided Technology in the Mechanical Engineering Industry at CADC.

14 Advanced Numerical Stress and Structural Testing at NEL.

15 Computer Aided Manufacture at NEL.

16 Technology transfer at NEL and CADC.

ANNEX 2

SUMMARY OF RECOMMENDATIONS AND RESPONSES

Recommendation 1 para 7.4

We recommend that DoI should produce and disseminate information on installation costs and training needs for CAD/CAM.

Response para 8

The Government accepts this recommendation. Considerable attention is already given to improving awareness. Consideration will be given to further effort.

Recommendation 2 para 7.4

We also recommend that DoI should maintain close watch on developments overseas.

Response para 9

The Government accepts the recommendation. A special effort is already being made in the case of Japan where a scheme has been agreed to use local consultants to obtain information over a wide range of topics. Wider dissemination of information obtained by Research Establishments is being considered.

Recommendation 3 para 7.5

We therefore recommend that the Government should sponsor able young people to work for a period overseas to learn about and participate in CAD/CAM.

Response para 10

Discussions have taken place between DoI and the Fellowship of Engineering. SRC will discuss the use of current schemes for the purposes discussed by ACARD.

Recommendation 4 para 7.6 and Recommendation 5 para 7.9

We recommend that the advisory and bureau services of NEL and CADC be coordinated to form an Institute of Computer Aided Engineering.

We recommend that the Institute be relocated nearer the centres of manufacturing industry.

Response para 4

Coordination between NEL and CADC is being improved. The Director of CADC has been appointed Director of NEL whilst retaining overall responsibility for CADC. The new Management will examine ways of improving the range and accessibility of the laboratories' services to industry. Relocation to a new site in the form of an Institute of Computer Aided Engineering is not thought to be necessary.

Recommendation 6 para 7.11

We recommend that the Government should consider how it might assist companies to adopt appropriate CAD/CAM systems.

Response para 11

The Government accepts the broad recommendation. There are several measures which assist companies including the provision of demonstration systems. There are no plans for a scheme which involves the initial leasing of equipment for evaluation.

Recommendation 7 para 7.13

We recommend that the public sector as a whole considers how it can promote CAD/CAM through its purchasing policy.

Response para 14

The Government accepts the recommendation. It believes that public purchasing has an important role to play in stimulating innovation and technical development throughout the public sector. There is scope for applying this principle in the CAD/CAM area.

Recommendation 8 para 7.14

We recommend that the National Economic Development Council should consider how market opportunities for the supply of CAD/CAM equipment by UK companies should be tackled.

Response

NEDO will be making their own reply to this recommendation.

Recommendation 9 para 7.15

We recommend that DoI should undertake a study of Linked Business Systems.

Response para 13

There is no formal study of Linked Business Systems under way at present. The Mechanical Engineering and Machine Tools Requirements Board (MEMTRB) of DoI is supporting the development of Linked Engineering Business Systems in Industry which should provide valuable practical experience.

Recommendation 10 para 7.16

We recommend that the DoI take the lead in improving coordination between the various organisations involved in the use of CAD/CAM.

Response para 6

There is already good liaison between the Computer Aided Engineering, and the Automated Small Batch Production Panels of MEMTRB. Further consideration is being given to better coordination of the activities of the various groups involved.

Recommendation 11 para 7.17

We recommend that the DoI should promote the use of bureaux and user clubs.

Response para 15

DoI will explore the question of user clubs and bureaux but there is already considerable activity in this field mainly in the private sector. It may therefore be more suitable for DoI to concentrate on making existing services better known.

Recommendation 12 para 7.20 and Recommendation 13 para 7.23

We recommend that computing principles be given more emphasis in schools. Universities should include CAD at undergraduate level and provide postgraduate course in programming. Existing staff should be educated in CAD/CAM.

We recommend that management courses should consider the management implications of the widespread use of CAD/CAM.

Response para 16

Engineering education is being examined in response to the Finniston Report. There may be scope for removing administrative restrictions and financial disincentives which appear to prevent institutions from providing courses of the type suggested. The recently announced National Development Programme in Microelectronics in Schools will give further attention to the place of computing in the school curriculum.

cc Mr Duguid

bf 16/12/80

WMHP.

PRIME MINISTER

The Advisory Council on Applied Research and Development (ACARD) published its report on "Technological Change: Threats and Opportunities for the United Kingdom" at the beginning of the year. I was invited to co-ordinate the Government response, and the enclosed paper is based on the detailed consideration of the Report undertaken by the interdepartmental Industrial Policy Group (IPG). This was circulated to colleagues, and the attached paper reflects their comments. With your approval, I propose to send it under a covering letter to the Chairman of ACARD, Dr Spinks; to place the paper in the Libraries of both Houses; and to draw attention to it by means of an arranged Parliamentary Question.

2 The process of putting together the Government response has been lengthier than I would have wished, largely because of the broad nature of its subject and the diffuseness of its recommendations. In discussion with ACARD I have made it clear that I should prefer the Council to address itself to more closely defined topics; and this point, together with criticism of some other points in the report on which ACARD shows itself to be ill-informed or naive, is also made in the response.

/3 ...

3 I am sending copies of this letter and the enclosure to the Chancellor of the Exchequer, the Secretaries of State for Defence, Employment, the Environment, Foreign Affairs, Scotland, Wales, Northern Ireland, Social Services, Trade, Energy and Education and Science, and to the Ministers of Agriculture, Fisheries and Food and Transport, to the Lord President, the Paymaster General, Minister of State for the Civil Service Department and to Sir Robert Armstrong.

K J

16 December 1980

Department of Industry
Ashdown House
123 Victoria Street

ACARD REPORT ON TECHNOLOGICAL CHANGE

Draft Response to ACARD

Introduction

1 The report of the Advisory Council for Applied Research and Development on "Technological Change: Threats and Opportunities for the United Kingdom" was published in January 1980.

2 ACARD have made eight principal recommendations, one of which encompasses four separate recommendations on small firms. The majority of the recommendations are aimed specifically at Government, and the Report also includes seven points of a more general nature which for the purposes of this response have been treated as recommendations.

3 Technological Change is an immensely wide and diffuse subject on which conclusions are likely to remain at a fairly high level of generalisation; and the more recent ACARD reports on Biotechnology and Information Technology show that, concentration on a closely defined topic is likely to produce more clearly focussed recommendations.

Economic Climate

4 Many of the ACARD recommendations call for greater direct Government involvement in the promotion of technological change. It is perhaps a pity that the Report omits reference to Government schemes designed to stimulate awareness and adoption of new or under-used technologies; for example the Micro-processor Applications Project, Microelectronics Industry Support Programme, the Product and Process Development Scheme.

However, the Government is convinced that the greatest contribution it can make to technological change is to create an economic climate favourable to enterprise and growth; and an important element in this, as ACARD suggests (para 2.4), is the avoidance of unnecessary changes in fiscal and economic policy. These are the primary objectives of this Government's policy. A firmer monetary policy and cuts in public expenditure are designed to secure the progressive reductions in inflation and interest rates, which are now under way. A start has been made on switching the burden of taxation from direct to indirect taxes, and on reducing excessive rates of income tax, in order to improve rewards and incentives. A variety of measures have been taken to improve the working of the market - among them the abolition of controls on foreign exchange movements, dividends and prices, changes in employment legislation and housing policy. Administrative burdens on firms are being reviewed and eased. A number of measures have been adopted, and others are under consideration, for helping small firms; an important source of innovation and new employment. P.S. Industry has welcomed these changes as offering the best prospect for financial stability and a revival of enterprise. A determination to stick to these policies, rather than the major expansion of Government involvement in industry that seems to be envisaged in some of the ACARD recommendations, is most likely to give industry the confidence to adopt new technology. When inflation and interest rates have come down, the fiscal and economic climate will by then already be found to have become more encouraging.

6 Although not discussed in the Report, adequate real profit levels are the critical influence on the ability of companies to cope with technological change. It is therefore extremely worrying that the real level of profitability, particularly in manufacturing industry, has been on a downward trend for many years, and more recently has reached damagingly low levels.

R&D Performance

7 Compared with leading OECD countries, the UK's performance over the last 15-20 years has been poor in areas such as productivity, value added per man and trade in finished manufactures. The result has been slower growth and relative economic decline. ACARD rightly identified research and development carried out by industry for its own commercial purposes as one of the most important elements in innovation leading to a strong economy. Here the UK's record is dramatically different from that of its competitors, with industrial funding of R&D falling by 10 per cent in constant price terms over the period 1967-75 whilst that in other leading OECD countries rose by an average of 30-40 per cent.

8 R&D focussed on the innovation of products and processes is increasingly important in determining industry's future performance. The Government will continue to invest in development when the private sector would probably not go ahead without help and when the results are likely to be to the public good.

The Science and Technology Act will be used for this purpose, and particular priority will be given to development projects likely to lead to marketable products.

New Industries and Services

9 Many of the new industries and services to which ACARD refers (paras 3.1 to 3.11) have already attracted the support of the Department of Energy and the Department of Industry's Research Requirements Boards at the R&D stage. In choosing projects to support, the Boards give priority to areas where industries based on new technologies might be generated and to research and development projects that can be carried through to commercial fruition. Examples include electric vehicle technology, composite materials, and process plant control and instrumentation. At the post-R&D stage, assistance is available under the Industry Act and through the NEB/in partnership with private enterprise to encourage the setting up of new technology-based companies: (recent examples being the support for the robot manufacturing company Unimation in establishing production facilities in the UK, and the NEB/private sector investment in Celltech).

10 ACARD suggest (para 4.11) that many of those displaced by increased productivity should be employed in service industries, thus improving the standard of many services. They cite in support of their view the proportions of the Japanese and UK national labour forces employed in manufacturing and service industries. However, the Government doubts whether a complete picture can be drawn from simple analogies based on the

experience of countries whose economic and social developments are historically different from our own. It is customer demand, rather than the availability of surplus labour, that is likely to determine improvements in services; and the scope for such improvements to generate substantial employment is limited both by competition and the application of new service sector technology. Overmanning would be highly damaging in those service industries subject to international competition; and any significant increase in costs in the tradeable goods sector is likely to lead to price rises.

11 The Government does however recognise the importance of service sector industries. Such industries commonly flow naturally from the technologies to which they relate and whose needs they serve; and if the climate is right and the time ripe they should not need government help to make them flourish. But in some areas, and notably in the development of software systems and the like, some support can help to stimulate and accelerate activity in rapidly-evolving fields. Thus, under existing support schemes, Department of Industry assistance to the computer services industry, directed mainly towards the development of software and systems, has amounted to approximately £1¼ million per year over the past three years. In view of the acknowledged importance to the UK of computer skills, the Department of Industry, within its overall budget,

will ensure that the Software Products Scheme and the Product and Process Development Scheme continue to receive priority.

Small Firms

12 The Government agree that small firms can and do play an important part in the development and application of technological change. However, it does not agree with ACARD (para 5.2) that a major new study, along the lines of the Birch Report, of the role of small firms is necessary in addition to work already in hand in the Departments of Industry and Employment. We think more we know the conditions which have been hostile to small ve for firms. The Government's purpose in improving the economic climate is to encourage the birthrate of new firms (as well as the growth of existing firms), including high technology firms, while removing such non-market obstacles to survival as excessive taxation and form-filling over which the Government has influence.

13 The main thrust of Government assistance to small firms must continue to come through fiscal measures and by creation of a climate favouring enterprise (as discussed in para 4 above). But worthwhile assistance for small firms is already available from the taxpayer. Examples include the Microprocessor Application Project, where over half the companies assisted have a turnover of less than £2m, and the Manpower Services Commission Training Opportunities Scheme (TOPS). TOPS has recognised the importance of the small firm in job generation by the development and expansion of the New Enterprises Programmes and Small Business Courses.

14 ACARD suggest (para 4.5) that large companies with R&D

results which they do not intend to exploit commercially should be encouraged "perhaps through fiscal measures" to set up or seek out small firms better able to utilise such results. They (ACARD) do not, however, offer any practical suggestions as to how this might be done. There is evidence of increasing interest and awareness on the part of large firms of their social role in helping to create new employment where they themselves have been the main creators of redundancies, but little of this activity has so far been in the R&D field.

15 General business advice and technical counselling is already available from a number of sources, such as the Department of Industry's Small Firms Service, through CoSIRA in rural areas and through the SDA and WDA in Scotland and Wales respectively. However, the Government will continue to examine what further help can be given to small firms, including the possibility of a scheme to encourage more small companies to take up Research Association membership.

Technology Transfer

16 The Government concur with the ACARD comments on the importance of the transfer of technology into the UK. As well as lagging behind other industrial economies in its spending on industrial R&D, the UK's technological payments to, and receipts from, other industrialised countries are also lower than those of our major competitors. The National Research Development Corporation (NRDC) is already assisting innovation in industry in this country. To assist with the transfer of technology, the

NRDC has engaged consultants in the USA to seek out new products or processes which have been successful there, but which have not yet been launched in Europe. The NRDC will then seek an option to exploit the innovation while a suitable UK manufacturer is sought to take on the licence. The Government do not believe therefore, that a new agency is necessary for the purpose of assisting the transfer of technology into the UK (para 6.8). The task with the transfer of technology is to encourage UK industry, as their foreign competitors are, to a large extent, apparently so encouraged to make more use of the opportunities for them in this direction.- and we see the change of economic climate as serving this purpose too.

17 While the Government accept the recommendation (para 6.9) that staffing policies in both technical and commercial sections of major overseas posts should be reviewed to see whether more engineers should be appointed to them, any increase in this aspect of embassy work could only be undertaken at the expense of other, perhaps equally important, work in the post. The Government is determined to reduce the size of the Civil Service, and any cuts must be shared between the Home and Diplomatic Service.

18 The Department of Industry is however planning to make some funds available for special studies to be undertaken in Japan of technological developments there and especially on opportunities for joint ventures and licensing agreements. These studies are likely to be undertaken by locally employed consultants, who will complement the work of the existing Science and Technology Counsellor.

Overseas Projects

19 The reference in the ACARD Report (para 4.3) to large export orders, and the recommendation that the machinery for tendering for large overseas projects be examined, appear to be peripheral to the subject of the Report and remote from the terms of reference ACARD had set themselves. Concern was expressed about this subject for a number of years, and in response the Department of Trade established in 1972 the Overseas Projects Board which represented both the public and private sectors concerned with overseas projects. Much progress has since been made in establishing a closer relationship between these two sectors. OPG was involved in many successful tenders for valuable overseas projects. In 1980 the work of OPG was taken over by the new Projects and Export Policy Division, which is part of the Department of Trade but also provides a common service to the Department of Industry.

Public Purchasing

20 The Department of Industry is taking the lead in initiating measures to increase the enlightened use of public sector purchasing to improve the performance and competitiveness of United Kingdom industry, both at home and abroad.

ACARD's comment (para 4.14) on the use of the public sector's purchasing power to improve our competitiveness in overseas trade is under separate consideration in the light of the Council's further report on R&D in public purchasing.

Training and Education

21 ACARD consider the impact of technological change on education and training in paragraphs 5.4-5.8 of the report. The Government fully shares ACARD's view that technological change has considerable implications for the organisation of education and training (5.4). Government policy on industrial training was outlined by the Secretary of State for Employment on 26 November. There is a need for greater flexibility in training arrangements to meet the changing demands of industry, and in particular, a need for wider opportunities for the training and re-training of adults. Deficiencies in training at technical level must be remedied if the best use is to be made of new technology in modernising the economy (see para 5.5). The Manpower Services Commission has recently been asked to come forward with a scheme of distance learning - an "Open Tech" - in conjunction with existing technical colleges and colleges of further education. More generally, the Department of Employment are considering with the MSC and those concerned in industry and education, proposals which would enable progress to be made on all these training issues. The Government expect to publish these proposals in the New Year. The specific suggestions in para 5.6 of the ACARD report for increasing the public sector's responsibility and for an earnings related "training benefit" will need to be considered in this context.

/The ...

The Government also recognise the need to improve the supply of graduates in fast growing branches of technology (including electronics, computer science and information technology). The Government is proposing to recommend the setting up of a new engineering body under Royal Charter following the recommendations of the Finniston Committee Report. This body will make a contribution to the development of engineering courses and the Government is considering what other action needs to be taken.

Sectoral Activity: EDCs and SWPs Requirements Boards and Research Associations

22 Two specific recommundations by ACARD concern the involvement of the National Economic Development Council and its tripartite sectoral Committees (para 6.5). It is already part of the remit of EDCs and SWPs to consider technological change as part of their work to improve the performance of their industries. They were asked to give particular emphasis to this work in 1979. A number have identified needs and opportunities for technological change and made recommendations to management and unions in their industries.

/However ...

However, in competitive conditions the job of developing technological strategies - which presumably should be one element in corporate strategies - is ultimately a matter for individual companies. The role of EDCs and SWPs is therefore less to draw up strategies for their industries than to influence the strategies of individual companies. This process of influence can be difficult, particularly in highly fragmented industries.

23 The reference to the involvement of Requirements Boards and the Research Associations with the development of technology strategies perhaps takes insufficient account of present efforts and past experience. The Requirements Boards have devoted considerable effort to establish priorities for the allocation of funds that they control and have sought close links with the EDCs and SWPs. However, the EDCs and SWPs cover less than 50% of the output of UK manufacturing, and it is therefore necessary to supplement these links with wider discussions. The Government's influence on Research Associations is now largely through the contracts that it places with them, although there are frequent policy discussions between officials and RA management. In recent years the Research Councils have taken more account of what industry wants and are willing to finance by research contracts.
The Department of Industry has encouraged them in this approach and has links with a number of programmes.

24 The ACARD recommendation (para 6.5) on the interfaces between EDCs/SWPs and industrial sectors touches on an area where action is already in hand. The Steering Brief issued by the NEDC to EDCs and SWPs early in 1979 asked the sectoral groups to

investigate the application of advanced technologies, including microelectronics, in their own and customer industries. A number of maker/user groups have been established between EDCs and SWPs bringing together traditional suppliers of manufacturing machinery and those of advance control systems and information technologies. These joint groups have identified specific supply problems and [illegible] technological gaps in development and production. Their work has also underlined the importance of formulating acceptable national and international standards to combat problems of incompatibility of equipment. While the Government will encourage EDCs/SWPs to continue with some aspects of this work, it is not the proper function of the sectoral groups to become more deeply involved in detailed R&D considerations. Nor does the Government believe that individual company representatives would welcome such a move.

Key Materials

25 The Government agree with the ACARD comment (para 3.7) on the availability of key materials. An announcement was made in Parliament on 19 May that industry were to be consulted on the prospects for the supply of essential minerals and the desirability of measures to improve continuity and security of supplies. The Government are now considering the results of these consultations. A proposed European Community R&D Programme on substitution is being supported by the UK.

Conclusion

26 The Government welcomes the public attention that this ACARD Report has brought to the area of technological change, and will

keep under review those recommendations where further action may be needed. But it cannot accept that the role of the public sector should be expanded in the present economic circumstances. The creation of a climate favourable to enterprise and risk-taking remains the principal contribution that the Government can make to technological change.

Department of Industry

December 1980

JU

DEPARTMENT OF INDUSTRY
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Secretary of State for Industry

11 November 1980

Mike Pattison Esq
Private Secretary to the
Prime Minister
10 Downing Street
London SW1

✓ MAP

Dear Mike,

Thank you for your letter of 3 November about the draft response to the ACARD Report on 'Computer Aided Design and Manufacture'.

We will look again at the draft in the light of the Prime Minister's comments and let you have a revised version as soon as possible.

Yours sincerely,
Cecily Morgan

CECILY MORGAN
Private Secretary

cc: MOD
D/Em
D/Env
DHSS
DES
D/Trans
HMT
CO
CPRS

VB

Gat
Mail

10 DOWNING STREET

From the Private Secretary

3 November 1980

Dear Catherine

The Prime Minister has seen your Secretary of State's minute of 27 October, in which he sought approval for a Government response to the Advisory Council for Applied Research and Development's report on "Computer Aided Design and Manufacture".

The Prime Minister does not like the draft. She believes it important to stimulate an informed debate on the kind of issues raised in reports like this from ACARD: indeed, she sees this role as a major justification for retaining the Council. But a number of paragraphs in the suggested response seem designed to make soothing noises as an excuse for Government inaction on recommendations, without spelling out the reasons for Government preference to do nothing. Mrs Thatcher has no objection to the Government rejecting recommendations, but she would like to see the reasons set out in a much snappier fashion.

The Prime Minister would therefore like the Department of Industry, as lead Department, to reconsider the whole tone and flavour of the proposed Government response. She feels that a response like the present draft simply means that the Council's time has been wasted in the exercise.

I am sending copies of this letter to David Omand (Ministry of Defence), Andrew Hardman (Department of Employment), Jeff Jacobs (Department of the Environment), Bernie Merkel (DHSS), Mary Bowden (Department of Education and Science), Barbara Riddell (Department of Transport), Peter Jenkins (HM Treasury) and David Wright (Cabinet Office), and to Gerry Spence in the CPRS (who will not have received your Secretary of State's minute with the proposed response).

Yours ever

Mike Pattison

Mrs Catherine Bell,
Department of Industry.

SK

PRIME MINISTER

ACARD reported this year on 'Computer Aided Design and Manufacture'. Keith Joseph suggests a Government response. Earlier in the year, you agreed that ACARD had a continuing role, at least for the present. It seems to me that its role is only really valid if it manages to generate some public debate. (I learned incidentally that these ACARD pamphlets are bought by some 5 - 8,000 people through HMSO outlets. This shows that there is a real interest on which one should try to build.) It can help in the kind of areas you discussed with John Ashworth.

This kind of Government response seems to me to be designed to stifle debate in a blanket of soothing bureaucratic noises. If the exercise is worth while at all, surely it would be better to have something snappier, backed up by much more detailed justification in the areas where ACARD recommendations are rejected.

Do you approve the proposed response or would you like to ask Keith Joseph to go for something in a completely different tone?

No. I agree that this report consists of an abundance of phrases such as 'government has a role to improve awareness' 'can play a valuable role' 'research establishments which should play a significant role' 'committees the effectiveness of whose work is being considered' 'should maintain a close watch' 'is currently examining the need for further awareness activities' P.T.O.

MAP

31 October 1980

'in having discussions which will
continue'

'will explore the question'

and so on. At the end of it
all nothing will be changed and
there is no dynamism behind the
report in terms of urgency.

Would you (1) ask John Brunt
to have a look at it and

(2) ask the lead department to
reconsider the whole tone of their
response.

If they go on like this we shall
never achieve anything and
ALARM will have wasted their
time'

Neil.

cc Speech folder HB

10 DOWNING STREET

From the Private Secretary

DR. ASHWORTH
CENTRAL POLICY REVIEW STAFF

The Prime Minister was grateful for the notes you submitted earlier this month, following up your conversation with her. I now return your copy of the NRDC report, and the booklet on the French approach to national innovation (with added value!).

We hope to be able to go ahead with the function for entrepreneurs and financiers early in the new year. I will be in touch with you again about this.

The Prime Minister's speech on 25 February is to the Parliamentary and Scientific Committee - this will be a much larger function than is implied by a Parliamentary Select Committee, see attached letter.

The Prime Minister is content to drop for the present the question of the use made by foreign companies of UK university laboratories.

I look forward to receiving the list of Wolfson Foundation supported units.

M. A. PATTISON

27 October 1980

255

cc Press Office

PRIME MINISTER

The Advisory Council for Applied Research and Development (ACARD) published its report on 'Computer Aided Design and Manufacture' in February 1980 and you invited me to co-ordinate the Government response. I suggest that, with your approval, the reply should take the form of the attached paper, under a covering letter from me to the Chairman of ACARD, Dr Spinks. The text has been agreed at Ministerial level with the Departments of Defence, Employment, Environment, Transport, Health and Social Security, Education and Science, the Treasury and has been seen by Sir Robert Armstrong. The paper would also be released to the press.

2 A summary of the recommendations of the ACARD Report and the Government's responses to them is provided for easy reference as Annex 2 to the paper.

3 I am copying this minute to the Secretaries of State for Defence, Employment, Environment, Health and Social Security, Education and Science, the Minister of Transport, the Chancellor of the Exchequer and Sir Robert Armstrong.

KJ

27 October 1980

K J

Department of Industry
Ashdown House
123 Victoria Street

RESPONSE TO THE ACARD REPORT ON COMPUTER AIDED DESIGN AND MANUFACTURE

1 The report of the Advisory Council for Applied Research and Development (ACARD) on Computer Aided Design and Manufacture (CAD/CAM) was published on 6 February 1980. The Department of Industry was invited to co-ordinate the Government response and this reply incorporates views and comments from several Departments, and from the Science Research Council (SRC). Annex 2 summarises each of the ACARD recommendations and the relevant Government response.

2 For the purposes of this response CAD/CAM is taken to include the use of computers in design, manufacture and testing as well as the extension to estimating, production planning and stock control involved in Linked Engineering Business Systems.

3 The Government welcomes this report from the Advisory Council drawing attention to an important area of technology and to the benefits that are already being experienced by UK industry from its application. It supports the Council's view of the economic advantage that could be derived from wider adoption of the technology and it believes that important elements in securing that adoption are, that the economic conditions under which industry operates should be improved and that there should be increased awareness of the potential of the technology. The adoption of advanced technologies such as CAD/CAM at a rate comparable to our major industrial competitors is essential for the future of British Industry. The Government notes that comments in this report to the effect that although other countries are at present in advance of the UK the position is not irretrievable and it is therefore important that efforts should be made by all to secure the advantages of these techniques. The main responsibility

clearly rests with industry but the Government accepts that for the present it has a role to improve awareness and to provide encouragement and support to help to accelerate the pace of application, within the limited resources available for public expenditure. Support for R&D via the tax-payer is important when private investors have difficulty in assessing the benefits of new techniques and are likely to underinvest in the state-of-the-art research from the point of view of society in general. Research aimed both at advancing the technology and demonstrating its benefits is therefore an area where Government can play a valuable role. A list of projects supported by the Department of Industry is at Annex 1; it includes work in the Department's own laboratories and in industry. Some of the industrial projects are "demonstration projects" in which access is provided to potential users of similar systems who can see them in operation.

4 The Government endorses ACARD's view (paragraph 7.6) that the DoI Research Establishments (the National Engineering Laboratory, NEL, at East Kilbride and the Computer Aided Design Centre, CADC, at Cambridge) should play a significant role in providing advice on CAD/CAM to industry. However, it does not feel that the creation of a new institute would significantly aid the process. Steps have already been taken to improve co-ordination between the two establishments by appointing the Director of CADC as Director of NEL and giving him overall responsibility for both organisations. An important task of the new management will be to examine ways of improving the range and accessibility of the services provided to industry. It is also felt that the costs of relocation to a new site would not be justified.

5 The two laboratories draw part of their financial support from the DoI Requirements Boards and part from outside sources, including

repayment work from industry. In the case of CADC the amount of industrial repayment work is now 37 per cent of the cost of the Centre and it is hoped to increase this in the future.

6 The Mechanical Engineering and Machine Tool Requirement Board (MEMTRB), the largest DoI customer in this field, is currently advised by the Computer Aided Engineering Committee and by the Automated Small Batch Production (ASP) Panel. In response to the ACARD recommendation (paragraph 7.16) that the co-ordination of research should be improved the effectiveness of the links between these two bodies is being considered. This committee structure will retain its present advisory role in respect of corresponsing Science Research Council programmes. More generally, co-ordinating machinery has been established across the broad range of the Department's (and Science Research Council's) activities in the field of CAD/CAM.

7 Paragraphs 4 and 6 above outline the proposals for improving co-ordination on both the customer and contractor sides of the customer-contractor relationship. Industry is represented on the customer side through the Requirement Boards and on their advisory committees, as it is on appropriate SRC Committees. Co-ordination is being improved in respect of DoI's other activities involving the supply industry, which is discussed in paragraph 12 below.

8 Government accepts the suggestion (paragraph 7.4) that DoI should take responsibility for producing and disseminating information and for promoting awareness of CAD/CAM. NEL already disseminates information on the cost of installation of CAD/CAM equipment and has run seminars for industry and others on CAD/CAM. The main thrust is on training and giving practical experience of using CAD/CAM systems. Seventeen three day courses have taken place over the past five years

and the majority of the participants have been from industry. CADC runs courses to instruct operators in the use of software under licence from CADC. It also acts as a "clearing house" through its Computer Aided Engineering Support Unit which assesses useful software packages and registers them in a library. Relevant work being done, for example, at the Research Establishments of the Departments of Environment and Transport could be included in any information dissemination exercise. ACARD made a comparison with the DoI's successful microelectronics awareness scheme (paragraph 7.4); However, the composition of the audience to be addressed is somewhat different, in the case of CAD/CAM, as is the scale of investment which may be involved in many cases. The Department is currently examining the need for further awareness activities in the CAD/CAM area.

9 Government accepts the ACARD recommendation (paragraph 7.4) that the Department of Industry should maintain a close watch on developments overseas. The Department already has very close links with the Science Counsellors in five Embassies (Bonn, Paris, Washington, Tokyo and Moscow) and it has a network of sources of information elsewhere. Reports on the development of CAD/CAM and its applications are included in the despatches from these posts. Arrangements are in hand to increase the flow of information from Japan by the use of local consultants. NEL and CADC also monitor developments overseas and the possibility of disseminating this information more widely is being examined.

10 The Department of Industry has had discussions with the Fellowship of Engineering arising out of the ACARD suggestion (paragraph 7.5) that the Government should sponsor young people to work for a period overseas to learn about and participate in CAD/CAM developments. This recommendation clearly has broad application to

other areas of technology and it will be studied carefully. We believe that for a scheme to be most effective it should be aimed at people with industrial experience. Some schemes already exist within the Science Research Council which could provide the sort of support ACARD has in mind. The discussions with the Fellowship of Engineering and the SRC about how these existing schemes could be better used and about whether additional funds are necessary will continue. In addition the Engineering Industry Training Board operates a Manufacturing Management Fellowship Scheme for trainee managers under which a number of young people pay short visits overseas to study, among other things, the impact of technology such as CAD/CAM.

11 The Government accepts the recommendation (paragraph 7.11) that it should consider how it might further assist companies, particularly those of small or medium size, to adopt appropriate CAD/CAM systems. The Council will be aware of the particular importance that the Government attaches to the role that smaller companies play in the economy. It already has a number of schemes specifically directed towards their assistance. For example the Manufacturing Advisory Service (MAS) provides consultancy on modern manufacturing methods to companies with less than 1000 employees. Twenty five projects on CAD/CAM are already complete and a further eleven are in progress. The assistance to industry through demonstration projects, such as that at Baker Perkins, is a successful way of promoting the development of the technology. The Teaching Company Scheme jointly funded by DoI and SRC is also a route for the encouragement of the use of CAD/CAM in industry. There are currently 33 projects and about a quarter of them involve computer aided engineering. In these, Associates, closely connected with a nearby university or polytechnic

work with the partner firm. In several cases CAD turnkey systems have been installed in the firm or university and can be used for the firm's own problems and also for demonstration to other firms and students. The resources of the Government research laboratories are available on a repayment basis to industry for specific tasks and industrial collaboration is encouraged. Companies can also submit proposals to the Requirements Boards and apply for support under the Product and Process Development Schemes. In collaboration with Universities and Polytechnics they can apply for support from the SRC under its Co-operative Grants Scheme. Many commercial organisations offer bureau services and there are thus many ways in which industry can obtain advice, both from the private and public sectors. The Government believes that encouragement of the use of CAD/CAM systems through the initial leasing of equipment is a matter for the commercial suppliers to consider. It has no plans to provide financial support for this purpose.

12 Government is aware of the importance to be attached to the supply of CAD/CAM equipment by UK manufacturers in view of the large potential market as the pace of application increases; the market for large turnkey systems is at present dominated by American manufacturers. It is important that the UK supply industry should be sufficiently closely associated with any new Government initiatives for it to benefit from resulting stimulation. The sooner industry is aware of these initiatives the better it can respond. A British company is developing a competitive system in partnership with the taxpayer. Other less comprehensive systems, mainly for drafting, are available from several UK firms. Much software development is carried out in the Universities and public sector research establishments. Where appropriate these can be marketed either by the originator or through the NRDC companies Compeda and Genesys. NRDC has been

providing development finance for joint ventures and engaging in technology transfer from public sector organisations for some time. Currently some 30 projects on CAD/CAM are supported by NRDC with an authorised investment of almost £7 million; a further 25 projects are under assessment. The need for standards and new software tools are two of the subjects of a study by DoI and the Electronic Engineering Association (EEA). One of the benefits of this study should be to help the supply industry by providing relevant information. The National Enterprise Board has been involved in discussions on the development of a CAD/CAM system with a view to producing a new UK initiative in this area.

13 The report recommends (paragraph 7.15) that DoI should study Linked Business Systems. Although there are no plans for a formal study at present MEMTRB are involved with industry in developing Linked Engineering Business Systems. The practical experience gained in this way will be very valuable.

14 The Government accepts the recommendation (paragraph 7.13) that Departments should consider how they can promote applications of CAD/CAM through their own purchases. The Government believes that it has an important role to play in stimulating innovation and technical developments through the use of public purchasing throughout the whole of the public sector. For example, it is urging the nationalised industries, as far as it is consistent with their overall objectives, similarly to have regard in their purchasing to the need to promote new technology and the interests of UK manufacturers. The potential of this approach for encouraging the wider use of CAD/CAM will be examined.

15 ACARD suggest (paragraph 7.17) that DoI should promote the use of CAD bureaux and user clubs. The DoI will explore the question of user clubs possibly at a Research Association or a Government Research Establishment. Its enquiries so far indicate that there are at least forty organisations currently offering various CAD services and some manufacturers of CAD/CAM equipment provide advice on a user club basis. A number of Research Associations such as PERA and MTIRA are also active in the field. The need for further effort therefore requires careful consideration and it may be best for the DoI to concentrate its effort on making the existing services better known.

16 The Council made a number of recommendations (paragraph 7.20) concerned with education in CAD/CAM techniques. The whole area of engineering education is being examined by the Government following the report by the Finniston Committee. More specifically there has been considerable debate about the place of computing in the school curriculum. The National Development Programme in Microelectronics for Schools and Colleges recently announced by the Department of Education and Science will give further attention to this issue. In the case of computer studies and CAD itself progress is limited by the availability of hardware and of trained teachers. Staff and equipment shortages are also a barrier to the expansion of effort in CAD/CAM in the higher education system. However, the universities and polytechnics are planning, with SRC help, to launch 5 new MSc courses in computer aided circuit design. In the context of employment-oriented continuing education there may be some scope for removing administrative restrictions and financial disincentives which appear in some cases to prevent institutions of higher and further education from providing courses of the type suggested and

which industry and commerce would wish to use and be willing to pay for. DES is considering the implications of the recommendation that universities should prepare post graduate courses on programming to train students capable of writing major software programmes and modifying existing software. Design engineering skills are one of the Manpower Services Commission's (MSC) priority training areas and the MSC will be exploring with the Industry Training Boards the question of updating training in CAD.

17 In conclusion the Government welcomes the attention that this ACARD report has focused on CAD/CAM. The Government is already involved in many of the activities recommended by ACARD. It is taking steps to improve further the co-ordination of its activities and it will continue to keep under review those recommendations made by the Council which require further action.

DEPARTMENT OF INDUSTRY PROGRAMMES IN SUPPORT OF CAD/CAM

The Department spends about £3 million per annum in support of CAD/CAM.

The major programme items are as follows:-

1 Computer aids for process plant design, manufacture and operation at CADC funded through CMRB.

2 Development of a British CAD/CAM system funded by MEMTRB and through the Pre Production Order Scheme.

3 Development and co-ordination of software for CAD of computers, funded through the Product and Process Development Scheme.

4 Integrated circuit design at RSRE funded by CSERB.

The following are funded by MEMTRB:-

5 Computer Aided Engineering at PERA

6 CAD system (demonstration project).

7 CAD/NC machining for tool making (demonstration project).

8 CAD for die, mould and pattern making at Cambridge University.

9 CAM system for sheet metal duct work.

10 Flexible Manufacturing System (demonstration system).

11 Computer Aided Draughting and Design System.

12 Automated Draughting.

13 Computer Aided Technology in the Mechanical Engineering Industry at CADC.

14 Advanced Numerical Stress and Structural Testing at NEL.

15 Computer Aided Manufacture at NEL.

16 Technology transfer at NEL and CADC.

ANNEX 2

SUMMARY OF RECOMMENDATIONS AND RESPONSES

Recommendation 1 para 7.4

We recommend that DoI should produce and disseminate information on installation costs and training needs for CAD/CAM.

Response para 8

The Government accepts this recommendation. Considerable attention is already given to improving awareness. Consideration will be given to further effort.

Recommendation 2 para 7.4

We also recommend that DoI should maintain close watch on developments overseas.

Response para 9

The Government accepts the recommendation. A special effort is already being made in the case of Japan where a scheme has been agreed to use local consultants to obtain information over a wide range of topics. Wider dissemination of information obtained by Research Establishments is being considered.

Recommendation 3 para 7.5

We therefore recommend that the Government should sponsor able young people to work for a period overseas to learn about and participate in CAD/CAM.

Response para 10

Discussions have taken place between DoI and the Fellowship of Engineering. SRC will discuss the use of current schemes for the purposes discussed by ACARD.

Recommendation 4 para 7.6 and Recommendation 5 para 7.9

We recommend that the advisory and bureau services of NEL and CADC be coordinated to form an Institute of Computer Aided Engineering.

We recommend that the Institute be relocated nearer the centres of manufacturing industry.

Response para 4

Coordination between NEL and CADC is being improved. The Director of CADC has been appointed Director of NEL whilst retaining overall responsibility for CADC. The new Management will examine ways of improving the range and accessibility of the laboratories' services to industry. Relocation to a new site in the form of an Institute of Computer Aided Engineering is not thought to be necessary.

Recommendation 6 para 7.11

We recommend that the Government should consider how it might assist companies to adopt appropriate CAD/CAM systems.

Response para 11

The Government accepts the broad recommendation. There are several measures which assist companies including the provision of demonstration systems. There are no plans for a scheme which involves the initial leasing of equipment for evaluation.

Recommendation 7 para 7.13

We recommend that the public sector as a whole considers how it can promote CAD/CAM through its purchasing policy.

Response para 14

The Government accepts the recommendation. It believes that public purchasing has an important role to play in stimulating innovation and technical development throughout the public sector. There is scope for applying this principle in the CAD/CAM area.

Recommendation 8 para 7.14

We recommend that the National Economic Development Council should consider how market opportunities for the supply of CAD/CAM equipment by UK companies should be tackled.

Response

NEDO will be making their own reply to this recommendation.

Recommendation 9 para 7.15

We recommend that DoI should undertake a study of Linked Business Systems.

Response para 13

There is no formal study of Linked Business Systems under way at present. The Mechanical Engineering and Machine Tools Requirements Board (MEMTRB) of DoI is supporting the development of Linked Engineering Business Systems in Industry which should provide valuable practical experience.

Recommendation 10 para 7.16

We recommend that the DoI take the lead in improving coordination between the various organisations involved in the use of CAD/CAM.

Response para 6

There is already good liaison between the Computer Aided Engineering, and the Automated Small Batch Production Panels of MEMTRB. Further consideration is being given to better coordination of the activities of the various groups involved.

Recommendation 11 para 7.17

We recommend that the DoI should promote the use of bureaux and user clubs.

Response para 15

DoI will explore the question of user clubs and bureaux but there is already considerable activity in this field mainly in the private sector. It may therefore be more suitable for DoI to concentrate on making existing services better known.

Recommendation 12 para 7.20 and Recommendation 13 para 7.23

We recommend that computing principles be given more emphasis in schools. Universities should include CAD at undergraduate level and provide postgraduate course in programming. Existing staff should be educated in CAD/CAM.

We recommend that management courses should consider the management implications of the widespread use of CAD/CAM.

Response para 16

Engineering education is being examined in response to the Finniston Report. There may be scope for removing administrative restrictions and financial disincentives which appear to prevent institutions from providing courses of the type suggested. The recently announced National Development Programme in Microelectronics in Schools will give further attention to the place of computing in the school curriculum.

E.R.

4.

PRIME MINISTER

In your conversation with John Ashworth, you asked him to "imagine we are French and construct a programme".

In this box, there are several short pieces from Dr. Ashworth reporting on developments in the areas you discussed. He suggests that you might like to glance at the attached booklet. It is precisely what you had in mind - the French approach to constructing a programme of innovation encouraged from the centre.

MP

mf.

22 October 1980

Prime Minister 4.
Three notes from John Ashworth, following his talk with you. (You saw one of them for the small business meeting)

THE PRIME MINISTER'S INITIATIVES

1. I undertook to ensure that the note on the problems of private investors and availability of venture capital commissioned from ACARD would constitute a background brief for the Prime Minister when she met British bankers. This work is now underway and should be completed by early December.

2. I have been giving some thought to the idea of the Prime Minister hosting a function designed to bring entrepreneurs and financiers together. I think it a good idea and, subject to any thoughts you might have, would suggest some time in January. The Prime Minister's programme (as far as I am concerned) might therefore look:

early December - receipt of ACARD note

early January - meeting with entrepreneurs/bankers

25 February - Speech to Parliamentary Select Committee.

I think it important to have at the January function a number of those, like Mr Naylor of Job Creation Limited and Mr L Cary of Venture Capital Reports, who have themselves successfully created small businesses designed to make a profitable commercial venture out of bringing entrepreneurs and financiers together in novel ways. Indeed I think the more of these the better - especially as I imagine the Prime Minister would not normally expect to see such people in other fora.

3. I hope to let you have a complete list of possible Wolfson Foundation supported units next week. The latest, slightly bizarre, success has been the development by a group at Strathclyde University of a novel fermentation method for the production of soy sauce. The product is currently undergoing trial market testing and will go into volume production if this is satisfactory. The new process is so much cheaper than that currently employed that those concerned are confident that they will not only be able to satisfy growing UK demand but have high hopes of exporting to Japan!

4. I have made discrete enquiries about the chances of Dr Cesar Milstein (inventor of the mono-clonal antibody technique) being awarded a Nobel

Prize. He has been nominated, is felt to have a good chance and we will know tomorrow when I believe the announcements will be made in Stockholm. However, any action by the UK government to press Dr Milstein's case is likely to be counter-productive.

As you know, Milstein did not get it MMP

5. I have made further enquiries into the use made by foreign companies of UK university laboratories. The Prime Minister said she wanted to take this up with both Sir Keith Joseph and Sir Raymond Pennock. On reflection my advice would be to let the issue drop for the following reasons:

(a) Many UK companies are currently suffering from severe cash flow problems and are having to retrench wherever they can - this retrenchment frequently includes the more long term and speculative work they might commission from the Universities.

(b) The reputation of UK Universities as centres of excellent research is deservedly very high and present Government policy is encouraging them to capitalise on this reputation wherever and however possible.

(c) A combination of (a) and (b) above has meant that a number of Universities have found it easier to interest foreign, rather than UK, companies in their contract research and development facilities.

On balance this will mean that foreign money will maintain, in UK Universities, facilities which would otherwise be likely to disappear or which would have to be supported by public funds. These facilities will be available to UK firms when they are again in a position to make use of them. The situation may be irritating but it is understandable and I do not see how the Government could affect things without prejudicing other, more important, policy objectives.

EXISTING AVAILABILITY OF VENTURE CAPITAL

The investment climate for new small companies has changed quite markedly since I first started canvassing opinion on this topic in 1978 (in connection with the work published as the ACARD report on Industrial Innovation). In part this seems to have been due to the establishment of "small firms" or "new venture" divisions of banks (clearing as well as merchant) and no doubt in part also due to the tax changes announced in the last budget and the other initiatives taken by the Government. As an indication of this change Mr P Naylor of Job Creation Limited (itself an innovative new company) tells me that he has no trouble finding capital for his (often rather risky) projects in depressed areas and Mr L Cary of Venture Capital Reports Limited (another innovative new company) has been able to maintain a creditable 30% success rate in finding financial backing for entrepreneurs - and it seems likely that entrepreneurs only go to the likes of Venture Capital Reports Limited as a last resort!

2. However, although the investment climate might be changing it is still too early to tell whether actual performance, in terms of the successful establishment of sound businesses, has really changed. In the crucial area of new technology based firms (NTBFs), for example, it is too early to tell whether the new-found enterprise of the NRDC will be commercially profitable.

3. It seems, therefore, that the Prime Minister will be more likely to be able to point to some promising signs and hopeful beginnings in this area by February 1981 rather than solid achievements. It is likely that the Advisory Council for Applied Research and Development (ACARD) in its reply to the Prime Minister's request for advice on the problems of the private inventor will reiterate the opinion they expressed in their 1978 report on Industrial Innovation, viz that the most effective help that can be given would be to establish some form of loan guarantee scheme in conjunction with tax relief for equity investment in NTBFs by private individuals and modest alterations in the way losses can be written off for tax purposes.

4. There are signs, however, that real problems are developing at what is coming to be called the "post-development gap". This is a term for the shift in emphasis (managerial as well as financial) when an innovative product or process ceases to be an exciting piece of high-technology and becomes a mundane, but potentially very profitable, article of general commerce. The finance needed to bridge the "post-development gap" is often far greater than that needed to bridge the "pre-development gap" between research and development. It is usually far beyond the resources of the likes of the NRDC or small companies and, as the attached article from the Financial Times of 25 September points out, has presented UK companies with awkward problems in the past.

5. I hope that in briefing the Prime Minister the clear distinction is made between venture capital needed to start new firms, or new businesses within existing firms (the "pre-development gap") and that venture capital needed to maintain an adequate market share in a growing market which is consequently attracting foreign competition ("post-development gap").

F.T. 25/1x80

LOMBARD

Exploiting our skills

BY DAVID FISHLOCK

EVERYONE knows that Britain once led the world in radio-astronomy because of its pioneering radio-telescope at Jodrell Bank. But that was back in the Fifties. Fewer know that as a direct result British industry led the world in the Sixties with its earth stations modelled on Jodrell Bank which picked up the whisperings of the first satellites.

Like so many other markets for novel products of high-technology the one for large earth stations has long been lost to the Americans and the Japanese. It wasn't a case of Britain failing to develop a scientific invention, but of Britain failing to mount a coherent industrial policy capable of sustaining from profits the unending input of cash and skills advanced technology demands.

Indispensable

On a grander scale Rolls-Royce made precisely the same mistake in the Sixties. It gravely under-estimated the financial and other resources needed to translate a brilliant new three-shaft concept of aero-engine design into the RB-211. A decade later it can point to 700 engines in service—including some in the North Sea—and orders for another 500, with new developments in the pipeline which suggest a production of at least 250 RB-211 engines a year in the early 1980s. Top of its attractions for airlines, Rolls-Royce engineers say, is that they expect to maintain a 4.5 per cent advantage in fuel consumption over all rivals throughout the decade. This fuel economy is a direct result of harnessing high technology; of more advanced materials operated at higher temperatures.

But had Rolls-Royce been a more typical British industrial situation, it would have vanished in 1971. Only the fact that it was an indispensable source of engines for military aircraft, warships and submarines obliged the government to keep it alive as a state-owned organisation.

With publication today of the eighth report from ACARD, the Advisory Council for Applied Research and Development—the body which has replaced the office of the government's chief scientific adviser—it is becoming increasingly clear that the development gap from which Britain is so often said to be suffering is in a significantly different place from the one normally perceived.

The truly serious gap is not that due to the reluctance of British scientists, engineers, inventors to launch into manufacture with their ideas. The real gap is far more wasteful of resources. It is the hiatus left when companies launch themselves enthusiastically upon the neck of some new technology, only to come a cropper because they failed to realise how much it would cost. It is a post-development gap.

EMI is a classic example of a company which, armed not only with a brilliant invention but with an unusually realistic estimate of what it might cost to launch the new product, still under-estimated the eventual scale of effort required to compete with U.S. industry.

The latest ACARD study surveys "information technology," a vast tract of fast-advancing technology embracing telephones and telecommunications, video systems and word processors—and of course the ubiquitous computer which now lurks behind each one. It finds a marvellously innovative picture in Britain, with such projects as Prestel and System X, and a strong presence in "software," the craft of computer programming which determines whether and how the new technology works.

But ACARD also finds ample evidence of post-development gaps yawning wide in the 80s. It finds too many British companies competing in every promising sector; too many "sponsoring" ministries and departments, each with its own idiosyncratic requirements, each encouraging someone to tailor the innovation precisely to its want.

ACARD's urgent message is that if the Thatcher Government expects industry to win and hold a significant slice of the looming £10bn-a-year world market for information technology, a single department of government must orchestrate the national effort. This probably means that the BBC, police, armed forces, Post Office, hospitals, schools—even the taxmen—must all defer to the technological choices of the Department of Industry.

Actually £50bn was the figure quoted at the Paris conference.

The ACARD report does NOT say this — what it does say is that public purchasing should be used intelligently (a rather different point!)

N R D C

1. The latest annual report of the NRDC (attached) records the retirement of Mr W Makinson as Managing Director and the appointment of Dr J C Cain as his successor. A number of other changes are reported which are probably not unconnected with this change in management:

(a) a 40% rise in authorised new projects (from 113 in 1978/79 to 157 in 1979/80) and hence in expenditure

(b) the establishment of a new subsidiary (Finovia Limited) to provide finance for leasing activities

(c) the establishment of the Small Company Innovation Fund (SCIF) with £2 million capital to provide tailor made financial packages for small companies was foreshadowed in the report and announced on 23 September.

2. The report shows that the NRDC has responded to the criticisms of those, including the Advisory Council for Applied Research and Development (ACARD), who have been keen to see a more aggressive and entrepreneurial spirit.

3. The Financial Times leader on 25 September (copy attached) seems to me to be a fair comment and, interestingly, makes a point I made earlier about the need to provide the NRDC with competition in the form of increasing the "number of decision-making units withing the public sector".

Financing new technology

F.T. 25.8.81

THERE is one category of public spending on industry which evokes a degree of sympathy, if not wholehearted approval, from Sir Keith Joseph, the Industry Secretary. The encouragement of research and development has emerged in discussions within the Government and at the National Economic Development Council as one of the few forms of Government industrial intervention which commands widespread support. Britain's main problem, however, seems not to be so much a lack of investment in research and development in relation to national income—R and D spending seems to be comparable to that in the U.S., Germany, France and Japan. Still less is Britain suffering from a shortage of scientific talent. The problem seems to be the inability of British companies and financial institutions to put finance, technology and production management together efficiently to generate marketable new products.

Joint ventures

The National Research Development Corporation exists partly to help fill this gap in Britain's corporate and financial system, by investing public money in joint ventures on the "technological frontiers" where Britain's private sector financial institutions frequently fear to tread. The difficulties facing any Government initiative to stimulate technological achievement are illustrated in microcosm by the NRDC's annual report, published on Tuesday.

The NRDC's financial success, based mainly on licence income from a number of spectacularly successful projects, particularly in pharmaceuticals, has exposed it to a line of criticism unknown in other parts of the public sector. It is widely accused of spending too little money. In the past ten years it has appeared to many technologists to have adopted an unduly cautious stance and the management's chief embarrassment has been the corporation's inability to spend as much on new projects as it receives from its licence income. Its borrowing limit of £50m, set in 1967, has never been approached and in recent years it has repaid loans to the Department of Industry and ended up with a substantial cash surplus.

The Wilson Committee's criticism, that the NRDC does not do enough to support innovation among the smallest companies and entrepreneurs and that it should play a more active role in seeking out investment opportunities, is being partly answered this year by the establishment of a new fund to invest in small companies and start-ups. But this will make only a marginal contribution.

The general worry about the lack of suitable opportunities for a marriage between the NRDC's resources and the private sector's technological achievements remains.

The NRDC's experience suggests that too much cannot be expected from selective Government intervention in commercial research and development. If their activities are governed by the sort of reasonably stringent profitability criteria which the NRDC adopts, there is no reason to expect public servants to be any more enterprising and less risk-averse than private investors. The fact that the public sector treats its scientific employees just as meanly, in relation to other professionals, as the private sector, suggests that public bodies are unlikely to have any advantage in technological knowhow.

None of this means, however, that a Government concerned about the low productivity and technological backwardness of British industry is entirely helpless. The stark choice seems to be between pushing on a piece of string, by insisting that all assistance for R and D should be done on a strictly non-risk basis, or, on the other hand, signing blank cheques for highly risky and often unsuccessful ventures—a policy which, in effect, has been adopted in some of the Ministry of Defence's purchasing.

Incentives

But between these extremes there are a number of more attractive possibilities. One which the Government is apparently considering is to provide more general assistance for research and development, perhaps in the form of fiscal incentives, while leaving the decisions on specific projects entirely to the private sector. Perhaps the most important general principle is to use a number of decision-making units within the public sector and not to concentrate too much energy and money on grandiose projects.

W 02097

MR RATTISON (dlr)
10 Downing Street

1. I do not expect that you often have the pleasure (?) of reading New Scientist and so I attach a couple of articles that you have probably missed. The first is an interesting example of the Social Science Research Council (SSRC) doing relevant research at last (!?); (the Centre for Socio-Legal Studies is one of the few "in-house" R & D units of the SSRC). The second seems to me much the more intellectually innovative and perhaps even more relevant - but I leave that to your more informed judgement!

PM has seen (and ignored!) MS 9/10

2. I believe the Prime Minister is having a meeting shortly with DoI ministers on the problems of venture capitalists, new companies, inventors and related topics. I thought it might be helpful, therefore, if I let you have a progress report on the follow-up work to my meeting with the Prime Minister on 11 September. I attach these as self-contained notes under the appropriate heading.

DR J M ASHWORTH

P.S. I'd like my marked copy of the NRDC report back sometime.

Cabinet Office

9 October 1980

As the major party conferences get underway we ask:

Photos from Keystone

Why are politicians so charismatic . . .

The leader speaks, and the party members break into spontaneous applause. Or do they?

Robert Eagle
is a freelance writer

Now is the season of the party conference. The time of the year when politicians take over the winter-gardens stages, recently relinquished by comedians, jugglers and mimics, to rally their fans and top up their egos with applause and mutual congratulation. Applause at party conferences is just as important as policy-making: it boosts morale, promotes solidarity and invigorates the lads and lassies before they throw themselves into another year of the "Order, Order" ordeal. The most successful party conference will be the one where applause comes loudest, oftenest, and appears most spontaneous. And the stars will rise temporarily at least, of those politicians who manage to elicit the most vigorous ovations.

The applause accorded to politicians may not look like a very fruitful field for scientific investigation. Far too much opportunity for observer bias. But for the past year an Oxford sociologist, Max Atkinson, senior lecturer at the Centre for Socio-Legal Studies at Wolfson College, has been taping and transcribing from the hustings and party conferences sections of speeches which brought applause for the speaker. He concludes that applause for politicians is hardly ever spontaneous. It is deliberately elicited by rhetorical devices which tell the audience exactly when it is supposed to clap. An orator's success depends on his or her knack for timing these tricks so that the audience responds on cue.

So far Dr Atkinson has identified only a handful of these applause-generating ploys. "But they are remarkably widespread. I was astonished to find every speaker I studied using the same devices to fish for applause."

The device most frequently used at the end of a speech is the "repetition and sign off". The speaker signals his audience that he is coming to the end by declaiming a string of sentences which are stylistically very similar, and signs off with a rallying cry ending on a downward intonation. An example from David Steel during last year's election campaign:

"The people of Liverpool Edge Hill showed it could be done.
The people of Leeds can show that it could be done on May 3rd.
And we're going to break through at this election and bring an end to 30 years of failure for Britain."
(Applause)

And from James Callaghan:

"As long as there's a family without a home,
as long as there is a patient waiting for a hospital bed,
as long as there's a man or woman without a job
or someone who suffers from discrimination because of their colour,
so long will our work as a Labour government not be done.
We go forward in that spirit and that resolve."
(Applause)

"Used correctly the repetition can have the audience so primed up that it begins clapping before the sign off is complete," Atkinson reports. "If applause comes while the speaker is still speaking, it sounds much more spontaneous."

Even more desirable than applause at the end of a speech is applause in the middle. "If you get applause during your speech as well as at the end, you are much

more likely to draw the attention of press reporters and party managers," Atkinson comments. To achieve this, orators use the "contrast" technique. *Vide* James Callaghan again:

"I can say to you, Mr Chairman, that in this election
I don't intend to make *the most promises;*
I intend to keep *the most promises."* (Applause)

Another contrast from Edward Heath:

"Neow, the Labour prime minister and his colleagues
are boasting in this election campaign
that they have brought inflation deown
from the disastrous level of 26 per cent.
But we are entitled to inquah:
Who put it up to 26 per cent?" (Applause)

And a classic example from Ronald Reagan:

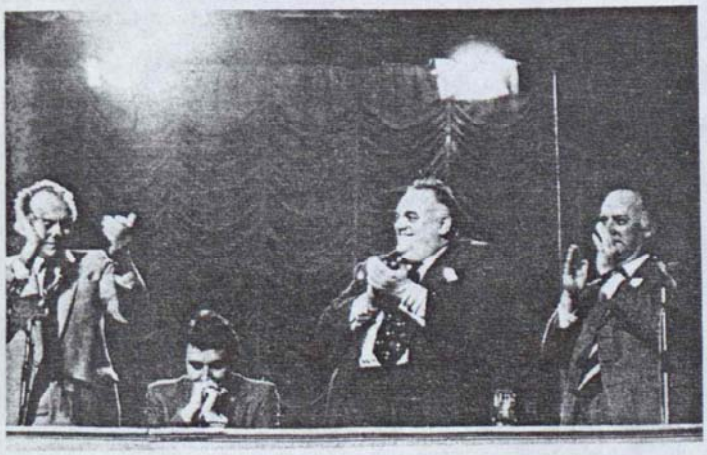
"I don't want Jimmy Carter's job.....
That's not what I want.
I want to be President of the United States."
(Uproarious applause)

Atkinson has found the contrast technique to be the commonest ploy for eliciting mid-speech applause. To achieve maximum effect the contrast should be crudely obvious. If it is not so obvious, the audience may take longer to catch on. It will still applaud, but less vigorously. If the audience does not seem to have recognised the contrast by applauding within half a second (after which the silence begins to become embarrassingly noticeable), an experienced speaker will follow through with a prompt such as:

"That's the difference!" (Callaghan)
or *"That is entirely unacceptable!"* (Heath)
which brings the audience back on cue.

Obviously speakers are likely to be cheered only by people who agree with their views, so at any meeting where various factions are present the ambitious politician should give his supporters as many opportunities as possible for applauding. Atkinson believes that Tony Benn's status in the Labour Party owes much to his skill at switching his faction on to applause more efficiently than other Labour orators. As an example he cites a passage from a speech Mr Benn delivered to the Labour Party special conference in May this year. In less than two minutes he elicited three ovations, and each ovation was cued in by a contrast:

"We shall find two or three million demoralised long term unemployed
who have to be put back to work in factories
not that Hitler has bombed
but that Thatcher and Joseph have closed." (Applause)
"... I am waiting for us to say more often
that some things are right.....
and some things are wrong." (Applause)
"... that it is wrong to cut down on money for
kidney machines



and spend five billion on a new Polaris submarine
(Applause)

Another technique favoured by Mr Benn, and occasionally by Mrs Thatcher, is to continue talking while the applause is going on. "You can say almost anything, repeat yourself or just waffle," Atkinson observes. "But if you keep talking you give the impression, *A:* that you were not really fishing for applause in the first place, and *B:* that you are so popular that you are being drowned by your audience's enthusiasm."

To support his case that applause, especially mid-speech applause, is a stylised ritual rather than spontaneous outburst, Atkinson points out that *it almost always lasts eight seconds,* give or take one second either way.

But it is a useful ritual, "If an audience is listening for cues to clap, it will also, presumably, be listening to the speaker's ideas."

Pauses are another way of keeping the audience hanging on your words. Even the most mellifluous speaker has to pause for breath now and then, but Atkinson finds that politicians tend to pause at the oddest places, in the middle of a phrase or train of thought. President Carter is particularly enamoured of the pause and uses it as often as possible:

In recent years (pause)
expanding (pause)
Soviet power (pause)
has increasingly (pause)
penetrated (pause)
beyond (pause)
the North Atlantic area.

"The pause increases anticipation and attentiveness. If you pause somewhere unusual, such as after an adjective or preposition, your audience will be intrigued to know what comes next," Atkinson suggests.

Although President Carter's style is perhaps not typical, the importance of the pause is recognised by professional speech writers. After giving a lecture recently in Boston, Atkinson was approached by a Democratic party speech writer who told him that it was their practice to write pauses into speakers' scripts. As a rule of thumb they allow bursts of no more than seven words before a pause. With an educated audience occasional bursts of up to nine words are permissible.

Atkinson's studies of political speechmaking have been made in his own time and are not part of an officially spon-

sored research project. He makes no claim to have laid bare all the secrets of oratorical success, and will be scrutinising the party conference speeches for other applause-eliciting devices and exceptions to the rule. "But this is the first time in a 15 year research career in sociology that I have come up with results which are so regular. And given the importance of public speaking in the making and breaking of political careers, I think these findings have more than academic interest."

His studies of applause have encouraged him to reflect on the negative aspects of that phenomenon, booing and jeering. He suggests that, paradoxically, boos and jeers may also serve the speaker's interests. And he disagrees with those who complain that the backchat and catcalls heard in the House of Commons reflect poorly on Britain's parliamentary system.

"In an assembly where only a few individuals get a chance to say their piece on any one day, jeering provides an escape for frustration. A convention which allows you to jeer also encourages you to follow the speaker till he gives you something to jeer at. From what I have seen in Europe and America it seems that quieter more polite assemblies are also more boring. Fewer people listen and more people sleep." □

. . . but why can't they converse normally?

If only they would learn the rules of conversation, they would be far more appealing

Dr Geoffrey W. Beattie
is lecturer in psychology at the University of Sheffield

Conversation involves difficult and subtle skills. We generally avoid interrupting the other speaker, and yet are able to respond efficiently and quickly when he or she stops: from records of different kinds of face-to-face conversation I found the average delay in responding was only 575 msec, and in more than one-third of all cases there was no delay at all. Clearly, this fluent yet unrehearsed dialogue depends upon subtle signals between the conversants. Inability to use these signals is characteristic of several kinds of mental disorder, including schizophrenia and neurosis. And I have found that politicians may also find them difficult.

Before the last general election I analysed how politicians behaved in television interviews: I was interested particularly in James Callaghan and Margaret Thatcher. Callaghan was generally seen as relaxed and affable, while Thatcher was generally viewed as condescending and domineering. Callaghan was seen as being the more effective interviewee.

Yet when I analysed video-recordings of Thatcher's interviews I found the general perception of her as dominant is something of an illusion. For example, in one *TV Eye* interview shown in April last year, James Callaghan interrupted his interviewer Llew Gardner more than Gardner interrupted him. This is in line with the general observation that dominant people interrupt more often than less dominant people. In the same week, Denis Tuohy interviewed Margaret Thatcher on the same programme—and he attempted to interrupt her much more often than she attempted to interrupt him. I have played a video-recording of the interruptions from this interview to various audiences and found a marked failure among viewers to identify accurately that it is Tuohy who does most of the interrupting.

One feature of Thatcher's interview style is that she tried to finish her point even when interrupted. She tenaciously clings on until the interrupter gives in.

In this example, from the *TV Eye* interview, the words in bold type were spoken simultaneously by Thatcher and Tuohy. Tuohy started speaking after the second "society":

M.T.: *. . . there are comparatively few people, they could be measured in thousands, who wish to destroy the kind of society which you and I value, destroy the free society.* **Please, please this is the most, please this is the most please this is** *the most important point you have raised, there are people in this country who are the great destroyers.*

D.T.: **You were talking about striking ambulance workers, you were talking about ancillary workers in hospitals.**

I have found from earlier studies that when two people did start to talk at the same time, one would typically give up within half a second; Thatcher and Tuohy persisted for as long as five seconds.

Margaret Thatcher often wins the battle for the floor when she is interrupted, and for this reason viewers see her as very domineering; they often fail to notice that it is not she, but her interviewer who interrupts in the first place. The reason interviewers interrupt her so often seems to be that she sends out ambiguous signals which interviewers misinterpret.

Over the past 15 years psychologists have investigated the signals that people use to indicate that they have finished speaking in conversation. In the mid-1960s Adam Kendon at the University of Oxford found that if the speaker looked at the listener when he stopped speaking, the listener was more likely to respond without any delay than if he did not. He suggested that this "work", was the crucial signal.

This research seems to have been based on the assumption that something analogous to traffic lights operates in conversation. When the lights turn green a driver should move off. Kendon suggested that when the speaker looks at the listener at certain points, the listener should then begin speaking. However, Kendon studied only one particular type of conversation, and subsequent research on other types showed that this nonverbal signal was not of central importance.

In the early 1970s, Starkey Duncan of the University of Chicago pioneered a different approach. He noted six

signals. Five of them are accompaniments of speech and are therefore carried in the auditory channel—things like drawl, intonation and so forth—and the sixth is the cessation of a hand gesture. Duncan argued that the more of these signals that were present at one time, the more likely the listener was to begin speaking without interruption. On the other hand, if the listener tried to speak when none of these signals was present, Duncan found that interruption was the inevitable result. In this framework, turn-taking seems to be viewed as analogous to a driver approaching an intersection where there are no traffic lights. He has to pay attention to a number of things—the speed of cars on the main road, their distance from his, their spacing, etc—and on the basis of all of these, he has to decide whether to move forward.

Duncan's research implies that conversation should not be much more difficult on the telephone than face-to-face; after all most of the signals, according to Duncan, are carried in the auditory channel. From the research of Adam Kendon we would make the opposite prediction. Recently Phil Barnard from the MRC Applied Psychology Unit in Cambridge and myself put this to the test; by studying real directory inquiry calls.

Directory inquiry calls may appear restricted but they are more interesting than one might imagine. For example, they need only 19 words to convey all the relevant information but we found some were as long as 492 words; and the average was 116. Some people seem to enjoy chatting to telephone operators. When we analysed the conversations we discovered that there were fewer interruptions on the telephone—in fact interruptions in face-to-face interaction are almost twice as frequent as on the telephone. We also found that listeners were just as quick at responding on the telephone when the speaker had finished. This research thus supports Duncan's conclusions that many signals involved in turn-taking must be carried in the auditory channel.

There are also signals in conversation to indicate that we have *not* finished speaking. Duncan had identified gesture as one such signal. Filled pauses—sounds like "ah", "er", "um"—seems to serve a similar purpose. They tell the listener that the speaker needs time to think in order to plan his speech. We discovered that filled pauses are used to compensate for lack of vision on the telephone—they are almost four times as frequent on the telephone as in face-to-face conversation, if one controls the number of periods of silence. Subscribers rely on them much more than do operators.

Psychologists have thus made some progress in identifying how speakers and listeners manage to take turns so efficiently in conversation. What then is Margaret Thatcher's problem? My research suggests that interviewers interrupt her in conversation because they misinterpret her nonverbal signals. Many of these interruptions occur at the ends of clauses in her speech in which there is drawl on the stressed syllable in the clause, and a falling intonation pattern on the clause. Duncan has identified all three of these as common signals that a speaker uses to signify that he has finished talking. When these three signals occur together in normal conversation, they often indicate that someone has finished, unless he uses other signals to indicate that he has not. Thatcher very rarely uses filled pauses which have such a function and which would be effective in this context; even the fluent Callaghan uses five times as many filled pauses as she does. Consider the following exchange between Margaret Thatcher and Denis Tuohy:

M.T.: *The police do a fantastic job*
D.T.: *Coming*
M.T.: *and we must support them in every way possible*
D.T.: *Coming towards the end of our time Mrs Thatcher.*

Tuohy starts to speak after Thatcher says "job", which seems appropriate because it is the end of a clause, there is downward intonation and there is drawl on the stressed middle syllable in "fantastic". Tuohy seems to think that Thatcher has finished and begins speaking, but she has not. A filled pause after "job" would probably have been effective in signalling that there was more speech to come.

This research has a number of practical applications. It is now widely believed that some types of mental illness are exacerbated by a lack of social competence, and the suggestion is that it may be possible to alleviate certain illnesses by a training in social skills. Turn-taking may be one skill in which it is necessary to provide instruction, and indeed Peter Trower, now at the Hollymoor Hospital in Birmingham, has been having some success at improving the social behaviour of patients, including certain aspects of turn-taking. In some ways the therapy could be improved because it is largely based on the earliest framework for investigating turn-taking. Patients are trained to display certain signals which indicate that they are ready to hand over the floor and there is heavy reliance on direction of looking as a crucial signal. Future training will have to pay more attention to the vocal aspects.

As for politicians, it is clearly important for them to become super-efficient at all the processes in conversation, especially as the televised interview has largely replaced the political address. Persuading these professional persuaders might be more difficult, however. □

EXISTING AVAILABILITY OF VENTURE CAPITAL

The investment climate for new small companies has changed quite markedly since I first started canvassing opinion on this topic in 1978 (in connection with the work published as the ACARD report on Industrial Innovation). In part this seems to have been due to the establishment of "small firms" or "new venture" divisions of banks (clearing as well as merchant) and no doubt in part also due to the tax changes announced in the last budget and the other initiatives taken by the Government. As an indication of this change Mr P Naylor of Job Creation Limited (itself an innovative new company) tells me that he has no trouble finding capital for his (often rather risky) projects in depressed areas and Mr L Cary of Venture Capital Reports Limited (another innovative new company) has been able to maintain a creditable 30% success rate in finding financial backing for entrepreneurs - and it seems likely that entrepreneurs only go to the likes of Venture Capital Reports Limited as a last resort!

2. However, although the investment climate might be changing it is still too early to tell whether actual performance, in terms of the successful establishment of sound businesses, has really changed. In the crucial area of new technology based firms (NTBFs), for example, it is too early to tell whether the new-found enterprise of the NRDC will be commercially profitable.

3. It seems, therefore, that the Prime Minister will be more likely to be able to point to some promising signs and hopeful beginnings in this area by February 1981 rather than solid achievements. It is likely that the Advisory Council for Applied Research and Development (ACARD) in its reply to the Prime Minister's request for advice on the problems of the private inventor will reiterate the opinion they expressed in their 1978 report on Industrial Innovation, viz that the most effective help that can be given would be to establish some form of loan guarantee scheme in conjunction with tax relief for equity investment in NTBFs by private individuals and modest alterations in the way losses can be written off for tax purposes.

4. There are signs, however, that real problems are developing at what is coming to be called the "post-development gap". This is a term for the shift in emphasis (managerial as well as financial) when an innovative product or process ceases to be an exciting piece of high-technology and becomes a mundane, but potentially very profitable, article of general commerce. The finance needed to bridge the "post-development gap" is often far greater than that needed to bridge the "pre-development gap" between research and development. It is usually far beyond the resources of the likes of the NRDC or small companies and, as the attached article from the Financial Times of 25 September points out, has presented UK companies with awkward problems in the past.

5. I hope that in briefing the Prime Minister the clear distinction is made between venture capital needed to start new firms, or new businesses within existing firms (the "pre-development gap") and that venture capital needed to maintain an adequate market share in a growing market which is consequently attracting foreign competition ("post-development gap").

F.T. 25/1/80

LOMBARD

Exploiting our skills

BY DAVID FISHLOCK

EVERYONE knows that Britain once led the world in radio-astronomy because of its pioneering radio-telescope at Jodrell Bank. But that was back in the Fifties. Fewer know that as a direct result British industry led the world in the Sixties with its earth stations modelled on Jodrell Bank which picked up the whisperings of the first satellites.

Like so many other markets for novel products of high-technology the one for large earth stations has long been lost to the Americans and the Japanese. It wasn't a case of Britain failing to develop a scientific invention, but of Britain failing to mount a coherent industrial policy capable of sustaining from profits the unending input of cash and skills advanced technology demands.

Indispensable

On a grander scale Rolls-Royce made precisely the same mistake in the Sixties. It gravely under-estimated the financial and other resources needed to translate a brilliant new three-shaft concept of aero-engine design into the RB-211. A decade later it can point to 700 engines in service—including some in the North Sea—and orders for another 500, with new developments in the pipeline which suggest a production of at least 250 RB-211 engines a year in the early 1980s. Top of its attractions for airlines, Rolls-Royce engineers say, is that they expect to maintain a 4.5 per cent advantage in fuel consumption over all rivals throughout the decade. This fuel economy is a direct result of harnessing high technology; of more advanced materials operated at higher temperatures.

But had Rolls-Royce been a more typical British industrial situation, it would have vanished in 1971. Only the fact that it was an indispensable source of engines for military aircraft, warships and submarines obliged the government to keep it alive as a state-owned organisation.

With publication today of the eighth report from ACARD, the Advisory Council for Applied Research and Development—the body which has replaced the office of the government's chief scientific adviser—it is becoming increasingly clear that the development gap from which Britain is so often said to be suffering is in a significantly different place from the one normally perceived.

The truly serious gap is not that due to the reluctance of British scientists, engineers, inventors to launch into manufacture with their ideas. The real gap is far more wasteful of resources. It is the hiatus left when companies launch themselves enthusiastically upon the neck of some new technology, only to come a cropper because they failed to realise how much it would cost. It is a post-development gap.

EMI is a classic example of a company which, armed not only with a brilliant invention but with an unusually realistic estimate of what it might cost to launch the new product, still under-estimated the eventual scale of effort required to compete with U.S. industry.

The latest ACARD study surveys "information technology," a vast tract of fast-advancing technology embracing telephones and telecommunications, video systems and word processors—and of course the ubiquitous computer which now lurks behind each one. It finds a marvellously innovative picture in Britain, with such projects as Prestel and System X, and a strong presence in "software," the craft of computer programming which determines whether and how the new technology works.

But ACARD also finds ample evidence of post-development gaps yawning wide in the 80s. It finds too many British companies competing in every promising sector; too many "sponsoring" ministries and departments, each with its own idiosyncratic requirements, each encouraging someone to tailor the innovation precisely to its want.

ACARD's urgent message is that if the Thatcher Government expects industry to win and hold a significant slice of the looming £100bn-a-year world market for information technology, a single department of government must orchestrate the national effort. This probably means that the BBC, police, armed forces, Post Office, hospitals, schools—even the taxmen—must all defer to the technological choices of the Department of Industry.

Actually £50bn was the figure quoted at the Rees conference.

The ACARD report does NOT say this — what it does say is that public purchasing should be used intelligently (a v. different point!)

Govt Machinery 4

You agreed that this should be published. PA now MS

See refs to France in eg pp 31-34

MS 15/8

ADVISORY COUNCIL FOR APPLIED RESEARCH AND DEVELOPMENT

INFORMATION TECHNOLOGY

August 1980

ADVISORY COUNCIL FOR APPLIED RESEARCH AND DEVELOPMENT

INFORMATION TECHNOLOGY

Foreword

In its first report "The Applications of Semiconductor Technology", ACARD discussed some of the implications of the rapid developments taking place in micro-electronic technology and put forward proposals to stimulate the use of this technology in United Kingdom industry. Two subsequent reports[1] of the Council have examined specific fields of application. However, the report "Technological Change: Threats and Opportunities for the United Kingdom"[2] identified information technology as possibly the area of application with the greatest potential for creating employment and suggested that the United Kingdom had advantages - for example the international use of the English language - which should enable it to gain a significant share of the world market for information services and associated products.

In the knowledge that some of this country's major competitors had well developed plans for promoting information technology by concerted action from their governments and industrial interests, ACARD decided that a Working Group should examine the subject in order to identify the likely directions of development and the constraints to development and application in the United Kingdom.

The Working Group met six times between January and May 1980. Its terms of reference were -

"To consider whether the development and application of information technology in the United Kingdom should be stimulated;

To consider whether there are constraints to the development of the industries in the United Kingdom which supply and apply information technology equipment, software and systems, compared with our major competitors;

To make recommendations."

[1] Items 2 and 4 in the Bibliography (p 60)

[2] Item 3 in the Bibliography

The members of the Working Group were -

*Sir Robert Clayton CBE F Eng (Chairman)	Technical Director, GEC Ltd
Mr C A P Foxell	Director of Purchasing, the Post Office
Mr D Leighton Davies	Deputy Managing Director, Racal Electronics Ltd
Mr C N Read	Director, Inter-Bank Research Organisation
Mrs V S Shirley OBE	Chairman, F International Ltd
Dr P E Trier CBE F Eng	Director, Philips Industries Ltd
*Mr G H Wright MBE	Regional Secretary for Wales, Transport and General Workers Union

*ACARD member

The Working Group's report was endorsed by the Council at its meeting in June 1980. [It has been submitted to the Government and is now published in order to draw attention to the importance of this area of technology.] The report, like previous ACARD publications, is intended to provide a non-technical guide to the subject and the issues raised; it does not aim to be a comprehensive technical account of information technology.

The Council are grateful to the Working Group for their contribution to ACARD's work and wish to acknowledge also the support provided by the Computer Systems and Electronics Division of the Department of Industry, the Central Policy Review Staff and the ACARD Secretariat in the Cabinet Office.

CONTENTS

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

1. Information Technology - which combines the technologies of computing and telecommunications - will perhaps be the most important area of application of microelectronics. It will eventually affect virtually every household and occupation. It will change patterns of employment and, if the opportunities to supply new goods and services are taken, has the potential to create many jobs.

2. Information technology offers new ways of manipulating and presenting information which are used in, for example, electronic telephone exchanges (which can provide many new services), word processors, electronic mail and viewdata systems. This country's future trading performance will depend greatly on its ability to compete in world markets for products and services based on information technology and on the rapid and effective application of such products and services by industry and commerce generally.

3. Certain of our overseas competitors - notably France - have recognised the importance of this subject and have established national programmes to stimulate its development. Despite some notable achievements there is less awareness in the United Kingdom of its potential impact and we have fallen behind other countries in our appreciation and application of the new developments.

4. Responsibility for the various elements of official policy that bear upon information technology is at present split between a number of Government Departments, the Post Office and other public bodies. A single focus within Government is required in order to ensure that this subject is given adequate attention and that its development is not inhibited through conflicting policies. Such a focus would increase the efficiency of decision making and actions and would reduce the number of bodies with which private sector interests have to deal. Also required is an explicit and publicly stated recognition by Government of the importance of information technology and a programme to increase general awareness amongst both industry and the public. It is important that these measures be introduced rapidly; we will otherwise fall further behind in the development and application of this crucial technology.

5. Our principal recommendations (with relevant paragraph numbers in parentheses) are -

i. One Minister and Government Department should be responsible for co-ordination of government policies and actions on the promotion and development of information technology and its applications through awareness, education and training, sponsorship of industry, provision of risk capital, public purchasing, publicly funded R and D, national and international regulations and standards, legislation, communications and related programmes such as satellite technology. (9.5)

ii. Responsibility for regulation of communications and broadcasting should be exercised by a single Government Department (7.11)

iii. The Government should make it clear that effective exploitation of information technology is essential to the future industrial and commercial success of the United Kingdom. This commitment should be emphasised on all suitable occasions by Ministers and officials.

The Government should support its views with publicity for existing United Kingdom achievements in information technology and imaginative promotion of them.

Innovative applications of information technology by Government Departments, local authorities and public corporations should be encouraged and plans for them should be publicised. (5.9)

iv. The Post Office (or its successor for telecommunications) should have the mandate to provide a world-competitive United Kingdom communications network and should have sufficient finance for procurement and installation, whether from public or private sources. (7.5)

Other recommendations are -

v. Careers services at both school leaver and higher levels should review the guidance given to students about opportunities in information technology, in order to attract entrants from a wide range of disciplines. (6.5)

vi. The Government, its agencies concerned with training, and educational bodies at all levels, should examine the provision of education and training courses in subjects related to information technology and propose measures to stimulate an increase of training in firms. (6.5)

vii. The Government, through Trade Associations and the National Economic Development Council, should improve the links between supplier and user interests in information technology in order that United Kingdom firms may be better able to anticipate future requirements. (6.6)

viii. The Government should recognise the importance, to the information technology supply and application industries, of United Kingdom strength in international discussions on regulations and standards, and staff and financial support must be available for such activities to ensure that our delegations go to them well prepared technically, commercially and politically, and ready to argue strongly for our national interests. Trade Associations must similarly be prepared to play their part on behalf of their industries. (6.14)

ix. The Government should bring forward proposals for data protection legislation, taking into account the views of the Data Protection Committee, without delay. (6.18)

x. The Government should put in hand urgently a review of the legal reforms required to aid and expedite the use of information technology in the United Kingdom and should then legislate to bring about such reforms as fast as possible. (6.20)

xi. The Government should consider legislation to permit the creation of new organisational forms to aid joint information technology projects, taking into account precedents in France and Belgium. (6.23)

xii. The Post Office should be free to supply terminal equipment and information technology services for use with its network but should not have an exclusive right to do so. It should not be the approving authority for terminal equipment and services provided by others. (7.8)

xiii. The Government should employ public purchasing to pull through novel developments in information technology. (8.1)

xiv. The Government should consider the possible role of information technology in promoting national objectives, and give appropriate financial support to relevant projects. (8.2)

xv. The Science Research Council and the Department of Industry should keep their research priorities under review in the light of the needs of information technology. (8.7)

xvi. The Department of Industry, with the Ministry of Defence, the Science Research Council and the Post Office, should increase the present co-ordination of all publicly funded R and D applicable to information technology. It should also make greater effort to ensure both that research which it supports is likely to be applied and that transfer of results to industry takes place. (8.8)

1. INTRODUCTION

1.1 The application of microelectronics technology in the United Kingdom and elsewhere is taking place mainly in two major areas of industry. One is the general field of product manufacture - improving manufacturing processes and the resulting products through automation, instrumentation, control engineering and the replacement of electromechanical devices by electronics. The other area is becoming known as "information technology", which for brevity we shall usually refer to as IT. Information technology is already being applied in many fields of activity, as the following illustrations show.

1.2 Word processors. Reports such as this frequently go through many drafts before the final version is produced. Authors make manuscript amendments, re-write sections and re-order material. Typists then have to re-type either the whole or major parts of the text. This re-typing takes time and carries the risk that new errors will be produced. The use of text processing typewriters (commonly called "word processors"), with storage of text on disc or tape and with visual displays, can now reduce the routine work of both typists (since unaltered sections can be re-typed automatically) and authors (since less checking is required) and enables successive drafts to be produced more rapidly. Word processors offer similar advantages in the preparation of such documents as tenders, contracts, legal papers and specifications.

1.3 Telecommunications. Large organisations, particularly those operating internationally, now find that the most cost effective way of providing internal communications may be via the international telecommunications network, by providing visual display units (VDUs) with keyboards and printers throughout the organisation and computers for routing and storing messages, letters and data. Such systems speed communications and allow records of the

information transferred to be filed automatically for as long as necessary. Once installed for international links, the system may also provide the best way of communicating even within a single building. Where the communication links involve satellites and there is sufficient traffic, the organisation may install its own terminals for direct satellite communications.

1.4 Video discs. When replayed on suitable equipment (which will sell for about the price of a television set) these will provide about an hour's moving pictures and sound for entertainment and education. The discs are expected to sell for about twice the price of a present full-price long-playing gramophone record. The ability to seek and "freeze" an individual picture will extend the use of such discs for information retrieval and educational purposes.

1.5 Telephones. Information technology is also bringing many new services for telephone users with the possibility of, for example, a telephone number for a person rather than a particular instrument. More important than the individual new facilities will be the transformation of the telephone system into a more flexible, personally acceptable service. For example, the ability to"switch off" the telephone but subsequently to identify the originators of any calls received, which is already possible with modern switching systems, will mean that telephone calls need not intrude on other activities.

1.6 These are just a few examples from the increasing range of IT applications. Because of its breadth of application it is possible to define information technology either widely or narrowly. On the one hand, the term may be confined to the actual equipment used to collect, store, process, transmit and display information. On the other, it may encompass not only the equipment

(and the software that controls it) but its interactions with human activities and the management systems necessary if the capabilities of new developments are to be fully exploited. We follow the latter approach in this report, in line with the UNESCO definition of information technology as:

> "The scientific, technological and engineering disciplines and the management techniques used in information handling and processing; their applications; computers and their interaction with men and machines; and associated social, economic and cultural matters."

1.7 We therefore include in information technology important sectors of the electronic components industry (with an emphasis on microelectronics), much electronic equipment (notably computers and their associated terminals, displays, etc) and the whole communications industry, including the broadcasting authorities and the Post Office. We further include the users and suppliers of information - industrial, financial, commercial, administrative, professional and individual - because their activities will be affected by new forms of information handling.

1.8 Governments in a number of countries, including the United States, France and Japan, have identified information technology as possibly their most important industrial growth area. The same view has been expressed in the United Kingdom, for example in several Conservative Party publications and in the ACARD report "Technological Change: Threats and Opportunities for the United Kingdom", while British electronics firms and the Post Office also demonstrate an awareness of the future importance of IT.

1.9 Two principal factors underlie current interest in IT. The first is that accurate and adequate information is a major component of industrial and commercial operations and an increasing proportion of the labour force in any

industrialised country is employed in information handling. The world market for IT products - in banks, shops, business houses, factories, government offices and the home - is vast (approximately £50 billion annual sales) and expanding rapidly (10% per annum in real terms). The second factor is technical - both computing and telecommunications now use microelectronic devices which offer fast data-handling capability at modest cost. This convergence of computing and communications (called 'compunication' in the USA and 'telematique' in France) creates radically new opportunities for data handling and the provision of information.

1.10 As some developing countries have created highly competitive manufacturing capabilities in traditional sectors of industry (steel making, shipbuilding, etc), so industrial nations have seen that future export opportunities will lie in advanced technology. Skills and expertise in IT, based on the design and manufacture of silicon integrated circuits and the writing of computer software, will form the basis for a substantial proportion of such exports. The value of these skills is enhanced considerably, with corresponding gains in employment if they can be incorporated in equipment sold to final consumers. (As an example, British technology lies behind the displays used in many pocket calculators and digital watches. It would have been much better if the United Kingdom had gained the Japanese market position in calculators and watches, rather than in displays alone.) A competitive United Kingdom share in the world IT market could thus be a major factor in our future industrial success; but equally important is an adequate use of IT in this country to improve the efficiency of industry, commerce and public services.

1.11 Information technology is of more than economic and industrial significance; it also has social and political implications. New forms of communication, and easier access to information, raise questions about the relationship of government to the governed, the responsibilities of professions to their clients, and the

privacy of personal data.[1] IT also offers advanced industrial countries a further way in which to promote cultural exchange and to open up new markets in developing countries, many of whom, advised by international bodies such as UNESCO, have identified IT as essential to their economic and social advance and are seeking advice and equipment. Control of information has always been a key factor in the organisation of power structures; new technologies, however, raise old questions in a more acute form. The social and political implications of IT cannot therefore be ignored.

1.12. In the light of the potential for IT outlined above, it is clear that the speedy and effective development and application of IT is of great importance to the future of the United Kingdom. We therefore aim in succeeding chapters -

i. to survey briefly the present position, likely technical developments and potential applications in the next 10 years;

ii. to review activity in other countries;

iii. to consider the degree of awareness of IT in this country and attitudes to its application;

iv. to identify constraints to the rapid and successful application of IT in the United Kingdom;

v. to consider the importance of communications to IT;

vi.. to assess the role of government in the development and application of IT in this country.

[1] These issues are studied in detail in the 'Nora' report (item 6 in the Bibliography)

1.13. Throughout the report, we make recommendations for changes which we believe will help the deployment of IT in the national interest and the creation of a strong United Kingdom presence in world markets. Further technical information, and more detailed discussion of some of the issues raised by IT, may be found in the books and articles listed in the Bibliography.

1.14. We have concentrated on the importance of IT in industry, commerce and government, and on the impact of IT systems on individuals. The basic technologies used in IT will also have wide applications in the domestic consumer and entertainment sectors. Examples are video tape cassette recorders, video discs, audio discs using opto-electronics (which can be smaller and less liable to damage), satellite broadcasting, traffic and route information in cars, and local and remote electronic control of the domestic environment and appliances. These and many other applications of the same technologies that are used in IT will create consumer demands at home and opportunities overseas.

2. TECHNOLOGICAL DEVELOPMENTS

2.1 The principal technological foundation for modern information technology has been the development of microelectronics, which makes possible small, low cost, reliable equipment which can perform complex operations on digitally encoded data. Increasingly, all types of information are being converted to digital form because of the ease with which such data can be handled and transmitted.

2.2 Information handling comprises five stages: input, processing, storage, transmission and output. Some or all of these five stages are built into various systems, which are made up of equipment ("hardware") and, most importantly, logical programs ("software") which control the operation of both individual pieces of equipment and of the system as a whole. Developments in each of these areas are reviewed in the following sections.

Input

2.3 Established input devices for information systems are the telephone microphone and the typewriter and calculator keyboards. Most information is now fed into computers through keyboards but automatic data input, for example by scanning magnetically encoded cards such as cash dispenser cards, is increasing. The telephone dial and keypad can also be used as input devices to an IT system. Microelectronics is making possible "intelligent" input devices, some of which will themselves incorporate information processing and storage. Numbers on cheques are already read automatically but use a special type font. Systems are under development which will enable normal typefaces to be read automatically. Special writing pads are already available which can translate letters and figures in a particular individual's handprinting automatically

into a computer input. The recognition of handwriting is a longer term problem. Voice recognition systems can already respond to a limited vocabulary from a wide range of speakers or a wider vocabulary from a limited number of speakers. Systems which will recognise a wide vocabulary from many speakers will eventually be developed. Systems are also being developed which will extract features from visual images such as photographs and television pictures, e.g. for control of robots, scientific investigations and medical diagnosis.

Processing

2.4 As integrated circuit technology advances, microelectronic devices used for information processing will in coming years have even more transistors per chip, and the cost per function will continue to fall. Annual world production of microcircuits in 1985 has been forecast to be up to the equivalent of 250,000 transistors for every person on earth. This is the equivalent of a present day minicomputer for everyone every year.

2.5 Local processing by a small computer or 'distributed' processing through a network of small computers is possible, and complex operations can be performed by terminals which previously merely acted as input or output devices. Large computers will still have a significant role, for maintaining and manipulating large banks of data (bank accounts, insurance policies, public administration records, scientific measurements, etc.) but will not be the fastest-growing sector of the computer market as they have been in the past. The greater power of small computers will enable text processing to be more readily available. Most information is

presented in the form of words; devices to allow easy manipulation of text (such as word processors) are now available. Their development may well be the most significant aspect of IT. Conversely, as electronic transmission filing and editing all become more widespread, the need for photocopying will decrease.

Storage

2.6 Information in the past has been stored in different forms; eg words, figures, graphs, charts, pictures. All such information can be translated into sequences of binary digits (bits) ie ones and zeros. There are now many ways of storing such digital data, each of which offers a particular combination of capacity, access speed and cost. Developments in electronic memories in the last decade have been particularly important since they have made the microcomputer feasible. The low cost and great data storage facilities of modern devices mean that it is economical to use more complex software than before. This allows the use of a "high level" programming language much more like ordinary English. Memories have grown in capacity and fallen in real cost by about 25 per cent per annum. A continuation of these trends is expected, with a single chip holding a million bits in a few years' time.

2.7 Other storage techniques have similar potential. Magnetic 'bubble' memories, in which tiny portions of material are magnetically polarised in different directions, to represent a one or a zero, allow even greater storage capacity in a small volume. Optical storage techniques are also developing rapidly. The first to be produced on a large scale will be the video disc (which can be read or played many times but, as yet, cannot be re-used to record other material).

Further developments are likely to lead to optical stores in which users can insert ('write') information; such stores will ultimately have erase and 're-write' facilities.

Transmission

2.8 Transmission over optical fibres (tiny flexible glass rods) is opening up the possibility of carrying very large quantities of information for a variety of uses. This technology can not only be used to relieve existing congested cross-city cable routes, it can also provide low cost trunk and local distribution networks for telephony, data transmission, and where required "wide band" services such as television and videophones.

2.9 The continuing reduction in the cost of small ground terminals for receiving signals from satellites has made direct communication between two points via a satellite economical, thus reducing dependence on cable and terrestrial radio systems. For example, a system is being installed for one of the largest American hotel chains, with a receiving aerial about a metre in diameter on each hotel roof, which will make its communications system independent of public communication facilities. The system will offer instant accessibility and is claimed to be cheaper than the use of public links.

2.10 The radio frequency spectrum available for broadcasting, communication, navigation, and other purposes is a limited resource. Digitised speech or video signals are very suitable for processing by microcircuits but by comparison with analogue signals, require a wider band of frequencies. However, micro

electronics technology also makes it possible to reduce the amount of information transmitted to reproduce a voice or picture. These techniques reduce demands on the frequency spectrum; this is important both for the introduction of digital radio transmission and for releasing radio frequencies for new services.

2.11 Microelectronics is making possible faster, smaller, more reliable, more versatile switching of transmission channels and is opening up many new services for users. In voice systems, the user can have many new facilities, for example to receive his calls on any telephone, to call often-used numbers without having to dial the complete number, and to obtain an engaged number as soon as it is free. Similarly, electronic switching will allow enhanced and new data services.

Outputs

2.12 Visual display of information using a cathode ray tube, as in a television set, is fast and versatile; it can use colour and show both text and graphical information. The real cost of such display units is falling. Further improvements in definition and reductions in power consumption may be expected. The major likely development is a flat screen display, based not on a cathode ray tube but on a thin sheet of light emitting material or a fine grid of light emitting devices. Another important output device is the printer; current technical advances offer the prospect of printers that are both faster and quieter. New output devices include voice synthesisers, which are already in evidence. They are likely to be important in personal voice communication systems, including the instruction of users in the use of new facilities.

Combinations of new developments

2.13 The following are examples of developments involving a combination of some of the advances reviewed in the previous sections -

a. telex to desks of individual users

b. cheaper, higher speed facsimile

c portable data terminals

d. communication without use of wire in offices, stores and factories, eg by infra-red radiation

e. 'information mains' analogous to electricity supply mains in offices and factories.

Software

2.14 The component parts of an IT system have to be brought together by systems engineering, and programs have to be developed to enable the parts to work, both individually and together, and the whole system to be operated. Systems engineering and program development can take considerable time and at present are labour intensive.

2.15 The output of systems engineering and programming is generally called 'software' and is essential for most systems and many subsystems. Software developments are making it increasingly possible for people unskilled in data processing to use and interact with systems. Future design and use may be envisaged as three concentric circles -

i. the innermost circle will be those specialists who devise software to program subsystems, for example microprocessors, so that these subsystems can be put together by others to produce information systems;

ii. the middle ring will be the engineers and others who take the subsystems with their programs (without being specialists in their development) and design systems which can be used by unskilled people;

iii. the outer ring will be the final users (with no knowledge of the skills required in the two inner areas) who will be able to use these systems to transmit, process, store or retrieve information.

3. APPLICATIONS

3.1 As a result of developments in information technology, there will be a marked increase in the quantity of rapidly accessible information and in the ability to manipulate it. Access to constantly updated information is already available in offices and homes through teletext and through Prestel and similar viewdata systems. As printing and distribution costs rise and communications and computing costs fall, such systems may come to replace some paper publications. Business viewdata systems, now starting to be installed, will enable information to be disseminated rapidly within a company. Further developments will provide individual users with the ability to interact with the systems for financial, shopping and other purposes. Immediate opinion gathering will be possible and could have major effects on the relations of the individual with commercial, financial and government institutions.

3.2 Financial services may be considerably affected by IT. The time taken for information transmission, at present accepted and sometimes used to advantage in some business operations, can be effectively eliminated. In particular, it will be possible to arrange instantaneous transfer of funds. This will have implications for credit services that depend on payments taking time to be completed. Stock and commodity markets will also find their activities assisted and changed by IT.

3.3 Most office work is directly concerned with information and is susceptible to change because of IT. Within the next ten years, it may be cheaper to capture information and to file, copy and transmit it electronically, than to perform the same functions on paper. Electronic equipment and systems are likely to be introduced because they will be competitive in costs with paper systems, as well as offering enhanced facilities. Electronic mail has already been initiated in West Germany. Office premises and factories may be constructed with information mains, just as they now have telephone lines, so that digital information may be transmitted freely. As with electric mains, a variety of devices could be connected.

3.4 Word processors are already available; intelligent copiers able to reproduce documents from digital signals will be available shortly. The ultimate development of an electronic 'work station', with the desktop including a large flat screen on which images may be viewed, moved and edited, can be foreseen, although development may take some years. However, sufficient new equipment will be introduced to bring about profound changes in office activities, with demands for some skills, eg copy typing and filing, reducing significantly while others, related to the new developments, will be in greater demand.

3.5 IT will affect organisational structures, since the ease with which information can be made available permits either centralisation or decentralisation of control, providing managements with extensive choices for developing the effectiveness of their organisations.

Suitably introduced, IT could also improve work relationships within a firm by enabling everyone to be informed of matters which affect them.

The rest of this chapter deals in more detail with applications in various sections of the economy.

Public Administration

3.6 Central government, through its computer operations, is one of the largest users of information technology in the country, many of its computer systems (eg that for social security records) being very large. Tasks such as payroll calculations, revenue collection, accounting and the planning of major activities (eg defence logistics or motorway maintenance) are already performed with computers. Some tasks would be impossible in their current form without computers; others, because of their size and relatively recent introduction (eg VAT transactions), have been planned with them in mind from the start. Computers have been of significant benefit to government administration. Some applications have resulted in useful staff savings - at least partly taken up by the provision of new or enhanced services - and efficiency has been improved. However, the dependence of administration upon computers can increase its vulnerability to disruption.

3.7 Local government also uses computers extensively. In addition to educational applications, and the technical calculations of architects, engineers and planners which count for a large proportion of local authority work, IT will find application in housing allocation (possibly in the future inter-authority and linked with employment information), housing maintenance, police work and fire services, environmental health and trading standards, as well as in improved management information systems and some strategic studies. Local authorities have in many instances to match people's needs with the services available. IT can assist this greatly. Rapid provision

of housing advice will be possible through the introduction of computerised record systems and the installation of terminals in, for example, public libraries. Social work will also be assisted; many people feel more at ease answering questions posed by a computer than by a professional worker (this is relevant to medical and legal services also).

3.8 There are potentially large applications of IT in the automated transfer of routine information between government offices, between central government and local authorities, and between different parts of national corporations such as the Post Office. This calls for compatibility between systems, and opens up many opportunities for joint working.

3.9 The administrative systems outlined above, and the basic operations of the office discussed earlier in this chapter, will provide the main areas for exploitation of IT. The result should be a more efficient administration, which should be able to manage its major operations more effectively and provide speedier responses to individuals' requests.

Defence

3.10 The armed forces are major users of IT, for communication, command and control and for administration. Naturally, many applications are classified but the potential commercial benefits of techniques, software, devices and equipment developed for defence are likely to be considerable. The pace of advance is such that developments should often be quickly declassified and spin-off from the defence sector would be improved by systematic examination of classifications in the light of advances in technology.

Manufacturing Industry

3.11 The ACARD report "Computer Aided Design and Manufacture" discussed the potential impact of a branch of IT on manufacturing industry and gave examples to illustrate the increases in productivity, the cost reductions, and the quality improvements that could come from the installation of CAD and CAM systems. As equipment costs fall, such systems will become economic for progressively smaller firms.

3.12 There is increasing use of data collection and display devices on the shop floor; these range from simple keypads to visual displays with associated input, processing, and storage capabilities. They assist in inventory control, monitoring the availability of components, scheduling of staff time etc. Systems using intelligent terminals linked to small computers and sometimes to larger machines are becoming widespread in manufacturing industry. The prospect is that such systems will eventually be linked with CAD and CAM systems, providing greater integration of different manufacturing activities.

3.13 Information technology will have an impact on research and development in industry. Experimental work and testing will be helped by automation and data processing; computer simulations may assist or replace experimental investigations; and competitiveness will be increased by the use of IT to transfer information within the organisation and to increase awareness of developments elsewhere through scanning the world's scientific and technical literature.

3.14 Great improvements in productivity have already been achieved in some manufacturing companies through the use of automated production methods and there is currently considerable interest in the wider application of such methods, in particular through the use of robotics. But many firms employ more staff in offices on administrative and sales tasks than on the shop floor. Equal attention will need to be paid to improving productivity in these areas through the use of IT if administration costs are not to dominate total production costs.

Service Industries

3.15 Service industries are an expanding part of the nation's economic activity and provide (in public and private sectors combined) some two-thirds of the employment in the United Kingdom. The service industries can be affected by information technology in two ways. On one hand, the adoption of new technology can reduce the number of people required, but on the other, as pointed out previously by ACARD, the adoption of new technology can lead to expansion both by natural growth and by the creation of new services (see Bibliography, item 3). The extent and skill with which IT is applied will play a major part in this balance.

The following sections consider different sectors of the service industries

3.16 Retailing

Retail stores are already users of "point of sale" equipment (generally electronic cash registers which can transmit sales information to stock control computers), automatic warehousing and conventional computers for management purposes. Bar codes which identify products have been developed and standardised internationally. These codes may be 'read' by low power lasers or magnetic detectors and the information automatically compared with price information held in the terminal's memory or transmitted from the store's central computer. The benefits of bar codes include faster check-out operation, improvement in stock control and more detailed bills for the customer. Retailing will be affected by new plastic card based payment methods now being studied by the banks and credit card companies, whilst "remote shopping" via home terminals is a future possibility. The provision of more complex terminals and systems in retail stores will be a large growth area for the supplying industry.

3.17 Insurance, banking and finance. Rapid communications and computers have already markedly influenced financial transactions. Terminals in branches are already linked with central computers; these terminals will have steadily more powerful data handling capabilities. More services, including self service, will be accessible through plastic cards with magnetic or microprocessor memories or through closer integration of the IT systems

of the financial institutions with those of corporate and private customers. International data links already provide financial and commercial information around the world. Further developments in rapid international data communications will have important implications for London and the world's other major financial centres.

3.18 Transport and communications Computers are already used extensively to schedule and monitor transport services and to maintain seat booking systems. The links between seat reservation systems and hotel and banking systems may be expected to grow. Better systems for traffic management can be foreseen, with more extensive linking of traffic controls. The extent to which improved telecommunication facilities (such as video-phones and conference systems) will reduce the demand for physical travel is unknown. As energy costs rise, a shift to the use of such services will take place, but psychological factors enter and some commentators have probably overstressed the extent to which meetings will be replaced by remote links.

3.19 Printing and publishing. Recent disputes in the newspaper industry have drawn attention to the changes that IT can bring to traditional printing activities. The editing and composing of a newspaper may now be done wholly electronically. In a related field, direct recording of news events on video tape, obviating the need for film, is widely used in many countries although not yet generally employed in the United Kingdom.

Printing and publishing companies will not in future be using IT only in their traditional activities, but will move into the new fields of electronic printing and publishing, becoming providers of information for Prestel and other viewdata services. The market for some publications, particularly reference books with short-lived information (eg stock market information, holiday booking guides, telephone directories, railway timetables) will be most affected by IT, while books and publications of a more permanent character will be less affected. We do not accept a forecast of the disappearance of the printed book by the end of the century.

3.20 Health services Administrative computers are already extensively used in the National Health Service. Small systems for keeping records in doctors' and dentists' practices are already in use and will become widespread. Systems providing improved monitoring in intensive care units are on the way. The wider accessibility of data banks will aid medical diagnosis and epidemiolocical investigations. Interactive terminals in surgeries will enable patients to prepare basic information for the doctor before an appointment. The consequential freeing of professional staff for more direct contact with patients will be a benefit of IT.

3.21 Legal Services The foundation of case law is precedent, and computerised data banks allowing rapid search for relevant cases will become part of the operation of the legal system. Several such systems have been launched but currently run at high cost. Such legal services share the problem common to many data banks that if charges attempt to cover the heavy initial

costs, there will be little demand for the service. A feasibility study of an economical system for solicitors' offices, where the terminal will also offer other office automation facilities (word processing etc), is in progress. This could also have significance for small professional practices outside the legal field. As we have previously noted, word processors offer a further advantage especially useful in legal work since a document, once typed correctly, can be amended without fear of introducing errors in the unaltered sections.

3.22 Education The introduction of teaching aids using IT is foreseeable. Some schools already have small computers for teaching purposes. These systems familiarise pupils with the concepts of computing. A recent Government programme will provide £9 million mainly for curriculum development and teacher training. But this programme will not provide funds for buying micro-computers. Instruction in many subjects could be provided with interactive learning systems, some of which already exist. The declining cost of IT equipment could lead to a wider equivalent of the language laboratory that is used in many schools and colleges and would enable teaching resources to be better used.

3.23 Throughout the service sector, there will be expanding opportunities, change in institutions and habits, and improved services to the consumer, provided that the new technology is fully exploited.

Personal

3.24 Information technology will give the individual at home a better, wider range of communications and immediate access to a far greater range of information. With developments in Prestel, it will be possible to store and use personal information. Electronic mail may replace some correspondence and telephoning, and electronic means may be used for the payment of bills if ways can be found for establishing personal identity and authority, to eliminate the possibility of fraud. IT will enable more people to work at home, with particular benefit for those who could not otherwise find employment.

3.25 The selection of houses, cars, holidays and even jobs will be assisted by IT. The computer's ability to classify and categorise information and to retrieve it through searching for particular categories means that closer matching of offers and needs can be achieved. Much work will go into the development of software that guides and prompts non-technical users through the system (as, for example, System X will do).

4. OVERSEAS ACTIVITIES

4.1 The governments of France, West Germany and Japan are providing considerable direct financial support for IT developments by assisting R and D, or financing large-scale demonstration projects. They justify this on the following grounds -

a. Economic: if their indigenous firms are competitive in a growing world market for IT products, there are national benefits from enhanced employment and incomes.

b. Technological: IT-related firms are important generators of technology which can be transfered to other industries.

c. Strategic: the growing dependence of national life on computers argues for each country having its own computer industry.

By contrast, Government support in the USA comes mainly from Federal contracts for defence and space programmes. A summary of the main features of official policy in the United Kingdom's principal competitors is below.

France

4.2 The French government have given IT a very high position in national priorities. Public awareness of the importance of "telematique", the new word coined to describe IT, was stimulated by the publication in 1978 of a report (item 6 in the Bibliography) of a Presidential Commission established to study the impact of IT on French society. The report (usually termed the 'Nora' report after one of its authors) discussed the decentralising influence that IT could have on a centralised society and the government organisation required to co-ordinate the use of computers in government and the promotion of industrial IT activities. It stressed the need for France to maintain indigenous computer and telecommunications industries to avoid dominance by American interests. This reflects French concern at the power of IBM. The report also emphasised the importance of software and the key position of data banks

in future industrialised society, again recommending that France had to establish appropriate data banks to avoid dominance from abroad. The consequences of IT for employment and the future importance of service industries were also discussed.

4.3 Since the 1960s, successive French governments have involved themselves closely in industry with the aim of transforming France from an agricultural economy to one based on advanced technology. IT is seen as central to this aim and expenditure on its promotion is currently £270 million annually. This is in addition to the support given to the major French computer manufacturer (£141 million), the development of computer peripherals (£94 million) and the components industry (£70 million).

4.4 Several highly publicised projects have been initiated to stimulate awareness of IT, to provide the incentive (and the funds) for industrial developments and to create the image overseas of French forward-thinking and competence in telecommunications and computing. One project, beginning in 1981, will provide cheap video-terminals in place of telephone directories to 250,000 households in a region, with the eventual intention of eliminating telephone directories throughout France. It is argued that the computer system will be cheaper and that it will have other applications. A second project will link telephone subscribers in Biarritz by optical fibres, enabling video telephones and private TV services to be distributed. Further projects include the French equivalent of Prestel, due to be launched experimentally late this year; a nationwide data network; a telephone handset incorporating a microprocessor; a push-button alarm for the elderly and infirm that automatically sends a distress message via the telephone; a national telecommunications satellite; and an extensive programme of introducing micro-computers into schools in order to teach pupils skills essential for their future work.

West Germany

4.5 West Germany is the largest European market for IT products and services. It has more than twice as many computers as the United Kingdom with a population only 10 per cent greater. Domestic manufacturers have been assisted by successive

government programmes, the last providing about £400 million over four years, one-third of which was for industrial R and D, one-third for the development costs of approved software projects, and the remainder for computer education and for research by the West German equivalent of the National Computing Centre. An information technology programme is awaiting approval. This will concentrate on the links between information technology and society and the impact of IT on individuals.

Japan

4.6 The Japanese government is closely involved with industry in the development of IT, as it is in many other industrial sectors. This involvement stems from a deliberate decision taken some 20 years ago to move Japan away from the more traditional labour-intensive heavy industries into high technology. The government provides financial support for R and D, co-ordinates industrial development and exports, and operates a preferential policy for public procurement. The main government agency involved (apart from the Ministry of Trade and Industry) is the Nippon Telegraph and Telephone Corporation (NTT) which operates Japan's public telecommunications system. However, the government also encourages competition among the major Japanese electronic firms and this provides a major spur to new developments (and to high R and D expenditure by firms). Particular projects under way include the development of a pattern recognition and processing system for coping with Japanese script, a comprehensive medical information system, a viewdata system ("Captain"), and the linking of a community with optical fibres and special terminals.

USA

4.7 In the USA, government involvement in industrial development and the promotion of advanced technology is primarily accomplished through the massive development and purchasing programmes of Federal agencies, notably in connection with defence and the space programme. Expenditure on computers in 1975 for these two purposes alone was thirty times that of the United Kingdom government. Current American dominance of much of microelectronics technology is largely the result of past defence funding for R and D and demonstration projects. There is no explicit government policy for the development of IT but increasing awareness that the very large development costs of advanced data transmission

and processing systems are likely to be beyond the resources of most private enterprises. The American position in IT is one of dominance; the USA accounts for half the world markets for computers, their associated equipment and satellite communications.

4.8 In contrast to most countries, the public telecommunications system in the USA is privately owned, with the Bell system serving 82 per cent of subscribers. Inter-state telecommunication is, however, regulated by the Federal Communications Commission (FCC). In a significant change of policy, the FCC decided early in 1980 that with many new types of electronic equipment being connected to the telephone system, and the increasing use of digital signals for speech transmission, they could no longer reasonably distinguish between data transmission and speech communication. They therefore decided to cease regulating the processing of data by telecommunications companies, and its transmission by data processing companies, thus opening up new markets for both interests.

Others

4.9 Many countries provide government support for advanced technology, particularly through development contracts and subsidies for R and D. Features of IT in other countries include the Canadian equivalent of Prestel ('Telidon'), where the graphics system is capable of much finer detail although needing greater transmission capacity and memory in the terminal, and the Swedish concern for the social implications of IT, in particular in personal privacy and the dependence of society on computers.

4.10 Discussions of an EEC initiative on information technology, aimed at establishing a stronger European share in world markets, have taken place in recent months.[1] Our view, based on previous initiatives, is that such discussions are unlikely to produce significant results in the foreseeable future. We should be concerned if United Kingdom action were to be delayed in the expectation that our competitiveness in world markets might be improved quickly by an EEC plan.

1. See Bibliography, item 13

5. AWARENESS AND ATTITUDES IN THE UNITED KINGDOM

5.1 The concepts of information technology are not radically new; they have been known and used for at least the last fifteen years. We are in an era of evolution rather than revolution; we shall in the future be doing many of the same things (editing texts, preparing reports, seeking access to files etc) more expeditiously or in new ways and doing some new things (rapid preparation of graphs and charts, for example). But the scale and pace of this evolution is unprecedented and we cannot be complacent. If the United Kingdom is to be effective in this field, we shall need the right decisions by industry, regulatory agencies and major purchasers, and acceptance of changes in working practices.

5.2 The current rapid advances in information handling are made possible by developments in electronics, particularly microelectronics, but it is the effects of these developments on individuals and organisations that are particularly arousing the present interest in IT. IT will notably affect methods of operation in offices, libraries and other organisations which primarily handle information. The great potential opportunities for this country in the supply of IT equipment and systems must not be neglected, but the impact of the application of IT on our society and economy is probably more important.

5.3 The techniques that can bring about these changes are already known. Although the time lag between invention and commercial application is decreasing, innovations which will have large scale impact during the next ten years will almost all be based on existing knowledge. The hardware required for most IT requirements is either already available or could be designed with present technology. Less certain is the ability to write the software necessary to use that hardware fully, and to apply the systems to specific industrial, commercial and administrative uses. The benefit that the United Kingdom derives from IT in the coming decade will depend more on education, training, work attitudes, the investment climate and regulatory systems (ie our ability to make successful use of IT) than on advances in technical knowledge. For this reason, many of our conclusions relate to these factors rather than the development of technology.

5.4 Previous ACARD reports have drawn attention to lack of public awareness of the potential of new technologies and the slowness of the United Kingdom in adopting them. The same failings may be discerned with IT. The present attitude in the United Kingdom is not as good as that in France, for example, where the government have publicly supported IT and have publicised the developments, the possibilities, the advantages and the problems to the point where there is public awareness of IT and attitudes have been influenced. Corresponding attitudes in this country are less favourable and include some resistance to change at all levels. We do not believe that there should be anxiety over the intelligent extension of the use of IT, but a sustained campaign to get this over to the public is necessary, since the pace of application of IT will hinge upon willingness everywhere to face the challenges posed by new developments. Firms overseas will be adopting the new developments in IT in order to gain competitive advantage; the United Kingdom must not be behind.

5.5 It is understandable that there is concern on the part of organised labour about the possible threat of IT to employment at a time when alternative employment opportunities do not appear plentiful. However, ACARD has commented before that failure to remain competitive in world markets through the use of new technology is the greatest threat to employment in this country. We hold the view that failure to use IT is a greater threat to employment overall than its adoption; the new services that will be generated will themselves be labour-intensive. They - and present communication services - will require more people to install them; there will be more maintenance to do (even taking into account the enhanced reliability of semiconductor devices) and more staff will be needed to educate and train the whole range of makers, installers and users.

5.6 There will be changes in the requirements for different skills. The demand for jobs which are 'skilled but routine', whether typing or turning out repetitive parts on a lathe, will be most affected by IT. The more basic manual tasks will be little affected, and jobs that require thought will be aided rather than displaced by IT. In introducing proposals for new IT-related equipment and work procedures, full consultation between management and staff - as envisaged in the discussions between the CBI and TUC on new technology - is essential, and provision of adequate training and retraining for those displaced from existing jobs must be a significant part of the arrangements.

5.7 Management attitudes must be positive for the full exploitation of IT. Complacency and ignorance of new possibilities will lead to commercial failure. Managers must be well informed on information technology so that they appreciate its full potential and understand its implications for their business. There is also a need for a better understanding of motivations for and against change. The education of both management and trades unions is an important factor in the application of IT.

5.8 There is more chance of public acceptance of IT and the necessary investment of money and people if it is clear that this is a key point in the future growth of the economy. This requires Government to take a public position in order to create the right climate for the improvement of efficiency and the acceptance of new technology. A clear statement of the importance that Government attaches to this subject is required.

5.9 A statement alone will not be sufficient - welcome though it would be. The French government have been successful in creating - on the basis of projects that are not yet operational - the impression that France is leading the world in IT. A firm Government policy on the importance of IT coupled with adroit publicity for some projects that catch the imagination has produced a situation highly beneficial to French industrial interests. We look for similar top-level support for the projects that show what British IT can do. We look also for the projects that will bring the significance of IT home to the public, like the French electronic telephone directory service.

We recommend that the Government should make it clear that effective exploitation of IT is essential to the future industrial and commercial success of the United Kingdom. This commitment should be emphasised on all suitable occasions by Ministers and officials.

The Government should support its views with publicity for existing United Kingdom achievements in IT and imaginative promotion of them.

Innovative applications of IT by Government Departments, local authorities and public corporations should be encouraged and plans for them should be publicised.

6. OPPORTUNITIES AND CONSTRAINTS IN THE UNITED KINGDOM

Availability of People

6.1 The development, production and application of IT are all constrained by a substantial, or even critical, shortage of people trained in the skills needed for IT. Suppliers and users are experiencing a shortage of people with the ability and training to design systems and write programs. The speed at which technology is advancing makes this problem particularly acute.

6.2 UK software is as good as any in the world and we have the advantage that English is the basic international computer language. It is unfortunate that exploitation of these advantages is constrained by a shortage estimated as between 25,000 and 40,000 trained people. The causes of the shortage include the rapid expansion of the applications, a popular misconception that the field is highly mathematical, inadequate provision for training at all levels and lack of in-career training courses.[1]

6.3 The ability to write programs successfully is logical rather than mathematical. (Recent projects at the National Computing Centre have shown that people of modest educational achievements - say no more than two O levels - can be taught to become competent programmers.) Schools must recognise that pupils with aptitudes other than mathematics could have a satisfactory career in this field, and there is need for guidance to both teachers and pupils on the routes which lead to such careers.

6.4 The movement of trained staff from firms prepared to spend money on training to those prepared only to offer higher wages is an argument often quoted against investment in training. This must not be allowed to undermine training programmes and the extension of the levy/grant system may be necessary to ensure an equitable sharing of the costs.

6.5 The ACARD report on technological change (item 3 in the Bibliography) drew attention to the shortage of skills in microelectronics and related subjects. Schools, polytechnics and universities, the Manpower Services Commission, Industrial Training Boards and the relevant Government Departments should consider urgently

1. See Bibliography, item 19

the ways in which the supply of trained manpower might be stepped up. It is regrettable that none of the £9 million allocated by the Government for microprocessor education will be used for the purchase of equipment for use in schools. IT will itself release resources by enabling many office jobs to be done with fewer staff; one way of smoothing the introduction of new technology could be to train people displaced from current jobs in skills relevant to the development of IT. Government support for such training schemes might be envisaged. However, the longer term shortages at higher levels will not be eased this way; they require immediate measures to indicate to A-level students and new graduates of all disciplines the opportunities available in IT - particularly in software preparation.

We recommend that careers services at both school leaver and higher levels should review the guidance given to students about opportunities in IT, in order to attract entrants from a wide range of disciplines.

We recommend also that Government, its agencies concerned with training, and educational bodies at all levels, should examine the provision of education and training courses in IT-related subjects and propose measures to stimulate an increase of training in firms.

Industrial Activity

6.6 Our study has made us aware of gaps in the range of products in IT available from UK industry. Much of the present equipment for IT, including probably 90 per cent of the peripheral equipment, is coming from overseas. There are opportunities for UK industry, for example in the banks, but apart from a few good examples (such as a new banking terminal), opportunities are being missed. With the present pace of development, a great deal of equipment is being purchased and this provides opportunities, some of which are particularly suited to small specialist firms. In some cases, industry appears to be slow in anticipating future demands. We also believe that UK customers show more antipathy to novel equipment, compared with organisations overseas. There is a need for closer contact between supply and user industries in IT.

We recommend that the Government, through Trade Associations and the National Economic Development Council, should improve the links between supplier and user interests in IT in order that UK firms may be better able to anticipate future requirements.

6.7 There have been major achievements in British IT upon which we should build. Major development programmes in fibre optics have been conducted by both public and private firms and the Post Office recently announced plans for 15 routes comprising 280 miles of optical fibre cables. Britain is unique in having an operational viewdata service - Prestel - accessible by local call from several major cities, and this world lead should be exploited vigorously. Similarly, teletext (ie Ceefax and Oracle) was first developed here and has now been adopted by several other countries. Finally, ICL is one of the few presently viable computer companies outside the USA and Japan.

6.8 However, our supplying industry is stronger in electronics than in the mechanical skills required for peripheral equipment. We are particularly concerned that the UK now appears to lack the capability to design the electromechanical components which are still required in information systems.

6.9 We also note that our R and D effort in this field is now less than that of many of our competitors. Thus our effort on opto-electronics is now only about 10 per cent of that in Japan. We have to be selective and deploy R and D effort where there are the best chances of successful exploitation. We indicate appropriate areas in Chapter 8.

6.10 We have noted that a constraint to development in this field is the lack of transferability and mobility of technical staff between universities, government and industry. This, we believe, results in government funded work not getting developed and applied in industry. Some government research establishments contain "centres of excellence" which it would be wrong to destroy but which are remote from development, manufacturing and marketing. The best solution would be the free movement of people with their ideas.

6.11 We are also concerned that there should be a balance between the production and design of hardware and software. Failure to recognise the importance of software, and of the know-how in applying the technology, could have grave consequences. This importance is recognised in the "Nora" report which urges

the development in France of strategies to enhance competence in software and IT applications for both domestic use and the export of expertise. There is considerable British competence in this area, despite shortages of people. With encouragement and assistance, this could become a major British asset.

Regulation and Standards

6.12 IT by definition involves communication from one location to another. It is essential, therefore, that the equipments making up the communication links are compatible so that information may pass freely. Bodies exist for making both national and international regulations and standards in the field. The present regulatory organisations for communications in the UK, (eg the Post Office and the Home Office) backed up by Trade Associations, are linked with their counterparts in other countries through organisations which have no legal jurisdiction but which enable compatible standards and systems to be developed. Such organisations work well (see Appendix 2 for details). The British Standards Institution is similarly linked with international standards bodies on other aspects of IT.

6.13 Regulations and Standards may promote or inhibit development. In a rapidly changing technology, care is needed to ensure that they do not inhibit progress. Their formulation requires careful, detailed but often tedious and time-consuming drafting and discussion. There is a risk of their importance being under-rated, so that the best people are not sent to standards negotiations. It can be unattractive work with apparently little of commercial value at the end of the day. However, the intelligent preparation, advocacy and, if necessary, defence of positions, in particular in international negotiations, is vital to the UK. Other countries seem more adept at exploiting such negotiations for their own advantage, either by obtaining agreement that their national standards will be adopted internationally, or by frustrating competitors' intentions to capitalise on a technological lead. Extensive negotiations over viewdata standards have so far prevented Prestel from gaining the immediate world acceptance that its technological lead would justify.

6.14 Commercial implications of international standards (not merely European, which are often irrelevant to world markets) can be considerable. But not all the work can be left to our negotiators supported by Trade Associations. It is also up to firms to establish de facto standards by taking up commercial opportunities. If they lose a position, they cannot rely on our representatives in international discussions to restore it.

We recommend that the Government should recognise the importance, to the IT supply and applications industries, of UK strength in international discussions on regulations and standards, and that staff and financial support must be available for such activities to ensure that our delegations go to them well prepared, technically, commercially and politically, and ready to argue strongly for our national interests. Trade Associations must similarly be prepared to play their part on behalf of their industries.

Legal Constraints on the use of IT from deficiencies in law

6.15 The successful use of IT in the UK is being impeded by the lack of reform to certain aspects of the law which relate to the use of information. Unless such reforms are carried out as a matter of urgency, many future developments will be either prevented or substantially hindered. These are discussed below.

Data Protection Legislation

6.16 Power from the use of information, which can now be provided by IT, is great and there is clearly potential for abuse. Justifiable fears of such abuse are a major contribution to resistance to new ways of collecting and handling data by both Government and the private sector. The legitimate interests of citizens and users of IT must therefore be defined and protected. Laws are needed to prescribe such matters as the information to be handled, the uses to which it may be put, its disclosure to the people covered by the data and to third parties, the assurances to be given on collection, the safeguards for ensuring accuracy, relevance,

timeliness and completeness, the measures for ensuring security and the circumstances in which users must seek the consent of subjects of the data or authorisation from an appropriate authority.

6.17 In the international sphere, the lack of data protection legislation will place the UK increasingly at a disadvantage with other countries who have already legislated; British commercial and industrial interests of many kinds will suffer as a result. Without domestic legislation, the UK will be unable to ratify the international convention on data protection already produced in draft by the OECD.

6.18 Data protection was examined by the Data Protection Committee under Sir Norman Lindop whose report (item 14 in the Bibliography) was submitted to the Government in December 1978. The Committee made many detailed recommendations, including the establishment of an independent Data Protection Authority. The Government has not, however, responded to these.

> We recommend that the Government should bring forward proposals for data protection legislation, taking into account the views of the Data Protection Committee, without delay.

Copyright Laws

6.19 The copyright laws need to be modified to cover information held in forms other than writing on paper. Developments in IT mean that information will in future be held in electronic, magnetic, or optical forms and so the lack of appropriate copyright law will constitute a hazard for the users of IT and could remove incentives to develop innovative concepts in IT itself. The risks to IT users of inadequate copyright protection will be enhanced by the ease with which copies of documents (whether paper or electronic) will be sent to distant locations.

Other Laws

6.20 The admissibility of information held other than on paper as legal evidence is said to be open to doubt. This and any similar uncertainties relating, for example, to the laws of libel and fraud could constitute a further inhibition to users of IT. If the UK is to have a leading position in the supply and use of IT, such inhibitions need to be removed.

> We recommend that the Government should put in hand urgently a review of the legal reforms required to aid and expedite the use of IT in the UK and should then legislate to bring about such reforms as fast as possible.

Present Organisational Problems

6.21 IT brings together computing and telecommunications. This makes possible the interchange of information not only between units of a single organisation, but also between independent organisations - eg between suppliers and their customers, banks and their corporate customers, airline companies, Government Departments, and between Government Departments and private sector organisations. This kind of interchange of information often precipitates a situation in which the costs fall to one party and the benefits to another. The motivation to create system linkages of this kind is hard to promote, unless it is done jointly by all the parties with a clear understanding of how the costs and benefits will be distributed among them.

6.22 This type of joint venture requires new legal forms of organisation which do not affect the separate identity and legal standing of the co-operating parties. Such a legal form has been created in France - known as a Groupement d'Intérêt Economique (GIE), and in Belgium there is a similar corporate entity in the form of a non-profit making co-operative society. Such entities have proved themselves excellent vehicles for joint action to meet a common set of goals, with minimum legal and fiscal difficulties. This has been so even where the joint action is by very disparate organisations with common communication needs, for example telecommunications authorities with banks, or airlines with railway companies.

6.23 We have no such legal structures in the UK and it is difficult to envisage how, for example, the Post Office might undertake a joint venture with other organisations. Already some international organisations utilising IT, such as the banks' SWIFT network, have been established with headquarters in Belgium or France where these legal forms exist, rather than in the UK.

We recommend that the Government should consider legislation to permit the creation of new organisational forms to aid joint IT projects, taking into account the precedents in France and Belgium.

7. THE ROLE OF COMMUNICATIONS

7.1 While some applications of IT will be contained within a single room, office, store or factory, the major applications of the future will be dependent on national and international communications networks. Some transmissions will be via communications owned by the user or provider of the IT system, but most will require the use of existing public communications networks, suitably improved. A first class, modern, economic communications system is therefore essential for effective application of IT.

7.2 IT users' requirements will not, in the main, be for facilities which are technically difficult to provide. They will rather be looking for low transmission costs, speed of installation, reliability, and competitive transmission and switching technology to provide them with modern services. They are much more concerned if, as at present, it can take 9 months to obtain a new connection to the public telephone network.

7.3 Most of the present traffic on the telephone network is voice communication. Even in an era of data transmission, information technology and electronic mail, we expect the majority of the traffic to remain voice telephony. This will only be changed when video telephones are introduced (and widely accepted by the public - which was not the case when an attempt was made by the Bell System to introduce them in Chicago), or television programmes are distributed to homes by the telecommunications network. Even then modern techniques can reduce the data transmission rate required. A network which provides digital voice transmission will also satisfy substantially all other IT requirements (except possibly videophone and television). There is therefore no need for a separate network for IT from that for speech, although some with whom we have had discussions look forward to the development of information ring mains in neighbourhoods. Users would connect to these and specify the amount of information carrying capacity required. There is, however, a case for national standards for data handling via the public network in order to permit data interchange between different organisations, in the same way that speech can now be freely transmitted between individuals.

7.4 We believe that a feature of the development of IT over the next few years will be the replacement of physical movement of some information by 'electronic mail' in which keyed-in information is transmitted over the telecommunications network, stored as necessary, and displayed on a screen at the recipient's address, with printed copies being produced when necessary. There will be scope for different classes of service at different tariffs, eg as soon as connection can be made; when the network is lightly loaded; or overnight. Even in an era of electronic mail, though, there will be cross-coupling between telecommunications and postal services (for those without telephones) and the separation of these services has not had any fundamental effect on our conclusions.

7.5 The provision of a telecommunications network and the transmission and switching of connections between subscribers can be a profitable business at the rates which subscribers will pay. Such a network is at the heart of applications of modern information technology. The relevant technology, however, is changing rapidly and major investment in research, development, procurement and installation is required if the network is to remain competitive in world terms. It is vital that the provider and operator of the network should have adequate funds for this programme, from either public or private sources.

We recommend that the Post Office (or its successor for telecommunications) should have the mandate to provide a world-competitive United Kingdom communications network and should have sufficient finance for procurement and installation, whether from public or private sources.

7.6 At present the Post Office not only provides the network but has a major influence on the introduction of those aspects of information technology which rely on the network.

It determines the tariffs charged, the service to be provided and the timing with which they are made available to users.

It controls the equipment which may be connected to the network. It provides some terminal equipment and at one time exercised a virtual monopoly over equipment directly connected to its terminals, although this has now been considerably relaxed.

It provides services such as Prestel, although it no longer monopolises the provision of viewdata services.

It has substantially a monopoly in the provision of point-to-point communication.

7.7 In our discussions, we have encountered a range of views on the future of IT, but nearly everyone would like a 'transparent' communications system with terminals (similar to the outlets for gas, electricity and water) to which they could attach equipment of their choice, provided that it has been approved as not harmful to the network. The role of the Post Office should be to provide the network. Such matters as approval of terminal equipment and approval of independent networks should not be the responsibility of the Post Office.

7.8 Opinions have varied on the future provision of services and equipment. Views include -

a. that the Post Office (or its successor, British Telecommunications) should be only the provider and operator of a transparent communications network (ie a 'bulk data carrier') and should not provide Prestel or similar services, nor should it supply terminal equipment;

b. that the Post Office should supply and operate the network and have the right to supply simple terminal equipment (eg a telephone) which would confirm the satisfactory working of the network;

c. that the Post Office should supply and operate the network and have the right to supply simple terminal equipment but would also be free to supply IT services and other terminal equipment in competition with private interests.

On balance, we support view c.

We recommend that the Post Office should be free to supply terminal equipment and IT services for use with the network but should not have an exclusive right to do so. It should not be the approving authority for terminal equipment and IT services provided by others.[1]

1. A Government statement on 21 July 1980 proposed changes in the Post Office's telecommunications monopoly which follow these principles.

7.9 We recognise that a consequence of the liberalisation of the Post Office's monopoly on terminal equipment could be the loss of this market to foreign competition and an increase in imports of such equipment.
We believe, however, that the rapid application of IT in UK service industries such as banking and insurance (which will lose competitiveness if they do not apply IT effectively) is so important that such liberalisation is necessary. It should, however, be introduced in ways that will give alert British manufacturing industry the opportunity to supply these users' needs.

7.10 The Post Office, together with the Department of Industry and the Home Office, at present have regulatory and supervisory powers for communications. Sound and television broadcasting systems have an increasing role in IT. Examples are the teletext (Ceefax and Oracle) services provided by the BBC and IBA, the use of television receivers for Prestel and other viewdata systems, and the possible use of broadcasting systems for regulating energy demands. Mobile radio (for emergency services, taxis, and industrial use) and point-to-point radio will also be part of IT systems, over which data as well as speech will be transmitted. These broadcasting and radio services (which are at present regulated by the Home Office) are parts of the total communications capability essential for IT. We believe that the supervision of their technology should be brought together with that of other communications, and this task is not appropriate to the Home Office.

7.11 The four principal responsibilities which should be brought together are: approval of equipment for connection to the public communications network; regulation of "value added" services using the network (eg data processing services); regulation of private communications systems; and control of the use of radio frequencies. We believe that, because of their interplay, it would be simpler, more efficient and less restrictive to make these the responsibility of a single organisation. This could also result in some staff savings.

We recommend that responsibility for regulation of communication and broadcasting, including the matters listed above, should be exercised by a single Government Department.

PUBLIC PURCHASING AND SUPPORT FOR R & D

8.1 Government is a major user of IT. It provides funds to support its development and controls the regulatory system in which broadcasting and telecommunications authorities operate. It also has a major influence on the general economic environment, which governs the willingness of firms to invest. As a user, Government can determine the direction and market for major items of computer-based equipment by policies of standardisation and by its willingness to introduce innovative features. Traditionally, Government seeks the lowest cost systems that meet its requirements. In IT (as in other areas of high technology), selection of the lowest cost systems may in the long run weaken United Kingdom industry by not providing the initial market for a new development which bears heavy initial costs. The USA particularly has supported many projects in advanced technology through enlightened and innovative purchasing. Public purchasing in this country needs similarly to provide some of the market pull required to encourage new developments. Cost minimisation is an important criterion for decision, but can stifle advance, whereas imaginative, innovative purchasing can provide great commercial benefits at relatively little extra cost.

We recommend that the Government should employ public purchasing to pull through novel developments in IT, (and offer examples of possible projects in Appendix 1).

8.2 Government funded applications of IT could also be used to achieve national objectives outside the industrial or IT areas. The following are examples:

a. IT could assist a national campaign for energy economy;

b. the creation of commercial and industrial employment in the regions could be promoted (a distance-independent tariff would help this);

c. technology could be developed to provide assistance to the physically handicapped;

d. a substantial British contribution to the needs of developing countries could be made by study of their environments where the pattern of available industrial and commercial skills is quite unlike our own. The use of IT to overcome deficiencies could speed up such countries' progress. Projects could have political value as well as substantial export value.

We recommend that the Government should consider the possible role of IT in promoting national objectives, and give appropriate financial support to relevant IT projects.

Public Sector Research and Development

8.3 Work on IT supported by government funds is being undertaken in government establishments and in industry and universities. The Ministry of Defence and the Post Office, as customers, are supporting research and development aimed at their own needs, while the Science Research Council and Department of Industry are supporting work in the universities and industry. In addition the Department of Industry is undertaking work in its industrial research establishments.

8.4 We do not advocate an increase in government funded R and D, particularly in government establishments or universities, because we believe that application of the results of R & D, in the form of marketable products which

are put to successful use, does not in general come about unless the R and D is done close to manufacture, marketing and applications. Government R and D establishments cannot be strongly motivated to achieve successful commercial exploitation of research.

8.5 While we do not see a case for expansion of Government-funded R and D, we believe that development of IT and its applications should be emphasised within the existing budgets of the Science Research Council and the Department of Industry and that all possible civil advantages should be taken of related programmes in the Ministry of Defence.

8.6 Areas of importance to IT which should be considered by the Science Research Council and the Department of Industry when deciding their supported programmes include:

a. development of special silicon integrated circuits (microcircuits) for applications in IT;

b. applications of special and standard silicon integrated circuits in IT;

c. opto-electronics;

d. system analysis and design, software systems and programs;

e. displays;

f. pattern recognition;

g. bandwidth compression techniques;

h. new memory technologies;

i. novel sensors and transducers;

j. organisation of large data bases;

k. printed copy generation.

We do not suggest that it is within the United Kingdom's resources to establish a viable world presence in all these areas. A selective approach will be required, based on the availability of first rate ideas and people, and on industry's views on ultimate commercial importance.

8.7 We would draw special attention to two areas. First, satellite communications and broadcasting could be particularly significant in future IT systems and it is important that this is kept in mind in considering priorities in this country's present substantial financial support for satellite science and technology. Second, the technology of opto-electronics (already in use in sensors, displays and transmission) will also be important for many aspects of IT. It may eventually be supplemented by what some term "microphotonics" - the use of quanta of light ("photons") without the intervention of electrons - for information processing, storage and transmission.

> We recommend that the Science Research Council and the Department of Industry should keep their research priorities under review in the light of the needs of IT.

8.8 There is a need for better co-ordination of the R and D on IT undertaken by the Ministry of Defence, Department of Industry, Science Research Council and the Post Office. At present the CSE Division of the Department of Industry and its Computer Systems and Electronics Requirements Board are endeavouring to improve co-ordination, trying to ensure that projects they support are likely to be applied and that they are applied when successfully completed. But there is room for improvement.

> We recommend that the Department of Industry, with the Ministry of Defence, the Science Research Council and the Post Office, should increase the present co-ordination of all publicly funded R and D applicable to IT. It should also make greater effort to ensure both that research which it supports is likely to be applied and that transfer of results to industry takes place.

THE ROLE OF GOVERNMENT

9.1 We have referred in previous chapters to a number of roles for government in the development of IT and its applications, concerning -

a. awareness and attitudes,
b. education and training,
c. sponsorship and support of industry,
d. international regulations and standards,
e. the legal framework for applications of IT,
f. public purchasing
and g. publicly funded R and D.

9.2 Responsibility for these roles is at present split between the Home Office, the Department of Trade, the Department of Industry, the Department of Education and Science, HM Stationery Office and the Central Computer and Telecommunications Agency (but the co-ordinating role of the CCTA in public purchasing does not extend to local authorities, the National Health Service or nationalised industries). In addition, public risk capital for IT ventures is provided by the National Enterprise Board and the National Research Development Corporation.

9.3 This spread of responsibilities for the advancement of developments and applications of IT does not seem to us to provide a coherent framework for policy making for such a nationally important subject. Decisions on one aspect of IT (eg satellite broadcasting) may have repercussions in a very different area (eg standards for data transmission). Responsibility for taking a view of the whole field should rest with one part of Government. We do not suggest the transfer of detailed responsibilities, for example, for education from the Department of Education and Science, but we do believe that it is necessary that all the factors which will influence the development and application of IT in the national interest should be studied together, and that Departments' plans and actions are co-ordinated and monitored.

9.4 There is also the difficulty that costs and benefits from the introduction of IT systems can fall to different Government Departments. Separate financial targets and accounting systems do not easily allow the redistribution of costs and benefits. Projects where the

net national benefit would be substantial may not then come to fruition. There is need for a system of project cost and benefit distribution which can overcome departmentalism.

9.5 We believe that a focal point is necessary, in view of the number of organisations involved, to improve awareness in government, to promote a programme covering both projects and publicity, to improve internal communications and provide necessary couplings, to avoid delays because of the rate of technical change, and to create a positive public consciousness of IT. There is a need to make existing United Kingdom efforts more coherent. The French have managed to achieve coherence in IT and have aroused national consciousness and international interest with a programme which is probably not vastly greater than the sum of United Kingdom efforts. By contrast, British activities, including those of the Department of Industry which already has many of the responsibilities in the IT field, are fragmented and organised in traditional sectors which do not correspond to the new technological possibilities. The creation of a focal point would also assist the private sector, which at present has to deal with many parts of Government on IT matters.

> We recommend that one Minister and government Department should be responsible for co-ordination of government policies and actions on the promotion and development of IT and its applications through awareness, education and training, sponsorship of industry, provision of risk capital, public purchasing, publicly funded R and D, national and international regulations and standards, legislation, communications, and related programmes such as satellite technology.

10. CONCLUDING REMARKS

10.1 Our concluding note, in line with the central theme of this report, is that Government, industry, commerce, trade unions and the professions must take the new developments in information handling very seriously. They will affect working arrangements, management systems and personal life. They offer great commercial opportunities for this country if successfully exploited. It will be necessary to examine the changes in management organisation and techniques which are necessary to make best use of information technology. The Civil Service, local government, and industrial and commercial managements are frequently aware of the systems which are available but are sometimes slow in

adjusting their methods of working to make effective use of them. It is essential to start not from the way that tasks are tackled with present methods but to examine the true tasks to be performed and how they can best be undertaken with the aid of the new technology.

10.2 The successful exploitation of IT is crucial to high employment, a satisfactory balance of trade, competititive industry and an efficient commercial sector. But time is not on our side. If we are to maintain a presence against the present commercial strength of the USA and Japan and the clear intentions of France and West Germany, to name but our major competitors, the message of this report has to be taken up by all sectors in effective action now.

APPENDIX I

DEMONSTRATION PROJECTS WHICH COULD PROVIDE IMPETUS FOR UNITED KINGDOM EFFORTS IN INFORMATION TECHNOLOGY

1. Creation of "centres of excellence" for communications in commercial centres such as the City of London.

2. Installation of an optical fibre cable communication network in an area such as part of a new town, with advanced terminal equipment for speech, text and other information.

3. Use of a United Kingdom satellite for communication and broadcasting.

4. Provision of cheap black and white Prestel-like video terminals for telephone directory information, for use with telephones.

5. Supplementing postal services by telex and facsimile transmission from post offices and other public places.

6. Establishment of a demonstration Government office with the latest, preferably British, electronic communications, word processing, copying, information processing and storage etc.

7. Creation of an effective information retrieval system for the Manpower Services Commission to assist job placement.

8. Provision of microcomputer systems for education, training and applications in schools and colleges.

9. Provision of Prestel receivers in schools and public libraries.

Note: These projects vary greatly in impact and cost. The Working Group would be prepared to provide assessments of impact and cost, if required.

PRINCIPAL REGULATORY BODIES IN TELECOMMUNICATIONS & ALLIED FIELDS

1. THE INTERNATIONAL SCENE

The main body involved in the regulation of international telecommunications is the INTERNATIONAL TELECOMMUNICATIONS UNION (ITU) through its INTERNATIONAL TELEGRAPH AND TELEPHONE CONSULTATIVE COMMITTEE (CCITT). Questions or recommendations raised by member Countries of CCITT at the Plenary Sessions are assigned to study groups and joint working parties (which are made up of experts from both participating PTTs and the private sector) who, in turn, report back to the Plenary Sessions with the results of their investigations.

The Plenary Sessions then decide on appropriate Standards based on the evidence presented. These Standards then become official CCITT Recommendations, the adoption of which is not mandatory but does provide positive benefits to the member Countries. Consequently, CCITT Standards are generally accepted throughout the world and are currently published and implemented covering the transmission of data in various forms over telex networks, telephone networks, and public data networks, including the modern 'packet switching' networks. Standards cover such factors as operating speeds, modulation techniques, interface connections and protocols, etc., etc.

The ITU also controls the allocation and use of radio frequencies throughout the world. The CONSULTATIVE COMMITTEE ON INTERNATIONAL RADIO (CCIR) is a sister organisation of CCITT and works in essentially the same way, i.e. via Plenary Sessions with their Study Groups and Joint Working Parties. The final Recommendations are then submitted to a WORLD ADMINISTRATIVE RADIO CONFERENCE which takes place periodically (the last one was in 1979, and the one before that in 1964). These conferences are attended by representatives of World Governments, e.g. the UK Government is represented by the Home Office, and the U.S. Government by the Federal Communications Commission (FCC). Agreements are reached at these conferences on the international allocation of radio frequencies, and the two main considerations are:

1. To keep the communications concerned with the safety of shipping and aviation clear and open.

and,

2. To avoid interference between one country's internal broadcasting services and those of its neighbours.

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Agreements reached at the World Administrative Radio Conference are then controlled and monitored by the INTERNATIONAL FREQUENCY REGISTRATION BOARD (IFRB) which is another ITU organisation. Complaints of interference whether to aviation or maritime communications or domestic broadcasting services are normally referred to the IFRB, the ITU and the country operating the radio station concerned.

Another regulatory mechanism in the international arena and of particular interest to the UK, is the EUROPEAN CONFERENCE OF POSTAL AND TELECOMMUNICATIONS ADMINISTRATIONS (CEPT), which has twenty six member administrations and which aims at 'the harmonising and practical improvement of their administrative and technical services'. Like CCITT, this organisation is essentially consultative and has no legal jurisdiction over its members.

Yet a further international organisation, though not strictly regulatory, is the INTERNATIONAL TELECOMMUNICATIONS SATELLITE ORGANISATION (INTELSAT) which has approximately 100 member nations. The technical and operational management functions of this organisation are supplied by COMSAT (the U.S. Communications Satellite Corporation) but under the overall direction of the Board of Governors which represent the member nations.

Other prominent organisations in the international area - although not strictly concerned with telecommunications per se - are the INTERNATIONAL ORGANISATION FOR STANDARDISATION (ISO) together with the INTERNATIONAL ELECTRO-TECHNICAL COMMISSION (IEC). The IEC, headquartered in Geneva, recommend Standards for electrically operated equipment for international use and, where possible, the BRITISH STANDARDS INSTITUTION (BSI), adopts the same or similar Standards as well as the same form of publication of those Standards. In the special area of radio interference, the IEC has set up an "INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE" (CSIPR), and many UK manufacturers are now designing equipment to meet the Standards defined by that Committee.

2. THE U.K. SCENE

In the field of telecommunications the main regulatory body is the BRITISH POST OFFICE (BPO) with powers vested in it by the Post Office Act - 1969 - which give it a virtual monopoly in the country. There are a number of exceptions to this monopoly, mainly concerned with systems which are installed entirely within a single building or site, or within and for the exclusive use of a single business. Furthermore, the BPO may license other organisations to run systems which it may, itself, from time to time not have either the resources or the desire to offer. In particular, the BPO has issued a general licence covering "Private Attachments to Post Office Telecommunications Installations" dated 1 July 1977. This licence

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has, in turn, resulted in a series of "Technical Guides" which detail various specifications which must be met by any equipment connected to BPO circuits. Such equipment must then be submitted to the BPO for evaluation and test before written permission is given. The requirements for connection to the PUBLIC SWITCHED NETWORK (PSN) are different from those, for example, for connection to BPO supplied private circuits, and separate listings are maintained for equipments for which BPO approval has been given for each type of connection.

Any communication system involving a radio link requires, in addition, the approval of the HOME OFFICE through a "Home Office Wireless Telegraphy Licence".

The BPO monopoly applies not only to the UK and the Isle of Man but also to International Systems in so far as they operate within the UK. A department of the BPO, known as the "External Telecommunications Executive" is involved in evaluating and licensing privately supplied equipment for connection to international circuits.

Although not strictly a regulatory body, the BRITISH STANDARDS INSTITUTION (BSI) publishes various Standards which are relevant to the general information processing industry, most importantly concerned with electrical safety and radio interference. Although these Standards are not mandatory within the UK, similar Standards frequently are in many other countries. However, compliance with the appropriate British Standard is considered by most responsible manufacturers to be of considerable importance and would be normal.

The BSI runs a testing and inspection service to assist manufacturers in ensuring that their equipment does meet the appropriate Standards. They also run an organisation called "Technical Help to Exporters" (THE), which assists manufacturers in respect of overseas technical requirements. The BSI also works closely with many other interested Bodies, e.g. the TELECOMMUNICATIONS INDUSTRY STANDARDS COMMITTEE which, in turn, consists of representatives of various Government Departments and scientific and industrial organisations, such that the resulting BSI Standards are, in fact, a joint recommendation of both Bodies.

BIBLIOGRAPHY

(1) "The Applications of Semiconductor Technology" ACARD (HMSO,1978)

(2) "Joining and Assembly: The Impact of Robots and Automation" ACARD (1979)

(3) "Technological Change: Threats and Opportunities for the United Kingdom"ACARD (1980)

(4) "Computer Aided Design and Manufacture" ACARD (1980)

(5) "The Future with Microelectronics" Ian Barron and Ray Curnow (Open University Press, 1980)

(6) "The Computerisation of Society" by S Nora and A Minc (MIT Press, London, 1980)

(7) "The Social and Employment Implications of Microelectronic Technology" Central Policy Review Staff (1978)

(8) "The Manpower Implications of Microelectronic Technology" (HMSO,1979)

(9) "The Collapse of Work" C Jenkins and B Sherman (Eyre-Methuen, 1979)

(10) "Employment and Technology" (TUC, 1979)

(11) "Proposals for a Conservative Information Technology Policy" Report of a Working Group (1979)

(12) "Cashing in on the Chips" by Philip Virgo (Conservative Political Centre, 1979)

(13) "European Society Faced with the Challenge of New Information Technologies: A Community Response" (Commission of the European Communities, COM(79) 650 Final, Brussels, 26 November 1979)

(14) "Report of the Data Protection Committee" (Lindop Report) (HMSO,1978)

(15) "Report of the National Committee on Computer Networks" (Department of Industry, 1978)

(16) "Longer Term Review of Administrative Computing in Central Government" - a study by the Civil Service Department and user Departments (1978)

(17) NEDO Sector Working Party Reports: Office Machinery and Electronics Components (National Economic Development Office, 1980)

(18) "Microelectronics: The Implications for Education and Training" (Council for Educational Technology)

(19) "Computer Manpower in the 80's" Report of the Manpower Sub-Committee of the NEDO Computer Sector Working Party (NEDO,1980)

PART 1 ends:-

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PART 2 begins:-

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