NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

COMPUTER SCIENCE AND ENGINEERING BOARD

9th Meeting

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NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
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COMPUTER SCIENCE AND ENGINEERING BOARD

9th Meeting

Room 200-A
Joseph Henry Building

AGENDA

January 7, 1969

EXECUTIVE SESSION

8:00 p.m. Opening remarks by the Chairman

8:15 p.m. Informal presentation by Mr. Robert Taylor, Director, Information Processing Techniques Advanced Research Projects Agency, of the general philosophy of ARPA's research program in information processing techniques, the main channels and directions of the ARPA research program, some accomplishments to date, and some of the more promising projects under way.

8:30 to 8:45 Questions, answers, comments.

8:45 Informal presentation by Mr. Robert Landau on:

The general information processing R&D program of the CIA.

The major aims and goals of this program.

The philosophy and purpose of FIRST, an experimental on-line network to be initiated shortly by OST, within the COSATI structure.

(NOTE-the unclassified content of the above will be presented to the general meeting of the Board on January 8, with a hands-on demonstration of the equipment to be used with the system and of the file query capabilities envisaged during the initial stages of the network operation.

The CS&E support staff will install an I/O in the Joseph Henry Building and full participation of the CS&E Board, its Panels, and interested elements of the Academy will be encouraged)

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

COMPUTER SCIENCE AND ENGINEERING BOARD

9th Meeting - Day Session

Room 200-A
Joseph Henry Building

January 8, 1969

AGENDA

GENERAL

1. Opening remarks by the Chairman on developments since the last meeting.

2. Report on developments in the computer export control field and the work of the CS&E Computer Export Panel - The Chairman.

3. Report on progress made in establishing a secure, all-source facility for the Computer Science and Engineering Board - The Chairman.

4. Status of plans for CS&E to enter computer network area - The Chairman.

5. Status of Plans for CS&E to enter standards field - The Chairman.

6. Status report on the National Programs Panel - Dr. Launor Carter.

7. Status report on the Data Base Panel - Dr. Sidney Fernbach.

8. Status report on the NSF survey - Dr. Miller.

9. Status report on the Educational Planning Group - Dr. Perlis.

10. Status of the proposal to undertake a study of Privacy, National Data Banks and Computers - Dr. Alan Westin.

11. Informal presentation on the interaction between computers and society by Professor Yngve, University of Chicago.

12. Informal presentation by Mr. Fred A. Powell, director of education, and Mr. Charles R. Bowen, manager of program development, IBM corporate headquarters, on recent studies on manpower needs in the computer field.

13. Status report on plans to undertake a comprehensive survey of manpower requirements in the computer science field - Dr. Bruce Gilchrist.

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14. Informal presentation by Mr. Robert Taylor, Director, Information Processing Techniques Advanced Research Projects Agency, on the operating philosophy and current research program of ARPA in the field of information processing techniques.

15. Presentation by Mr. Robert Landau of OST/COSATI on information processing philosophies, current information processing research efforts, and the forthcoming FIRST experimental data network being initiated by OST/COSATI. Mr. Landau's presentation will include a film, a brief talk and a hands-on demonstration of the I/O equipment to be used in the FIRST experimental network, as well as file query and file modification capabilities.

The FIRST presentation will begin promptly at 1:45 p.m. to assure correct timing for advance commitments on line and CPU time, which begin at 2:30 p.m.

NOTE--The CS&E support staff as a part of the FIRST experimental network will install an I/O station in the Joseph Henry Building and full participation of the CS&E Board, its panels, and interested elements of the Academy will be encouraged throughout the experimental period.

Tentative arrangements have been made for more detailed briefings on the information processing research and techniques development programs of ARPA and the CIA for the February meeting, should the interest of the Board so indicate.

ADMINISTRATIVE PLANNING ITEMS

16. Summer Study--We have reserved the period from July 13 to July 26 for a Summer Studies or conference program for the Board.

17. Scheduling of CS&E Board Meetings through April, May, June and July of 1969.

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D. C. 20418

Reply To: Aiken Computation Lab.
Harvard University
Cambridge, Mass. 02138

December 19, 1968

Professor Victor Yngve
University of Chicago
Chicago, Illinois

Dear Vic:

This is to confirm my invitation to you to meet with the Computer Science and Engineering Board on the morning of Wednesday, January 8. The meetings are held at the Academy building, 2101 Constitution Avenue. Prior to the meeting you will receive an agenda from Mr. Warren House, the Executive Secretary of the Board, who may be reached at AC202, 961-1386 in case of last minute changes in plans.

As I told you on the phone, I think the Board will be quite interested in your own work on the interaction between computers and society and will, I think, also be interested in the possibility you raise of using the $20,000 from Encyclopedia Britannica to sponsor a meeting on this general issue at Chicago during the first couple of days of July, 1969.

The critical issue, as we agree, is whether or not anyone can be found who is sufficiently interested in taking the time and energy to organize the meeting, solicit papers of appropriately high quality, and see the manuscripts through to publication with or without the aid of a paid editor. I think that several members of the Board may be interested and through the presence of Bruce Gilchrist, the Executive Director of AFIPS, and Don Madden, the Executive Director of the ACM, we might well be able to tap someone in those organizations.

Sincerely yours,

Anthony G. Oettinger

Dec 26, 1968

Dear Professor Yngve,

Delighted to have you attend the January Board meeting, You should receive on schedule an agenda in advance and we'll prepare a meeting book for you to use at the meeting. Please let me know about how much time you would like to have with the Board, either for direct presentation or for general discussion. I am copying Bruce Gilchrist and Don Madden in case they should like to chat with you prior to the meeting of the Board.

Warren House

js

cc: Warren House

cc: Tony

NATIONAL ACADEMY OF SCIENCES
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WASHINGTON, D.C. 20418

January 8, 1969

M E M O R A N D U M

TO : Computer Science and Engineering Board

FROM: Alan Westin

RE : Progress Report on Project to Study the Social Impact of Computer Data Banks

As board members may recall, a preliminary proposal was drafted and submitted for discussion to the Russell Sage Foundation on November 26, 1968. This version was also reviewed by the board at its December meeting.

On the basis of useful comments made by the Russell Sage Foundation staff and several board members, the proposal has been extensively rewritten, though its basic design remains. The changes have been checked through with the administrative staff at the National Academy of Sciences, and a new proposal is being drafted for submission this week to NAS, for formal presentation to the Foundation.

When copies of the revised proposal become available, they will be circulated to board members for their information.

The Trustees of Russell Sage meet in mid-February, and funds for the project, if it is approved, would be available immediately. Two potential field investigators for the project have indicated their willingness to participate if the project is approved. They are Professor O. E. Dial of the Joint Center for Urban Studies at Harvard and MIT, who is trained in both law and political science and has recently written a survey of urban information systems; and Lance J. Hoffman, a graduate student in computer science at Stanford University who has written a survey of computer safe guards for confidentiality and privacy that will appear in the ACM Communications. Hoffman expects to have his Ph.D. in June. A third potential staff member, Joel Cohen, of the Society of Fellows at Harvard University and a recent attendee at our board meeting, plans to indicate this week whether he will be free to join the staff or will accept an African ecology study that will have him away for the coming summer.

If and when the project is approved, the selection of the advisory panel will be of great importance in demonstrating the coverage of major view points and interests in the operation. At that point, I hope board members will offer suggestions for the best possible nominees from the various groups and communities to be represented.

JACK BROOKS
9TH DISTRICT, TEXAS

COUNTIES:
CHAMBERS GALVESTON
FORT BEND JEFFERSON
BRAZORIA*

all

COMMITTEES:
JUDICIARY
GOVERNMENT OPERATIONS
CHAIRMAN:
GOVERNMENT ACTIVITIES
SUBCOMMITTEE

Congress of the United States
House of Representatives
Washington, D.C.

FOR RELEASE
January 3, 1969

WASHINGTON, D. C.— "Use of computers in the legislative process of Congress could save billions annually," Congressman Jack Brooks (D-Texas) declared today as he introduced legislation to set up effective use of computers by the House and Senate. Under the Brooks legislation, the Comptroller General is authorized to acquire the computer capacity necessary to provide data needed by the Congress.

In explaining this legislation, Congressman Brooks stated, "Data processing has reached the point of development where it can be of material assistance to Congress in coping with the constantly increasing complexity and volume of data inherent in the legislative process. The time has come for Congress to make full use of these new capabilities.

"With a flow of more accurate, up-to-date information on government operations," Brooks continued, "better decisions could be made throughout the budget and appropriations cycle, deficiencies in government operations more easily corrected, and wastes and duplications more easily recognized.

"Computers," the Congressman continued, "could also be used to perform a number of other informational purposes in the legislative process. These include, maintaining the status of bills and resolutions that have been introduced, as well as the index of the Congressional Record. Prompt and effective data of this type would be of material assistance to individual Congressmen in evaluating the many complex proposals that are introduced in the House and Senate each year."

Under the Brooks proposal, responsibility for establishing and maintaining a congressional computer system would be delegated to the General Accounting Office. According to Brooks, the overall responsibilities of the GAO, the

"Congressional Watchdog" agency, closely coincide with the operations to be established. Much of the data to be processed in these systems for the Congress will also be needed by the GAO.

The Brooks proposal also provides for the development of a staff of specialized cost analysis experts in the General Accounting Office to assist the Congress in the analysis of legislation and appropriation requests. It also provides for the establishment of a Division for Budget Information and Analysis under the Comptroller General to assist in the performance of the duties and functions extended him under this legislation.

Brooks urged prompt action on this measure, declaring, "Based upon sound experience in business, industry, and Government, a significant increase in operational efficiency can be expected incident to the efficient and effective introduction and use of data processing. If data processing were to provide us with only a five percent increase in efficiency in handling budget and appropriation matters, the annual saving under present budgetary levels would exceed $5 billion annually."

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Proposed

AFIPS

Study of Manpower

in the

Computer Field

Prepared by:

Bruce Gilchrist
Executive Director

November 1968

I. Objectives

The aim of this study is to provide the industry and the profession with a firmer understanding of the manpower picture within the computer field. Attention will be concentrated on those manpower aspects which are likely to impact the growth of the industry. In general the depth of study will be proportional to the time and experience required to prepare an individual for a particular job classification. Thus, heavy emphasis will be placed on the programming manager, senior programmer and systems analyst categories.

Specifically the study will attempt to answer the following questions:

1. What is the current manpower availability in comparison with manpower requirements?

2. How are manpower requirements related to the "computing capacity" available at a given time?

3. What is the contribution of the various educational institutions (Universities, Colleges, Jr. Colleges, Trade Schools, etc.) to the manpower supply?

4. Is the gap between available manpower and required manpower closing?

5. How is the manpower picture likely to change over the next five years?

It is recognized that in order to attack these five questions it will be necessary first to agree upon a working set of job classifications and appropriate industry or functional groupings of jobs.

II. Need

For some time there has been a general feeling in the industry that the shortage of available manpower is a deterrent to growth. Quantitative data to support this qualitative statement have, however, been virtually non existent. In April 1966, for example, an AFIPS study found that estimates of the number of programmers at that time varied by a factor of 2 and estimates of the number required by 1970 varied by a factor of 4.

Recent difficulties encountered by many organizations in implementing large real time systems have frequently been blamed on the shortage of experienced managers and senior programmers. Turnover of employees in "software" firms have been reported as high as 35% per year - a clear concern to both employers and customers and a good indication of a shortage of trained personnel.

With the processing capability per dollar of cost going steadily up, the health of the computer industry depends on new applications being developed to use the ever increasing supply of computer power.

Some of the work will be generated by applications programs produced by the hardware manufacturers, but even well documented applications programs need people in the user installations for customization and operation. Thus both manufacturers and users will require a growing number of people for full exploitation of the increased computing power which is becoming available.

III. Plan of Attack

A one year study is proposed which would be divided into four phases as follows:

Phase I (2 months)

1. Definition of (a) occupational classifications to be included
   (b) appropriate industry and/or functional groupings
2. Determination of sample size and composition

Phase II (4 months)

1. Sample survey of computer installations to to determine employment patterns.
2. Sample survey of educational institutions to determine input patterns of students coming into the computing field.

Phase III (4 months)

1. Extrapolation from survey data to obtain national totals
2. Development of a model relating available computing power, manpower needs, and available manpower.

Phase IV (2 months)

1. Conclusions regarding existing manpower situation and projections for future years.

During Phases I and IV, use will be made of panels of experts drawn in part from the membership of AFIPS societies. These panels will ensure that the overall study starts and remains on a balanced course.

The major parts of Phases II and III will be subcontracted to a consulting organization with appropriate experience in the survey and modelling areas.

IV Personnel

It is estimated that the following personnel will be needed during the several phases:

Phase	AFIPS man months	Subcontract man months	Panel Member Days
I	3	2	20
II	5	8	
III	5	8	
IV	3	2	20
TOTALS	16	20	40

The 16 man months of AFIPS' time includes a full time research assistant and part time involvement of the Executive Director.

V. Cost

Based on the above personnel estimate and allowing for extensive travel during the Survey Phase (II), the total cost for the study is estimated at $125,000. Since AFIPS is a non profit organization, the cost estimate includes only directly attributable costs and overhead.

VI. AFIPS Qualifications

AFIPS is a non profit federation of professional societies all engaged in or closely related to the computer field. Currently there are eight member societies:

The Association for Computing Machinery

The Institute of Electrical & Electronics Engineers Computer Group

The Simulation Councils, Inc.

The Association for Computational Linguistics

The American Society for Information Science

The American Institute of Certified Public Accountants

The Society for Information Display

The Special Libraries Association

These societies have within their memberships almost all the senior computer professionals in the United States and a high percentage of all experienced programmers.

While AFIPS is probably best known for its semi annual computer conferences and exhibits, it has a growing number of activities in other areas of significance to the computer profession. Very pertinent to this proposal are two studies. The first was conducted in 1966 and resulted in a widely read report entitled "The State of the Information Processing Industry". The second is a study of the education, work experience, salaries, etc. of the membership of the AFIPS member societies, the Data Processing Management Association and the Numerical Control Society. A report based on the 30,000 completed questionnaires will be issued in December 1968. This report will be of great help in the conduct of the proposed study.

AFIPS is managed by a Board of Governors appointed by the member societies. Day to day operation of AFIPS is the responsibility of a full time Executive Director. For 1968-1969 the AFIPS Board of Governors and Officers are:

President	Paul Armer	Rand Corporation
Vice President	Richard Tanaka	California Computer Products, Inc.
Secretary	Arthur Rubin	Martin Marietta Corp.
Treasurer	Walter Hoffman	Wayne State University
BOARD OF GOVERNORS	B. A. Galler	University of Michigan
	Walter Hoffman	Wayne State University
	R. G. Canning	Canning Publications, Inc.
	J. D. Madden	ACM Headquarters
	L. C. Hobbs	Hobbs Associates, Inc.
	Richard Tanaka	California Computer Products, Inc.
	K. W. Uncapher	The Rand Corporation
	Samuel Levine	Bunker-Ramo Corporation
	J. E. Sherman	Lockheed Missiles & Space Corp.
	Harold Borko	School of Library Service, UCLA

Executive Director	Bruce Gilchrist
Executive Secretary	H. G. Asmus

Executive
Section

NATIONAL ACADEMY OF SCIENCES
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COMPUTER SCIENCE AND ENGINEERING BOARD

Executive Session

10th Meeting - February 4, 1969

1. Update on developments in the computer export problem and the work to date of the Export Panel, with a forecast of things yet to come (Canaday, Fernbach, Ling et al) UNCLASSIFIED

2. Discussion of the Summer Study programs to be held at Wood's Hole from July 13 to 26, inclusive.

   At the last Board meeting, the first week was reserved for a broad examination of the computer export problem, perhaps in the context of the U.S.-World technology balance.

   The second week was reserved for the conference being sponsored by the Education Panel, contingent upon appropriate funding being obtained. The Chairman is planning to spend several hours at a meeting on March 3rd of the Commission on Engineering Education of the Academy of Engineering and may have some thoughts on coordinative possibilities.

   UNCLASSIFIED

3. Report from Professor William Miller on the NSF Survey.

4. Draft report of "Reaction to Hoover Commission" -Dr. John Meyer

5. U. S. Office of education exchange.

NATIONAL ACADEMY OF SCIENCES
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ATTENDANCE LIST

Executive Session - February 4, 1969
Planned 8 p.m. Room 200-A Joseph Henry

Planned Attendees

Dr. Launor F. Carter
Professor Wesley A. Clark
Professor David C. Evans
Dr. Sidney Fernbach
Mr. Jerrier Haddad
Professor William F. Miller
Professor Stephen Fenves
Professor Anthony G. Oettinger
Mr. Kenneth Olsen
Professor J. Barkley Rosser
Dr. Alan F. Westin

Mr. John Griffith

Absentees

Dr. Glen J. Culler
Dr. John R. Meyer
Dr. Alan J. Perlis
Dr. John R. Pierce
Dr. J. C. R. Licklider

Guests

Dr. C. E. Sunderlin
Dr. Bernhard Romberg
Mr. Joel Cohen

Computer Export Panel Members

Mr. Rudd Canaday
Dr. Donald Ling
Dr. Joseph Berliner
(Prof. Anthony G. Oettinger)
(Dr. Sidney Fernbach)
(Dr. John Meyer)

Woods Hole

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

Reply To: Aiken Computation Lab.
Harvard University
Cambridge, Mass. 02138

January 15, 1969

Dr. Alan J. Perlis, Head
Department of Computer Science
Carnegie-Mellon University
Schenley Park
Pittsburgh, Pennsylvania 15213

Dear Alan:

Now that the Board has accepted the draft report of your education working group, I think the way is clear toward organizing the conference that you recommend. I trust that you have been in touch with Milton Rose and that you will keep me informed about the progress of your negotiations with NSF regarding the funding of the conference. Please let me have a draft proposal as soon as possible. Warren House and Gene Sunderlin can help you with what's necessary to make the budget format acceptable to the Academy's business office. I note, for example, that on page 7 of your report no figure for overhead is included.

Here is the list of additional names I promised you. The total size of your two groups should, of course, be governed primarily by your own wishes and by the limitations the physical accommodations at the Academy's site in Woods Hole. I trust you will settle the precise date in July with Warren House as soon as possible.

July 13-thru 26th

You will recall that noone on the Board had objections to the people now included on your list, but that there was a strong feeling that representation ought to be broader particularly with respect to knowledgeable users of computers and trained computer people. The following list is therefore biased in that direction to provide you ample opportunity for selection and enough alternatives to make up for any refusals you might get on first approaches. Perhaps the only one on that list whom I feel very strongly about is Andrew Schultz, Dean of the Engineering College at Cornell University, who as a replacement for or in addition to Myron Tribus on your list would leaven the group with a dean who is not as ardent a convert and proselytizer as Myron is. My list is a composite of suggestions supplied by various members and observers of the Board. In each case, I know the man personally or else he has been strongly recommended by someone who knows him very well. The number of names on your list and mine is also large enough to enable you to attain a reasonable geographic balance without in any way

'25?

Alan - Here are the 60's for work at Woods Hole. Tony is thinking about asking the 15th week if overlap between the CS&E B.C and the Science Advisory Board, which includes Foster of DoD. Jr Warren

compromising quality.

Andrew Schultz, Dean of Engineering College, Cornell University

Charles Bowen or Fred Powell, IBM (you have met both gentlemen and might wish to pick one of them to help supply background of the kind that they presented to the Board at our January meeting)

William F. Sharpe, UCLA and RAND (Sharpe has recently written a book called "The Economics of Computers". This is concerned primarily with problems of equipment, but Bill is an economist who has made lots of use of computers as work in the Computer Science Department at University of Washington and continues to pursue interests in both computer science and economics at UCLA)

Chuan Chu, Vice President and Assistant General Manager, Honeywell Data Processing, Wellesley, Mass.

Ross McDonald, Vice President and Director of Research, Texas Instruments, Dallas, Texas.

Simon Ramo, Bunker-Ramo Corporation

Ed Jacks, General Motors Corporation

Charles Missler, Manager, Computer Applications/Engineering Staff, Ford Motor Company, Dearborn, Michigan

Jordan Baruch, EDUCOM, Boston, Mass.

Isaac Nehama, International Computing Company (he is located in the Maryland suburbs of Washington; you will recall that he was responsible for the AFIPS manpower study and through his background at Bell Telephone Laboratories later working with the computer problems of both the Gemini and the Apollo Project and now with his own software firm, he has considerable experience that would be quite relevant to your effort)

Jerry Noe, University of Washington, Seattle (Noe collaborated with Bank of America in one of the earliest bank computer developments; has been at Stanford Research Institute since then and recently has become Chairman of the Computer Science Department at the University of Washington)

Walter Ramshaw (Walter was with United Aircraft for many years and two or three years ago took charge of data processing efforts in one of the Hartford hospitals.)

Burton Colvin, Boeing Scientific Research Laboratory

George Michaels, Livermore

Donald L. Farr, Assistant Chief of Engineering, Data Systems Division, Autonetics Corporation

George A. Garrett, Director, Information Processing, Lockheed Missiles and Space Company, Sunnyvale, California

Roger Lazarus, Head, Computer Division, Los Alamos Scientific Laboratory, Los Alamos, New Mexico

Charles DiCarlo, President, St. Lawrence College

Arnold Pratt, NIH

Earl Althoff, Joint Computer Evaluation Group, Eastman Kodak, Bldg. 205, Kodak Park, Rochester, New York

Charles Briggs, Central Intelligence Agency

Ruth Davis, National Library of Medicine

Howard Campaigne, National Security Agency

Walter Baer, Office of Science and Technology

Ned Irons, Institute for Defense Analyses (Princeton)

Paul Brock, NASA, Houston, Texas

I think that this should be enough for you to select from! If you need any help, just holler! Best regards.

Sincerely yours,

Anthony G. Oettinger

js

cc: Warren House
John Pierce
C. L. Sunderlin

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

TO: Warren House

FROM: Tony Oettinger

DATE: January 30, 1969

I saw Al Perlis on January 24 and agreed with him that July 20-26 would be reserved for his study at Woods Hole, leaving the week from July 13-19 for the Export study. Having those date assignments nailed down should now help us firm up our planning for both events.

js

TO: NATIONAL ACADEMY OF SCIENCES
(Computer Science & Engineering Board)

FROM: John R. Meyer (Nat'l Bureau of Economic Research)

DATE: January 13, 1969

SUBJ: Reaction to "Hoover Commission"

A strong possibility seemingly exists that the Nixon Administration will convene a new "Hoover Commission" to review managerial practices in the federal government. If such comes to pass, it would seem to offer an excellent opportunity to evaluate the role and capabilities of computers as an administrative or managerial tool in the federal establishment.

Such a review would seem justified on several grounds. To begin, a suspicion exists that possibly the computer has not been used as effectively as a managerial tool within the public as the private sector. As stated, this is merely a suspicion; formal documentation of the point is certainly lacking. Nevertheless, a good deal of informed opinion tends to this view.

This is not to assert that computers are not used in the federal establishment. Clearly, they are and in very large numbers. As is well known, the federal government is the single largest customer of the computer industry. It has also shown foresight and a commendable willingness to bear risks in developing new and better computers on numerous occasions.

The question, rather, concerns the use made of the computer within the government as an aid to management and particularly whether that use is as effective as it should be. Above all, the question arises of whether the "information revolution" induced by the computer has really permeated public managerial procedures in the way that it should if the computer is to make a maximum contribution to improving government administrative practice.

In this context, it should be noted the computer is not envisaged as simply a device for reducing data processing costs or the total clerical or computational bill. It is a commonplace that computer installations very often do not create the "savings" that "justified" or otherwise rationalized the original sale of the computer. But while the expected "savings" sometimes do not materialize, the computer application usually does result in some jobs being done more thoroughly or better or entirely new tools being undertaken. In particular, management, after replacing clerical help with computers, often steps up demands for information or for the speed with which information is processed.

Often, this non-realization on "expected cost savings" is taken as a sign of failure. It is highly probable that computers have been applied where they should not have been. Nevertheless, to observe that the total clerical bill does not always decline when a computer is installed is hardly significant evidence of failure. Rather, it could be a sign that the com-

puter was simply sold on improper grounds.

Indeed, there are some rather good economic reasons why one would not necessarily expect the total clerical bill to decline with the advent of computers --- the same arguments as apply to other major technological innovations. For example, it is quite obvious that the "total transportation bill" of most modern societies has not declined when animal power has been supplanted by machine: in fact, it usually is higher today. It would quite obviously be difficult even to conceive of operating a modern economy on a transportation system geared mainly to animal power, such as was available one hundred or so years ago. Increasingly, much the same applies to the computer: it would simply be infeasible to operate a modern and complex society or economy in many cases without the availability of large computers.

The phenomenon observable in these cases of major technological change is described by economists as a case where the price elasticity of demand for a service or product is greater than unity. This means that the total consumption of the good or service simply rises more than proportionally to any price reduction. That is, if you observe a 10% reduction in the unit price or cost of rendering a particular service, a greater than unity price elasticity would imply that you would observe more than a 10% increase in the quantity consumed. There are many goods or services for which greater than unity price elasticities

seem to hold. To put it quite simply, if you make a good thing cheap enough, you should not be terribly surprised if people spend more rather than less on it as its price is reduced.

The essence of the "computer revolution" then, is that information becomes relatively cheap and as a consequence, larger amounts of information are consumed or used. In fact, the increase in consumption of information may rise to the point where the total bill for processing or obtaining information actually goes up even though the unit cost of obtaining that information falls dramatically. From the standpoint of managerial practice, the real question then becomes just exactly what does the increase in availability and quality of information really imply?

The direct effects are reasonably obvious. Management demands and receives good information more promptly than before. Customers are also benefited. More and better analyses of data are usually brought to bear upon individual management decisions. Management feels free to go back to subordinates and to ask that additional numbers be processed or additional facts be obtained before reaching decisions in marginal or difficult cases. Simply put, demands are made for analyses that just simply could not have been conceived or rationally requested before the computer. As a consequence, fewer decisions are made on the basis of hunch or so-called "rules-of-thumb", or other simple short cuts that tend to reduce the information requirement.

The indirect effects upon management of the computer information revolution may, however, be more important than the direct effects. Indeed, it seems hihgly likely we do not even yet understand fully what all of these indirect influences might be.

Perhaps the most obvious of these secondary effects concerns personnel policy. When the computer comes on the scene, the personnel requirements for the organization tend to shift in important ways. Fewer clerical people performing in a rote way are usually needed, or at any rate, those that are required, tend to need slightly different skills, such as key-punching, rather than those previously used. Almost certainly, more people with mathematical and analytical skills will be sought for employment. This change in recruitment policy, in turn, can have subtle effects upon the organization overtime. It not only changes the quantities of different talents or skills available for promotion, but also tends to influence those particular talents singled out for more responsibility.

Similarly, to the extent that adoption of new technologies attract the more venturesome and imaginative elements in the work force, it may be that the organization that accelerates computerization may find itself with a better quality or at least more flexible and innovative work force.

ROUGH DRAFT

One might also speculate that the advent of the computer could alter personnel policies at the other end of the age spectrum, that is at the point of retirement as contrasted with recruitment. Organizations, of course, may adapt their retirement or promotion policies with the advent of the computer in quite different ways. Some, for example, may go over to an early retirement policy. Others quite possibly may avoid an acceleration of retirements, but instead shift jobs of senior personnel.

Needless to say, alterations may also occur in terms of personnel policies at intermediate stages of the employment process, that is between recruitment and retirement. Thus, with the advent of computers, the reaction of the firm to prospective employment switches or withdrawals may change: for example, the organization may find itself more willing to accommodate itself or accept attrition of clerical employees.

Whatever the particulars, it's quite clear that there are many ways in which personnel policies and organizational development might be altered with the advent of the computer and almost certainly are to some extent within the private sector of the economy. And several questions for the public administration arise from all of this. For example, do civil service rules and other rigidities that characterize employment relationships in government inhibit the best use of computers in government: Does governmental observance of rather strict seniority rules tend

to insure that government administrators realize fewer managerial advantages from computerization than would otherwise be the case?

Once one has posed these questions, considerations of their ramifications leads one into many speculations. For example, it is often observed that many sectors of the so-called service industry, and in particular medicine and government, have lagged badly in terms of productivity gains compared with other sectors of the economy. One obvious comparison to make would be to ascertain whether certain kinds of government record keeping or bookkeeping activities (and that after all constitutes a fairly considerable proportion of total government activity) have experiences the same gains in productivity as equivalent record keeping or bookkeeping activities in the private sector?

But, if true, the real implications of less than full participation in managerial aspects of the information revolution for government productivity may go much deeper. Specifically, if government hiring and personnel policies have not or are not able to adapt in the same way as those in the private sector to the advent of the computer or other technological changes, you may induce personnel selection policies that are self-reinforcing and negative. For example, government might not have been able to recruit its "fair percentage" of the more imaginative and innovative spirits in recent college generations. Over time, the price that one might pay for this, if true, in terms of government efficiency could be quite substantial.

ROUGH DRAFT

Of course, it's entirely possible that such a price is justified on broader social grounds. We may not want government to be all that efficient. Some ~~stock~~ slack in government performance may seem justified as a disguised form of "work relief".

Nevertheless, if that is the public decision, it would appear better that it not be made totally unconsciously (if not too consciously either). At least, some rough calculation should be made of the costs of "work relief" rendered in this fashion as against other alternatives. If there is any merit in the notion that the computer has not made the same contribution to public as to private administration, and that the costs of this omission can accumulate over time, then these inefficiencies could be a quite expensive means of creating jobs. Finally, but perhaps most importantly, one can also wonder whether "deliberate inefficiency" is ever a very constructive approach to alleviating unemployment.

In general, it would seem far better to emphasize the positive. In particular, there should be exploration of how adaptations in government administrative procedures and personnel policies might make government agencies better able to exploit the capabilities of the computer and other new technologies. An important dimension, in short, for any new "Hoover Commission" to consider is the extent to which government administrative practices hinder or aid adaptation to new managerial technologies, broadly construed.

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D. C. 20418

Reply To: Aiken Computation Lab.
Harvard University
Cambridge, Mass. 02138

January 14, 1969

Professor Patrick Suppes
Institute for Mathematical Studies
in the Social Sciences
Ventura Hall
Stanford University
Stanford, California 94305

Dear Pat:

Many thanks for your comments about approaching the U. S. Office of Education. I like your suggestions, and will keep you informed of what materializes as a consequence of following through with them. Best regards.

Cordially,

Anthony G. Oettinger

js

bc: ✓ Warren House
John Griffith
John Pierce

*** Dear Warren: I'd like to take up this Suppes/US Office of Education matter at our evening executive meeting in February. Please put it on the agenda.

T.O.

2/5 February Mtg

STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94305

INSTITUTE FOR MATHEMATICAL STUDIES
IN THE SOCIAL SCIENCES
Ventura Hall

January 6, 1969

Professor Anthony G. Oettinger
Aiken Computation Laboratory
Harvard University
Cambridge, Massachusetts 02138

Dear Tony:

I write in response to your letter of December 19. I do have one or two suggestions that just possibly might be effective in determining the future policies of the U. S. Office of Education with respect to computers. The first suggestion is that you as Chairman attempt to talk about general policy with the new Commissioner of Education, once he is named. Falling short of this, I would suggest you contact the Associate Commissioner, Norm Boyan. The difficulty with Boyan is that he will almost certainly be leaving in a few months. It might be wise perhaps to wait until the new Associate Commissioner for Research is appointed. I do think it would be very appropriate for you to approach him and ask what kind of liaison could be set up between the Board and the Bureau of Research in the U. S. Office of Education.

I rather suspect that if a contact is successful you will know what to do from that point onward and certainly need no suggestions from me.

If one of these two approaches, either to the Commissioner or to the Associate Commissioner for Research, does not work, perhaps you and I can talk about other strategies which would involve approaching other people in the hierarchy, but I would recommend having a bang at the top first.

Best of luck and a Happy New Year.

Cordially,

Pat

Patrick Suppes

PS:dk

INFORMATION SYSTEMS
IN EDUCATION
PROJECT ISE

ASSOCIATED UNIVERSITIES, INC.
1717 MASSACHUSETTS AVENUE, N. W.
WASHINGTON, D. C. 20036
202-462-1676

PROJECT ISE

Summary of Status--September 15, 1968

Description:

Project ISE is a one year project whose purpose is to study the needs for information systems in higher education and to consider the establishment of a national center as a mechanism for helping meet such needs. Project ISE is placing major emphasis on the problems in the information sciences which are so large that no single university or small consortium of institutions can handle but are of such nature that their solution will be of use to a large number of the approximately 2,500 institutions of higher learning in the United States.

The Project is funded by a grant of $150,000 from the National Science Foundation made in March of 1968 to the Associated Universities, Inc.

Project Staff:

The Project was initiated April 1, 1968, when Dr. John A. Hrones, Provost of Science and Technology, Case Western Reserve University, assumed the directorship of the Project. In addition, the following staff has been assembled:

Charles Blair, Associate Director (May 27, 1968)
Lloyd Slater, Assistant to the President of AUI (June 1, 1968*)
** Anita Magnus, Research Associate (April 15, 1968)
Shirley Hamilton, Secretary (May 1, 1968)

Advisory Committee:

An Advisory Committee, national in character and representing various institutional interests, has been appointed. A list of members is attached. A Steering Committee has been appointed with members selected from the Advisory Committee. Dr. T. K. Glennan is Chairman of both committees.

(*on loan from AUI one-half time)
(**resigned Sept. 30, 1968)

INFORMATION SYSTEMS
IN EDUCATION
PROJECT ISE

ASSOCIATED UNIVERSITIES, INC.
1717 MASSACHUSETTS AVENUE, N. W.
WASHINGTON, D. C. 20036
202-462-1676

Summary of Status-2
August 28, 1968

Trustees Committee:

The AUI Board of Trustees has appointed a committee to assist in the Project direction. Its members are:

Dr. Carl C. Chambers, Vice President for Engineering Affairs
University of Pennsylvania

Dr. Ralph S. Halford, Special Assistant to the President
Columbia University

Dr. Peter T. Demos, Director, Laboratory for Nuclear Science
Mass. Institute of Technology

Dr. Thomas Gold, Department of Astronomy
Cornell University

Dr. Bruce J. Partridge, Vice President for Admin. and Treasurer
The Johns Hopkins University

Provost Charles H. Taylor, Jr.
Yale University

Plan of Project Activities:

The planned activities are concerned with the three major areas of college and university operations -- instruction, research and administration. In addition, two large, long-range problems of central importance, the library, and computer resource sharing, are being examined. The method of attack is:

1. To conduct a quick bibliographic search in each area,
2. To list active projects in areas of concern and the leader of those projects,
3. To draft a summary of findings in each area,
4. To discuss draft of summary of findings with:
   a. Steering Committee
   b. Advisory Committee
   c. Representatives of institutions of higher learning
   d. Other interested parties
5. To conduct workshops involving outstanding people for the purpose of firming up recommendations for action,
6. To summarize findings and recommendations in report with appropriate distribution.

INFORMATION SYSTEMS
IN EDUCATION
PROJECT ISE

ASSOCIATED UNIVERSITIES, INC.
1717 MASSACHUSETTS AVENUE, N. W.
WASHINGTON, D. C. 20036
202-462-1676

Summary of Status-3
August 28, 1968

Status of Project:

1. Staff was completely assembled by June 1, 1968.
2. Bibliographic search has been conducted in three of the four work areas -- instruction, administration, the library.
3. A first draft summarizing findings has been prepared in these three areas.
4. Work on the research area has commenced.
5. A first model has been drafted of an organization to make possible resource sharing of information systems assets of an area encompassing approximately 200 institutions of higher learning.
6. Four meetings of the Steering Committee have been held.
7. Two meetings of the Advisory Committee have been held.
8. The Project Director, Associate Director, and Chairman of the Advisory Committee have shared visits to a number of colleges and universities including:
   - University of Massachusetts
   - Dartmouth University
   - Harvard University
   - Massachusetts Institute of Technology
   - University of Dayton
   - University of Rochester
   - Brooklyn Polytechnic Institute
   - University of California-Berkeley
   - Stanford University

   A meeting was held with the Executive Committee of the Cooperating Institutions of New England and also with members of the Dayton-Miami Valley Consortium. In addition, visits have been made to the Educational Testing Service and the Bell Telephone Laboratories.
9. Plans and arrangements for six regional 1-day seminars are now being made. The intention is to reach a substantial number of all the colleges and universities of the country.
10. Plans and arrangements for five workshops will be commenced early in September.

INFORMATION SYSTEMS
IN EDUCATION
PROJECT ISE

ASSOCIATED UNIVERSITIES, INC.
1717 MASSACHUSETTS AVENUE, N. W.
WASHINGTON, D. C. 20036
202-462-1676

ADVISORY COMMITTEE

CHAIRMAN

T. Keith Glennan..... Assistant to the Chairman
The URBAN COALITION
Former President, Associated Universities, Inc.

MEMBERS

F. E. Balderston..... Vice President-Planning and Analysis
University of California at Berkeley

G. Octo Barnett..... Laboratory of Computer Science
Massachusetts General Hospital

Edward H. Bowman..... Comptroller, Yale University

John G. Caffrey..... Director, Commission on Administrative Affairs
American Council on Education

Edward E. David, Jr..... Executive Director of Research
Communications Systems Division
Bell Telephone Laboratories, Inc.

George E. Forsythe..... Executive Head, Computer Science Department
Stanford University

Edward L. Glaser..... Director, Jennings Computing Center
Case Western Reserve University

John W. Hamblen..... Project Director, Computer Science
Southern Regional Education Board

Howard W. Johnson..... President
Massachusetts Institute of Technology

Clark Kerr..... Chairman, Commission on the Future of
Higher Education
Carnegie Foundation

Frederick G. Kilgour..... Director
Ohio College Library Center

Henry Chauncey..... President
Educational Testing Service

INFORMATION SYSTEMS
IN EDUCATION
PROJECT ISE

ASSOCIATED UNIVERSITIES, INC.
1717 MASSACHUSETTS AVENUE, N. W.
WASHINGTON, D. C. 20036
202-462-1676

ADVISORY COMMITTEE
continued

Thomas Kurtz ..... Director, Kiewit Computation Center
Dartmouth College

Roger Levien ..... Head, System Sciences Department
The RAND Corporation

Richard G. Mills ..... Director, Information Processing Services
Massachusetts Institute of Technology

Philip M. Morse ..... Director, Operations Research Center
Massachusetts Institute of Technology

Joseph B. Platt ..... President, Harvey Mudd College

Ithiel de Sola Pool ..... Chairman, Political Science Department
Massachusetts Institute of Technology

Wesley Posvar ..... President, University of Pittsburgh

Joseph Raben ..... Computers and the Humanities
Queens College

Blair Stewart ..... President
Associated Colleges of the Midwest

Don R. Swanson ..... Dean, Graduate Library School
University of Chicago

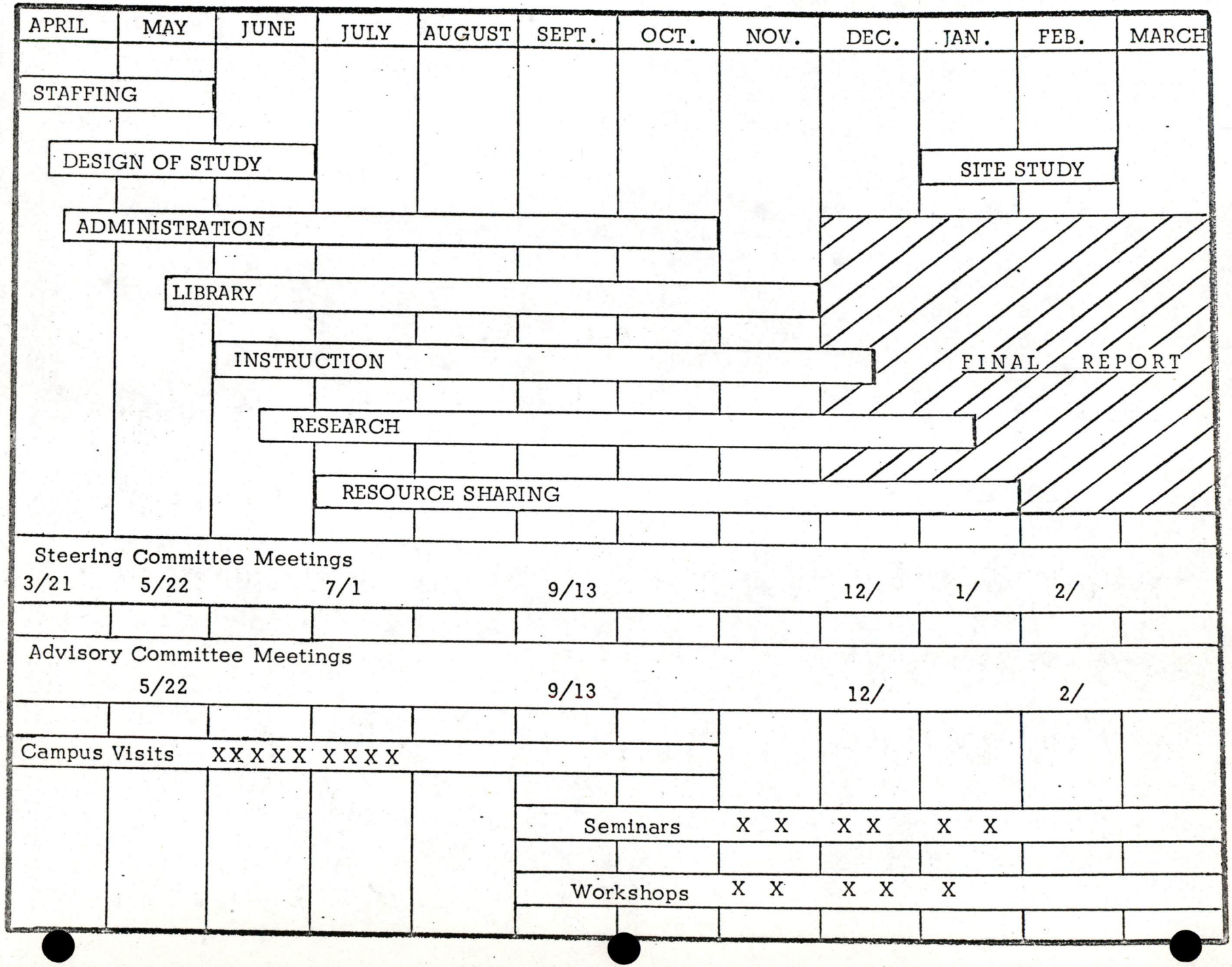
Fred M. Tonge ..... Director, Computing Facilities
University of California at Irvine

W. Allen Wallis ..... President, University of Rochester

Lawrence Weed, M.D. ..... Director, Out-Patient Clinic
Cleveland Metropolitan General Hospital

Norman Zachary ..... Director, Computing Center
Harvard University

PROJECT ISE ACTIVITY CHART



Day Session

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

COMPUTER SCIENCE AND ENGINEERING BOARD

Day Session

10th Meeting - February 5, 1969

1. Opening remarks by the Chairman on significant developments since the last meeting.

2. Report on developments in the computer export problem -- The Chairman

3. Status reports on:

   -Plans for CS&E to enter the information systems field-- The Chairman

   -Plans for CS&E to enter the standards area--The Chairman

   -The National Programs Panel work--Dr. Launor Carter

   -The Data Base Panel work--Dr. Sidney Fernbach

   -The NSF survey work--Dr. William Miller

   -The Education Panel's summer conference, including funding-- Dr. Alan Perlis

   -The proposal to study Privacy, National Data Banks and Computers--Dr. Alan Westin

   -The proposal to undertake a comprehensive survey of manpower requirements in the computer science field--Dr. Bruce Gilchrist

4. Discussion of the Summer Study program at Woods Hole on computers and computer technology transfer, perhaps in the context of the U.S.-World technology balance.

5. Administrative items.

6. Other.

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

ATTENDANCE LIST

Computer Science and Engineering Board
February 5, 1969

Planned Attendees

Board Members

Dr. Launor F. Carter
Prof. Wesley A. Clark
Prof. David C. Evans
Dr. Sidney Fernbach
Mr. Jerrier Haddad
Dr. John R. Meyer
Prof. William F. Miller
Dr. Nathan M. Newmark
Prof. Anthony G. Oettinger
Mr. Kenneth Olsen
Dr. Alan J. Perlis
Prof. J. Barkley Rosser
Dr. Alan F. Westin
Mr. John Griffith, Consultant

Observers

Dr. Walter Baer
Mr. Bradley Byers
Dr. John Egan
Dr. Bruce Gilchrist
Dr. Herbert Grosch
Mr. Newman Hall
Ann Marie Lamb
Mr. Robert Landau
Mr. Donald Madden
Mr. Richard McCann
Mr. Arthur Melmed
Dr. Milton Rose
Dr. Charles V. L. Smith
Mr. Robert Taylor
Mr. Bernard Urban
Dr. Bruce Waxman
Mr. Charles Witter

Guests

Mr. Charles Yost
Mr. Robert Howard
Mr. C. E. Sunderlin
Mr. Joel Cohen
Dr. Romberg
Mr. Herman Fasteau

Absentees

Board Members

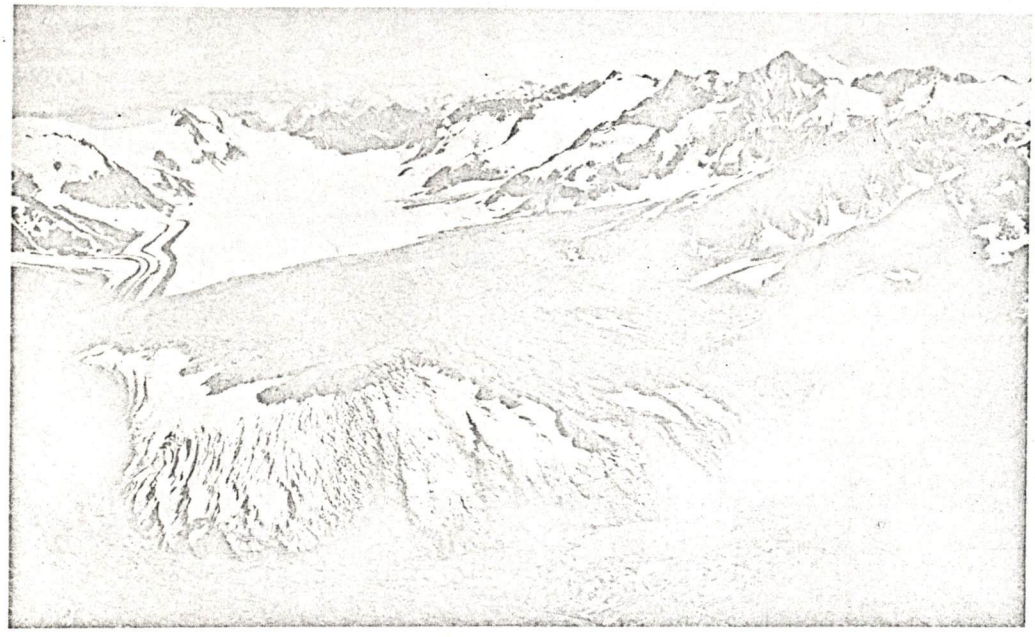
Dr. Glen J. Culler
Dr. John R. Pierce
Dr. J. C. R. Licklider

Observers

Mr. Ernest Baynard
Mr. David Beckler
Dr. Hood Roberts
Prof. Laurence Tribe

News Report

NATIONAL ACADEMY OF SCIENCES • NATIONAL RESEARCH COUNCIL • NATIONAL ACADEMY OF ENGINEERING



AUSTIN POST, U.S. GEOLOGICAL SURVEY

Massive rock avalanches like this one onto Sherman Glacier were triggered by the earthquake.

Alaska Earthquake First To Show Global Hydrological Effects

At 5:36 p.m. on Good Friday, March 27, 1964, a devastating earthquake hit south central Alaska, releasing in three to four minutes twice as much energy as the earthquake that destroyed San Francisco in 1906. One hundred fifteen persons were killed in Alaska, $300 million worth of public and private property was destroyed, and the state's economy was crippled. The quake's magnitude, duration, and geographical scope rank it among the major earthquakes of history. That the death toll was not many times higher was due to a happy combination of several chance elements: the sparse population, the fortuitous timing (the earthquake occurred on the evening of a holiday, when schools were empty and most offices deserted), a low tide, the absence of fire in residential and business areas, the generally mild weather, and the fact that it was the off-season for fishing.

Since then, the Alaska earthquake has become the best documented and most thoroughly studied in history. Accurately described as a "natural scientific experiment on a grand scale," it has provided insights into a host of long-standing scientific problems.

Now, the first report in what will eventually be an eight-volume series on the earthquake has been published by the National Academy of Sciences. With the over-all title *The Great Alaska Earthquake of*

(continued on page 2)

Commission on Engineering Education Becomes Unit Of Engineering Academy

On January 1 the Commission on Engineering Education, Inc., officially became the Commission on Education of the National Academy of Engineering. The 20 persons on the Board of Directors of the previously independent organization, incorporated in April 1963 in the District of Columbia, are now members of the Commission on Education. Gordon S. Brown, an NAE member and *Dugald C. Jackson Professor of Engineering* at Massachusetts Institute of Technology, is chairman.

The move is expected to strengthen the programs of the Commission. At the same time, the NAE will be able to draw on the experience and established projects of the Commission as it begins work on educational needs.

The Commission on Engineering Education was one of seven commissions organized several years ago as a result of a charge to the National Science Foundation to become concerned with the far-reaching problems of improving undergraduate education in the sciences, mathematics, and engineering. NSF gave initial funding to establish a small office and hold exploratory meetings of engineers from industry

(continued on page 7)

Medical Guides Offered To Help Improve Design Of 'Unsuitable' Ambulances

Most ambulances in the United States do not provide enough space or equipment for even the minimum emergency care necessary in potentially fatal accident situations, according to a new report of the Committee on Emergency Medical Services of the National Research Council.

The committee concludes that "most ambulances in this country are unsuitable, have incomplete fixed equipment, carry inadequate supplies, and are manned by untrained attendants."

The report emphasizes that the mortician's vehicle and the station wagon, commonly used as emergency vehicles, do not provide sufficient space for the necessary equipment or the carrying out of modern resuscitative procedures either at the accident scene or during transportation.

With accidental injuries the leading cause of death in the first half of life's span, action must be taken to develop and enforce nationwide standards for ambulance services, the report states. It notes that only 10 states have statutes requiring that any equipment be carried by an ambulance, and the federal guidelines for motor vehicle safety do not cover the special features necessary to safe transport of the critically ill or injured.

Medical Requirements for Ambulance Design and Equipment, (see "New Publications," p. 8), prepared with financial support from the Division of Emergency Health Services of the U.S. Public Health Service, represents the second stage in the committee's efforts to develop nationally acceptable standards for ambulance design and for the equipment to be used by ambulance personnel. The report stresses that any vehicle not designed and equipped to respond to emergency calls should not be

(continued on page 8)

CONTENTS

JANUARY 1969 • XIX No. 1

Engineering Education

(continued from page 1)

and education. Most of the programs that materialized were separately financed by NSF or private foundations and eventually turned over to another organization for continuation or dissemination, with the Commission continuing only as an adviser, monitor, or coordinator.

The development of Engineering Case Studies as an educational resource, for example, was a program begun with Commission encouragement but financed, first, at Stanford by NSF, and more recently, at the University of California, Berkeley, by Ford. The Engineering Concepts Curriculum Project (ECCP), a high school course to teach the theories and techniques that contribute to our technological civilization, was developed by the Commission with a grant from NSF. Course materials include a textbook, *The Man-Made World*, laboratory experiments, and special equipment. The project is now administered by Polytechnic Institute of Brooklyn, but the Commission is investigating an adaptation of the program for liberal arts colleges, two-year colleges, and vocational schools.

Moving Toward New Concept

Originally charged with developing a program focusing on faculty and institutional development, learning materials, and student motivation, the Commission is now moving toward the broad concept of educational systems design and the interface between engineering education and the social and physical sciences. This evolution is the natural outgrowth of some of its more specific programs, such as the Design Laboratory Workshops, involving faculty with their students in real engineering situations having social, economic, and political implications. Another is the Engineering Concepts Curriculum Project, with its strong orientation toward information systems.

BUILD (Bi-University Institutional Liaison for Development) is a pilot project now in its fourth year testing the feasibility of combining the engineering resources of a large, well-established university with those of a smaller, but rapidly developing university. It has stimulated programs benefiting engineering education beyond the immediate interests of the two participating schools, the University of Illinois and the University of Colorado. Under consideration is a proposal for a Center for Laboratory Oriented Studies and Experimentation (CLOSE). In addition, a conference is being organized under BUILD auspices to consider specific ways to make engineering education more relevant to social problems.

Studying Computer Uses

The Commission's involvement with the computer began with a project at the University of Michigan in 1965 to study the use of computers in engineering design education. Currently, it is sponsoring the COSINE program, a study of the role of computer related subjects and the use of computers for teaching in electrical engineering. This program has also laid the groundwork for similar activities in other fields of engineering. A Committee on Computer Animation, with membership from physics, chemistry, mathematics, and engineering, is experimenting with this technique, which has great potential in presenting concepts by film without the irrelevancies that are impossible to eliminate in the usual studio film.

The Teaching Aids Committee has been building extensive background material on computer-aided instruction and educational television. A preliminary document for NAE's Technological Assessment Committee has been completed as the basis for more intensive investigation, particularly concentrating on integration of the computer in the educational system.

The Commission has also published two nontechnical books about engineering.

The Commission on Education is now permanently quartered in NAE offices on the sixth floor of the Joseph Henry Building in Washington. The full-time, permanent staff has been retained: Newman A. Hall, Executive Director and a member of the Commission; David C. Miller, Senior Staff Associate; and Jean P. Moore, Administrative Assistant.

Panel Meetings

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

ATTENDANCE LIST

Data Base Panel
February 5, 1969 - 3 p.m.
Dr. C. Fernbach, Chairman

Planned Attendees	Absentees
Margaret Fox	Robert M. McClure
Chris Shaw	Paul Armer
Sidney Fernbach	
William F. Raub	
Patrick J. McGovern	
John Hamblen	
C. A. Phillips	
Ann Lamb	
Don Madden	
Bruce Gilchrist	

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

January 17, 1969

Dear

This is to notify you that the next meeting of the Data Base Panel will be held on the afternoon of the next Board meeting, February 5, 1969, at 3 p.m. It will be held in room 200-C of the Joseph Henry Building, 21st and Constitution Avenue, N.W., Washington, D.C. Enclosed are the minutes from the last meeting and a copy of the National Academy of Sciences publication "Guidelines" which outlines some of the functions and responsibilities of Panel Members.

The agenda will consist of reports of the panel on computer service and application, requested by Dr. Fernbach at the last meeting.

Please signify on the enclosed sheet whether or not you will be attending and what accommodations you will need, if any. Please let me know at least 5 days before the meeting as to your attendance.

Sincerely,

Karen T. Chamblee

Karen T. Chamblee
Secretary for
Warren C. House

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

COMPUTER SCIENCE AND ENGINEERING BOARD

Minutes
Meeting #1

DATA BASE PANEL

January 7, 1969

Attendance:

Dr. Sidney Fernbach	-	Chairman
Dr. William Raub	-	Member
Dr. John Hamblen	-	"
Dr. Ann Lamb	-	"
Dr. A. Oettinger	-	Visitor
Mr. Joseph Kasputys	-	"
Dr. Bruce Gilchrist	-	"

Dr. Oettinger discussed briefly his views of the mission of this panel namely, "to develop knowledge and data on the present status of the computer industry, identify the gaps of areas in which information or data are inadequate or unsatisfactory, make recommendations on what actions should be taken."

As a starting point Dr. Gilchrist outlined some recent work by his organization which highlighted the absence of data on the need vs supply of programmers. Other questions were raised such as, "How many computers are now in operation and expected, what is manpower requirement for this, also for subsidiary services.

The Bureau of the Budget raised the problem that civil service data probably will not give correct data because of their method of job classification. This raised a point of the significance of the data that may develop and the need to ask the proper questions.

Dr. Hamblem cited a report and follow up survey he is undertaking on the status of computer technology in higher education. Some of these data can be made available to the panel.

In order to make a start and to serve as trial balloons the members of the panel were requested to prepare, prior to the next meeting, a listing of the data - or source of data - known to them that would pertain to computer service and application, especially on data available on computer population, where the data is, how to get it and how good is it. Cover manpower needs, machines, auxiliary services, etc.

CS&E Board - Meeting #1
Minutes - DATA BASE Panel - January 7, 1969

Copies of this report should be sent to Mr. Warren House, N.A.S. by January 24 for his reproduction, assembling and transmittal to others on the panel.

It was also recognized that other panels may feed in questions on data needs, which can be handled as received.

The possibility of additional members to broaden the coverage was discussed and the chairman received several suggestions.

The next meeting is scheduled for February 5, about 3:00 P.M., following the Board Meeting of that day.

SOUTHERN REGIONAL EDUCATION BOARD

130 SIXTH STREET, N. W. · ATLANTA, GEORGIA 30313 · 875-9211

January 17, 1969

Dr. Sidney Fernbach
Chairman, Data Base Panel
Engineering and Computer Science Board
National Academy of Science
2101 Connecticut Avenue
Washington, D. C. 20418

Dear Sid:

As per our discussions at the meeting of the Data Base Panel (I would like to suggest Information Base Panel as a name since it seems more appropriate for what we are likely to do) I submitt the following items for our initial collection of information or data studies on computers in education:

A. Published:

1. Hamblen, John W.
   Computers In Higher Education: Expenditures, Sources of Funds, and Utilization for Research and Instruction 1964-65 with Projections for 1968-69 (NSF supported study) Southern Regional Education Board, Atlanta, 1967, 325 pp., $5.50.

2. Keenan, T. A.
   Sixth Survey of University Computing Facilities, University of Rochester, Rochester, N. Y., 1963, 71 pp., $7.00 (out of print)

3. Computer Society of Canada
   "Census of Computers in Canada", Quarterly Bulletin Vol. 5, No. 4 June, 1965, 76 pp., $2.00.

4. Computer Society of Canada
   "Census of Computer Education in Canada", Quarterly Bulletin, July, 1965, $1.00.

5. American Association of Collegiate Registrars and Admissions Officers
   AACRO Electronic Data Processing Survey (1965 and possibly 1966, complete information may be obtained from Mr. M. D. Scherer, Chm., New Developments and Techniques Committee, AACRAO, Indiana University, Bloomington, Indiana)

6. Willis, Benjamin C., Educational Services, Inc.
Data Processing in the Great Cities, Research Council of the Great Cities, Chicago, Illinois, 121 pp., 1967, $3.00.
(Reviewed in June 1968 issue of the Journal of the Association for Educational Data Systems)

7. Hamblen, John W.
"Estimates of Costs of Furnishing Computer Services in Computer Science Education"
(Study done at request of ACM Curriculum Committee) Computer Science Project, Southern Regional Education Board, Atlanta (mimeographed)

8. U. S. Office of Education
Higher Education General Information Survey (HEGIS) contains Computer Science and Systems Analysis (with subgroups) as an Academic Area on which certain data is collected.

B. In Process:

1. Inventory of Computers in U. S. Higher Education
1966-67 is the base year for this NSF and SREB supported study. Publications expected by summer 1969. Contact: John W. Hamblen, Project Director, Computer Science Project, Southern Regional Education Board, Atlanta, Georgia 30313.

2. AEDS - RCA Study. The Association for Educational Data Systems will soon publish the results of a study done in cooperation with the RCA Instructional Systems Division. The survey sampled the public school systems concerning plans and progress in computer utilization.

3. Study of Computers in Secondary Education. The Office of Computing Activities of NSF has issued RFP's to conduct a national study of computers in nations 26,500 secondary schools.

When we get this initial collection assembled, I suggest we get it published somewhere. The ACM Communications and the AEDS Monitor are good possibilities.

Sincerely,

John W. Hamblen
Project Director
Computer Sciences

1239

JWH:dh

Dear Sid,
Please indicate which ones you would like to have procured for the Data Base Panel's Basic reference center. Also, any additional ones. By the way, where would you like to start this Basic Reference Center; in your basement at home, at your office, at the CS&E staff's luxurious quarters, the Library of Congress, etc. Also, how do you propose to notify the world of your holdings, how often, to what depth of content, and the like.

CC: Tony, John G. Bruce Gilchrist, Hohn Hamblen, John Pierce

Ad Hoc Survey Panel

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
BETHESDA, MD. 20014

NATIONAL INSTITUTES OF HEALTH
AREA CODE 301 TEL: 656-4000

January 23, 1969

Dr. Sidney Fernbach
Head, Computation Department
Lawrence Radiation Laboratory
University of California
Box 808
Livermore, California 94550

Dear Doctor Fernbach:

My efforts at identifying tidy sources of information on computer science manpower availability and requirements have been generally unproductive. My best source (albeit trivial in comparison to the need) continues to be the one closest to home, namely, the NIH files associated with our computer resource grants. Since we participate in supporting the full operating costs of some 40 computer centers, we have available some rather solid data on staffing levels and personnel allocation. Moreover, to the extent that some of these centers can be said to be characteristic of a given type of computing milieu, there may be some basis for valid extrapolation in concert with survey data on computer installations per se (e.g., those of the Southern Regional Education Board). Staffing data similar to that available at NIH may also be available at NSF, AEC, and DOD.

On the question of sources for general computer science information I offer the following:

a. the annual COSATI inventory of information science research projects, and

b. "Bibliography of Research Relating to Communication of Scientific and Technical Information," Rutgers University, 1966.

The latter was supported under NIH contract and a copy is available should the panel wish to examine it.

I hope the other panel members were more successful than I seem to have been.

Sincerely yours,

W.F.R.

William F. Raub, Ph.D.
Acting Chief
Special Research Resources Branch
Division of Research Facilities
and Resources

cc:
Mr. Warren House
Executive Secretary
Computer Science and
Eng. Board, NAS

Data Base Panel - Initial List

A. Data Only About Federal Government

1. Title - Inventory of Automatic Data Processing Equipment in the Federal Government.

   Frequency - Annual 1960-68 (except 1967).

   Source - GPO published document prepared by BOB/GSA.

   Pertinent Content - For past FY, current FY and next FY.

   1. Complete detailed inventory of general purpose computers (make and model) in the executive branch of the Federal Government and includes contractors on cost-type contracts.
   2. Summary data by agency on costs and man-years.

2. Title - ADP MIS Reports

   Frequency - These reports are prepared at various times from a computer data base which is updated at different frequencies for different items.

   Source - GSA prepares and makes these reports available to Federal agencies.

   Pertinent Content - These reports contain the complete detail upon which the first item on this list is based. Computer systems are given by component. Cost, utilization, maintenance and manpower data are shown at the system and/or installation level.

3. Title - A Study of the Impact of Automation on Federal Employees.

Frequency - One time.

Source - GPO published document (1964). Prepared by Civil Service Commission and referred to Subcommittee on Census and Government Statistics of the Committee on Post Office and Civil Service, 88th Congress, 2nd Session.

Pertinent Content - Survey was made of positions in automation equipment operations in Federal agencies.

4. Title - Recruiting and Staffing of U.S. Government ADP Computer Centers (1966) and Data on Computer Staffing in the Federal Government (1967).

Frequency - One time.

Source - Prepared by the Task Force on Manning for Computer Operations of the Interagency Advisory Group Committee on Automation and Manpower. Limited distribution by the Civil Service Commission.

Pertinent Content - This task force sent a questionnaire to all Federal agencies . Analyses of the responses are contained in these two documents. Questions included type of application (business) scientific, projected recruitment requirements and the number of employees assigned to various computer series.

B. Other Data

1. Title - Study of the Interdependence of Computers and Communications Services.

Frequency - One time.

Source - BEMA submission to the FCC. Inquiry prepared by Booz-Allen & Hamilton, 1968.

Pertinent Content - Results of the BEMA Survey of Data Processing Equipment conducted to determine the number of systems and the annual rental value of data processing and data communications equipment in the U.S.

2. Title - Reading Machines for Data Processing

Frequency - One time-1963.

Source - Published by U.S. Department of Labor..

Pertinent Content - Estimates of OCR equipment and projections of growth and effects on keypunch employment.

3. Title - Automated Data Processing in State Government.

Frequency - The original was published in 1965. It has been updated at least once since.

Source - The study is by The Council of State Governments and Public Administration Service; published by the latter.

Pertinent Content - Thirty one states responded with data on equipment, personnel, costs, and applications.

4. Title - The County Benefits of EDP.

Frequency - One time - 1966.

Source - A county government survey was sponsored by the National Association of Counties and reported in American County Government, August 1966.

Pertinent Content - Number of computers, costs, manpower.

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

COMPUTER SCIENCE AND ENGINEERING BOARD

Minutes
Meeting #1

National Programs Panel A

January 7, 1969

Attendance:
Dr. Launor Carter - Chairman
Dr. Bruce Gilchrist - Member
Dr. A. Oettinger - Visitor
Dr. Joel E. Cohen - Observer

Because of the limited attendance, caused by weather conditions primarily, the meeting directed itself to planning for future presentations to the committee that could be a basis for its study and recommendations.

The Panel will summarize the current and projected plans and perceptions of needs of the organizations mentioned above. It will explore problems which require attention within a broad context. It will analyze the several alternate solutions to these problems and prepare recommendations for CS&EB. The Panel will prepare informative material and recommendations for review by the full Computer Science and Engineering Board and stand ready, on the basis of the information it has gathered, to assist government agencies which might seek the Board's advice in this area.

The primary needs of the Panel are for information on what is being done, planned or proposed by the various government agencies, universities, non-profit institutions, and private industry involved in broad scale utilization and promotion of computer technology. To gain this information the next two meetings are planned for presentations by the following:

Meeting #2 - February 4, 1969 - National Academy of Sciences
Dr. Milton Rose - National Science Foundation
Mr. Robert Landou - OST/COSATI
Dr. Herbert Grosch - Director Center for Computer Sciences and Technology, N.B.S.

Meeting #3 - March 11, 1969 - National Academy of Sciences
Mr. ~~Robert Landou~~ - OST/COSATI
Mr. Robert Taylor - Director, Information Processing Techniques, ARPA
Mr. S. Pratt - Director, NIH Computer Center

Alternate - in case needed - Representative of U.S.O.E.

Public Systems Division
SYSTEM DEVELOPMENT CORPORATION
2500 Colorado Avenue, Santa Monica, California 90406

January 9, 1969

Richard Bloch
Sullivan Campbell
David Evans
Bruce Gilchrist
Butler Lampson
J. C. R. Licklider
John Meyer
Samuel Morgan
James Rowe

Gentlemen:

On Tuesday of this week we held the first meeting of the National Programs Panel A. Because of the short notice, the flu, and travel problems, only a limited number of the Panel members were able to attend. However, we did have a worthwhile session. In the morning we talked some about the mission of the Panel and arranged agendas for programs in February and March. The February meeting is scheduled for Tuesday, February 4. At this time we will hear Milt Rose of the National Science Foundation and Herb Grosch of the National Bureau of Standards and Mr. Hrones of the Associated Universities. On Tuesday, March 11, we have arranged to hear Bob Taylor of ARPA and are arranging to hear Scott Pratt of the National Institutes of Health and Bob Landau of the Office of Science and Technology. I hope all of you will be able to make these meetings.

In the afternoon we held a very useful discussion with Mr. Yost, representing the Associated Argonne Universities. They are examining the possibility of establishing a major computer institute at Argonne. He left several papers with us describing their program, and I have asked the NAS office to send you copies of the material he left with us.

We have a new staff associate who will support us in the work of our Panel. Mr. Arthur Lytle has been with the Adademy for some time, where he has supported several committees, particularly as they relate to problems of maritime transportation. He will devote part of his time to supporting us and I recommend that you contact him with respect to problems of transportation, hotel accommodations, etc. His phone number is (202) 961-1-452, and his address is National Academy of Sciences, 2101 Constitution Avenue, Washington, D. C. 20418. Mr. Warren House is the Executive Secretary of the Board and can assist if Mr. Lytle is not available. His phone number is (202) 961-1386.

Will you please let me know soon whether or not you can attend on the dates I have indicated above.

Sincerely yours,

Launor F. Carter
Vice President and Manager
Public Systems Division

cc: Warren House
Arthur Lytle
Tony Oettinger
John Pierce

A-2960 (2/69)

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D. C. 20418

Dear

This is to notify you that the next meeting of the National Programs Panel A will be held on February 4, 1969 at 9 a.m. to 5 p.m. in Room 200-C of the Joseph Henry Building, 21st and Pennsylvania Avenue, N.W., Washington, D. C. Enclosed are the minutes from the last meeting and a copy of the National Academy of Sciences publication "Guidelines" which outlines some of the functions and responsibilities of Panel members.

The agenda will consist of:

9:00 a.m. to 10:00 a.m.	Introduction and Organizing Session
10:00 a.m. - 12:00 noon	Dr. Milton Rose of the National Science Foundation
1:30 p.m. - 3:00 p.m.	Mr. Robert Landau - OST/COSATI
3:00 p.m. to 5:00 p.m.	Dr. Herbert Grosch of the National Bureau of Standards

Please signify on the enclosed sheet whether or not you will be attending and what accommodations you will need, if any. Please let me know at least 5 days before the meeting as to your attendance.

Sincerely,

Karen T. Chamblee

Karen T. Chamblee
Secretary for
Warren C. House

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

ATTENDANCE LIST

National Programs Panel
February 4, 1969 - 9 a.m.
Launor F. Carter, Chairman

Planned Attendees

Dr. Sullivan Campbell ✓
David Evans
Bruce Gilchrist ✓
Butler Lampson ✓
Samuel Morgan ✓
James Rowe ✓

Ottmyer
Barclay

Absentees

Richard Bloch
J. Licklider
John Meyer

BOARD MEMBERS

TABLE OF CONTENTS

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

COMPUTER SCIENCE AND ENGINEERING BOARD

Evening Session

March 11, 1969

ATTENDING

Members

Professor Anthony G. Oettinger
(Chairman)
Dr. Launor F. Carter
Professor Wesley A. Clark
Professor David C. Evans
Professor Stephen Joseph Fenves
Dr. Sidney Fernbach
Mr. Jerrier Haddad
Mr. Warren C. House
Mr. Kenneth Olsen
Dr. Alan J. Perlis
Professor J. Barkley Rosser
Dr. J. C. R. Licklider

Consultants

Mr. Joel Cohen
Mr. John Griffith
Dr. Bernhard Romberg

Guests

Mr. Brad Byers
Dr. Walter Hoffman
Dr. C. E. Sunderlin
Dr. Willis Ware

NOT ATTENDING

Members

Dr. Glen J. Culler
Dr. John R. Meyer
Professor William F. Miller
Dr. John R. Pierce
Dr. Alan F. Westin

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

COMPUTER SCIENCE AND ENGINEERING BOARD

Day Session

March 12, 1969

ATTENDING

Members

Professor Anthony G. Oettinger (Chairman)
Dr. Launor F. Carter
Professor Wesley A. Clark
Professor David C. Evans
Professor Stephen Joseph Fenves
Dr. Sidney Fernbach
Mr. Jerrier Haddad
Mr. Warren C. House
Mr. Kenneth Olsen
Professor J. Barkley Rosser
Dr. J. C. R. Licklider

Observers

Dr. Walter Baer
Dr. Bruce Gilchrist
Dr. Herbert Grosch
Mr. David C. Miller
Miss Ann Marie Lamb
Mr. Donald Madden
Mr. Richard McCann
Dr. Milton Rose
Dr. Charles V. L. Smith
Mr. Bernhard Urban
Mr. Charles Witter
Mr. Ken Hunter
Mr. Robert Landau

Consultants

Mr. Joel Cohen
Mr. John Griffith
Dr. Bernhard Romberg

Guests

Mr. Brad Byers
Dr. Walter Hoffman
Dr. C. E. Sunderlin
Dr. Willis Ware

NOT ATTENDING

Members

Dr. Glen J. Culler
Dr. John R. Meyer
Professor William F. Miller
Dr. Alan J. Perlis
Dr. John R. Pierce
Dr. Alan F. Westin

Observers

Mr. David Beckler
Dr. John Egan
Mr. Arthur Melmed
Dr. Hood Roberts
Mr. Robert Taylor
Professor Lawrence Tribe
Dr. Bruce Waxman

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D. C. 20418

COMPUTER SCIENCE AND ENGINEERING BOARD

Eleventh Meeting

March 11, 1969

Executive Evening Session

Preliminary AGENDA

The main item for the Evening Session will be a general discussion of standardization in the computer field and the role of the Board therein. The Chairman has invited Dr. Walter Hoffman, Wayne State University, Detroit, Michigan, who is the Chairman for the Board's Standardization Panel, and Dr. Willis Ware, The Rand Corporation, Santa Monica, California, who has done considerable work in standardization recently, to attend the Board meeting and to participate in the discussion.

Following this, there will be a brief EXECUTIVE session in order to keep the Board appraised of aspects of the items listed below which would not be appropriate for the general Board session on March 12, 1969.

1. Brief update on developments in the work of the Computer Export Panel --The Chairman.

2. Status of plans for the Summer Conference on the Computer Export Problem --The Chairman.

3. Brief update on the work done on the NSF Survey, --The Chairman, for Professor Miller.

4. Brief update on the status of plans for the Summer Conference by the Education Panel, including status of the proposal to NSF for funding, --Dr. Alan Perlis

5. Brief summary of results of attending March 3 meeting of the Commission of Engineering Education and of chat with Dr. John Hrones of AUI --The Chairman

6. Further discussion of the draft by Dr. John Meyer, "Reaction to Hoover Commission."

7. Recent developments in connection with the FCC.

8. Discussion of inviting key industrial people providing support and assistance to the Computer Export Panel to attend, from time to time, meetings of the Board.

NOTE--The Chairman is calling an EXECUTIVE session after lunch on March 12, 1969, for the purpose of appraising the Board in some detail of the status of the Privacy proposal and of certain developments connected therewith affecting the conduct of the proposed work. The status of the Privacy proposal will be covered briefly during the open session in the morning.

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

COMPUTER SCIENCE AND ENGINEERING BOARD

Eleventh Meeting

March 12, 1969

DAY SESSION

Preliminary AGENDA

1. Opening remarks by the Chairman on significant developments since the last meeting.

2. Report on developments in the work of the Computer Export Panel --The Chairman.

3. Report on preparations for the Board to enter the standards field --The Chairman.

4. Status reports on:

   -Preparations for the CS&EB to enter the information systems field --The Chairman.

   -The National Programs Panel A work --Dr. Launor Carter.

   -The Data Base Panel work --Dr. Sidney Fernbach.

   -The NSF Survey work --The Chairman, for Dr. William Miller.

   -The Education Panel's Summer Conference --Dr. Alan Perlis.

   -The proposal to study Privacy, National Data Banks and Computers --The Chairman, for Dr. Alan Westin.

   -The proposal to undertake a comprehensive survey of computer manpower requirements in the computer science field --Dr. Bruce Gilchrist.

   -The plans for a Summer Conference on the Computer Export problem with emphasis on computer technology and computer technology transfer, perhaps in the context of the U.S.-World technology balance.

5. Administrative items.

6. Other

LUNCH: 12:00 Noon

EXECUTIVE SESSION OF THE BOARD -- 1:30 p.m. to 4:00 p.m.

Education Panel

NATIONAL ACADEMY OF SCIENCES
NATIONAL RESEARCH COUNCIL

Executive Office

Feb 18,1968

Dear Gene,

Attached is a rough draft of a proposal to support the Summer Conference on Computer Science Education for your review. I would appreciate any comments and suggestions.

I have structured the budget along the convential NAS lines. However, this is for a conference rather than an effort involving sustained NAS support over a period of time. Most of the "Professional,Clerical" item will be for people hired on the spot during the conference. Only a tiny splinter of my time, my secretary's time, and a small part of Art Lytle's time will be required. A bit more of Art's time may be used under the "Materials & Services" item. I have, however, applied the NAS Indirect Cost rate of 35% to all items.

NSF is, of course, anxious to keep the cost of the conference to a minimum. If there is a modified Indirect Costs rate for this kind of activity, please ask Bernie to make the needed adjustments.

I am forwarding a copy to Bernie for his usual careful scrutiny.

Thanks much.

W. Whitten

PS-Tony checked this out while in town working with the Export Panel on Friday. Perlis checked this out over the phone yesterday.

NATIONAL ACADEMY OF SCIENCES

COMPUTER SCIENCE AND ENGINEERING BOARD

PROPOSAL

TO: The National Science Foundation

FOR: A Summer Conference on Computer Science Education

FUNDS REQUESTED: $37,625

DURATION: July 21-25, 1969

Contract Administration:

B. L. Kropp
Deputy Business Manager
961-1213

Program Administration:

Warren C. House
Executive Secretary
961-1386

February 17, 1969

SUMMER CONFERENCE ON COMPUTER SCIENCE EDUCATION

The objective of the proposed conference is the preparation of a report outlining the results of a general analysis of computer science education in the United States, with particular attention being given to:

1. Graduate Education in Computer Science, and
2. Education in software (and hardware) systems.

Within each of the above areas, detailed analysis will be made of the Economic and Content aspects. By Economic is meant the creation of input-output models relating to the development of programs, production of trained students and faculty, and the needs of industry and government for people so trained. A timetable reflecting the estimated velocity and acceleration rate of these programs will be produced. In accord with the estimated growth rate of these programs, a study will be made of the resources (plant, people and money) required to provide the needed educational development under various response alternatives. Content refers to the undergraduate and graduate courses and programs which should be properly identified as computer science. Also, an evaluation of these programs will be made to provide the basis for determining their adequacy in relation to computer science education needs, both in the immediate future and the longer term. Accreditation and standardization will also be considered. Similar treatment will be accorded hardware and software education programs.

The conference is planned to be held from July 21 through July 25, 1969, at the Hilton Hotel in Annapolis, Maryland. A separate report is scheduled for the Economic and the Content areas, and these are then to be combined into one final report. Annex A contains further details on the planned conference proceedings and particular questions to be examined. Annex B is a list of selected professionals who will be invited to participate in the conference. Annex C is an estimated budget for the conference. The cost of producing the copies of record for the National Science Foundation is included in the estimated budget.

ANNEX "A"

It is planned to organize the conference as a series of open working group sessions for the two major technical working groups for Economics and Content. Plenary sessions of the entire conference body will be held periodically to review the work progress of the technical groups. A tentative schedule for the two major work groups (Content--Working Group I and Economics--Working Group II), plenary review sessions and special lectures follows:

	9:00 - 12:00 Noon (morning)	1:30 - 4:30 p.m. (afternoon)	7:00 - 10:00 p.m. (evening)
Monday	Keynote Plenary Session I	Working Sessions	Special Lectures
Tuesday	Working Sessions	Plenary Session II Report of Working Group I	Special Lectures
Wednesday	Plenary Session III Report of Working Group II	Working Sessions	Working Sessions
Thursday	Plenary Session IV Report of Working Group I	Plenary Session V Report of Working Group II	
Friday	Draft of reports of working groups	Plenary Session VI Draft of final report - content and conclusions	

There are a large number of questions that the conference should address. Among them are:

-Of the reasonably large number of graduate departments of computer science now existing, are these programs producing in kind and in number the graduates that are needed?

-Are there needs, insofar as computer science is concerned, which these programs are not meeting?

-Are these programs separating the mathematical from the engineering too much?

-What alternatives to this mode of educational development can be proposed?

-Does there exist a natural education sequence in the field of computer science like that, e.g., in another mathematical science? Thus, how does one characterize education in computer science through the range of junior college, B.S., B.A., M.S., M.A., Ph.D, and professional degree?

-In the field of computer science what are the goals of the various degrees?

-Is the education program best organized so that students from the lower degree programs provide the major source of the students in the advanced degree program?

-Will computer science departments become as introverted as has happened, for example, in mathematics?

-How do the programs now in operation compare with those outlined by study groups such as the ACM Curriculum Committee and COSINE?

-Are the professional societies the appropriate groups to recommend or set curricula? What orderly alternatives are there?

-Are there large problems in software production and use that are largely caused by the lack of well trained software specialists?

-If there are such large problems, should they be solved within a formal education system by educating specialists at various degree levels?

-Or can this matter be best solved by those now responsible for the production of software using on-the-job training?

-Thus, can hardware manufacturers be depended upon to supply the software systems that are needed and also train the personnel, produce and service them?

-Would not software education in a university environment be likely to produce technological derelicts since the software problem seems to change so rapidly?

-Put another way, won't the very nature of software make the solution to these problems be solved by meta software produced by a very small number of specialists?

-If one speaks of software engineering, then why not let the engineering schools and disciplines define and develop the programs?

-Is it possible to meaningfully separate the software problem from the hardware problem?

-How could national institutes of computer science, several of which are now being proposed, contribute to education in computer science?

Other questions will arise during the course of the discussions, but certainly the goal of the conference should be to focus not only on the nature of the problem but also to prepare recommended solutions.

Though it is not required for participation, there will be full distribution of any written comments that might be made prior to the meeting. While formal papers are not being asked for, careful organization of thoughts on the above or related matters would be helpful. If a working paper can be provided by June 15th, copies will be made available to all the participants to study before the conference commences. These working papers will undoubtedly provide a strong basis for discussion during the conference.

During the conference, duplication and secretarial facilities will be provided for quick preparation of working papers and intermediate reports. The goal of the conference will be the preparation of an initial report outlining the conclusions and recommendations of the conference. Toward that end, in each of the two areas (economics and content), a chairman and two younger recording secretaries will be assigned the responsibility of preparing the draft of each section, and these two drafts will then be coordinated into a final report.

ANNEX"B"

The current list of invitees is:

1) The Economic Group:

B. Gilchrist	Secretary of AFIPS
G. Forsythe	Chairman, Department of Computer Science, Stanford
J. E. Rowe	Computer Operations, Union Carbide Corp.
J. W. Carr III	Chairman, Department of Computer Science University of Pennsylvania
A. J. Perlis	Head, Department of Computer Science, CMU Chairman of this working group
T. A. Standish	Assistant Professor, CMU, Department of Computer Science -- Recording secretary of this working group
A. VanDam	Associate Professor, Computer Science, Brown University -- Recording secretary of this working group
L. Zadeh	Professor of Computer Science and Electrical Engineering, University of California (Berkeley)
J. Snyder	Professor of Computer Science, Physics and Computer Center, University of Illinois
W. Humphrey	IBM, Manager, Software Systems
F. Brooks	Chairman, Department of Computer Science, University of North Carolina
John Hamblen	SRE Board
Richard Jones	Manager, Applied Data Research (Private software house)
Tom Jones	President, University of South Carolina (university administrator and electrical engineer)
R. Tanaka	Calcomp, Electrical Engineer and Systems Desigrer
Andrew Schultz	Dean of Engineering College, Cornell University
Charles Bowen	IBM
William F. Sharpe	UCLA and RAND
Chuan Chu	Vice President and Assistant General Manager, Honeywell Data Processing, Wellesley, Mass.
Ross McDonald	Vice President and Director of Research, Texas Instruments, Dallas, Texas.
Simon Ramo	Bunker-Ramo Corporation
Isaac Nehama	International Computing Company

Walter Ramshaw	Hartford hospitals
Burton Colvin	Boeing Scientific Research Laboratory
George A. Garrett	Director, Information Processing, Lockheed Missiles and Space Company, Sunnyvale, Calif.

2) The Content, Audit and Accreditation Group:

E. McCluskey	Professor of Electrical Engineering Stanford University, Group Chairman
J. Gries	Assistant Professor, Computer Science Stanford University, Recording Secretary
F. Gruenberger	Educator, SanFernando State College Recording Secretary
R. Spinrad	Software Manager, Scientific Data Systems
J. Hartmanis	Chairman, Department of Computer Science Cornell University
S. Conte	Chairman, Department of Computer Science Purdue University
R. Hamming	Computer Science, Bell Telephone Laboratories
F. Corbato	Project MAC, Massachusetts Institute of Tech.
J. Schwartz	SDC
W. Bauer	President, Informatics
R. Andree	Computer Educator, Professor of Mathematics University of Oklahoma
J. Harr	Director of Software, AT&T, Central Office Computer Systems
A. R. Zipf	Computer Operations, Bank of America
V. Vyssotsky	Software Management, Bell Telephone Laboratories
D. Knuth	Professor of Computer Science, Stanford Univ.
T. Climis	Manager of Software, IBM
C. G. Bell	Computer Systems Designer, Professor, Carnegie-Mellon University
R. Graham	Director of Computing Operations and Software Production, University of Waterloo
Charles Missler	Manager, Computer Application/Engineering Staff, Ford Motor Company, Dearborn, Michigan.
Jerry Noe	University of Washington, Seattle
Roger Lazarus	Head, Computer Division, Los Alamos Scientific Laboratory, Los Alamos, N.M.

Charles DiCarlo	President Sarah Lawrence College
Earl Althoff	Joint Computer Evaluation Group, Eastman Kodak, Bldg. 205, Kodak Park, Rochester, N. Y.
Ruth Davis	National Library of Medicine
Howard Campaigne	National Security Agency
Ned Irons	Institute for Defense Analyses Princeton
Eugene Brock	NASA, Houston, Texas

ANNEX "C"

COMPUTER SCIENCE AND ENGINEERING BOARD

SUMMER CONFERENCE ON COMPUTER SCIENCE EDUCATION

Estimate of Costs

The following budget is based on an attendance of fifty people at the Summer Conference on Computer Science Education, with the understanding that any observers, who may attend will pay their own costs:

Professional, Clerical	$ 2,750
FICA, Pensions and other Payroll Costs	275
Travel - Conferees	15,000
Rooms and Meals	8,100
Materials and Services - (postage, telephone, paper and duplicator expenses, charges incurred in preparation, distribution of the final report)	2,300
Communications and Shipping	200
Indirect Costs	9,000
TOTAL	$ 37,625

who are close to students, feel the same way. Demands for in-city training programs increase; urban research needs pyramid. Extracurricular activities, for both students and faculty, follow the same patterns. City governments are also exerting more pressure on the university; they find growing uses for the expertise of academics and the prestige of a big-university name, which can make politically unpalatable decisions seem more respectable.

Most of these projects live and die with little guidance from the central university administration. The implication is that, whatever the central administration does, Harvard's involvement in urban problems will depend primarily on the attitudes of the individual faculties. (The committee did suggest that urban projects would have the best chances of survival if they successfully combined service goals with the central training and research functions of the university.)

One reason for the committee's caution—apart from its respect for the fragmentation of decision-making—was internal disagreement over just what good the university *can* do. The prevailing tone was set by the chairman, James Q. Wilson, a professor of government who did most of the writing. The following passage, which bears his imprint, characterized the report:

> The intellectual disciplines are concerned with discovering what is generally true about human affairs, not what is true in the specific case . . . with simplifying our ways of describing or measuring complex situations, not remaining *au courant* about the details of current affairs. Occasionally, such intellectual knowledge is of value, but just as often it is not relevant to the particular political judgments that are vital to the direction of public policy. . . . Even the best social scientists rarely answer, expertly, a question put to them by a public official; typically, they tell the public official that he is asking the wrong question.

NSF: Funds Augmented, but Uncertainties Linger On

The budgetary fortunes of the National Science Foundation (NSF) brightened a bit more last week when President Nixon personally announced a $10-million elevation of the ceiling on spending which was imposed on NSF last spring. The latest increase brings the amount NSF can spend during fiscal year 1969, which ends on 30 June, to about $490 million. This is some $30 million less than the $520 million in spending authority NSF anticipated before congressional budget cuts and administration spending limits were applied last spring. The Nixon action was the second emergency transfusion. In November, the Johnson Administration had released $17 million in "rescue" funds to cushion the effect of spending restraints which seem to have fallen most heavily on NSF's university clients (*Science*, 22 November 1967), many of whom counted on receiving money granted in past years.

NSF director Leland J. Haworth said last week that the additional funds would be used first "to take care of the most critical situations that we know still exist among our grantee institutions." No details of the distribution of the new funds are yet available.

Nixon, who was accompanied by his science adviser, Lee A. DuBridge, when he made his announcement of the release of funds at the White House, said he had directed White House officials "to examine other research and development programs to ascertain where offsetting savings can be obtained," but he did not specify where. Nixon also noted that he felt the preceding administration had made a "serious error" in limiting NSF expenditures so severely.

If some observers saw in the President's remarks hints of happier days for NSF, it must be said that currently a number of uncertainties beset the foundation, and that some of these uncertainties stem from unmade decisions awaiting action in the President's "in" basket.

A leading question is that of the NSF directorship. Haworth's term expires on 30 June, when he will have passed his 65th birthday. Neither Haworth nor the Administration have indicated what their plans are, but many observers expect a change. And there has been a totally unconfirmed but unusually strong rumor on the Washington science grapevine which touts Emanuel R. Piore as successor to Haworth. Piore, 60, is an IBM vice president and chief scientist, and a former chief scientist of the Office of Naval Research. He is a member of the inner circle of national scientific leaders and is probably best known for leading rescue operations when the scientific community's fat is in the fire. Piore, for example, helped to liquidate Project Mohole, which was acutely embarrassing NSF, and played a key role in defusing the controversy over selection of a site for the proposed 200-Gev accelerator.

While the question of NSF directorship remains hanging, it seems evident that the whole top echelon of NSF positions will also remain unfilled. The amendments to the NSF basic law passed last spring provide that the NSF director's five top aides—the deputy director and four assistant directors who will occupy newly created posts—be Presidential appointees. Formerly only the director was the President's appointee. The five jobs have been kept open for more than 6 months, so changes in policies and programs as well as in top personnel await the President's pleasure.

Also, as a result of the amendments fostered by Representative Emilio Q. Daddario (D–Conn.), NSF faces its first authorization hearings. Until this year the foundation had operated under a continuing authorization, and its officials were required only to make annual appearances—usually brief, if sometimes in an uncongenial atmosphere—before House and Senate appropriations subcommittees. For the first time the agency is facing a program-by-program examination of its activities, to gain an authorization for its fiscal 1970 appropriation. The foundation appears to be taking the prospect very seriously, and an agency-wide committee has been preparing testimony.

In the House, NSF will face the Science and Astronautics Committee's subcommittee on science, research, and development, headed by Daddario, who is likely to be a friendly, but well-informed and inquisitive, auditor, anxious to know what NSF has done to implement congressional imperatives in the Daddario bill to extend such NSF programs as those in applied science and the social sciences.—JOHN WALSH

NBER RESEARCH, INC. 261 MADISON AVENUE, NEW YORK, N.Y. 10016

(212) MU 2-3190

February 26, 1969

FEB 28 Rec'd

Mr. Warren House
National Academy of Sciences
2101 Constitution Avenue
Washington, D. C.

Dear Warren:

Enclosed you will find a slightly amended version of John Pierce's rewrite of my "Hoover Commission" memo. I feel that John's rewrite is easily the most constructive of the many suggestions that we have received -- though I do not take exception to most of the others either.

I leave it to the Committee to decide on whether the other suggestions merit inclusion. Clearly, though, John Pierce's revised version should be the point of departure.

See you in April!

Sincerely,

John R. Meyer
President

/vb
encl.

cc: Messrs. Griffith
Oettinger
Pierce

SUGGESTED REVISION TO J. R. MEYER'S
"REACTION TO 'HOOVER COMMISSION'"

J. R. Pierce - February 17, 1969

It seems that the Nixon Administration may convene a new "Hoover Commission" to review managerial practices in the federal government. This would offer an excellent opportunity to evaluate the role and capabilities of computers as an administrative or managerial tool in the federal establishment [in the context of the computer being a major technological innovation].

Such a review would be justified on several grounds. Many feel that the computer has not been used as effectively as a managerial tool within the public [particularly at the national and state levels], as in the private sector. This is of course merely a suspicion, and formal documentation of the point is certainly lacking. Nevertheless, a good deal of informed opinion tends to this view.

This is not to assert that computers are not used in the federal establishment. The federal government is the single largest customer of the computer industry. It has also shown foresight and a commendable willingness to bear risks in developing new and better computers.

The question, rather, concerns the use made of the computer within the government as an aid to management and particularly whether that use is as effective as it should be.

Above all, the question arises of whether the "information revolution" induced by the computer has really permeated public managerial procedures in the way that it should if the computer is to make a maximum contribution to improving government (administrative practice.)

The computer should not be envisaged as simply a device for reducing data processing costs or the total clerical or computational bill. Computer installations very often do not create the "savings" that "justified" or otherwise rationalized the original sale of the computer. However, even when expected "savings" do not materialize, the computer application usually does result in some jobs being done more thoroughly or better or in entirely new tasks being undertaken. In particular, management, after replacing clerical help with computers, often steps up demands for information or for the speed with which information is processed.

Often, nonrealization on "expected cost savings" is taken as a sign of failure. It is highly probable that computers have often been applied where they should not have been. Nevertheless, to observe that the total clerical bill does not always decline when a computer is installed is no more an evidence of failure. It could be a sign that the computer was sold on improper grounds.

There are good economic reasons why one would not necessarily expect the total clerical bill to decline with the advent of computers. The same arguments apply to other

major technological innovations. The "total transportation bill" of most modern societies has not declined with the advent of the railroad and automobile. It is higher today, and life is different, more productive and better. Much the same applies to the computer. It would be impossible for some sectors of our complex society and economy to operate without the availability of large computers.

The phenomenon observable in these cases of major technological change is described by economists as the case in which price elasticity of demand for a service or product is greater than unity. This means that the total consumption of the good or service rises more than proportionally to any price reduction. If you observe a 10% reduction in the unit price or cost of rendering a particular service, a greater than unity price elasticity would imply that you would observe more than a 10% increase in the quantity consumed. There are many goods or services for which greater than unity price elasticities seem to hold. If you make a good thing cheap enough, you should not be surprised if people spend more rather than less on it as its price is reduced.

The essence of the "computer revolution" is that, once information becomes relatively cheap and as a consequence, larger amounts of information are consumed or used. The increase in consumption of information may well rise to the point where the total bill for processing or obtaining information actually goes up even though the unit cost of obtaining

that information falls dramatically. From the standpoint of managerial practice, the real question then becomes just exactly what does the increase in availability and quality of information really imply?

The direct effects are reasonably obvious. Management demands and receives good information more promptly than before. Customers are also benefited. More and better analyses of data are usually brought to bear upon individual management decisions. Management feels free to go back to subordinates and to ask that additional numbers be processed or additional facts be obtained before reaching decisions in marginal or difficult cases. Simply put, demands are made for analyses that could not have been conceived or justified before the computer. As a consequence, fewer decisions are made on the basis of hunch or so-called "rules-of-thumb", or other simple short cuts that tend to reduce the information requirement.

The indirect effects upon management of the computer information revolution may, however, be more important than the direct effects. Indeed, it seems highly likely that we do not even yet apprehend all of these indirect influences.

Perhaps the most obvious of these secondary effects concerns personnel policy. When the computer comes on the scene, the personnel requirements for the organization shift in important ways. Fewer clerical people performing rote tasks are needed, and those that are required need different

skills, such as keypunching. More people with mathematical and analytical skills will be sought for employment. Such highly talented men do not easily fit into existing patterns of pay and responsibility. Necessary changes in recruitment policy can have subtle effects upon the organization. It not only changes the quantities of different talents or skills available for promotion, but also tends to influence those particular talents singled out for more responsibility. Similarly, to the extent that adoption of new technologies attract the more venturesome and imaginative elements in the work force, the organization that accelerates computerization will find itself with a better quality or at least more flexible and innovative work force.

Whatever the particulars, it is clear that there are many ways in which personnel policies and organizational development can be and are being altered with the advent of the computer (and within some areas of the private sector of the economy.) Questions concerning public administration arise from all of this. Do civil service rules and other rigidities that characterize employment relationships in government inhibit the best use of computers in government? Does governmental observance of rather strict seniority rules tend to insure that government administrators realize fewer managerial advantages from computerization than would otherwise be the case?

Other questions —

It is often observed that many sectors of the so-called service industry, and in particular medicine and government, have lagged badly in terms of productivity gains compared with other sectors of the economy. Yet the computer is particularly adaptable to service industries. Have various kinds of government record keeping or bookkeeping activities (and that after all constitutes a fairly considerable proportion of total government activity) experienced the same gains in productivity as equivalent record keeping or bookkeeping activities in the private sector?

If government hiring and personnel policies have not or are not able to adapt in the same way as those in the private sector to the advent of the computer or other technological changes, this may induce personnel selection policies that are self-reinforcing and negative. For example, government may not have been able to recruit its "fair percentage" of the more imaginative and innovative spirits in recent college generations. The long-run tenor and success of government operations ~~is~~ may be better measured by the Post Office than by the Apollo program, and the evidence is disquieting.

If there is any merit in the notion that the computer has not made the same contribution to public as to private administration, and that the costs of this omission can accumulate over time, this should be known to responsible men in the government and to the public as well. While it could be argued that inefficiency can create jobs, it can be a quite

expensive means of creating jobs. One can wonder whether "deliberate inefficiency" is ever a very constructive approach to alleviating unemployment. What we all need to know is whether there is remedial inefficiency. Then we can choose whether or not to remedy it.

In short, an important task of any new "Hoover Commission" should be to consider the extent to which government administrative practices hinder or aid adaptation to effective new managerial technologies, broadly construed.

DEPARTMENT OF CIVIL ENGINEERING | UNIVERSITY OF ILLINOIS, URBANA, ILLINOIS 61801

February 18, 1969 Hoover report file

To: Warren C. House

From: Steven J. Fenves

Subject: John Meyer's memorandum

I am not quite sure where the following thought fits in the report, but I believe it ought to be mentioned.

Until now, we have seen only "single-user" systems. Obviously, in the case of, say, the Navy procurement program or Standard Oil management information system, these are very large systems, with management at various levels having access to appropriate sets of procedures and data, and (I hope) being prevented from accessing data inappropriate to the level of the inquirer. From now on, however, government systems will have to go in the direction of multiple-user systems, with several agencies (federal, state and local) having access to the system. The value and by-products of such systems may no longer be measured solely by the criteria used for the earlier ones. In particular, the degree to which an agency may maintain control and self-confidence may be as important a measure as the integration and streamlining achieved.

SJF:bar

cc: Dr. John Meyer

22069

Dear Steve,

Amen! And, more so from now on. Am passing copy to Tony.

Dear Tony,

We are setting up a folder for all comments on John's paper. We should reserve some time on the 11th to work through it. I suppose we can fill in whatever chinks there are in the schedule--perhaps go without dinner ?????

WASHINGTON UNIVERSITY

ST. LOUIS, MISSOURI 63110

COMPUTER SYSTEMS LABORATORY
724 SOUTH EUCLID AVENUE

TELEPHONE: AREA CODE 314
FO 1 - 7356

February 13, 1969

Dr. Anthony Oettinger
Aiken Computer Laboratory
Harvard University
33 Oxford Street
Cambridge, Massachusetts 02138

Dear Tony:

In response to your request for comments on "secondary effects" attending the use of computers as administrative or managerial tools in the federal establishment (ref: John Meyer's letter of 13 January), I would like to give voice to the following consideration:

It seems to me that, among other things, we ought to keep in mind the fact that machine systems in fact may tend to diminish the range of managerial and administrative choices in many situations, especially those in which any interpretation of the rules comes into play. A chosen alternative will, of course, most likely be one provided within the framework of the system, which, in turn, can be expected to take its own side in any question of interpretation. Likely pragmatic result: over-simplication of any situation not anticipated by the system designers.

I would guess that the vast middle of the managerial heirarchy is of greater concern here than are the extremes. Top management is generally entitled to augment and even contravene the system in order to arrive at sound administrative decisions, while at the supervisory level and below there are always people who are expected to beat the system when necessary to get the job done (though the civil service is a bit deficient in this regard).

Middle-management, on the other hand, has seldom been characterized by either imagination or enterprise, and to reduce its freedom of choice to a level even below its present, rather modest level of improvisation might well accelerate hardening of the civil arteries. It would be unfortunate indeed if we unwittingly lost what few middle-management flexibilities do exist in managerial and administrative procedures through algorithmic zeal.

My concern is scarcely a new one, of course, and there is always the hope that rapid, organized access to great masses of information will jazz up even middle-management. But we all know that system designers are poor, finite beings of well-bounded prescience and that the Machine tends to dazzle and dominate.

> "To such a state of affairs it is convenient to give the name of progress. No one confessed the Machine was out of hand. Year by year it was served with increased efficiency and decreased intelligence. The better a man knew his own duties upon it, the less he understood the duties of his neighbor, and in all the world there was not one who understood the monster as a whole. Those master brains had perished. They had left full directions, it is true, and their successors had each of them mastered a portion of those directions. But Humanity, in its desire for comfort, had overreached itself. It had exploited the riches of nature too far. Quietly and complacently, it was sinking into decadence, and progress had come to mean the progress of the Machine."

I nominate E. M. Forster to the board!

Yr. obdt. svt.,

Wesley A. Clark
Research Professor
of Computer Science
Director

WAC/lz
cc: Warren C. House

SDC SYSTEM DEVELOPMENT CORPORATION
2500 Colorado Avenue · Santa Monica, California 90406

February 11, 1969

Dr. John R. Meyer, President
National Bureau of Economic Research
261 Madison Avenue
New York, New York 10016

Dear John:

At the last meeting of the Computer Science and Engineering Board we were asked to offer suggestions as to some of the aspects the computer has had on the way in which management conducts their business. These were to be indirect aspects rather than direct ones, such as, I presume, production control.

Recently I had a most interesting visit with one of the major textile firms. They demonstrated with real examples the way in which they are using linear programming to control the entire operation of their fabric production and merchandising through the astute application of linear programming techniques. I was surprised to find that they control production down to the individual loom in plants which are widely dispersed geographically. Likewise, the sales mix and the marketing effort are largely determined by considerations of profitability relative to various capacities which are analyzed by linear programming techniques. Since we were asked to respect the proprietary nature of the detailed application of these programs, I cannot be much more specific, but, clearly, here is an application which would not be possible without computers and which ten or fifteen years ago would hardly have been within the vaguest understanding of top management.

I hope this example may satisfy the need Tony seemed to feel regarding your paper on "Reaction to Hoover Commission."

Cordially yours,

Lauror P. Carter
Vice President and Manager
Public Systems Division

LPC:db
cc: Warren House
John Lyons

The Washington Post, March 5, 1969

Nixon to Appoint Group On U.S. Reorganization

President Nixon will soon name a Federal commission on government reorganization to plan major changes in U.S. departments and agencies, White House officials reported yesterday.

The new commission, similar in scope to the former Hoover Commission, was promised by Mr. Nixon in a radio address last June 27. One job of the new unit would be to seek ways to modernize existing agencies, Mr. Nixon said then. In addition, it would seek to transfer Federal functions to state and local governments where feasible, he said.

On Jan. 30, Mr. Nixon asked Congress to grant him authority previously given other presidents to reorganize Federal departments subject to Congressional veto. A two-year grant to such authority passed the Senate last Friday, and now is pending in the House Government Operations Committee.

United Press International reported yesterday that Mr. Nixon will send to Congress reorganization plans covering six of the Government's 12 cabinet departments—Health, Education and Welfare, Housing and Urban Development, Labor, Commerce, Agriculture and Interior. The disclosure was attributed to an unnamed White House aide "close to the Chief Executive's thinking."

Presidential Counsellor Arthur M. Burns said yesterday he knows of no such sweeping plans, and said any forecast of major reorganization actions would be "premature."

John Ehrlichman, counsel to the President, said he had no information supporting a forecast of major reorganization in the six departments. Dwight A. Ink, recently appointed assistant director of the Bureau of the Budget with special reorganization responsibility, said he had not yet formulated any recommendations for government reshuffles.

In an announcement naming Ink to his post Feb. 5, Mr. Nixon was said to be "very much concerned with overlapping activities in the Federal Government" and "deeply concerned about the complexity of governmental procedures."

In addition to Ink, whose appointment was said to be "an important step" toward government improvement, Mr. Nixon is advised about government organization by Roy L. Ash, president of Litton Industries, who has been acting as a special presidential consultant.

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

MAR 4 RECD

February 28, 1969

Dr. Orville G. Brim, Jr.
President
Russell Sage Foundation
230 Park Avenue
New York, New York 10017

Dear Dr. Brim:

Thank you very much for your letter of February 25 advising us of the action of your Board of Trustees in approving our proposal for a Study on Privacy and Due Process Issues in Computer Data Banks. We are very pleased to have the support of Russell Sage in this important activity and, with the assurance provided by your letter, we shall take steps to get this program underway without delay.

In accordance with the request in your letter, I have signed the original and forwarded it along to Professor Oettinger and Dr. Westin with the request that it be returned directly to you.

I am assured by Dr. Oettinger that Dr. Alan Westin of Columbia has confirmed his willingness to serve as Director of the Study as outlined in our proposal to you. We will, of course, be glad to comply with the conditions of the grant concerning public information news releases and in the matter of any reports to be issued by this study group, as specified in your letter.

I have asked our Deputy Business Manager Mr. B. L. Kropp, to reply to you directly concerning the desired schedule and method of payments, and you should hear from him shortly.

We look forward to this further opportunity of working with the Foundation and we shall make every effort to see that you are fully and continuously informed of the progress of the work under the generous grant which has been provided.

Sincerely yours,

John S. Coleman
Executive Officer

cc: Mr. W. C. House
Mr. B. L. Kropp
Dr. A. Oettinger
Dr. C. E. Sunderlin
Dr. A. Westin
JSC:ah

FCC WIDENS COMPUTER INQUIRY

The United States Federal Communications Commission (FCC) has announced recently that it was launching an investigation into the Western Union International's (WUI's) worldwide "store and forward" data transmission system.

WUI's Deferred Datel Service is the international equivalent of Western Union's Broadband Exchange Service persently offered by RCA, WUI, and International Telephone and Telegraph on an international basis. The FCC inquiry grew out of a WUI tariff permitting the deferral of Datel calls by the common carrier at a customer's request.

Outbound Datel calls received from customers via data tielines, the domestic Broadband Exchange Service or DataPhone connections, would be stored on punched paper tapes for retransmission as stipulated by customers. Inbound Datel calls similarly would be stored for subsequent in-country calls.

The FCC finds this service a direct departure from customer-to-customer services proferred by other international common carriers in that its carrier processing would be introduced into there services. Since this is a new venture, the FCC feels that new principles must be formulated to govern charges, terms, and conditions under which service will be offered.

In announcing its inquiry, the FCC stated that it would attempt to determine whether "the provisions of store and forward or other traditional message handling functions in conjunction with a customer-to-customer service should be held to be in the public interest, just and reasonable and otherwise lawful."

The FCC has allowed WUI to continue its current charge but warned Deferred Datel Service customers that it could be terminated or the terms and conditions upon which it is precently proffered could be modified by the outcome of the investigation.

POST OFFICE DATA TRANSMISSION IN GREAT BRITAIN

John Stonehouse, Postmaster General of Great Britain, recently announced improvements in the Post Office data transmission service designed to keep up with the "explosive pace" of demand. Among the features announced were: free service after midnight beginning in April, 1969; and a new switched 48 kilobit service, to be operational by the end of 1969.

INTERNATIONAL FEDERATION OF AUTOMATIC CONTROL CONGRESS

The Fourth Congress of the International Federation of Automatic Control will be held June 16-21, 1969, in Warsaw, Poland. Topics to be discussed include: theory, application and components of automation systems, as well as bionics and automation in management. Registration information may be obtained from: Komitet Organizacyjny IFAC IV, Warszawa 1, ul. Czackiego 3/5 (POB No. 903), Poland.

Zurich Computerized Fingerprint Identification

The Zurich police department has developed a new system of computerized fingerprint identification. The system classifies fingerprints according to comparison with basic types.

NEWS RELEASE

from | Cornelius E. Gallagher, M.C.
Democrat, New Jersey 13th District
203 House Office Building, Washington, D. C. 20515

(FOR FURTHER INFORMATION, CALL
CHARLES WITTER (202)225-6751)

FOR RELEASE THURSDAY MARCH 6--AM

GALLAGHER HAILS INCREASING CONCERN OVER COMPUTER PRIVACY

"Within the past two weeks, my staff and I have cooperated extensively with three universities--Iowa State, Lehigh, and George Washington--by providing materials and advice on the study of the social implications of the computer. When the Special Subcommittee on Invasion of Privacy focused nation-wide attention on computer privacy by holding hearings into the suggested National Data Bank in 1966, there was almost no academic or other attention being paid to this crucial question. Now, in 1969, virtually every college and university in the country has special courses within its political science department, its law school, or as a part of its studies of information science. This fact is further attested to by the bulging files in my office, containing thousands of requests for copies of our hearings, our Report"Privacy and the National Data Bank Concept," and the many public statements I have made.

"It is also a source of deep satisfaction to me that three extremely influential groups are directing their attention to the impact of the computer on American values. They are: (1) the Harvard Program on Technology and Society, (2) The American Academy of Arts and Sciences' Working Party on "The Social Implications of the Computer," and (3) The National Academy of Sciences' Computer Science and Engineering Board. These groups and American educators generally recognize that human values are vulnerable to an unevaluated application of the new technology. The implications of the computer-spawned revolutionary trends in our society are particularly important to our young people, for every American life will be altered in some degree by sophisticated information handling. The increased concern over computer privacy makes me hopeful that we can control machines, rather than being dominated by them."

++++++++++++++++

Data Processing Group

bema

Business Equipment Manufacturers Association

235 East 42nd Street, New York, N.Y. 10017 – 687-5969

MAR 3 REC'D

1969 February 28

Dr. Sidney Fernbach
Head, Computation Department
Lawrence Radiation Laboratory
University of California
Box 808
Livermore, California 94550

Dear Dr. Fernbach:

As a member of a NEA-NRC Advisory Panel to the Center for Computer Sciences and Technology, National Bureau of Standards, I attended a meeting at the Center on February 20. At this meeting the Panel was briefed on the activities of the Center and I was particularly interested in the description of the work done by the Office of Computer Information as it relates to the assignment of the Data Base Panel of the CS&E Board.

Very briefly, the Office of Computer Information with a staff of 14 is engaged in compiling information about computer information and maintaining this on magnetic tape. I understand that the description or abstract of the information is as complete as that contained in the reports submitted to the Data Base Panel by Miss Ann Lamb at the last meeting. The Chief of the Office of Computer Information is Miss Margaret Fox, a member of the Data Base Panel.

In view of the fact that there is an organized effort with full time staff in the Center doing what appears to be essentially the same thing that our Panel is doing on a part time and inadequately organized fashion the first task we set for ourselves, I would suggest that we suspend further action on this particular task until we assure ourselves that it is not a duplication of effort. I would also suggest that Miss Fox be asked to arrange for a presentation on the work of the Office of Computer Information possibly supported by a sample print-out of the "catalog" at the next meeting of the Panel, scheduled for March 11.

Another activity in the Government that appears to be engaged in a similar function, although limited to federally-sponsored research and development over a broad range of subjects, is the Referral Services Division, Office of State Technical Services, Department of Commerce. I am enclosing a copy of the "Introduction" of a recent publication STS-108 PB-180137, "Computers-Selected Bibliographic Citations."

Sincerely yours,

CAP/mh
enc.
cc: M. R. Fox
W. C. House ✓

C. A. Phillips, Director
Data Processing Group

INTRODUCTION

The Referral Services Division, OSTS, has undertaken the task of providing the States with selected reviews and abstracts of recent federally sponsored research and development serving specialized technology areas of industry as compiled from existing Government information services. Accordingly, OSTS arranged with the Clearinghouse for Federal Scientific and Technical Information (CFSTI) to accumulate selected bibliographic citations from specific COSATI subject groups that were published in the U. S. Government Research and Development Reports (USGRDR) during 1966. USGRDR is published semi-monthly by CFSTI from machineable records of the R&D reports announced by AEC, NASA, DDC/DOD, and CFSTI.

The following is an accumulation of those citations on COMPUTERS. Entries are arranged alpha-numerically by accession number.

With few exceptions, reports listed can be purchased by the public from the CLEARINGHOUSE, SPRINGFIELD, VIRGINIA, 22151, or from any Department of Commerce Field Office. When reports are announced as available from a source other than the Clearinghouse, then order directly from the source at the price indicated in the entry.

Documents sold by the CLEARINGHOUSE are priced according to a "unit pricing policy" at $3.00 for a paper copy reproduction and $0.65 for a microfiche reproduction.

grants, a view that seems to be widely shared on the Senate Labor and Public Welfare Committee. Pell's education subcommittee will have ample work in trying to bring order out of all the "Great Society" education legislation passed during the Johnson Administration, committee observers believe.

In the health area, the Congress will have to decide what it wishes to do about the Hill-Burton Act which provides money for hospital construction. There seems to be little sentiment on the committee for greatly increasing the money spent on medical research, instead the emphasis seems to be on improving the quality and amount of research done with existing funding levels.

Kennedy in Science

As of this writing, the committee has made no final decision about what to do about science and its newly acquired responsibility for annual authorization of the National Science Foundation (NSF). In past years, Senator Edward M. Kennedy chaired an ad hoc subcommittee on science for the committee. Kennedy expects that the NSF authorization will now come under his auspices. There has been some talk in the committee, however, of giving authority over NSF either to the whole committee, or to the health subcommittee, or to the education subcommittte. Kennedy can be expected to do battle over such an attempt to deprive his group of jurisdiction over NSF.

The scientific, medical, and educational communities have few better and more effective friends in high office than Kennedy. He combines his great political potential with hard work, a willingness to listen to expert advice, and his own influence as Democratic whip. In the past, he has, along with Senator Fred Harris (D–Okla.), helped to oppose those who wanted to cut the NSF budget. Kennedy has, of course, many leading educational and medical institutions in his own state and seems to keep in touch with their problems. Whatever Kennedy's own record of championing scientific research, there is a feeling on the committee that Congress must subject NSF to much closer scrutiny that it has in the past.

Hill, during his leadership years, was able to exert special strength not only through his committee chairmanship but also because he was chairman of the appropriations subcommittee which handled health, education, and

Lee DuBridge Passes Senate Test

Lee A. DuBridge, President Nixon's science adviser, passed his first major congressional test last week with colors flying. Congressmen did, however, pass along the word that while some scientists may aspire to the stars, congressmen and their constituents tend to be more interested in what science can do to improve their lives on earth.

The occasion for this exchange was DuBridge's confirmation hearing on 6 February for the position of director of the Office of Science and Technology (OST) before the Senate Labor and Public Welfare Committee. The committee, and then the whole Senate, quickly approved DuBridge's nomination.

A theme for the relatively brief session was set by one of the committee's senior Democrats, Jennings Randolph (W.Va.), who noted that although the United States could orbit the moon, it could not perfect an automobile panel clock which would keep time. Randolph asked DuBridge where he would place his energies as OST director. DuBridge mentioned three areas in his response: (i) the analysis of weapons systems; (ii) the environmental area and the effect of technology and pollution on the environment—DuBridge termed environmental problems "an ever more important aspect" of OST's work; and (iii) the utilization of science and technology by numerous government departments. Later, committee chairman Ralph Yarborough (D–Texas) told DuBridge that he was "glad" he was concerned about pollution.

One of the committee's new members, Henry Bellmon (R–Okla.), asked DuBridge whether his office planned to pay more attention to social problems. DuBridge replied that he did plan to concern himself with these topics and that he hoped to increase the number of social scientists on the President's Science Advisory Committee from one to two, but that OST couldn't cover the whole range of social problems. At another point, DuBridge said that he thought that some federal agencies, such as the Department of Housing and Urban Development (HUD) and the Department of Transportation, did not have adequate research funds and that he hoped they would be given increased support.

Perhaps the most substantive challenge of federal policy was offered by Yarborough when he cited figures indicating that about five-sixths of all federal R&D money was spent by the Department of Defense, the National Aeronautics and Space Administration, and the Atomic Energy Commission. Yarborough asked DuBridge to have his staff determine whether "an inordinate proportion" of R&D money was not going into these areas, instead of into agencies like NIH. DuBridge replied that President Nixon was highly interested in the research effort in other agencies such as the National Science Foundation. He also said that he was sorry that allocations for basic research were declining in agencies such as the DOD, NASA, and the AEC because such agencies "will profit by good relations with universities."

But the hearing did not dwell on substance for lengthy periods; much of the time was taken in presenting verbal bouquets to DuBridge. Peter Dominick (R–Colo.) called the former Caltech president "as qualified for this job as anybody we could find in the country." One senator who is not a member of the committee, Charles Percy (R–Ill.), who serves as a Caltech trustee, came to the hearing to deliver his "personal testimony" about DuBridge, saying that he was "one of the most respected if not the most respected over-all balanced scientist in the United States today."

DuBridge looked a little nervous when he went before the Senate committee but as the hearing progressed, it was apparent that he had nothing to be nervous about. If DuBridge can translate the respect in which he is held in Congress and elsewhere into more extensive federal support for worthwhile programs, scientists will be able to leave the doldrums which have affected their community during the final years of the Johnson Administration.—BRYCE NELSON

OFFICE OF THE
REGISTER OF COPYRIGHTS

COPYRIGHT OFFICE
THE LIBRARY OF CONGRESS
WASHINGTON, D. C. 20540

ANNOUNCEMENT

On January 22, 1969, a bill, S. 543, for general revision of the U. S. copyright law was introduced by Senator John L. McClellan, Chairman of the Subcommittee on Patents, Trademarks, and Copyrights of the Senate Judiciary Committee.

The new bill is similar to the bill which was under consideration by the Subcommittee and was the subject of extensive hearings in the 90th Congress. A companion bill was passed, with certain amendments, by the House of Representatives in April 1967.

Made a part of S. 543, as Title II thereof, is a provision to establish in the Library of Congress a National Commission on New Technological Uses of Copyrighted Works. This measure, in the form of a separate bill, was passed by the Senate in October 1967 but was not acted upon by the House.

Senator McClellan stated, in his remarks made at the time of the introduction of the bill, 115 Cong. Rec. S664 (daily ed. Jan. 22, 1969), that the same text as the previous bill was introduced in order for the Subcommittee to resume its consideration at the point where it was suspended by the adjournment of the 90th Congress. He noted that the public hearings on this legislation were concluded during the 90th Congress and that any comments or proposed amendments not previously communicated should be submitted at the earliest possible time. In addition Senator McClellan reaffirmed his earlier statement that the Subcommittee would undertake to report a copyright revision bill at the earliest feasible date in this session of the 91st Congress.

* A COPY OF S. 543 IS AVAILABLE IN THE SATCOM OFFICE.

CC: Messrs. Cairns, Green, House, Sunderlin and Weyl

ML-68
(Jan. 1969-5000)

CONGRESSIONAL RECORD - 91th CONGRESS, FIRST SESSION

Wednesday, January 22, 1969
Vol. 115, No. 14, p. S 664

S. 543—INTRODUCTION OF COPYRIGHT REVISION BILL

Mr. McCLELLAN. Mr. President, as chairman of the Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, I introduce, for appropriate reference, a bill for the general revision of the copyright law, title 17 of the United States Code, and for other purposes.

The bill which I am introducing today contains two titles. Title I provides for the general revision of the copyright law. Other than for necessary technical amendments, relating principally to the effective dates of certain provisions, this bill is identical to S. 597 of the 90th Congress, which I introduced at the request of the Librarian of Congress. Extensive hearings on this legislation have been held by the Subcommittee on Patents, Trademarks, and Copyrights. The purpose of introducing the same text is that the subcommittee may resume its consideration of this subject at the point where it was suspended with the adjournment of the 90th Congress. The text of certain sections of the bill, notably those relating to the copyright liability of operators of coin-operated phonorecords and cable television systems, has been, for all practical purposes, rendered moot by events subsequent to the original introduction of S. 597.

Title II of this bill provides for the establishment of a National Commission on New Technological Uses of Copyrighted Materials. This title is identical to the provisions of S. 2216, which was passed by the Senate on October 12, 1967. The House of Representatives took no action on this bill primarily because of the lack of progress in the Senate on the copyright revision bill. The purpose of the Commission is to study and compile information on the use of copyrighted works in various information storage and retrieval systems and through various forms of machine reproduction and to recommend any necessary changes in our copyright laws or procedures.

I have previously stated that the subcommittee will undertake to report a copyright revision bill at the earliest feasible date in this session. The public hearings on this legislation were concluded during the 90th Congress. Any comments or proposed amendments not previously communicated to the subcommittee, should be submitted at the earliest possible time.

The VICE PRESIDENT. The bill will be received and appropriately referred.

The bill (S. 543) for the general revision of the copyright law, title 17 of the United States Code, and for other purposes, introduced by Mr. McCLELLAN, was received, read twice by its title, and referred to the Committee on the Judiciary.

AGENDA FROM PANEL MEETINGS (MARCH)

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

COMPUTER SCIENCE AND ENGINEERING BOARD

DATA BASE PANEL MEETING

March 11, 1969 10 a.m. - 12 noon

AGENDA

10:00 a.m. to 12 noon

Discussion by Miss Josephine Walkowicz (representing Miss Margaret Fox) of data and information processing available at the Bureau of Standards.

Discussion of other submitted memoranda.

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

NATIONAL PROGRAMS PANEL A

MEETING #3

ROOM 600-A

March 11, 1969

AGENDA

9:30-12:00 Mr. Robert Taylor, ARPA

Lunch

1:30-3:00 Dr. John Hrones, Associated Universities

3:00-5:00 Panel Discussions

A. Review charter of panel, particularly items A-G (these were prepared earlier). Are they sufficient; are there alternates; additional areas; can we set priorities?

B. Discussion of methods of procedure. What kind of report should we plan; to whom will it be directed; what should it try to accomplish?

C. Desired future presentations or meetings. Universities, government, industry, non-profit organizations?

D. Committee members, other disciplines, etc.

Service to Management Program

Arthur D. Little, Inc. ACORN PARK • CAMBRIDGE, MASSACHUSETTS 02140 • (617) 864-5770

INDUSTRY COMMENT • ELECTRONICS

February 26, 1968

Subjects
New IBM Computers
European Computer Shipments

NEW IBM COMPUTERS

Since the beginning of 1968, IBM has announced two new computers within the System/360 series: the Model 25 and the Model 85. The Model 25 is the smallest IBM computer to be fully compatible within System/360; it is priced between the Model 20 and the Model 30. The Model 85 will be the most powerful computer generally available within System/360.

Model 85

The introduction of the Model 85 marks the twelfth announcement of a large-scale System/360 computer. However, only three of these twelve are currently available: Models 65, 67, and 75. The first delivery of the Model 85 is scheduled for the third quarter of 1969. The distant delivery date, coupled with a lack of detailed descriptive data about the Model 85, would indicate that adjustments of the high end of System/360 are still proceeding, and the present picture may not be final.

Model 85 appears to be a very powerful, large-scale computer of conventional design. In design it does not differ greatly from the Model 75, which failed to capture a significant market. However, the Model 85 represents a significant increase in computing power over the Model 75; its central processor has a buffer memory with an 80-nanosecond cycle and a main memory with a 960-nanosecond storage cycle, in which 16 bytes are accessed at a time, and the available memory is expanded to 4 million bytes. The Model 75 has no buffer memory. Its main memory offers 1 million bytes (maximum) and a cycle time of 750 nanoseconds for 8 bytes.

The Model 65 is IBM's primary large scientific computer, with more than 300 installed and on order. Its users wish to be assured that a larger, compatible successor can be obtained if they need it. The Model 85 meets this requirement; apparently the Model 75 did not do so satisfactorily. IBM does not seem to agree with Control Data that a basically different kind of "super computer" is wanted by many of the users who outgrow the Model 65. The Model 85 is more like Univac's 1108, itself a large, very fast computer of conventional organization. The Model 85 therefore competes more directly with the 1108 than with Control Data's machines.

Model 25

The announcement of the Model 25 was accompanied by complete descriptive information. It therefore is possible to infer IBM's intentions regarding this model more clearly.

At the time of the original announcement of System/360 in April 1964, the Model 30 was the smallest in the series. It was described as the natural successor to the 1401 and 1460, because of the emulation circuitry which enables it to run their programs. However, most users have to pay more for the Model 30 as well as suffer the performance penalty associated with emulation. Although the Model 20, which was introduced later, is identified with System/360, it is not directly compatible with the larger machines. The Model 25 is thus the first fully compatible extension of System/360 to a smaller computer.

Prior to the announcement of System/360, the Honeywell 200—with its LIBERATOR (and later EASYTRAN) programs for efficiently converting 1400 programs to run on the Honeywell 200—had been announced as a replacement for the IBM 1400 series. Although Honeywell achieved significant success, IBM did not retaliate directly, because its interest in protecting the revenue from the 1400 family outweighed its losses to competition. Now, however, with the 1400's depreciated and many converted to Model 30's, IBM has introduced the Model 25 as a comparably priced, third-generation successor to the 1401, 1440, and 1460 computers. Honeywell, of course, has by now moved on to other and larger business areas and will presumably not be hurt so seriously by the introduction of the Model 25 as it would have been earlier.

One of the major innovations of the Model 25 is its method of attaining compatibility with 1400 series computers. With the Model 30, compatibility is achieved by adding special circuitry (a microprogram) which can be switched in. With the Model 25, one need only load either of two special punched card decks into "control storage" for the computer to operate either in System/360 mode or in 1400 mode. One might say that the Model 25 is neither a System/360 nor a 1400 series computer until it has been loaded with the appropriate microprogram deck. By using this approach IBM has solved the problem of producing a low-priced System/360 computer which is both compatible with the 1400 series and, when operating in 1400 mode, more efficient than the 1401. It is interesting to speculate what other microprogram decks will be made available for the Model 25, or developed by users, in the future.

In addition to the control storage used for determining operating mode, the Model 25 uses three other types of storage: 2000-4000 bytes of auxiliary storage containing general registers and used for controlling input/output operations, a small "scratchpad" memory with a 180-nanosecond cycle, and program storage with a capacity ranging from 16,000 to 49,000

bytes. The read/write cycle for program storage is 1.8 microseconds for 2 bytes, compared to 1.5 microseconds for 1 byte with the Model 30. Despite the increased speed in accessing program memory, however, the Model 25 is rated at two-thirds the effective speed of the Model 30; the flexibility achieved by the novel use of control storage apparently is accompanied by an operating speed penalty. The fact that its smallest program storage contains 16,000 bytes, whereas this is the maximum size of 1401 memories, also indicates that the Model 25 is intended as a step-up for current 1400 series users.

Compared to the Model 30, the Model 25 is much more limited in its input/output capabilities. Only one general-purpose input/output channel is provided for attaching peripheral devices. However, four of the most basic peripheral devices—keyboard typewriter, printer, card reader/punch, and disk files—have special input/output attachments to the central processor which permit them to operate simultaneously with the main input/output channel and with the processor.

In summary, the Model 25 appears to be an attractive addition to System/360. It should be a desirable replacement for many 1401/1460 and 1440 installations. For an average commercial mix of 1401 instructions, IBM claims the Model 25 to be over 50% more efficient than the 1401. The Model 25 will also attract some of the Model 20 users whose needs are expanding. Although the task of program alteration is equally formidable in making the transition from Model 20 to Model 25 or Model 30, the lower cost of the Model 25 processor and memory ($400/month less for a 16,000 byte memory) would make it more attractive than the Model 30. The Model 25 may even attract some current users of Model 30. The Model 25 consolidates IBM's position in the very large $5000-7000/month rental market, then, providing the long-awaited direct successor to the 1400 family.

EUROPEAN COMPUTER SHIPMENTS

Since our report *The Electronic Data Processing Industry in Europe* was issued in August 1967, we have received considerable additional data from manufacturers and industry surveys. The new data lead us to conclude that:

- Our estimates of number of computers installed at the end of 1966 were too low for some countries;
- Shipments during 1967 were excellent, resulting in an estimated 43% increase during the year in the total number of computers installed;
- Our estimates of the manufacturers' market shares in France were in error.

Table 1 shows our estimates of the numbers of computers installed, by country, at the end of 1966 and at the end of 1967. The first column repeats the 1966 estimates shown in the summary table on page v of our August 1967 report and the second column contains our revisions.

TABLE 1. NUMBER OF COMPUTERS INSTALLED

Country	Number of Computers		
	1966 (original)	1966 (revised)	1967 (est.)
West Germany	2,600	2,900	4,200
United Kingdom	2,100	2,200	3,200
France	1,800	2,100	3,100
Italy	1,200	1,200	1,700
Belgium-Luxembourg	350	400	600
Netherlands	390	450	700
Sweden	400	400	480
Switzerland	360	400	450
Other Countries	760	850	1,200
Total	**9,960**	**10,900**	**15,630**
Value (MM U.S.$)	**3,350**	**3,670**	**5,100**

The revisions show increases for all but two countries (Italy and Sweden): the largest increases are for West Germany and France. The revised estimates of the total number of computers and dollar value of installations for Europe are about 10% higher than the original ones. The third column, presenting our estimates as of the end of 1967, shows a 43% increase in the number of computers installed and a 39% increase in the dollar value of installations; the proportion of less expensive computers installed was larger during 1967.

Table 2 shows our estimates of the division of the French market by manufacturer as of the end of 1966.

TABLE 2. MANUFACTURERS' SHARES OF FRENCH MARKET, END OF 1966
(percent of total value)

Company	Original	Revised
IBM	60	61
GE–Bull–Olivetti	14	19
Univac	8	4
CII (CAE and SEA)	7	8
ICT	3	3
CDC	3	3
Honeywell	1	1
NCR–Elliott	1	1

Again, the first column shows the estimates presented in the summary tabulation on page vi and also on page 27 of our August 1967 report, and the second column shows our revised estimates. The primary changes are an increase in the share of GE–Bull–Olivetti and a decrease in that of Univac.

Service to Management Program

THE ELECTRONIC DATA PROCESSING INDUSTRY IN EUROPE

ABOUT THE AUTHOR

MICHEL DAWANCE holds a degree in physical engineering from the University of Liege (Belgium), an M.S. in materials science from Northwestern University (USA) and a diploma in business administration from the European Institute of Business Administration (INSEAD) in Fontainebleau (France), where he specialized in industrial economics and finance.

In 1961 and 1962 he was a research assistant in solid state studies at Northwestern University. Prior to joining Arthur D. Little, Inc., he was with Cockerill-Ougree S.A., the major steel producer in Belgium, where he worked in the production and product development areas. In product development, he worked in close association with many European wire and pipe manufacturers and cold rollers.

Since joining ADL Mr. Dawance has been concentrating his efforts on inventory control, production scheduling, and distribution problems for consumer and industrial goods. He has also carried out various market studies in the field of computers and peripheral equipment.

THE ELECTRONIC DATA PROCESSING INDUSTRY IN EUROPE

Arthur D. Little, Inc.

August 1967

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SUMMARY

The general interest in computers in Europe started when the first relatively low-cost business computers (in particular the IBM 1401) became available in December 1963. Since then, the number of computers installed has grown 2.5 times—from 4000 to an estimated 9960 systems by December 1966. The total value increased from $1.4 billion to $3.3 billion. Our estimates in the tabulation below show that the four largest countries (West Germany, the United Kingdom, France, and Italy), with 7700 systems worth $2.6 billion, accounted for about 77% of the total number of systems installed as of the end of 1966. Belgium-Luxembourg, the Netherlands, Sweden, and Switzerland accounted for another 15%, with 1500 systems worth an estimated $500 million.

	Number of Computers				
Country	1963	1964	1965	1966	1970
West Germany	975	1,400	1,900	2,600	6,500
United Kingdom	700	1,000	1,500	2,100	4,500
France	750	1,050	1,400	1,800	4,000
Italy	500	670	850	1,200	2,800
Belgium-Luxembourg	140	200	260	350	700
Netherlands	155	230	300	390	800
Sweden	150	240	320	400	830
Switzerland	180	220	280	360	700
Other Countries	255	380	550	760	1,600
Total	3,805	5,390	7,360	9,960	22,430
Value (MM U.S. $)	1,400	2,000	2,500	3,350	6,200

We estimate that until 1970 the annual growth rate of installations for most of the European countries will be 20–25%. By the end of 1970, a total of about 22,000 computers, worth over $6 billion, will be installed.

Because of increased competition from strong international companies such as Univac, Honeywell, and, to a lesser degree, Control Data, as well as from Siemens in Germany, and because of internal delivery problems, IBM's share of the market decreased between 1963 and 1966. We expect, however, that since deliveries of the 360 family have now reached a high rate, IBM's share of the market will again increase to about 60%. In the United Kingdom, IBM has progressed steadily.

After a period of decline, ICT's market share has returned to the level it reached three years ago. This recovery has primarily been a result of ICT's ability to deliver rapidly. Univac has consistently increased its share as it has strengthened its market base in the various countries with successful sales of large installations. In spite of GE's acquisition of Bull, Bull's position has not improved. Next in rank, but still considerably behind, is Honeywell, which has consistently increased its market share. NCR-Elliott has maintained a fairly constant position.

After a slow start, Siemens has been improving its position in Germany substantially with the 4004, and for the first time has become a significant competitor in the market. Control Data, successful in the scientific market and expanding in the business data processing market, has also improved its share of the total market. CII, the consolidation of CAE and SEA, has gained strength in the French market. Because of increasing competition and internal limitations, English Electric Computers has not expanded as rapidly as the entire British market and has not established itself abroad; consequently, its market share has been decreasing.

The major computer suppliers' participation (in percent of the value of computer installations) in the European market is shown below.

	Percent of Market (by Value), 1966									
									Total, 8 countries	
Company	Germany	United Kingdom	France	Italy	Belgium-Luxembourg	Netherlands	Sweden	Switzerland	1966	1963
IBM	60	38	60	63	66	59	65	68	56	62
ICT	1	32	3	—	—	—	7	—	9	9
Univac	13	5	8	11	7	12	2	22	9	5+
GE-Bull-Olivetti	4	2	14	21	14	8	8	5	7	8.7
Honeywell	3	6	1	—	1	2	—	1	3	0.5
NCR-Elliott	2	7	1	—	—	1	1	2	2+	2.7
Siemens	8	—	—	—	—	—	—	—	2+	0.8
CDC	2	—	3	—	2	4	—	2	2	0.4
CII (CAE and SEA)	—	—	7	—	2	—	—	—	2–	1.5
English Electric Computers	—	9	—	—	—	—	—	—	2+	3
AEG Telefunken	2	—	—	—	—	—	—	—	—	—
Others									6±	6.4–

There are no significant technological differences between the United States and Europe. In teleprocessing and real-time applications, the United States is still ahead of Europe, but Europe is ahead of the United States in process control, which is the fastest growing segment of EDP in Europe and has been the focus of much pioneering technological work.

1. INTRODUCTION

This report is concerned with general-purpose digital computers marketed and used in Europe; it does not include special-purpose computers designed to be part of military weapons systems or small office computers such as accounting machines or desk calculators. It updates our 1964 report (**EDP and The European Electronics Industry**), but is complete in itself.

We have estimated the present market and forecast the future market in the main Western European countries. No official statistics on the market are available, and estimates and surveys vary widely. As the number of computer installations increases and the number of obsolete systems returned to the manufacturer grows, it is increasingly difficult to evaluate the number of installations accurately. Our estimates are based on figures supplied by manufacturers, professional associations, and knowledgeable respondents, and on published reports and ADL work.

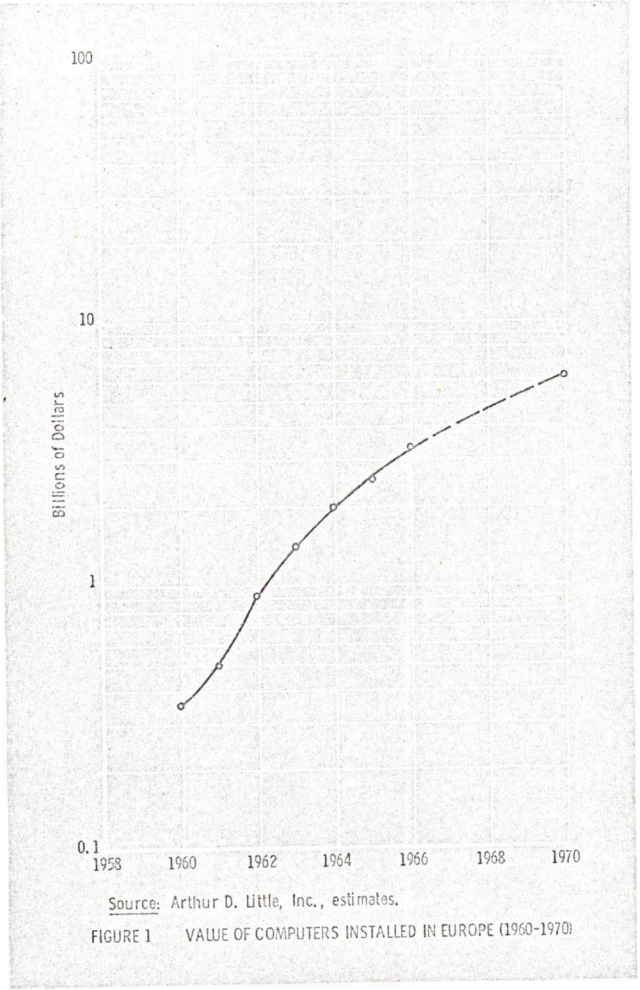
We have evaluated the position of each of the major suppliers of computing equipment. Estimates of market shares vary widely with the sources. Our estimates of the ranking of the various suppliers are based on field research and secondary sources, and interpretation of data so derived; we believe them to be representative of the actual situation.

Finally, this report also presents a discussion of developments in selected computer applications.

2. EVOLUTION AND TRENDS

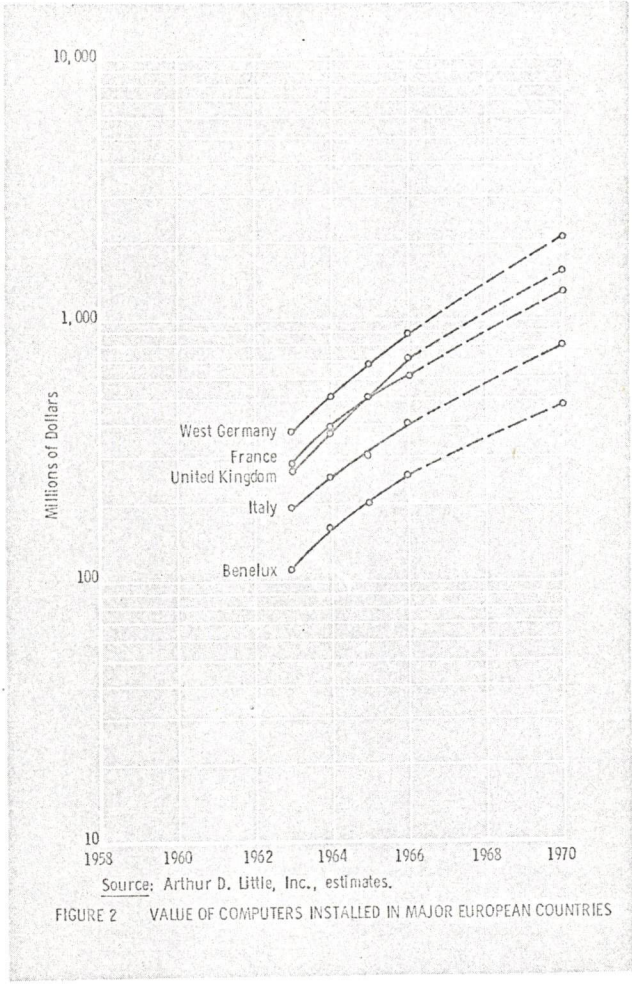
OVERALL EUROPEAN EVOLUTION

Figures 1 and 2 show the increase in value of computer installations over the past six years in Europe and in the major countries, respectively. The installations of computers as of December 31, 1966, are estimated to be as follows:



Source: Arthur D. Little, Inc., estimates.

FIGURE 1 VALUE OF COMPUTERS INSTALLED IN EUROPE (1960-1970)



Source: Arthur D. Little, Inc., estimates.

FIGURE 2 VALUE OF COMPUTERS INSTALLED IN MAJOR EUROPEAN COUNTRIES

Computer Category	Number	Value (MM$)
Small scientific and process control computers (average value $50,000)	700	35
Small business computers ($90,000–250,000)	4,630	755
Medium-sized computers ($200,000–750,000)	3,640	1,570
Large computers ($500,000 and above)	990	990
Total	9,960	3,350

In this breakdown we have classified computers by central processor type, the range being based on the purchase prices of the typical minimal and maximal configurations around the central unit. Yearly deliveries (value of new computers installed, sold, or rented) increased from about $150 million in 1961 to an estimated $1 billion in 1966. The growth rate of the number of installations decreased from a high of over 40% in 1964 to about 26% in 1966.

Delivery of the current generation of computers is reaching its full rate. On the basis of a year's worth of booked orders, we expect the value of installations to grow through 1970 at an average annual rate of 20–25%. A recent reduction in the rate of new orders appears to have been only temporary. Although the total number of new orders has been

overestimated by many as a result of optimistic statements made by manufacturers, the fundamental need for computers is as great in Europe as in the United States, and therefore no slowdown in the rate of installations and orders is expected. The small scientific and process control computers are expected to show the highest growth rate—an average increase in total value of over 30%/year.

Both positive and negative factors are affecting trends in the various market segments, as discussed below.

POSITIVE FACTORS

Increasing international competitive pressure is forcing a growing number of firms to improve their efficiency. There is a trend toward larger organizations, and large firms can effectively use computers and related data processing methods. Moreover, the improvement in the performance of computers at the various price levels provides smaller firms with new access to computers capable of fulfilling essentially all their data process requirements at reasonable costs.

Conscious of the need to boost office automation, and interested in the economic potential represented by the computer industry, several European governments are developing "computer policies" to stimulate the use of computers in their countries. In addition, the growing uneasiness in European government and industry circles about the gap between U.S. and European productivity is stimulating a positive attitude toward computers.

Government organizations have become more aware of the advantages of electronic data processing and are actively planning and implementing new applications. In most countries, some prominent proponents of the use of computers are members of government organizations. Many local governments have introduced data processing systems and more are planning to do so.

The first wave of massive computer installations is now reaching replacement age. This replacement opportunity will substantially increase the market potential for new installations. Of the 3805 computers installed by December 31, 1963, few will be left in 1970, and by that time many recent installations will also have been replaced.

INHIBITING FACTORS

Although the cost of clerical personnel has been rising continuously, the labor shortage is becoming less acute. Thus some of the pressure for use of computers as a substitute for manpower has been relieved.

Some European countries are encountering economic difficulties. The fear that more difficult times will come may restrict computer installations.

Many companies are still struggling with the problems encountered in the implementation of their present computer applications. Also, they are becoming increasingly aware of the advantages of using their machines in second and third shifts, before introducing a larger model.

Teleprocessing, actively promoted by manufacturers and considered an attractive solution to data handling problems by a large part of the market, is inhibited by the quality, cost, and overload of the telephone and telegraph networks in many countries. Some spectacular applications exist and perform very satisfactorily (e.g., Groupe Drouot), but the cost and technical difficulties are still considerable deterrents for most users. The most satisfactory applications are those based on leased lines or international communication lines, which are both of better quality than average.

The most important limiting factor is the increasing lack of qualified personnel in both the manufacturing companies and the using companies. Users are complaining that the quality of technical assistance provided by manufacturers is deteriorating and that they themselves have increasing difficulties in finding qualified personnel. The situation will probably become worse in the next few years. The awareness of EDP in Europe came later than in the United States, and the effort to identify, attract, and train qualified personnel for all aspects of EDP (including systems analysis and overall planning) has been insufficient to keep up with increasing requirements. More attention has been given to this problem lately, but it will be another few years before enough trained people are available. A survey made by the EEC information office forecasts a need for 200,000 programmers in 1970.

TRENDS IN TECHNOLOGY AND SELECTED APPLICATIONS

Technology is available directly through the European subsidiaries of U.S. firms or indirectly through the European firms which keep close contact with U.S. developments. No significant technological differences exist between the United States and Europe; the technological trends in the United States described in **The Computer Industry—The Next Five Years*** apply to Europe as well.

Applications are at different stages of development in the United States and Europe, however. In the following paragraphs we will discuss those applications of particular interest.

DATA TRANSMISSION AND TELEPROCESSING

Although there is a high degree of interest in data transmission and teleprocessing in Europe, the short-to-medium-term potential is not comparable to that in the United States even in proportion to the total market. There are several reasons for this: European transmission networks are of lower quality than those in the United States, the networks tend to be constantly overloaded, and at peak hours switched lines are often difficult to obtain. Systems based on the use of switched lines are frequently unreliable. While leased lines of better quality are available, they are expensive and justifiable only for very large installations. Mail, in contrast, is generally reliable, fast, and inexpensive. Finally, most potential users still prefer to ship documents or data in machine-readable form, such as punched cards or tapes.

The most significant existing or planned applications in this category are the integrated management information systems, in which most or all data processing functions of a company are performed without movement of physical documents. Although some of these spectacular systems have been widely advertised, only a few companies (e.g., large banks, insurance companies, and large industrial firms) will have these systems implemented by 1970.** The limiting factors for such systems are:

- The high cost of hardware, software, and systems analysis is beyond the reach of most companies;
- The complexity of these systems, if they are to perform satisfactorily (i.e., at savings which justify their implementation), requires greater technical capabilities than most companies possess.
- Currently the technical problems cannot be solved at a cost which is in line with the system's value to the user. In many applications the biggest problem is the collection of data in machine-usable form. (The development of flexible, inexpensive optical character-readers designed for a wide range of applications would greatly alleviate this problem.)
- Most companies are reluctant to make the drastic changes required in their structure, procedures, or information flow to exploit an integrated system.

REAL-TIME SYSTEMS

Real-time data processing can be defined as the ability to receive and process data so rapidly that results are available in time to influence operations still in progress. The total market for real-time systems does not seem large at this point. Many firms are considering such systems, but find that the cost is often prohibitive. When needed, direct access interrogation can often be performed more economically, with greater flexibility and less preliminary systems planning, by mail or telephone. Time is not necessarily a limiting constraint: mail, messengers, and other physical means of transmitting information are often adequate. However, for data which must be repeatedly transcribed and ultimately put into machine-usable form, less cumbersome methods are welcome if they can be economically justified. In some cases, the simple lack of clerical personnel favors automated data collection and transmission. Frequently, cost rather than time considerations determine whether the applications are on-line or off-line. The greatest interest is in inventory and production management applications, where competitive pressures are strongest and advanced methods seem to promise significant improvements.

MEDICINE

For the past two years, the use of computers for diagnosis, analysis of laboratory tests, information retrieval, patient monitoring, and processing records of recovering patients has been the subject of many investigations. Although further development is necessary before computers will be routinely used in medicine, the number of hospitals and medical research centers which follow the developments in this field closely and the existing and planned experi-

* Arthur D. Little, Inc., February 1967.

** The situation is similar in the United States.

mental installations point toward an important computer market in medical research alone.

RESERVATION SYSTEMS

Reservation systems represent a substantial proportion of recent installations and orders for large computer systems. Airlines are the most significant users of reservation systems. Several of the major airlines (BEA, BOAC, SAS, Air France, and Swissair) already have systems implemented, on order, or in active planning. By 1970, all European airlines will have their systems in operation. Meanwhile, the market for other reservation systems is developing. Several of the national railways have computerized reservation systems on a limited or nationwide basis, and more systems are planned.

A large German travel agency has just installed a computer system to perform most of the clerical functions associated with the organization of a trip, including seat and carriage allocation on transportation facilities on which the company has already reserved space, and printing of the tickets and other travel documents. Several other travel agencies are looking into such systems. Some hotel chains are also working on computer reservation systems. However, none of the hotel chains in Europe is comparable in magnitude with nationwide American hotel chains.

The firms most active in reservation systems are Univac, Siemens, and IBM, and, recently, Ferranti, which is supplying a $10-million system to BOAC. This market could rapidly become saturated.

DATA LOGGING AND DIRECT DIGITAL CONTROL

This class of computer applications is characterized by numerous problems, and, accordingly, a variety of solutions. When companies that want to have some computer activity find they cannot afford to maintain a broad general-purpose computer activity, they generally retreat into this field. As a result of the fragmentation in this sector, little information is available; however, much has been written on a few fairly sophisticated direct control systems which, in spite of their comparatively high unit value, represent probably only a small proportion of the total sector.

This sector comprises three general types of systems: data logging and process or instrument monitoring, closed-loop process control, and process optimization. The first type is the most common. We estimate that in 1966 there were over 300 such systems in Europe. This type is used most frequently in power plant monitoring, atomic plant supervision and experimentation, chemical process and pilot plant monitoring, and data logging and analysis in research laboratories.

Various sources estimate that between 100 and 200 closed-loop systems are in operation, including systems not based on a central unit but on a set of smaller, interconnected control units, each of which governs only a single function of a process or a plant. Although many of these closed-loop control systems were built as extensions of initial data logging systems, many of them were initially planned as integrated control systems. Some process control systems in the chemical industry and in pilot plant monitoring have been technically more advanced than the systems in use in the United States; however, some disappointing results have been obtained by firms that attempted to do too much too quickly. As a result, the trend now is to progress very cautiously and to limit the investment in effort and in equipment for this purpose until processes become well enough known to permit effective implementation of closed-loop control systems.

The most important process control applications are found in the chemical and oil industries (50–60 systems), the metal industry (40 systems), public utilities (50 systems), and the cement and paper industries (20–30 systems). There are no process optimization systems in operation today, although some experimental work is being done by chemical and glass manufacturers.

In this general area of application, one can also include traffic control. With traffic developing at a catastrophic rate in cities not designed to cope with this problem, the need for effective traffic control in most major European cities is urgent. The first stages of such systems already exist in Berlin, Frankfurt, Nuremberg, Vienna, Paris, London, Liverpool, and Helsinki. We expect that this specialized computer application will continue to develop rapidly.

In all data logging and direct digital control applications the current trend is toward low-cost computers used only for this purpose. It is generally expected, however, that the computer will later be interconnected with other computers or with a more powerful central unit which will be used for process optimization; it will thus be directly integrated into the overall data processing circuit of the company. However, we do not expect the process optimization stage to be reached for several years in the majority of installations.

Many data logging and direct digital control systems are being planned, and we anticipate rapid growth in this application in the next few years, to about 1500–2000 such systems in Europe by 1970. However, the unit value of the central digital unit being small, this segment will represent only about 2% of the total EDP market in Europe. Process-oriented peripheral devices and analog/digital converters will account for the majority of the value of the systems.

No company dominates this field as IBM does the general data processing field. The most active companies are:

- Elliott Automation, an early starter, which now has the largest share in England but is also well established in other European countries;
- CAE (now part of CII), which has the largest market share in France and is making increasing efforts in other European countries;
- Siemens, which concentrates on Germany, where it has the largest share of this market;
- Digital Equipment Corporation, a comparatively recent newcomer to Europe; and
- IBM, for which process control represents a very small activity, but which is not to be underestimated, since it has placed a number of 1130 and 1800 systems in Europe.

In addition, Philips recently entered the field; Honeywell, with the newly acquired Computer Control Corporation, may develop an important activity in the field in connection with its control equipment; and Telefunken/AEG is active, mainly in Germany. For several other companies, (e. g., AEI, Ferranti, Marconi, Brown Boveri, and Hartmann & Brown) process control represents a comparatively small activity.

In the process control field there are also many instrumentation firms that do not have their own processor capabilities, but instead build their systems around a central processor supplied by one of the specialized manufacturers. A number of other firms specialize in process control systems as a consulting or engineering activity.

COMPUTER PERIPHERALS

Europe, unlike the United States, has never had a significant computer peripherals industry comprised of companies distinct from the main computer manufacturers. Most computer manufacturers have, whenever possible, attempted to make the main peripheral devices themselves. They bought the parts they did not manufacture from U.S. suppliers or even from their competitors. Thus, ICT, Bull-GE, and Siemens all have lines of computer peripherals. All main American peripheral manufacturers are established in Europe; they have as dominant a position as the American computer manufacturers. The main firms are: Ampex, ANelex, Data Products, Librascope, Potter (ties with Facit/Addo), Bryant, Tally Corporation (which recently acquired Mathematic Punch Type Limited, a U.K. distributor), and Mohawk Data Science Corporation (ties with Automatic Input Systems Limited in the United Kingdom).

European peripherals manufacturers have been oriented toward punched tape equipment, a particularly popular input/output medium in Europe. Such equipment is manufactured by Olivetti, Facit/Addo, Electronic Machine Ltd. (of the Electronic Machine Company group), A/S Regnecentalen, several members of the ITT group (Creed, Standard Elektrik Lorenz), and others. Printers are made by Olivetti and Electronic Machine Ltd. Optical character readers are made by the ITT subsidiaries and Telefunken.

SPERAC, the new French company (Systèmes et Périphériques Associés aux Calculateurs) represents perhaps the first effort to develop a company whose activity is based on computer peripherals only. Concerned initially with disc memory systems (a Data Products license and a current development of its own) and with teleprocessing peripherals, SPERAC plans to expand its activity to include other main peripherals.

As computer peripherals represent a growing proportion of the value of computer installations, the main computer manufacturers will put increasing emphasis on integrating production of peripherals into their activity. However, the main European firms such as Siemens, CII, and ICT have come to recognize that the requirements in capital and in technical talents are such that they cannot devote the necessary efforts to all computer peripherals. If the European computer industry succeeds in its efforts to acquire a larger share of the European computer market, the potential for independent suppliers of peripheral equipment may also increase. In particular, outsiders might find profitable activities in producing cathode ray tubes, optical and magnetic character readers, and input equipment for specialized applications.

3. COMPANIES

The position of American companies in the European market has not changed significantly. A few European companies, however, are showing a new strength which points toward the possible development of independent European general-purpose computer companies. The significant element is a more planned approach to the computer business than in the past, when most European companies were developing their computer activities on a rather haphazard basis. The past lack of long-term planning led to basic financial difficulties which very few companies were able to surmount. But today, ICT, Siemens, CII, and to some extent Philips are making well-founded attempts to build up a strong, European-wide computer activity. This process is very slow, however, and for the time being American companies, with over 80% of the total market, are maintaining their position in Europe.

With the exception of ICT, American companies are the only ones to have a European-wide computer business. The main contenders, Siemens and CII, are making efforts to broaden their geographical base, a condition for long-term success in this field, as national European markets are too small to provide a profitable long-term demand volume.

The following paragraphs contain brief comments on companies which either have or will have a significant position in the European computer business.

IBM

As in the United States, IBM remains the unchallenged leader in Europe, covering almost all countries and all classes of applications. With manufacturing and product development facilities in most major countries, it is also the only company with a truly European-wide integrated organization.

IBM's share of the total value of installations in Europe in 1966 was an estimated 56%, down from 62% in 1963. This decrease was a result of IBM's having greater delivery difficulties than its main competitors (Univac, Honeywell, ICT, Bull-GE, and Siemens) experienced. We expect the decrease to be temporary and IBM's market share to stabilize around 60%. A larger share is unlikely because of the increasingly aggressive competition from other firms. IBM's domination of the market through a strong marketing organization, the existence of only two other firms (Bull-GE and ICT) as suppliers of conventional punched card equipment, and the volume generated through expansion and replacement of equipment in existing installations are guarantees of a stable position for IBM.

In Europe and Africa, IBM World Trade employs approximately 50,000 persons. IBM has two plants in France (Essonnes, modules; Montpellier, 360/40 and 360/50, specialized telecommunication input-output equipment), three in Germany (Sindelfingen, input-output devices, disc-packs, circuit cards and boards; Mainz, 360/30, 360/20, I-O equipment disc drives; Berlin, typewriters), one in Italy (Vimercate, 360/20, input-output devices), one in United Kingdom (Greenock, 1130, read-only storage, terminals, unit record equipment), one in Holland (typewriters, composers), and one in Sweden (input-output devices).

In addition, IBM imports very large systems and the 1800 and other equipment from the United States, some computers from Japan, and keypunches from Brazil. The European plants also export to the rest of the world, including the United States. IBM also has product development laboratories in each of the following countries: Germany (small computer systems and associated programming), France (communications and communications-based systems), United Kingdom (memories and programming), Holland (document handling), Sweden (production and process control), Switzerland (basic and applied research, including solid state physics, numerical analysis), and Austria (programming).

UNIVAC

Univac increased its market share from around 5% in 1963 to about 9% in 1966. New orders have run 10–12% of the market in the last 18 months. Its most remarkable advances have been in France (present share almost 8%, mostly in 1108 and 490 systems) and the United Kingdom (5%). Univac has been particularly successful with the 1004/1005 in Germany and Italy; ICT has sold this in the U.K. Main 1107/1108 customers have been (in order) commercial, airline, and Government organizations. With recent aggressive sales efforts in selected market segments and its addition of the 9000 series,

Univac is now in a strong competitive position and should maintain its market share in the near future. However, once other manufacturers gain experience with real-time applications and are in a position to deliver large computers for this purpose, Univac's strength will depend upon its ability to maintain an advanced position in particular areas or to broaden its market base to include ordinary data processing applications.

GENERAL ELECTRIC-MACHINES BULL-OLIVETTI

Although Machines Bull lost comparatively little of its market share at the time of its financial difficulties and subsequent agreement with General Electric in 1964, the group has not been able to improve its position substantially since that time. There was a period of considerable optimism based on the success of the Gamma 10 and the GE 200 and 400 series, but the recent difficulties with the Gamma 140 and GE 600 show that the organization's troubles in Europe are not over. The last two years were essentially a period of adjustment, and considering the fundamental differences between General Electric and Bull, one could have anticipated difficulties. It appears that Bull-GE was too ambitious in its plans, trying to expand its business and completely renew its product line simultaneously. The withdrawal of the 140 series demonstrates this overambitiousness problem very clearly. In addition, difficulties were encountered by Bull-GE with the 600's in Europe, wherever they were to be used for data processing rather than scientific calculation. Recent indications of these problems have been the cancellation of orders for two 600's by French Government organizations, and the layoff of 250 workers by Bull-GE in France.

Considering that other models, including the Bull-produced GE 400 series and Olivetti-GE's small-scale 115, have been successful—not only in France, but also in Germany, England and other countries—and considering that Bull and GE still enjoy a good reputation in the market, one can expect that Bull-GE will recover from its temporary difficulties and maintain or even improve its position in the long term. Much will depend upon the success of the newly announced Gamma 55, a computer for small (even very small) firms, as well as other forthcoming models from Bull-GE. In Italy Olivetti-GE is doing well, as is De La Rue-Bull (now 75% controlled by GE) in the United Kingdom.

GE is attempting to redirect these international operations into a fully integrated organization. The company's long-term success in Europe will depend upon its ability to establish a strong worldwide product and marketing policy. Under favorable conditions, GE could remain one of the strongest companies and gain a market share approaching 10%.

SIEMENS

Until 1965, Siemens performance in EDP was disappointing—a typical case of "too little, too late." However, since its licensing agreement with RCA in 1964 to produce the Spectra 70 under the name Siemens 4004 in Europe, Siemens has made a strong commitment to this business, and it appears to be moving toward a substantially better position. During 1966 Siemens delivered 42 systems, a large proportion of which were for the company's internal use. Most of the remaining systems were sold in Germany. Siemens had additional orders for 118 systems.

Siemens has shown considerable interest in data transmission applications, with which it has been experimenting for several years. Because of its strength in telecommunications Siemens should be able to obtain a good position in the teleprocessing market with the 4004.

Siemens has the leading position in Germany in process control, for which it developed the 300 series. At the end of 1966, 42 installations were operating and 40 on order in the steel, cement, and power production industries, and in road traffic control.

For the first time, Siemens is making a strong international sales effort, with encouraging results. (Siemens has a strong international sales organization for other products.) We expect, however, that for some time yet its main growth will be in Germany, where it has more than doubled its market share, to approximately 8%, and could well expand its share to 15%. Siemens does not have a privileged position in the other European countries, as it has in Germany. Thus it has to face strong competition from established manufacturers who have generally shown a much more dynamic sales performance. We expect that by 1970 Siemens will have 5% of the overall European market, up from about 2% in 1966.

Siemens recently acquired 70% of the capital of Zuse, taken over by Brown Boveri two years ago.

The acquisition by Brown Boveri did not put Zuse in a strong position, and subsequently, because of internal and external pressures, much of the Zuse organization disintegrated. What is left of Zuse now is largely production capacity, which Siemens will need if its market success continues.

AEG-TELEFUNKEN

From being a fully owned subsidiary of AEG, Telefunken has been integrated into the parent company. As a result, coordination between the two organizations is closer in all areas, including data processing.

Soon after its early work in data processing with the TR 4, Telefunken decided to move out of general applications and to concentrate on special large-scale applications such as air traffic control and scientific computation centers. The company has sold 25 TR 4 computers. Continuing the same policy, Telefunken recently announced the TR 440, a large general-purpose computer and compatible successor to the TR 4, specifically oriented toward real-time applications requiring multiple access points. It is designed initially for use by universities, banks, airlines, and railroads. Telefunken expects to install a substantial proportion of TR 440's for business applications, either as a central computer in large organizations or in teleprocessing service bureaus. In addition, Telefunken will offer the TR 8, a small computer basically intended as a peripheral unit to the TR 440, but available in different versions (e.g., for process control or military purposes). The company expects that this policy of selectively pursuing the market for very large or special installations where sales costs are relatively low will put it in a particularly favorable price-competitive position.

AEG is maintaining a strong position in Germany in the application of process control and scheduling computers and has 23 computers installed or on order. AEG has done some development work on process control computers in collaboration with General Electric, is presently using GEPAC computers, and is establishing production under license from GE. (GE holds approximately 10% of AEG's shares.)

Telefunken also works on peripheral equipment and markets a digital tape drive and instrumentation tape drives, display consoles, character readers and document sorters, miscellaneous data transmission equipment, and mail sorting equipment. It also manufactures analog computers and hybrid digital/analog computing systems.

Telefunken follows a cautious policy of keeping the sales and service organization as small as possible. It tends therefore to concentrate its efforts on the German market, although it has made some installations in the Netherlands and France.

CONTROL DATA CORPORATION

As in the United States, Control Data has found that to gain a larger market share in Europe it had to expand its activity from the scientific market to the general-purpose market. It is now making active and successful efforts in this market with the 3000 series, while at the same time maintaining a strong position in its original field. The 1700 has had only limited success, but CDC is not devoting great attention to developing the market for small computers. Although the number of CDC installations in Europe is small, the value of individual installations is sufficiently large that CDC has 2% of the market. The company has been trying to strengthen its sales organization in the major European countries and is likely to maintain and possibly improve its position over the next few years.

ITT (STANDARD ELEKTRIK LORENZ AND STANDARD TELEPHONE & CABLES LTD.)

ITT moved out of the computer field in the early 1960's, but has maintained an interest in data processing through its German and British subsidiaries. As a leading supplier of communications equipment in many European countries, ITT is particularly interested in data communications. Standard Elektrik Lorenz and Standard Telephone & Cables Ltd. are producing miscellaneous data transmission components, including modems. Standard Elektrik is also working on post office automation. In England, ST&C provides the message-switching market with both conventional punched tape equipment and computer-based systems (ADX 6300 and 8300), using, in part, computers purchased from outside. ITT has also opened subscriber data processing centers in France, Germany, and England. These serve both ITT subsidiaries and other commercial customers directly connected to them.

COMPAGNIE INTERNATIONAL POUR L'INFORMATIQUE (CII)

CII, formed within the framework of the French Plan Calcul, resulted from the merger of two small but successful French companies—Compagnie Européene

d'Automatisme Electronique (CAE) and Société d'Electronique et d'Automatisme (SEA). CAE has secured a substantial share of the market for small and medium-sized scientific computers and for process control equipment. Its main activity has been in France, but during the last two years it has also been working in the international market, especially in Italy, Germany, and the Benelux countries. SEA has experience in commercial data processing. Under the stimulus of the French Government, CII will probably establish itself in all areas of data processing. If it pursues its past aggressive market approach, it can expect to acquire a significant market share, particularly in France.

SPERAC

SPERAC (Systèmes et Périphériques Associés aux Calculateurs), also born under the influence of the French Plan Calcul, will limit its activity to computer peripherals, teleprocessing equipment, and process control. SPERAC should be able to develop a strong market for its type of equipment in Europe. Companies such as ICT and Siemens, whose development and production activities are limited in scope by shortages of technical capabilities and capital, have a large demand for peripherals of European origin.

DIGITAL EQUIPMENT CORPORATION

Established in Europe only a little over two years ago, Digital Equipment has been successful in small scientific and process control computers, of which it had installed 140 by the end of 1966.

Many of these were sold to original equipment manufacturers for incorporation into control, message-switching, or other systems. If DEC succeeds in maintaining its strong competitive price position, which it also has in the United States, the company should be able to capture a significant share of this market.

SCIENTIFIC DATA SYSTEMS

Although not nominally represented in Europe, SDS is present in Europe through its agreements with CAE in France and GEC in England. However, whether this policy of agreements with European firms will successfully establish SDS in the European market in the long term is questionable.

BURROUGHS

Burroughs has maintained only a marginal position in the European computer market, partly as a result of its decision to limit its effort to its own service bureaus. With the introduction of its new lines, however, Burroughs seems to have become interested in maintaining its position among its accounting machine customers when they move to more sophisticated equipment. Recently, Burroughs received two orders in the United Kingdom—one from the Barclays Bank Ltd. for the giant B8500, and the other from the Midland Bank Ltd. for terminal equipment. These two orders—amounting to almost $50 million—are among the largest ever placed for computers by private enterprises in England. Because of its well established position in accounting machines and its spectacular entry into the market for on-line real-time systems, Burroughs will probably become a significant competitor in the European market in the near future.

RCA

RCA has consistently maintained an indirect position in Europe through agreements with European firms (Siemens and English Electric). As discussed under Siemens, it is likely that for some time the association with Siemens will provide RCA with attractive returns without direct efforts.

ICT

The pessimism generally expressed in 1963 about the future of ICT was confirmed by a decreasing market share and poor profit performance in 1964 and 1965. During 1966, however, ICT showed signs of strengthening its position: it regained its market share of three years ago (9% of the total European market); and its 1966 profits were about $6.2 million, against a previous loss of about $1.4 million. Most of the credit for this strengthening goes to the introduction of the 1900 series, which ranges from large to small machines. Before the 1900's introduction, ICT's line had very large to very small machines, but was composed of too many models (many resulting from mergers and licensing and marketing agreements); there were too many designs and too small production runs. The 1900 series, the first single compatible series introduced by ICT, was, like the IBM 360's, a high-speed modular system suitable for scientific and commercial applications. Its success was also due to its relatively simple pro-

gramming, the availability of good software packages, and ICT's ability to deliver rapidly. As a result, 269 computers of the 1900 series, out of a total order of 652, were delivered by the end of 1966. By the beginning of 1967, orders for the series topped $280 million.

Besides the introduction of this new series, other factors which played an important role in the strengthening of ICT were the following:

- A restructuring of the company organization which coincided with the reshaping of the product line;
- An increase in the export market—about one-third of the output now goes abroad, and half of this to European countries;
- The Government interest in developing computers and in promoting their use, and particularly the $14 million loan from the National Research and Development Corporation (repayable out of profits in 1970 and thereafter); and
- An increased business interest in computers.

The future of ICT will depend strongly on its ability to keep up with its American competitors—mostly in terms of product development, software, and marketing. The design of its projected microcircuit computer to enhance and expand the 1900 series is being completed; the first deliveries are anticipated by the beginning of 1968. Extensive research is also being carried out on peripheral equipment such as scanning and reading devices, and a "universal document transport" which is now being marketed. We believe ICT can maintain its present market share in the United Kingdom; however, if it wants to expand its overall European share, ICT will have to make additional efforts outside the United Kingdom.

ENGLISH ELECTRIC COMPUTERS

English Electric Computers is a wholly owned subsidiary of English Electric and was formerly known as English Electric Leo Marconi. The British market accounts for the majority of EEC's computer sales, which amounted to about 9% of the U.K. total in 1966.

At the end of 1965, EEC introduced a new line (and a new generation) of computers with its System 4 series. This series is a compatible line of processors using micro-integrated circuitry and takes advantage of English Electric's long-standing technical information exchange with RCA.

In 1965, EEC was, with ICT, involved in the study of the Anglo-French giant computer plans; CITEC was participating on the French side. Since then little definite planning has emerged, and for the time being the idea is dormant. The idea of European cooperation in the computer field, however, makes inescapable sense, in view of the massive research investments required. Last year EEC looked to Germany as a more fruitful area. The firm in Germany most likely to be interested is Siemens; Siemens, like EEC, is closely associated with RCA. Nothing yet has come out of this effort at cooperation.

ELLIOTT AUTOMATION

Elliott Automation is active in all aspects of automation and in instrumentation equipment and components. Consequently, it has decided to concentrate its computer activity in the industrial and defense control market. Elliott and NCR have agreements by which Elliott manufactures most NCR computers, but markets only process control computers of its own or of NCR design. NCR also sells the NCR Elliott 4100 computer for commercial applications at home and abroad.

Most Elliott sales are in the United Kingdom, where they account for 7% of the market. Elliott has been successful in small process control computers (the low-cost 900 series computers are designed for process control, but are also used for data processing by small businesses) and will probably maintain or improve its position as the market develops.

Lately, British computer manufacturers have been very active in the Eastern European market. The desire of Eastern Europe to catch up with the West in automation and particularly in computer technology has repeatedly been hindered by the restrictions on trade with Eastern Europe imposed on American companies by the U.S. State Department. This U.S. attitude has traditionally kept others out of the market also. However, the British, particularly in 1966, have been much more venturesome in this market, where they in effect face no American competition. Elliott-Automation was the first to foresee a potentially rich market and has landed $10 million in orders, mainly in Czechoslovakia, Russia, Hungary, Poland, and Rumania. (ICT has obtained orders totaling about $10 million and EEC about $4 million.) The potential of the Eastern European market has been estimated at $100 million per year for the next three or four years.

HONEYWELL

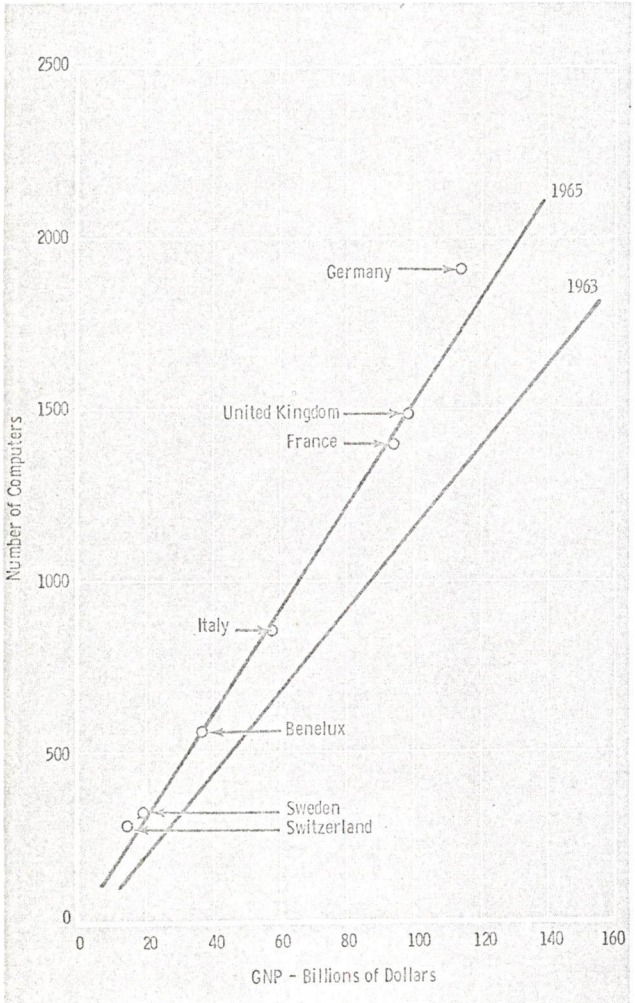
Honeywell entered the European computer market in 1962, when it made its first delivery in the United Kingdom. Honeywell now has a market share of 3%, up from 0.5% in 1963, and has the fifth largest sales in the European market.

Honeywell's growth has mainly resulted from the success of its 200 series, but it is also due to the strengthening and development of its marketing organization and to its broad capabilities in digital equipment and in controls and associated equipment. Honeywell's position is strongest in the United Kingdom, where it has 6% of the market. In 1966, the first full year of computer production at the plant in Scotland, more than half of the 200 series systems were exported to Common Market and EFTA countries, and to the Commonwealth. Honeywell has also formed a new U.K. division—the Computer Control Division—to strengthen its position in the process computer market and to incorporate the activities of the newly acquired Computer Control Corporation.

Honeywell is also expanding in France, Scandinavia, the Benelux countries, Switzerland, Italy, Spain, and Germany; 1966 saw it start production of the H 200 computer system in Germany. By 1970, Honeywell may have as large a market share in most of the European countries as it now has in the United Kingdom.

4. MAIN MARKET DEVELOPMENTS IN INDIVIDUAL COUNTRIES

Between 1963 and 1965, the ratio between the number of computers and GNP consistently increased for most European countries, as the two trend lines in Figure 3 show. The only notable exception is Germany, which was slightly above the European trend line in 1963 and was even further above it in 1966. As in the past, Switzerland has remained above the trend line; the United Kingdom, however, has come closer to it.



Source: Arthur D. Little, Inc., estimates.

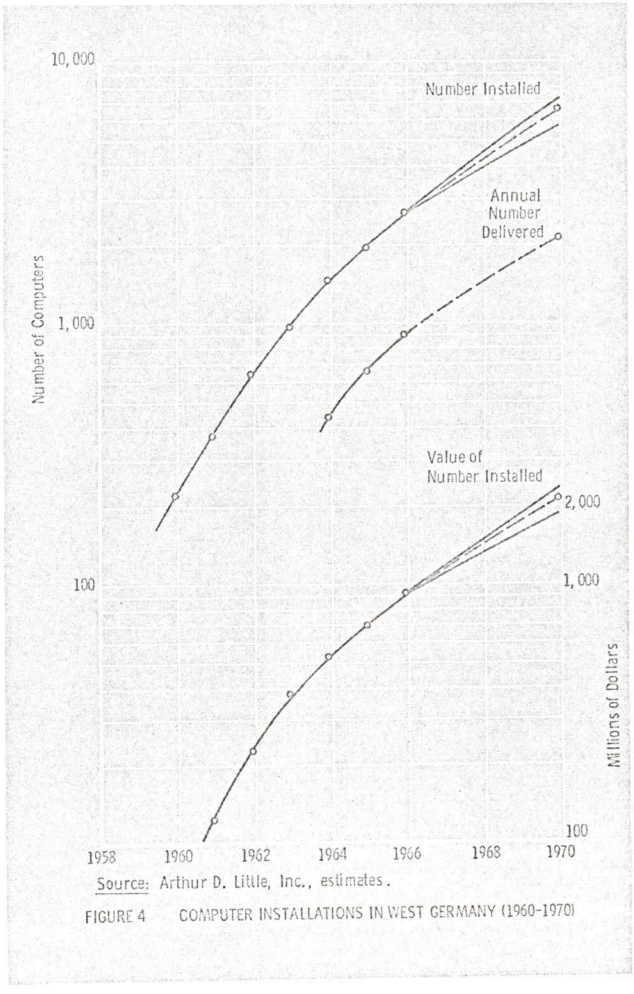
FIGURE 3 COMPUTER INSTALLATIONS VERSUS GNP IN MAJOR EUROPEAN COUNTRIES

We anticipate that past rates of growth in individual countries will continue and that the market will follow a similar pattern of development in most European countries. Germany and Switzerland will probably remain somewhat ahead of the other countries in their ratio of computers versus GNP.

WEST GERMANY

MARKET

At the end of 1966, the installed computers in West Germany, including those in process control systems, had an aggregate value of about $900 million (Figure 4). Computer installations have grown more



Source: Arthur D. Little, Inc., estimates.

FIGURE 4 COMPUTER INSTALLATIONS IN WEST GERMANY (1960-1970)

rapidly in Germany than in most European countries. The main reasons for the growth have been the rapid growth of the GNP (19% from 1962 to 1966), rapidly rising wages coupled with a labor shortage, the existence of numerous large companies, and the high rate of investment as a percent of GNP (13.3%). In addition, Germany has long been interested in scientific management, particularly via the use of data processing, and has had a large number of punched card installations.

In 1966, the German economy slowed down. The growth rate of the GNP was 2% in 1966 and is expected to be about the same in 1967. Despite the credit squeeze, the economy has maintained a high level of activity, in part through export growth. Although the slowdown may continue for some time, its overall effect is to normalize a too rapidly growing economy.

The current difficulties seem likely to result in a greater awareness of the need for effective management. The slowdown in computer orders observed in mid-1966 was only temporary; in late 1966, orders were again at a high rate comparable to that of earlier years. We anticipate that for the next few years the number of computers installed will increase by about 25%/year, to a total of 6500 in 1970, worth about $2 billion. Taking into account the replacement of obsolete computers every year, we estimate that about 1100 computers will be delivered in 1967, 1400 in 1968, 1700 in 1969, and over 2000 in 1970.

PRODUCTION AND TRADE

Despite the Government's efforts to improve them, official West German statistics give only an approximation of the production and trade of data processing equipment there. Table 1 shows Govern-

Table 1. EDP Equipment Production and Trade in West Germany (millions of dollars)

	1963	1964	1965
Production	372	544	524
Imports	292	264	504
Exports	200	240	324
Sales within Germany	464	568	704

Source: Government statistics.

ment figures for total sales of data processing equipment (including computers, punched card equipment, and related parts) in West Germany; these figures are below our estimates of the value of computer deliveries. One reason is that part of the equipment which makes up a computer installation can be classified into statistical categories outside of data processing equipment. IBM, which has the largest production and market share in Germany, reports its statistics in such a way that it is difficult to conclude specifically what its total activities in Germany are. Also, the value of installations is estimated at sales prices to users, while production and sales figures are generally reported without sales markups. Production of computers as reported in these official statistics shows a substantial increase (46%) in 1964, but a slight decrease (3.7%) in 1965. To a large extent, these figures reflect IBM's position in the industry. The German IBM factories are part of an overall European setup, and production is transferred from one country to another as necessary to optimize production schedules.

The Government's statistics show that data processing equipment produced in Germany represented 6.4% of the total German electronics industry in 1964 and 5.5% in 1965. Exports of EDP equipment accounted for 9.2% of all electronics exports in 1964 and for 11.2% in 1965. In 1964 and 1965, trade was divided among the main geographical areas as shown in Table 2.

Table 2. German EDP Trade with Major Geographical Areas (percent)

	Imports		Exports	
Area	1964	1965	1964	1965
EEC	53.8	53.8	43.9	55.0
EFTA	20.1	17.1	31.9	28.6
USA	22.3	26.7	1.9	2.1
Others	3.8	2.4	22.3	14.3
Total	100.0	100.0	100.0	100.0

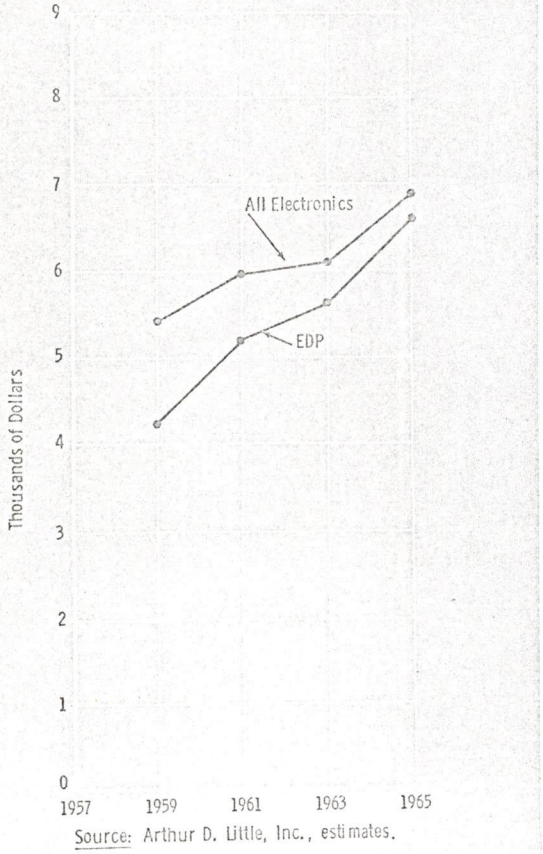
Source: Government statistics.

U.S. and German statistics indicate that for 1965 total German imports of U.S. data processing equipment, parts, and accessories amounted to $33.7 million. In 1963, exports from the United States to Germany amounted to $27.7 million. Exports of data processing equipment from the United States to Germany have thus continued to increase, although

at a reduced rate (57% in 1961–1963, 30% in 1963–1965). American companies are producing more computers in Europe, but most of them still ship new models, special equipment, and parts from the United States, so that total imports from the United States will continue to equal or exceed the present level.

COMPANIES

The EDP manufacturing companies employed 19,900 people in 1965 out of 335,900 for the total electronics industry. This figure has been increasing rapidly (5300 in 1959, 11,000 in 1961) and is expected to continue to grow at a high rate. The output per employee in the EDP industry was 6600 in 1965 and has been rising (Figure 5) at a faster rate than the output per employee in the total electronics industry.



Source: Arthur D. Little, Inc., estimates.

FIGURE 5 OUTPUT PER EMPLOYEE IN THE ELECTRONICS AND DATA PROCESSING INDUSTRIES IN WEST GERMANY

The major companies and their estimated shares of the German market in 1963 and 1966 were:

	% of Total	
Company	1963	1966
IBM	76	60
Univac	8	13
Siemens	3–	8
Bull-GE	2+	4
Honeywell	—	3
NCR-Elliott	—	2
CDC	—	2
Telefunken	2	2
ICT	—	1

Other companies with minor market shares in Germany in 1966 were Burroughs, Digital Equipment Corporation, Philips/Elektrologica, and Eurocomp. The companies manufacturing EDP equipment in West Germany are IBM, which manufactures the 360 series with components coming from France; Siemens; AEG-Telefunken; Univac; Eurocomp; and a number of smaller firms.

There are practically no new ventures in the data processing field in Germany. Zuse, which had 3% of the market in 1963, has virtually disappeared from the market. It encountered financial difficulties and subsequently was acquired first by Brown Boveri and then by Siemens.

Competition is increasing between established firms of American and German origin. Siemens is the first German firm that has offered strong competition to other firms. Although Siemens is not likely to substantially affect the results of the other major firms, its success certainly foreshadows harder competition in the future.

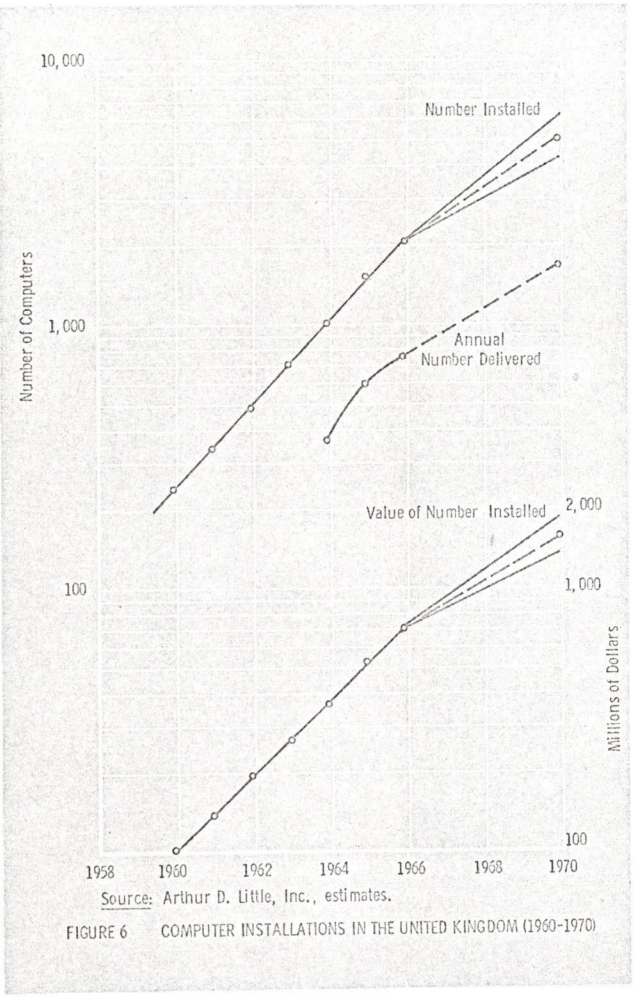
UNITED KINGDOM

MARKET

By the end of 1966, 2100 computer systems were installed in the United Kingdom (Figure 6). The total value of these installations was about $700 million.

The ratio of the number of computer installations per million of working population rose from 26 in 1961 to about 100 at the end of 1966. The United

Kingdom, however, still ranks only ninth in this respect among the European nations and is surpassed by countries such as Norway, the Netherlands, and Belgium.



Source: Arthur D. Little, Inc., estimates.

FIGURE 6 COMPUTER INSTALLATIONS IN THE UNITED KINGDOM (1960-1970)

The British Government has realized the importance of speeding up the automation process in all sectors of the economy, if the goals set in last year's National Plan are to be reached, and if the trade balance is to be improved. The Ministry of Technology is concentrating its efforts, in addition to those in the computer field, mainly on industrial research, electronics, machine tools, telecommunications, and technical and scientific instrumentation. Through the Ministry of Technology, the Government has taken the following steps:

- Set up the "Computers Advisory Unit," which is responsible for identifying computer needs in the public sector;
- Commissioned two studies; one to analyze in detail the computer requirements of universities and research centers, and the other to determine how computers may be used with greater impact and economy by small and medium-sized firms;
- Set up the National Computing Center in Manchester to:

  Promote increased and more effective use of computers;

  Provide service, assistance, and advice;

  Collect, publish, and distribute information about computers and their use;

  Provide education and training; and

  Sponsor and encourage new research work in the field.

- Loaned ICT $14 million and Elliott Automation $5.6 million (through the National Research Development Corporation and the Advanced Computers Techniques Project) to increase research and development; and,
- Created incentives such as a more liberal depreciation schedule for acquiring EDP equipment.

The creation of a Computer Science and Cybernetics Institute in London and new chairs for mathematics at the Imperial College of Science and Technology and the London School of Economics are other signs indicating how important the development of the computer field has become in England. These steps are a part of the Government's effort to resolve England's economic problems. The fall in industrial production and the sharp scaling down of private investments, both consequences of the deflationary policy adopted by the Labor Government to straighten out the balance of payments situation, will continue until 1968. The GNP is not likely to grow more than 1% in 1967. The Board of Trade predicts an 8% decrease and the Confederation of British Industries a 20% decrease in private investment spending for 1967, a decrease which will be only partly offset by a small rise in public spending.

The present difficulties and the planned Government measures will result in a drive for higher productivity and efficiency, and in increased usage of computers. We anticipate that the total number of computers installed will increase by about 25%/year over the next few years, to about 5000 computers worth approximately $1.5 billion by 1970. Taking into account the replacement of obsolete computers, we estimate that the following number of computers will be delivered in the United Kingdom:

1967	900
1968	1,100
1969	1,300
1970	1,600

PRODUCTION AND TRADE

The production value of computers, as reported by the Ministry of Technology, sharply declined in 1965, compared to 1964 (Table 3). This decline in production resulted in the Government measures described earlier.

Table 3. Production Value of Computers in the United Kingdom

Year	MM$
1963	69.4
1964	123.8
1965	96.9
1966	165.0

Source: Ministry of Technology.

Imports of computers and electronic data processing equipment from 1963 to 1966 rose 182%, while exports rose only 83% (Table 4). In 1964 imports exceeded exports for the first time, and the gap between the two has been widening since.

In 1966 the export total reached $72.2 million, a gain of 126% over 1965. The computer sector has had the highest rate of export growth in the electronics industry. Electronic data processing equipment, peripherals, and ancillaries accounted for about 14% of the total electronic and allied product exports in 1966, compared with 6.5% in 1965. British computer exports are likely to continue to rise. One reason is that British manufacturers have had considerable success in Eastern European markets, where U.S. competition is small because of the limitations on trade with Eastern Europe imposed by the U.S. State Department on American computer manufacturers.

In 1966 imports of computers and peripherals rose 93% over 1965 figures—from $48.4 million to $93.2 million. These imports accounted for 33% of the total electronic and allied product imports in Great Britain in 1966, compared with 22% the previous year.

Table 4. U.K. Trade in EDP Equipment (millions of dollars)

Year	Imports	Exports	Difference Exports versus Imports
1963	33.1	39.5	+ 6.4
1964	39.8	36.7	− 3.1
1965	48.4	31.9	−16.5
1966	93.2	72.2	−21.0

Source: Government statistics.

COMPANIES

The major companies and their shares of the market value in 1963 and 1966 were:

Company	% of Total 1963	% of Total 1966
IBM	33	38
ICT	33	32
Elliott Automation	9	6
English Electric Computers	13	9
Honeywell	2	6
Univac	2	5
Bull-GE	0.5	2

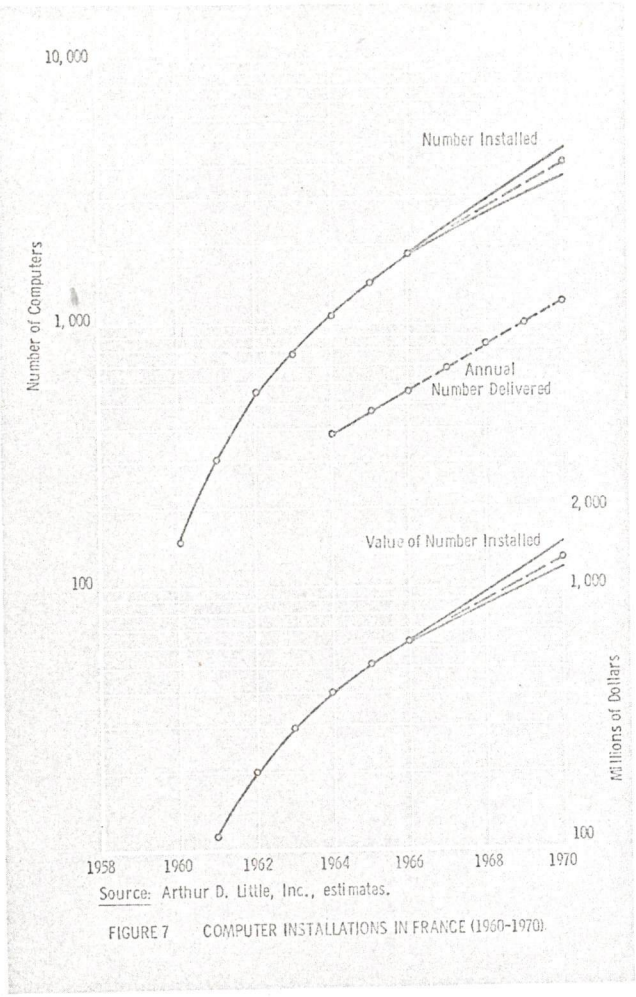
The gradual improvement of computers produced by British manufacturers, along with Government help to the industry and a greater emphasis on buying domestic products, will result in increased competition for IBM and other foreign manufacturers.

Over the last few years, the British computer industry has changed: formerly a large number of manufacturers offered a diverse range of equipment; now a smaller number offers a series of compatible machines. The three main British companies specializing in different market segments are ICT; specializing in small and medium-sized business computers; English Electric Computers, in large business and scientific computers; and Elliott Automation, in process control and small scientific computers.

FRANCE

MARKET

Figure 7 shows the increase of computer installations in France since 1960. At the end of 1966, the total



Source: Arthur D. Little, Inc., estimates.

FIGURE 7 COMPUTER INSTALLATIONS IN FRANCE (1960-1970)

value of installed computers was about $610 million. The following trends have influenced the growth of computer installations in France:

- Clerical labor costs have been rising rapidly—8%/year from 1960 to 1963, and over 6%/year between 1963 and 1965. Furthermore, the compulsory fringe benefits (56% of salaries) are the highest in Europe.
- A large number of users have been replacing their punched card installations.
- Under the pressure of Common Market competition, small and large companies have been merging at a rapid rate, and the companies' ability to make effective use of data processing equipment has increased correspondingly. The average size of French companies formerly was small compared to that in England and France; there had been only a very few large companies.
- As a user, and in an effort to promote greater effectiveness in information processing, the Government has been giving increasing attention to data processing.
- The French economy has been developing at a high rate: in 1962–1965 the GNP rose 37% in current prices (20% in constant prices).

These trends point toward a continuing high growth rate of computer installations. We expect an average yearly growth rate of almost 25% for the next few years to a total of 4000 computers worth about $1.3 billion in 1970. If the obsolete computers withdrawn from the market are taken into account, about 1200 computers will be delivered in 1970.

PRODUCTION AND TRADE

As in Germany, in France official statistics reflect an inaccurate picture, since specific statistics on the production of data processing equipment are not available. IBM's production of components represents a substantial proportion of the total value of computer equipment produced in France. A large part of IBM's production is exported to other countries for assembly. Government trade statistics, summarized in Table 5, should be considered with caution, because of confusion introduced at customs offices or created on purpose by manufacturers.

Table 5. French Trade in EDP Equipment (millions of dollars)

	1959	1961	1963	1965	(1st half) 1966
Imports					
a) Computers and calculators	2.3	8.7	15.0	9.9	4.2
b) Punched card equipment, computer peripherals, and spare parts	5.4	10.0	34.5	86.4	62.8
Total	7.7	18.7	49.5	96.3	67.0
Exports					
a) Computers and calculators	3.3	3.0	3.6	9.4	3.2
b) Punched card equipment, computer peripherals, and spare parts	23.5	41.1	39.6	128.0	66.1
Total	26.8	44.1	43.2	137.4	69.3

Source: Government statistics.

Accounting for 41.4% of French imports, the United States is still the biggest supplier of data processing equipment (Table 6). This share has been decreasing since the peak in 1963 (50%), but it is still substantially larger than it was in 1961 (26%). U.S. exports of such equipment to France (according to U.S. trade statistics) grew from $9.2 million in 1961 to $35.1 million in 1963 and $35.6 million in 1965.

Table 6. French Trade in EDP Equipment by Geographic Area, 1965 (percent)

Area	Imports	Exports
EEC	45.4	60.6
EFTA	10.2	20.5
USA	41.4	1.1
Other Countries	3.0	17.8
Total	100.0	100.0

Source: Government statistics.

Computers sold by American companies in France are increasingly being assembled either in France or elsewhere in Europe (mostly in Germany). However, large computers and special systems will continue to come from the United States, and it is likely that the total value of imports from the United States will remain at about the same level, representing a slowly diminishing share of the French market.

THE FRENCH PLAN CALCUL

In 1964, when Bull fell under the de facto control of General Electric, some people in industrial, government, financial, and political circles decided that a French data processing industry not under direct control of American companies should be maintained. The reasons were neither sentimental nor political, but were mainly based on economic and defense considerations. For example, French manufacturers of components raised the question whether foreign-controlled companies in France might not one day decide to purchase their components outside France if they could obtain them elsewhere at a lower price. It was also questioned whether these companies would maintain the technical capabilities needed for French military independence. This decision to support a truly French industry was contested by Bull-GE and particularly by IBM. IBM has a large research, development, and production activity in France and is a large supplier of the French military forces through a division kept separate to comply with security regulations; it is also the biggest exporter of data processing equipment manufactured in France.

By 1964 a number of smaller firms affiliated with larger industrial groups had developed a significant capability in computer equipment. To some extent, they were able to take advantage of the Bull difficulties, since many of Bull's personnel left it to join other computer firms in France.

These firms, especially the biggest, Compagnie Européenne d'Automatisme Electronique (CAE) provided the impetus for French firms to join forces in order to avoid inefficient duplication and to reach more quickly, with the assistance of the Government, the critical volume necessary for economic production in this industry. CAE, initially formed as a joint venture between CSF (the biggest French electronics firm), TRW (supplier of the basic technology), and Intertechnique (a holding company), was integrated into CITEC (Compagnie pour l'Informatique et les Techniques Electroniques de Contrôle, a company formed jointly by CSF and Compagnie Générale d'Electricité) for the purpose of regrouping their activities in computers, automation, telemetry, and supervisory controls.

In a second stage, the possibilities for forming a strong computer group were investigated. This included the possibility of forming a European-wide venture (for example, with ICT in England) in an effort to achieve in the computer field what has been reached in the aeronautics industry with the Concorde. Agreement on such a venture has not been attained, and therefore these plans have had to be shelved, though probably temporarily.

In early 1966, it became known that the Government would be prepared to give the industry substantial financial support, in the framework of the Plan Calcul, with the condition that all interested firms get together within a coordinated program. The Government decided that it would support this effort with $130 million over a five-year period, the money to be used for R&D contracts and development assistance, and to be reimbursable. Under this program, Mr. Galley, a Government official reporting directly to the Prime Minister, has been appointed to coordinate the efforts of the computer companies, the apportionment of the Government's industry support funds, and the application and implementation of EDP within Government organizations.

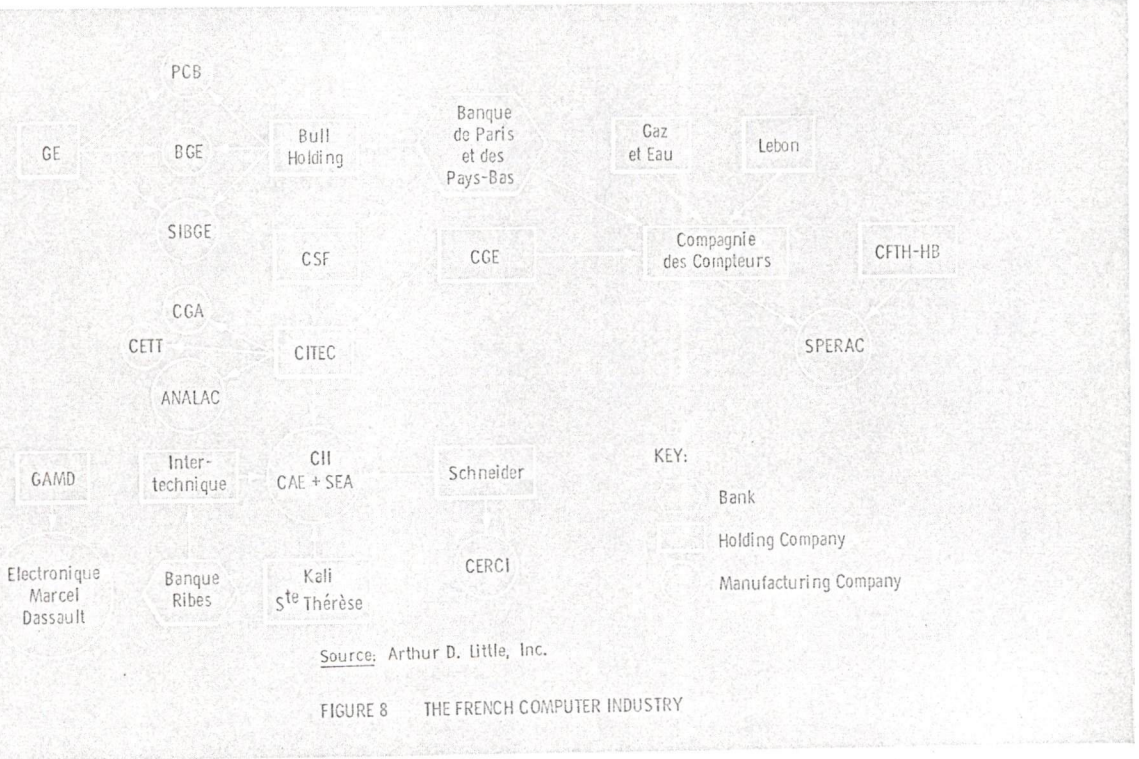
The most recent step in this effort has been the merger of CAE with Société d'Electronique et d'Automatisme (SEA), the second largest computer firm in France and a member of the Schneider group. This merger resulted in the formation of Compagnie

Internationale pour l'Informatique (CII). A second merger took place between the Peripheral Equipment division of the Compagnie des Compteurs and the computer equipment division of Compagnie Francaise Thomson-Houston, which formed SPERAC (Systèmes et Périphériques Associés aux Calculateurs). Since then, SETI (Société Européenne de Traitment d'Information) has been reintegrated into Compagnie des Compteurs and will be active in automation and systems analysis.

Under the Plan Calcul, CII will do the work concerned with the computers and some related equipment, whereas SPERAC will be concerned with peripheral equipment only. In addition, other companies active in this field, now or in the future, will be given a chance to participate provided that they synchronize their efforts with the common interests. Figure 8 shows the present organizational setup of the French companies manufacturing EDP equipment.

tributed some original developments. In the future, emphasis will be on the development of French general-purpose computers, to cover ultimately the whole scope of computer applications. Initially, however, the new series will exclude very small business computers and very large scientific computers.

The Plan Calcul is not expected to hurt foreign computer manufacturers too much, although it is obvious that under the Plan the French firms might capture more than 25% of the French market. The Government is not certain that if IBM did move some of its production out of France, the loss in exports could be compensated for by CII; it is also aware of the importance of firms such as IBM and Bull-GE in the French economy. In the long-run, CII will be interested in establishing itself in international markets, including the United States; this goal will be possible only if foreign companies are treated



Source: Arthur D. Little, Inc.

FIGURE 8 THE FRENCH COMPUTER INDUSTRY

The purpose of the Plan Calcul is not to move toward the control of the French computer industry by the Government, but rather to support private initiative. Much of the equipment being marketed by the firms engaged in the Plan Calcul is based on American developments (SDS 900 and Sigma 7 series, Data Products disc files), although all the firms have contributed some original developments. In the future, emphasis will be on the development of French general-purpose computers, to cover ultimately the whole scope of computer applications. Initially, however, the new series will exclude very small business computers and very large scientific computers.

The Plan Calcul is not expected to hurt foreign computer manufacturers too much, although it is obvious that under the Plan the French firms might capture more than 25% of the French market. The Government is not certain that if IBM did move some of its production out of France, the loss in exports could be compensated for by CII; it is also aware of the importance of firms such as IBM and Bull-GE in the French economy. In the long-run, CII will be interested in establishing itself in international markets, including the United States; this goal will be possible only if foreign companies are treated fairly in France. Another reason to treat foreign firms well is that joining forces on an international basis might one day be in the best interests of both CII and other European computer manufacturers.

COMPANIES

The market shares of the companies active in the French market in 1963 and 1966 were as follows:

Company	% of Total 1963	1966
IBM	66	60
Bull-GE	21	14
Univac	1	8
CII	7	7
ICT	1+	3
CDC	1−	3
Honeywell	—	1
NCR-Elliott	0.5	1

The manufacturing companies are IBM, Bull-GE, and CII.

With Univac and Honeywell becoming increasingly aggressive in the French market, and with the French Plan Calcul in effect, the industry is likely to change significantly in the next few years. Enjoying the strong support of the Government, CII may capture 20–25% of the French market, essentially at the expense of IBM, Bull-GE, and probably ICT. The most threatened company at this point is Bull-GE, which might lose many customers that used to buy Bull's equipment because the company was a truly French firm, and which has recently shown some weakness with the 140 and GE 600. However, Bull-GE might solve these problems and regain a strong competitive position with its current and new lines by the time the Plan Calcul gains momentum.

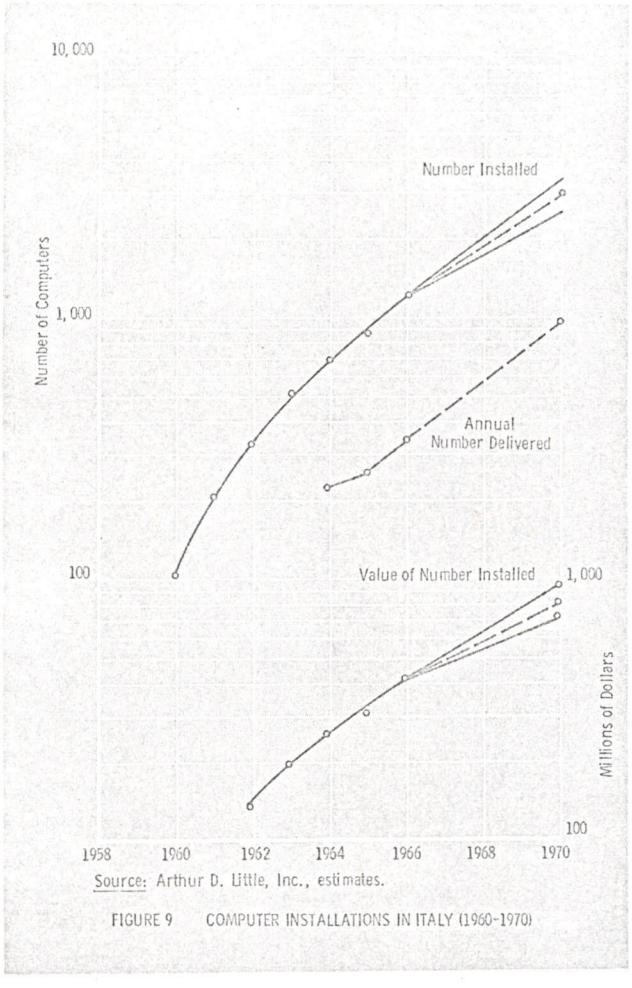
ITALY

MARKET

In Italy the ratio of computer installations to the working population is still low compared with that of other European countries. Now that the initial phase of computer use, characterized by such commonplace applications as invoicing and order keeping, is over, more firms and institutions will use computers in many new applications. Together with the replacement of obsolete computers, this increase in applications will support the present growth trend. Therefore we expect about 2900 computers valued at approximately $800 million to be installed in Italy by 1970, up from around 1200 worth about $400 million in 1966 (Figure 9).

PRODUCTION AND TRADE

In 1965, the production value of computers in Italy was about $41 million. In 1967, it should exceed $65 million, mainly because of IBM's 360/20 production in Vimercate. The import/export figures shown in Table 7 for finished equipment cannot be compared directly with the production figures, due to the problem of pricing computer parts for purposes of figuring export or import duties.



Source: Arthur D. Little, Inc., estimates.

FIGURE 9 COMPUTER INSTALLATIONS IN ITALY (1960-1970)

COMPANIES

The major companies active in the Italian market and their respective market shares are as follows:

Company	% of Total 1963	1966
IBM	62	63
Olivetti-GE	19	21
Univac	7	11

Also active in the Italian market are Honeywell, Siemens, Control Data, CEA Perego, SDS, Friden, and Burroughs. Honeywell, Siemens, and Control Data

are showing increased activity. This group of companies is expected to get about 10% of the market in the next few years, at the expense of the major companies.

Table 7. Italian Trade in EDP Equipment (millions of dollars)

	1963	1964	1965	1966
Exports				
Punched card equipment, statistical machinery, computers	9.3	11.4	20.1	55.8
Parts	3.5	2.4	4.3	4.9
Imports				
Punched card equipment, statistical machinery, computers	18.3	21.7	12.2	29.7
Parts	4.7	5.5	13.9	25.6

Source: Government statistics.

BENELUX

MARKET

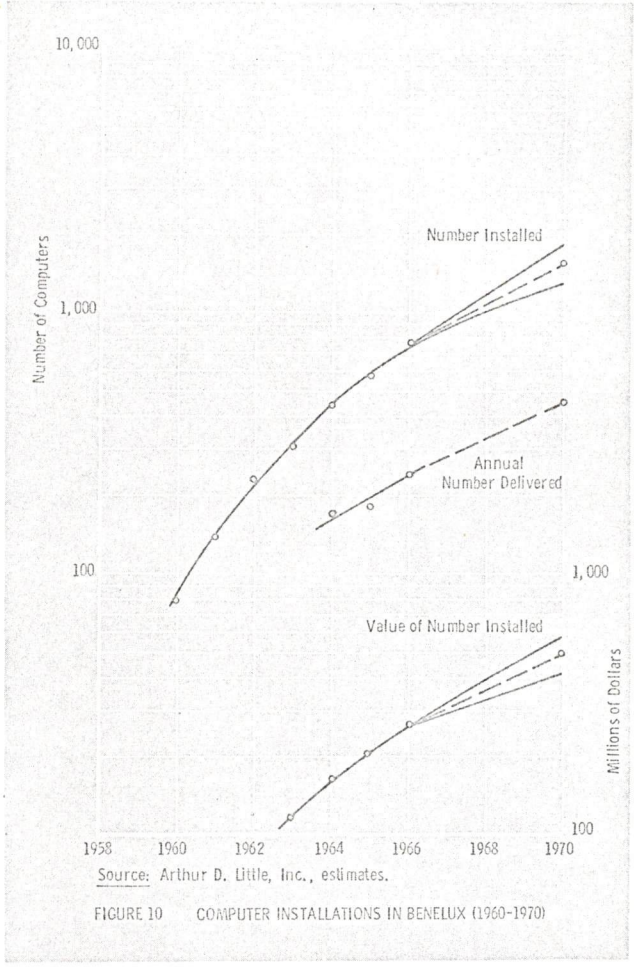
An estimated 740 computers worth about $250 million had been installed in the Benelux countries by the end of 1966: about 390 in the Netherlands and 350 in Belgium and Luxembourg, a division approximately proportional to their respective GNP's. Although these countries are experiencing a reduced growth rate, we anticipate that by 1970 there will be a total of 1500 computers installed, valued at almost $500 million (Figure 10).

COMPANIES

The following major companies were active in the Benelux market in 1966:

Company	Belgium-Luxembourg	Netherlands
IBM	66	59
Bull-GE	14	8
Univac	7	12
CII	2	—
CDC	2	4
Honeywell	1	2
NCR-Elliott	—	1

Bull-GE has about 14% of the market, the same share it has in France. In the Netherlands, Univac has gained a substantial share of the market, and CDC has been quite active.



Source: Arthur D. Little, Inc., estimates.

FIGURE 10 COMPUTER INSTALLATIONS IN BENELUX (1960-1970)

Since its acquisition of Electrologica, Philips has dominated the EDP and electronics industries in the Netherlands. Philips has under development a family of computers which it states will be announced in the coming year.

Belgium has no EDP industry, although a few firms have some developments in the field.

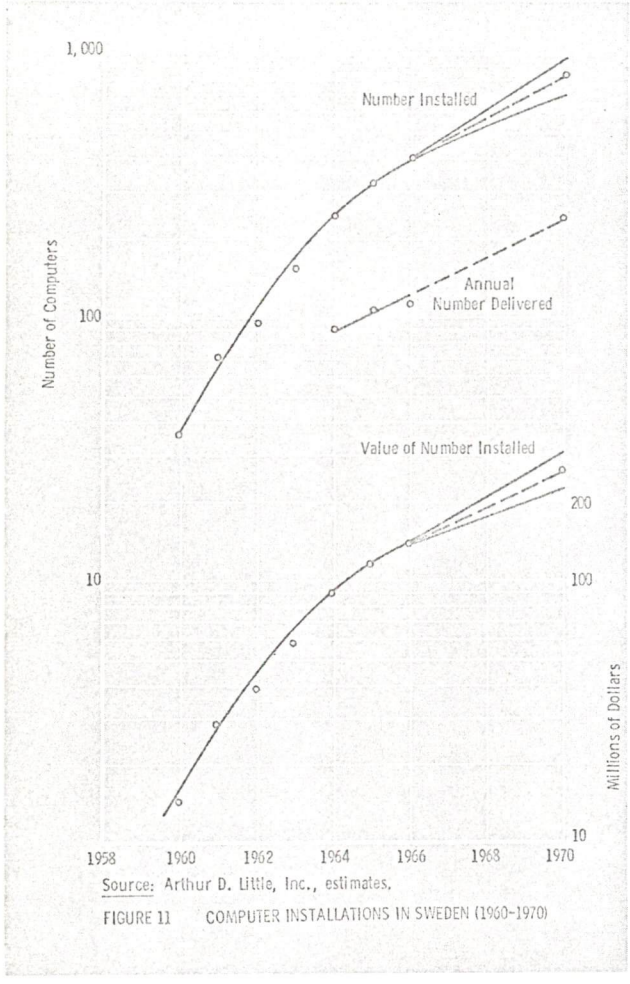
SWEDEN

MARKET

Switzerland, Germany and Sweden have the highest number of computer installations per working population and the highest ratio of computers versus GNP in Europe. The main reasons for the extensive use of computers in Sweden are the labor shortage,

the high cost of manpower, the numerous large firms, and the progressive and dynamic management of most Swedish companies.

The number of computers installed in Sweden is estimated to be 400, valued at about $140 million (Figure 11). The current growth trend should continue in the near future, and therefore we expect a total of about 830 computer installations by 1970. During this period many small firms will use computers for the first time, and large firms will advance into more sophisticated uses of computers. Sweden may be considered the most advanced country in Europe in computer use, especially in real-time, on-line applications, which are of great interest there; by 1968 many such systems will be operating in the banking field. In teleprocessing, Sweden has the advantage of being the best equipped country in Europe for data transmission.



Source: Arthur D. Little, Inc., estimates.

FIGURE 11 COMPUTER INSTALLATIONS IN SWEDEN (1960-1970)

PRODUCTION AND TRADE

Computer production statistics are not available in Sweden. Imports of computer equipment have increased rapidly to $29 million, whereas imports of punched card equipment have stabilized. Exports of computer equipment are small.

COMPANIES

The major companies active in the Swedish computer market and their estimated market shares are as follows:

	% of Total	
Company	1963	1966
IBM	62	65
Bull-GE	13	8
ICT	12+	7
Univac	—	2
NCR-Elliott	2	1

Saab, with its D21 system, still accounts for a small part of the market. Except for some efforts in Eastern European countries, it has not tried to market the system outside Sweden.

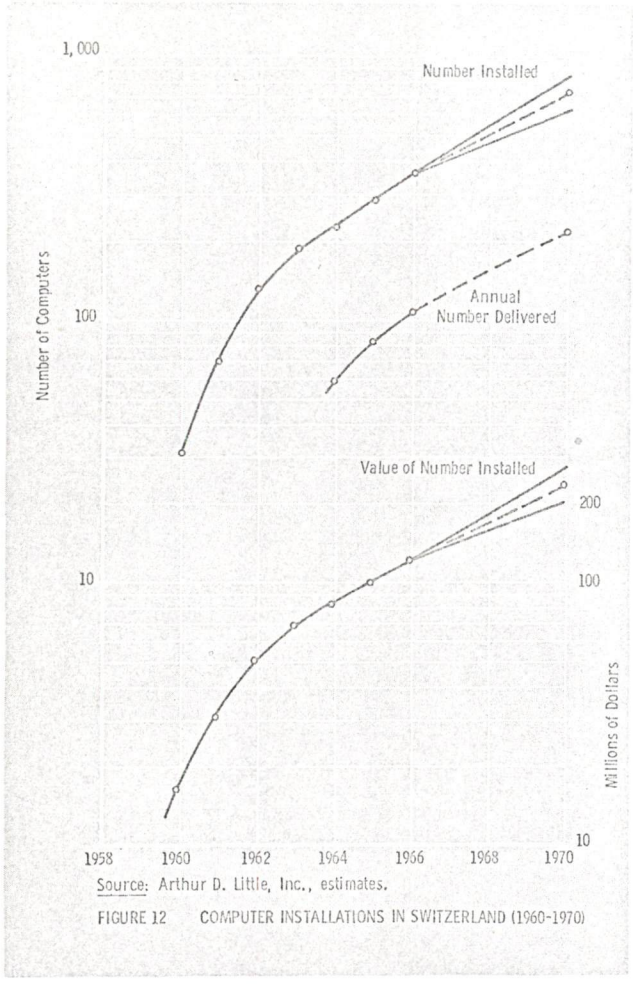
ICT is represented in Sweden by L. M. Ericsson, and this accounts for its good standing in that country. Facit has recently acquired Addo and is expected to promote Addo's computer peripheral equipment along with its own adding and calculating machines.

SWITZERLAND

MARKET

The Swiss market continues to be characterized by a high number of computer installations per working population and a high ratio of computers versus GNP. This market developed rapidly because of a labor shortage; a great number of punched card installations offering a large replacement market; and an early, strong effort by the main computer manufacturers. The first factor is particularly significant for the future. The Government is trying to reduce the number of foreign workers in the country, and both Government and industry plan greater efforts and investments in automation. The estimated number of computers installed in Switzerland is

about 360, valued at $120 million (Figure 12). We anticipate a total of over 700 computer installations by 1970.



Source: Arthur D. Little, Inc., estimates.

FIGURE 12 COMPUTER INSTALLATIONS IN SWITZERLAND (1960-1970)

COMPANIES

The Swiss market is divided as follows:

	% of Total	
Company	1963	1966
IBM	72	68
Univac	22	22
Bull-GE	4+	5
CDC	—	2
NCR-Elliott	—	2
Honeywell	—	1

IBM has been losing a small part of its share to the newcomers CDC and Honeywell, but its loss is minimal.

Univac is maintaining its strong position. The most significant new firm in Switzerland is Honeywell, which started only a year ago and is likely to perform as well there as in other European countries.

There is no Swiss EDP industry, although several major Swiss electronics firms have done some computer development work. Developments and production today are oriented toward military and special industrial systems, such as numerical machine tool control. Brown Boveri, which may have gained a part of the process control market through its control of Zuse by BBC-Germany, may still penetrate this market through work of its own.

Switzerland ranks sixth among importers of EDP equipment from the United States. Its imports totaled $6.5 million in 1965.

EASTERN EUROPE

Eastern European countries lag four years behind Western countries in some fields of data processing, but they plan to close this gap as rapidly as possible. During the last two years, Eastern European countries have shown increasing interest in computer equipment of Western origin. In early 1966, a member of the Soviet Academy of Science publicly recommended that the Soviet Union buy some computer equipment outside the country rather than develop it in the Soviet Union. This interest in Western equipment is substantiated by the recent success of several Western European manufacturers in their sales efforts to the Eastern countries. The number of installations ordered or installed for the Eastern countries is estimated to be about 130.

The total potential Eastern European market is the subject of much speculation. Most companies consider that the Eastern countries are worth a substantial sales effort, inasmuch as the value of individual orders is generally high. Eastern Europe also represents a timely potential for used computers, such as those being replaced by third generation equipment.

Dr. Fernbach

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

February 10, 1969

COMPUTER SCIENCE AND ENGINEERING BOARD

Minutes
Meeting #2
February 5, 1969

Data Base Panel

Attendance:

Sidney Fernbach, Chairman
Margaret Fox, Member
Chris Shaw, Member
William F. Raub, Member
Patrick J. McGovern, Member
John Hamblen, Member
C. A. Phillips, Member
J. Donald Madden, Member
Ann Lamb, Member
Herman Fasteau, Guest
Bruce Gilchrist, Guest
Paul Armer, Member - Absent

In view of full attendance, primary attention was directed to trying to agree on what the Panel should do to accomplish its objective. It seemed that in view of the complexity of the problem as viewed now, the best procedure was to obtain information on as many sources of information on computers as possible. From this assembly, even if incomplete, some ideas may be generated concerning the next steps.

It was agreed that our interest lies in four areas:

1. Availability of information on numbers, types, etc., of computers in the United States as well as worldwide with possibility of breakdown into categories.

2. Availability of information on capital, operating, etc., costs involved.

3. Availability of information on manpower used and available at all levels of association with computer usage.

4. Availability of information on training plans and programs feeding into the total area.

For the meeting preliminary searches had been made by Hamblen, Raub and Lamb. These were reviewed and it seemed that one, copy attached, represented a desirable form for our Panel study.

The Chairman asked each member to submit a compilation, listing or survey available within his purview for the next meeting. At this time there is no desire to limit the type of source to only direct references, indirect ones from which the information can be culled should be included. These should be in the hands of the staff by March 1, 1969 and all will then be reproduced and mailed to the Committee for their study prior to the next meeting.

The next meeting will be in the Joseph Henry Building, March 11, 1969, at 10:00 a.m. Further information and agenda will be mailed later.

A. R. Lytle

Attachment

NOTE

TO: Dr. Fernbach

Please note the listed members. I believe the list is correct. Dr. Gilchrist was earlier referred to as a visitor, not member; Mr. Armer being the member. We will have Mr. Kasputys as a guest at next meeting.

A. Data Only About Federal Government

1. Title - Inventory of Automatic Data Processing Equipment in the Federal Government.

Frequency - Annual 1960-68 (except 1967).

Source - GPO published document prepared by BOB/GSA.

Pertinent Content - For past FY, current FY and next FY.

1. Complete detailed inventory of general purpose computers (make and model) in the executive branch of the Federal Government and includes contractors on cost-type contracts.

2. Summary data by agency on costs and man-years.

2. Title - ADP MIS Reports

Frequency - These reports are prepared at various times from a computer data base which is updated at different frequencies for different items.

Source - GSA prepares and makes these reports available to Federal agencies.

Pertinent Content - These reports contain the complete detail upon which the first item on this list is based. Computer systems are given by component. Cost, utilization, maintenance and manpower data are shown at the system and/or installation level.

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

February 18, 1969

COMPUTER SCIENCE AND ENGINEERING BOARD

Minutes
Meeting #2
February 4, 1969

National Programs Panel A

Attendance:

Launor Carter, Chairman
Sullivan Campbell, Member
Bruce Gilchrist, Member
Butler Lampson, Member
Samuel Morgan, Member
James E. Rowe, Member
Milton Rose, Guest Speaker,
National Science Foundation
Robert Landau, Guest Speaker,
OST/COSATI
Herbert Grosch, Guest Speaker,
National Bureau of Standards
Richard M. Bloch, Member (absent)

In recognition of the fundamental need of the Panel for information on "current and projected plans of various government agencies, universities, non-profit institutions and private industry involved in broad-scale utilization and promotion of computer technology," the Panel considered the most likely sources of such information. Agencies such as G.S.A., A.E.C., U.S.O.E., N.I.H., I.B.M., and Bell Labs. seemed proper sources as well as those that are already scheduled. Special attention should be placed on institutions heavily funded by the government. These will be gradually worked into the schedule. The need to sample industry (I.B.M., Bell, others) is to help determine whether a massive effort is needed in research (or development) to accomplish sooner or more

effectively the progress that is necessary but which may not be amenable to small-scale incremental effort. It is possible that industry may not have the funds or may not wish to commit them for that purpose or at that scale within the time frame.

Further specific discussion on how best to accomplish the mission was more or less deferred till subsequent meetings after more information has been developed on the present status.

In line with this the next meeting scheduled for March 11, 1969 will have Mr. Robert Taylor, ARPA and Mr. Hrones, Associated Universities.

Three extended presentations were heard by Dr. Milton Rose, N.S.F., Mr. Robert Landau, OST/COSATI and Dr. Herbert Grosch, N.B.S. The following are some of the elements of these presentations; more complete documentation has been promised by Rose and Landau for our records and later reference. Data and information presented by Mr. Yost, Argonne, at the January meeting are attached herewith.

N.S.F., Dr. Milton Rose:

N.S.F.'s mission is in support to Research and Education and in the computer field was earlier concerned with the support of Institutional Computing Services with grants being based on research needs for computer and equipment needs for teaching in small colleges. As decisions, even trends, were difficult to formulate the Rosser report was developed. The recommendations of this report were not adopted due partly to lack of funding. The data in the Rosser report were supplemented by additional data in an area not covered adequately in the Rosser study and analyzed by the Southern Regional Education Board. The general picture,

from these studies, of distribution of funding for computer costs in educational institutions were as follows:

	1965		Forecast 1969		N.S.F.
	Rosser	SRED	Rosser	SRED	Analysis
Direct Federal Support to Center	18%	23%	19%	20%	12%
Funding of Federal Projects	35	13	41	15	11
Private Funding, Industry, Other	15	30	13	20	23
Institutional Funds	32	34	27	45	54
TOTAL, in millions (approximately)	185	160	360	320	265

So far as determined these include all direct costs of the unit, but the individual elements may vary depending on government and institutional policies. Special interest was attached to the apparent growth in requirements -- or usage -- of institutional funds. This element includes teaching, research, library work, other unsponsored work.

Computer technology takes two forms in most universities:

1. Direct on-campus computer service.
2. Cooperative effort between universities.

The Pierce report noted the increased use of computers for education purposes and made a strong plea for spread of this trend -- with necessary support -- to small colleges. In later discussion it was brought out that small colleges have problems -- they may not have the level and amount of competence; they are short of money and, in many cases, they specialize and may have no interest or concern with computer research or education.

N.S.F. is confronted with the question, "What kind of research can it support; how much money will it have available over the next 10 years?" Although the science will grow, this will be limited by inadequate staffing in most schools. There are now 250-350 computer scientists (Ph.D. level) outside of faculties. These are too few. ARPA will probably support the large activities with heavy funding. These, however, may devolve back to NSF as ARPA charter does not imply continued large-scale support. There is a strong need to develop computer science as well as to broaden computer usage and education needs much help.

Regional Research Computing Centers -- Current Thinking

1. Funded through institutional grants.
2. Scope of operations very broad -- cover many disciplines including social sciences.
3. Must provide for service as well as research -- this will affect type of equipment. Boulder is an example, is self contained but focused on one job.

Other questions in N.S.F.:

1. Is there need (needs) not being met?
2. How can a computer serve all disciplines?
3. Is there need for support for software development to help universities get into and stay current with flow of technology?
4. Will one large center solve problems for all areas? Current answer is "No", large, intermediate and small centers are necessary.

N.S.F. recognizes that a critical mass (people and machines) is probably necessary for satisfactory research. This mass may,

however, represent as few as five qualified people and a large machine system.

It was pointed out that there is no computer designed for research primarily -- such as the Cyclotron for high-energy physics. Research needs a simulator, but there is no design for that as of now.

OST/COSATI, Mr. Landau:

The principal purpose is to improve management and coordination of Science and Technology programs in Federal Agencies. For this purpose Science and Technology is considered to include Computer Sciences. The BOB and GSA also have appropriate roles in the area. An ADP inter-agency group with about 60 members meets monthly.

This presentation was mainly addressed to the frontal attack that COSATI has been making on the information retrieval phase of computer technology. As a preliminary Mr. Landau expressed the belief that progressively users are getting further away from the data they are manipulating, to the detriment of optimum utilization of the primary data or ease of recovery. Basically he questioned the cost-benefit ratio of large networks of computers being proposed in the information retrieval field -- believes that many operations should remain decentralized. Ninety percent of data transformations are alpha-numeric and ninety percent of these are very local, justifying the local handling.

He reviewed the many problems and questions raised and partly answered up-to-date in the development of the FIRST network (which will probably be very large!) and gave a demonstration of its operation. Very much remains to be done even with this relatively simple system. There must be a common language; this may entail the development of a new five letter language. For versatile,

widespread acceptability, a very large data base with automatic accessibility must be in the system.

The question was raised as to why COSATI was carrying on operations rather than setting policy. Mr. Landau said that this work was started in COSATI Panel #2 on Information Science and Technology and funded by NSF and NLM (National Library of Medicine) in order to have an actual system to test and evaluate, rather than only recommendations to consider. The Panel is continuing to monitor this experiment until its usefulness is determined. Mr. Landau agreed that this procedure, although an effective way to demonstrate and introduce new methods, is not a forerunner of what his group may do. He referred to several reports in areas in Science and Technology communications being considered by OST containing recommendations -- not yet implemented.

The discussion ended with the statement that lack of competent personnel -- not money -- holds back development and exploration of ideas. OST is very concerned about the need for properly trained personnel at all levels -- a critical situation.

National Bureau of Standards, Dr. Herbert Grosch:

In a condensed history of Computer Technology at NBS, Dr. Grosch focused on some of the factors that have influenced, positively and negatively, the progress of this technology in their laboratories. These include demand on the part of other government agencies for computer services, greatly increasing requests for advice in the area, and obvious needs for research and standardization.

At the present time the Center for Computer Science and Technology is a separate unit parallel to the Institutes in the NBS structure. It operates with a $6-800,000 budget and employs about 160 people distributed about as follows:

1. Systems Development Division (software, application, language) 30 people
2. Office of Processing Information Standards 25 people
3. Computer Services (1108 Installation) 45 people
4. Information Processing Division (experienced in equipment, methods) 40 people
5. Office of Computer Information 15 people

The many sources and activities of this Center are well outlined in a special NBS bulletin. They cover the normal spectrum for a laboratory of this type.

There are, however, many unfilled needs for research, development, and standardization for which funds are not now available. Dr. Grosch described a tentative plan for being able to carry out much of this work at little direct government cost. The plan involved setting up equipment testing and demonstration centers -- say in Washington -- in which much experimental work could be done on donated or exhibition equipment, using personnel who would be simultaneously upgraded for government operations. Of great assistance would also be the Senior Research Associates program now in being.

This program is speculative but may develop in some form. There are, however, pressures on OST, ARPA for setting up an Institute of Computer Sciences. Dr. Grosch agrees on this need and feels it should be associated with NBS. Universities are overcommitted -- they should expand their teaching activities and minimize computer operations and program development. Along with their teaching should be much more research on the overall technology.

Dr. Grosch's concept would entail National Institutes for Information Science to cover Communication, Computer and Documentation sciences. These institutes would not be primarily for R&D -- they would concentrate on the use of these sciences for the benefit of the government and industry. A certain amount of research would undoubtedly be necessary but only incidental to the very badly needed process and application development work.

There is a great, urgent need for development. Industry will do it only slowly as it is needed or may be profitable. The Institutes would initiate and complete the work and have the results ready when need develops. Thus the technology can advance as rapidly as is compatible with the general or specific needs.

Enclosures

REVIEW OF COMPUTER SCIENCE AND ENGINEERING BOARD ACTIVITIES

A. INTRODUCTION

This memorandum is an attempt to review the activities of the CSEB, with a view to relating these activities to the objectives of the CSEB and to place both these current activities and possible future activities in a context which would provide a coherent overview of the Board's activities. Hopefully, the results of this will be a better understanding of how the current activities relate to the objectives of the Board and also to identify future areas for attention.

B. OBJECTIVES

As frequently stated:

> "The Board will examine in broad perspective (a) the state of the computer science field including applications to computation and non-numeric information analysis, storage, retrieval and transfer; (b) the state of computer technologies and related technologies; (c) the state of computer engineering applications, including systems concepts, systems development directions, and related methodological approaches; (d) the social and economic context of computer technology and its applications; (e) the availability of computer scientists, engineers, teachers, and anticipated needs; and (f) such tasks as may be designated by DOD to meet the needs for computer applications and systems for the defense establishment."

Stated somewhat more concisely, the CSEB will review computer-related activities to determine the need for various types of Government action, such as funding, legislation, and administrative decisions. The CSEB will also function as a resource to the DOD and other areas of the Government as a group which represents an exceptionally broad cross section of computer knowledge and which can provide relatively expert and impartial guidance or assist the Government in obtaining such help.

Examining "the state of" various aspects of computer science and engineering is not possible in terms of any absolute index. Various subjective measures, such as "good", "bad", or "wanting" may be applied, and one can also talk in terms of whether "more" or "less" should be done. However, the diversity of what comes to mind when one says the words "computer science and engineering" requires that further substructuring of the field must be done in order to define it more precisely and to be able to talk about specific aspects. One approach to such substructuring might be to consider a breakdown in terms of

technical factors, using as a guideline any one of a number of classification schemes (such as the ACM Index). Unfortunately, this is not very useful when we attempt to examine the activities of the CSEB. Initially, it appears that it is better to think in terms of various classes of participants in computer science and engineering activities, and their interaction between each other and computer science and technology. To this end, we might consider the following classes:

1. Manufacturers - Includes all those who provide computer hardware.

2. Services - Those agencies providing primarily services in programming, systems design, implementation, etc.

3. Education - Includes all organization and people concerned with education and training (universities and colleges, computer training schools, etc.).

4. Users - Includes all those whose primary concern with computers is in their application, whether for commercial, technical, or other purposes.

5. Government - Primarily the Federal Government, but any governmental agencies which an affect the operations of the groups mentioned above.

It is also helpful to think in terms of a distinction between "science" and "technology". The former is more generally regarded as that which adds to the store of knowledge but need not have immediate application, while the latter is the transfer of science into applications.

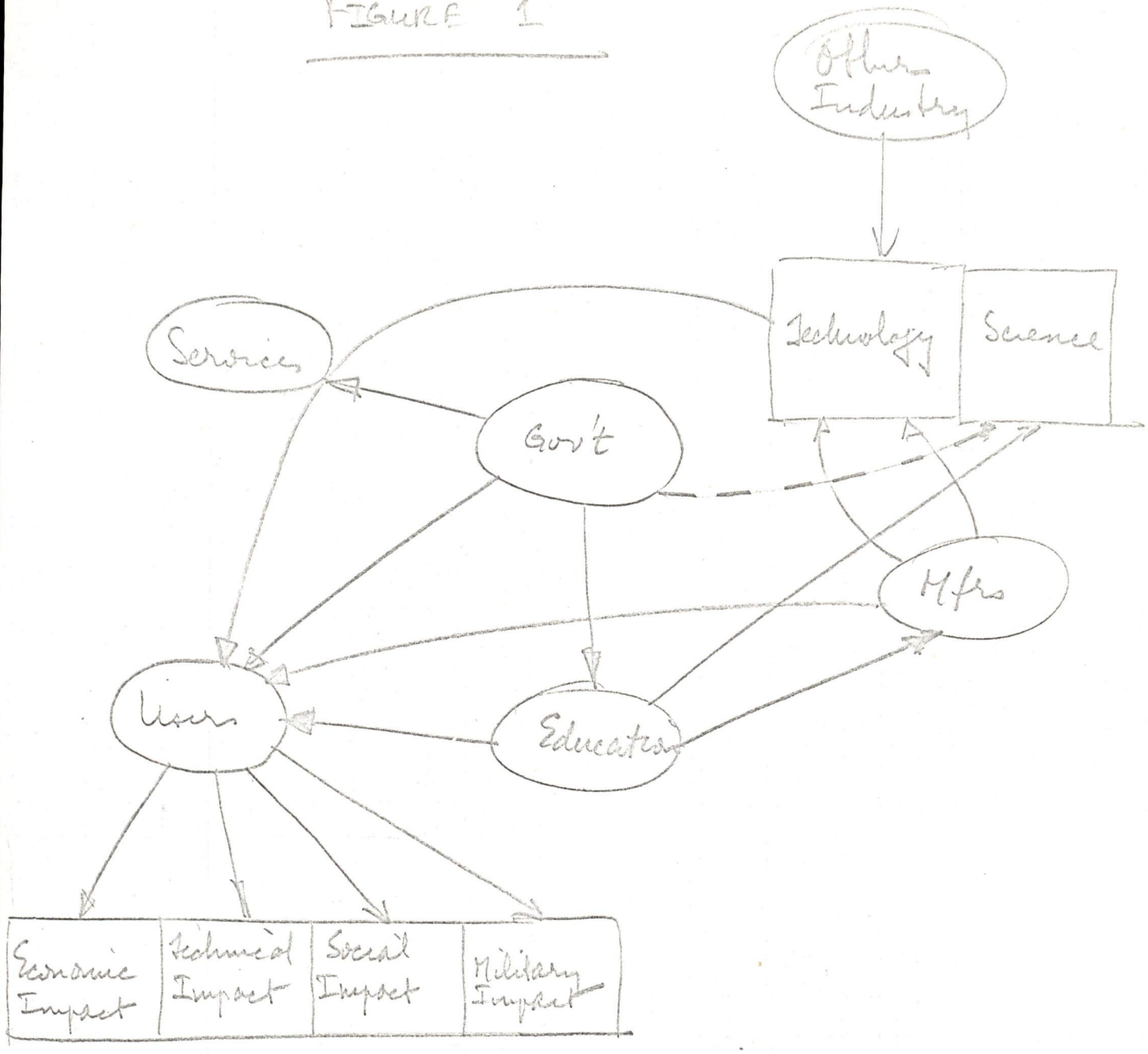
With this background, Figure 1 presents a possible structuring of the interactions between these various groups. Admittedly, it is incomplete (and may in some instances even be incorrect), but it is a rough attempt at trying to show how various aspects of the computer community interact with each other. For instance:

1. Manufacturers both add to the store of technology and use technology in developing their products. Also, manufacturers rely on the education element for their basic resource - people.

2. The services sector is primarily concerned with transferring technology into users applications.

3. Government can contribute directly to technology and science through institutes, and can affect the activities of others through funding (such as for education), legal action (such as anti-trust and protection of proprietary interests) and users

FIGURE 1


Other Industry
Technology
Science
Services
Gov't
Mfrs
Users
Educators
Economic Impact
Technical Impact
Social Impact
Military Impact

(through administrative and policy decisions such as in communications and exports).

Clearly one can refine (and probably even augment) the various participants in computer activity, and one can then elaborate further on the interaction between these activities. Another dimension can be introduced by the technical subdivision of computer science and in technology, as suggested before.

Through its activities, the CSEB will seek to obtain a better understanding of the interactions within the field of computer science and engineering, in order to be in a position to recognize imbalances, and areas where Government action might be particularly appropriate in terms of overcoming technical problems in applying technology to current or future needs.

C. APPROACHES

The Board consists of a relatively small number of people who meet monthly for one-two days. The participants serve in a volunteer capacity and have limited time available outside of the regular Board meetings. However, they provide considerable competence, with representatives from all of the sectors of computer activity mentioned above, with most being leaders in their respective fields. The point in this is that although the Board represents a high level of knowledge, its resources and time are quite limited. Accordingly, the Board has evolved a style of operation where it identifies an area of concern, establishes a task force (generally chaired by a Board member and drawing on others for additional assistance) to examine the matter, with the Board subsequently serving in a review and advisory capacity. These task forces have taken the following forms:

1. Study Groups - The mode of activity in these has generally been to work within the Group (or "panel") to explore the area of particular concern, with the export/import panel being perhaps the most notable example of this mode of operation.

2. Panels - For the purposes of this memo, "panels" are more generally thought of as groups which serve more to draw together information from others, through interviews, presentations, and other forms of discussions. This style seems to have been characteristic of the National Programs Panel (which examine the needs for various types of "institutes"), and the Data Base Panel.

3. Conferences - Here the primary activity is the sponsoring of a conference which brings together a large community of interested participants, with the result that new insights may be developed by

a broadly representative group and quickly disseminated to the community, possibly followed by a written report. This type of activity was pursued by the Panel on Computer Science and Software Engineering Education (which held a week long conference concerning computer technology and related education and training provided by schools of higher education).

4. Special Studies - In this mode, a single investigator or a small group will undertake a study in a particular area, with the study generally requiring a fairly intensive effort and being directed towards particular objectives or areas of emphasis. Typical of this are the studies done for the NSF concerning the trend of industrial support for computers in educational institutions and the study being sponsored by a private foundation to examine questions of privacy related to computers and data banks.

The policy of the Board has been to permit considerable autonomy in the operation of the various task forces, while still assuring that the work is objective and thorough. Where activities are undertaken on behalf of special agencies or where the work does not fit directly in the scope of the ARPA basic contract, separate funding has been sought.

D. ACTIVITIES

Table 1 summarizes the scope and status of current and past task forces sponsored by the CSEB. In order to show how these activities relate to the computer science field, a copy of Figure 1 has been annotated in Figure 2 to show the aspects of interaction which were of concern in the various task forces.

(This section will certainly have to be expanded somewhat, but this can probably be done best after Table 1 is completed - which can best be done once I have spoken with the various Panel Chairmen).

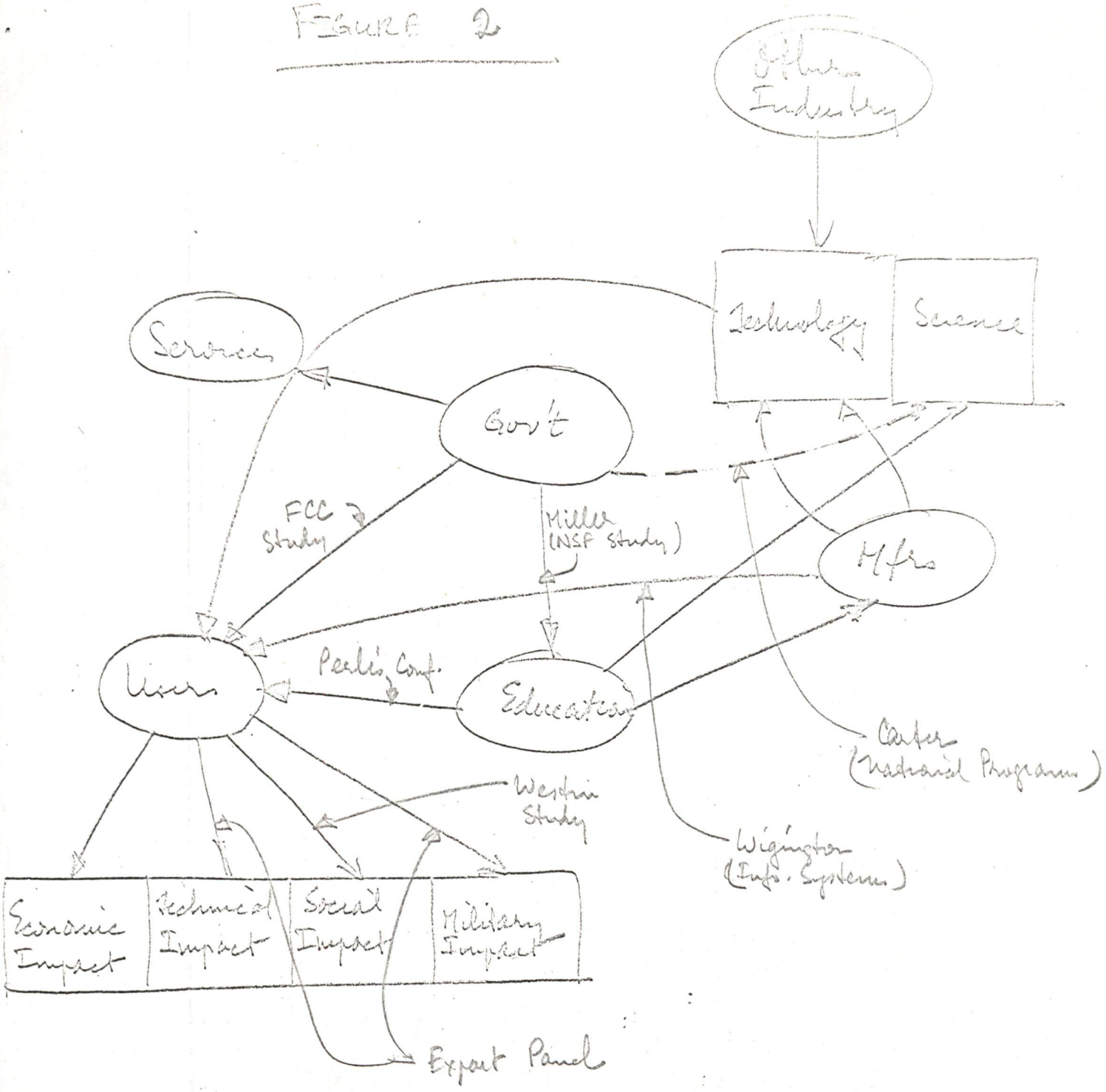
E. FUTURE ACTIVITIES

It is probably fair to state that much of the activity of the CSEB to date has concerned investigations and technical assistance in particular areas, as represented by the Export Panel, the Study for the NSF dealing with industrial support of computing in universities, and the Technical Assistance Panel for the FCC. However, one important task force has assessed (through a conference) the state of computer education provided by colleges and universities - the types of programs offered and the needs of students and users and operators of computing systems. Another study, dealing with questions of privacy and computer data banks, is now

TABLE 1

TASK FORCE	PURPOSE	STATUS	FUNDING

FIGURE 2


Other Industry
Technology
Science
Services
Govt
FCC Study
Miller (NSF study)
Mfrs
Users
Pearlis Conf.
Educators
Carter (National Program)
Westrin Study
Wigington (Info. Systems)
Economic Impact
Technical Impact
Social Impact
Military Impact
Expert Panel

underway. Another major activity has been the objective assessment of the needs for various Government sponsored institutes related to computer science and engineering, and a report on this is now in preparation.

In its future activities, the CSEB should perhaps give increasing attention to "an examination of the state of computer science and engineering". This is a rather loosely defined question, but one might attempt to address it by asking somewhat more specific questions, such as:

1. What are forecasts of technology and computer utilization? What might be the consequences of various technical developments and agency actions?

2. How relevant is current work in computer science to needs as they are perceived in technology and applications?

3. Suppose the Federal Government provided $100,000,000 per year (or $50,000,000, or $200,000,000) for "computer science and engineering". How would the CSEB recommend that these funds be spent? What would be the likely results in one year, two years, and five years?

With reference to the figures showing possible interaction between various elements in the computer science and engineering community, the Board might concern itself with questions such as the following:

1. What is the effectiveness of computer-based information processing systems in Government administration, including the executive, legislative, and judiciary branches?

2. The impact of the Government on manufacturers and the likely long term technical and economic effects, of steps such as anti-trust actions.

3. What are the needs and problems in protecting proprietary interests in computer software and related developments.

In the area of specific technical assistance to the Government, the CSEB conceivably might provide guidance to agencies (such as the Bureau of Budget) in establishing Government policies with regard to lease/purchase (in light of evolving technology), the desirability of single versus multi-manufacturer systems (i.e., is all equipment in a system provided by a single manufacturer, or should configurations having components from several manufacturers be strongly encouraged).