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

COMPUTER SCIENCE AND ENGINEERING BOARD

April 8 & 9, 1969

List of Attendees

Professor Anthony G. Oettinger
Dr. Launor F. Carter
Professor Wesley A. Clark
Dr. Glen J. Culler
Professor David C. Evans
Dr. Sidney Fernbach
Mr. Jerrier A. Haddad
Dr. J. C. R. Licklider
Dr. John R. Meyer
Professor William F. Miller
Dr. Stephen J. Fenves
Mr. Kenneth Olsen
Dr. Alan J. Perlis
Dr. John R. Pierce
Professor J. Barkley Rosser
Dr. Alan F. Westin
Mr. Joel Cohen
Mr. John Griffith
Dr. Bernhard Romberg
Mr. Warren C. House
Mr. Bernard Strassburg
Mr. Daniel Ohlbaum
Mr. Louis Feldner
Mr. Lewis Billig
Mr. William Lurie
Dr. Stephen Breyer

Dr. John Coleman
Dr. C. E. Sunderlin
Mr. Arthur Lytle

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

COMPUTER SCIENCE AND ENGINEERING BOARD

Twelfth Meeting

April 8, 1969

EXECUTIVE EVENING SESSION

AGENDA

8:00 to
9:00 P.M. 1. The FCC Situation

Introduction will be made by the Chairman. Messrs. Strassburg and Billig will be available to answer questions by the Board and elaborate on various aspects of both the procedures and purpose of the possible role of the Board in providing support to the FCC.

8:30 to
9:00 P.M. 2. EXECUTIVE SESSION

Mr. Billig will report to the Board on his findings and recommendations regarding possible support to be provided to the FCC. Executive Session will be continued to discuss the recommendations of the Chairman of the FCC Planning Group.

9:00 to
10:00 P.M. 3. Anti-trust and Computer Manufacturing in the U. S.

The Chairman will introduce Professor Bryer of the Harvard Law School to comment on alternative courses of action which the Board might consider in this area.

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COMPUTER SCIENCE AND ENGINEERING BOARD

Twelfth Meeting

April 9, 1969

EXECUTIVE DAY SESSION

AGENDA

CLASSIFIED

9:00 a.m. 1. The computer inspection problem.

--The Chairman.

UNCLASSIFIED

10:00 a.m. 2. Elements of a National Computer Policy

--The Chairman, Mr. Jerrier Haddad

11:00 a.m. 3. Status of the work of the Planning Group for the Information Systems area.

--The Chairman, CS&EB.
--Ron Wigington, Chairman, Planning Group for Information Systems area.

L U N C H

E X E C U T I V E S E S S I O N

1:00 p.m. 4. Special report on the study on Privacy, National Data Banks and Computers -- Dr. Alan Westin.

1:30 p.m. 5. Special report on the status of the NSF survey of computer support patterns in educational institutions.

--Dr. William Miller

2:00 p.m. 6. Regular reports on the status of:

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

-Data Base Panel work--Dr. Sidney Fernback

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

-Computer Export Summer Conference Plans--The Chairman.

-Proposed Comprehensive Survey of manpower requirements in the computer science field--Dr. Bruce Gilchrist.

3:00 p.m. 7. Administrative items, for example, provision of No. 2 men on all working groups and panels.

8. Other.

Bernard Stallung (MIT)

File: 2/2/2 (Billig)

LEWIS S. BILLIG

Position:

The MITRE Corporation - Associate Technical Director, Communications Systems, 1967 -
Responsible, on an associate level, for directing MITRE's technical activities in the field of communications.

Experience:

MITRE, Acting Department Head, Communications Systems Planning, 1967;
Department Head, Range Systems, 1965-1967; Associate Department Head, Communications Systems and Techniques, 1963-1965.
General Electronics Laboratory, Chief Engineer, Vice President - General Manager Military Electronics, 1954-1963.
Raytheon Co., Project Engineer, 1949 - 1953.
Martin Co., Design Engineer, 1948 - 1949.
Billig Manufacturing Co., Production Manager, 1946 - 1948.
U. S. Navy, Radar Maintenance Officer, 1943 - 1946.

Education:

C.C.N.Y., B.S.E.E., 1944.
Northeastern University, M.S.E.E., 1952.
Harvard and MIT Navy Radar Schools.

Professional Societies:

I.E.E.E., Professional Engineer, Massachusetts.

LEWIS S. BILLIG

Lewis S. Billig was born 1 November 1923 in New York City, and is married with three sons. He makes his home in Wayland, Massachusetts. His education includes the BSEE degree from CCNY, class of 1944 and the MSEE degree from Northeastern University in 1952. As a Naval Officer during WW II, he attended Harvard Pre-Radar, MIT Radar, and Bell Labs Fire Control Radar Schools, in addition to several other service schools.

His background of technical experience began as a Radar Maintenance Officer in the U. S. Navy where he served from 1943 to 1946 and included installation and maintenance of various radio, radar, and sonar equipments on vessels of the fleet. Following his naval service, he was Production Manager of Billig Manufacturing Co., a company engaged in the manufacture of lamps of various types. He left the lamp business in 1948 for employment by the Glenn L. Martin Company where he was engaged in the design of elements of the electronic guidance system for the matador missile.

Mr. Billig joined the Raytheon Manufacturing Co. in 1949 and until January 1954, was Project Engineer in the development of various electronic equipments, including active countermeasure systems, storage tube memory systems, commercial height control radar systems, and telemetry systems.

In 1954, he joined the General Electronic Labs of Cambridge as Systems Section Head where he was engaged in studies and design in the field of active countermeasures, communications anti-jam and vulnerabilities of radar and communications systems. He became Chief Engineer of GEL in 1955 and as such, was responsible for technical and administrative organization and supervision of the Engineering Department engaged in studies and development of various military and commercial electronic equipment. In 1958, he was appointed Vice President and Manager of Military Electronics.

He left GEL in October 1963 for employment as Associate Department Head with The MITRE Corporation where he was responsible for developments in communications technology including error

LEWIS S. BILLIG (Continued)

control, modulation, and data compaction as applied to telemetry and long-haul systems in support of range operations. He was subsequently Department Head of the Communications Technology Department and later Head of the TACSATCOM program. In 1967, he was appointed to his present position of Associate Technical Director of the Communications Division where he is involved in a broad array of communications problem areas, including common use and tactical systems with work encompassing planning, system engineering, and technology.

He is a senior member of the IEEE and either has been granted, or has in process, eight patents. He was Editor and head of the research team that wrote the five-volume "Anti-Jam Design Practices Manual" for the Air Force. He presented a paper on Mechanized Intelligibility Determination at the 1955 University of Michigan ECM Symposium and one on A Systematic Approach to Error Control for Space Support Communications Systems to the Seventh International Symposium on Space Technology and Science held in Tokyo, Japan in 1967. He has given numerous classified briefings in the field of communications, ECCM, and Intelligibility Determination.

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NATIONAL COMPUTER POLICY ITEMS

Notes From The Meeting of the Board - March 11, 1969

1. R&D in Computer Hard and Software.
2. Education and training of Personnel.
3. Use, Misuse and Application of Computer in Education & Weather, etc. (National Uses)
4. The structure of the computer industry as an element of the economy.
5. The Patent Law as affected by computers.
6. The Copyright Law as affected by computers.
7. International relationships - ie. export
8. The structure of computing in the government (including misuse) and operation.
9. Impact of technology on feasibility of computer networks.

USES--
Scientific -- ie. Weather
Military
Industrial
Commercial
Education
Public Administration

Specific Opportunities in Government where not now recognized or used adequately.

Legislative & Judicial Cases
Personnel Managements
Education, teaching & Administration
Manpower Information Systems
Medical Information Systems
Law Enforcement
Administration of Welfare
Defense
Post Office
National Labor Systems
Physics
Weather - ie. International watch
Intelligence

APR 7 REC'D

Ronald L. Wigington, Director
Research and Development

April 4, 1969

CHEMICAL ABSTRACTS SERVICE
A DIVISION OF THE AMERICAN CHEMICAL SOCIETY

Professor Anthony G. Oettinger
Aiken Computation Laboratory
Room 200
Harvard University
Cambridge, Mass. 02138

Dear Tony:

Enclosed are some notes I have prepared as a result of our visit with Dr. Baker and a subsequent telephone conversation with John Griffith. I am interested in your reaction to these points and suggestions for improvement. I would intend to use such notes as "pump priming" to get the planning group started.

I am still considering the selection of individuals to invite to participate in the planning group and/or the final panel. I have more than enough names to consider already, and I expect to receive some additional recommendations from Ken Lowry and John Griffith.

The minimum categories of knowledge that I think should be represented on the final panel are:

1) A Librarian competent in application of computers.
2) Someone from BTL, because of their traditional "systems approach" and habit of economic evaluation.
3) An information science researcher.
4) A man-machine experimentation expert.
5) A person employed by a computer manufacturer, preferably with both hardware and software competence.
6) A practical information system designer or operator.

I am undecided about a government employee but tend, at this time, not to include one as a panel member, but use observer invitations as suitable.

I will be in touch with you shortly to discuss individuals to be invited.

Sincerely yours,

Ron

Ronald L. Wigington

RLW:me

cc: Mr. John Griffith
Mr. Warren C. House

Concepts of Formation For

Information Systems Panel of

Computer Science and Engineering Board

National Academy of Science

Draft Scope

The purposes of this Panel are:

1) To assess the application of computer science and engineering to national needs for information systems of all types and to determine the extent to which present activities are sufficient or deficient to provide the basic principles and information processing capabilities on which future information systems can be built.

2) To identify the primary roadblocks to the more rapid employment of computer science and technology to solve critical information problems,

3) and thus, to focus national attention on where resources should be directed to assure the development of the needed principles and capabilities in a form that can be widely used.

Some Points of Guidance

There are, and have been, a great many activities directed at study or development of techniques and systems for specialized segments of the overall national information problem. There are library-oriented views, traditional scientific discipline-oriented publication activities, man-machine interaction experiments, various business information services, specific mission orientations, etc. However, the total picture has no real coherence.

There have been many study groups, coordinating committees, and evaluation task forces which have struggled with various aspects of the information problem, and the use of computer-based systems to solve it, with various end purposes in mind. It will be essential for this Panel (and its planning group) to become generally familiar with those results and their context. However, in order to be successful and effective, the activities of this Panel must quickly identify a few key areas needing attention and delve into them in depth so that concrete contributions can be made in concentrating national attention on truly important and productive endeavors.

It will not be the purpose or power of this Panel to directly control or manage any endeavor or to have effect other than by force of argument based on competent analysis. Further, it cannot take any partisan position. It must express opinion only based on scientific principle and technical judgement. It certainly is not the purpose of this Panel to push or counter any special interest. If anything, its purpose should assist special interests in cooperating for fulfillment

of national needs by identifying and expressing scientific and engineering principles which must be known and observed in order that national progress can be made.

Mechanism of Formation

A small planning group, 2 or 3 persons, plus the Panel chairman, will meet to develop the statement of scope and initial panel projects for submission to the CSEB for approval. The planning group will lay out tentative plans for approximately the first year's work of the Panel with specific attention to the first one or two studies in depth. The final program of work of the Panel will be subject to revision when the full Panel is formed and is subject to the guidance of the parent CSEB. The full size of the Panel will be of the order of seven. Tenure of appointment should be two years.

Initial Action and Sources of Technological Guidance

A project, conceived as a pioneering effort in applying advanced computer and information handling technology to library systems for development of advanced information transfer systems, is Project INTREX. It is conducted in the midst of the vigorous and highly developed computer system research environment of MIT and has the vigorous backing of the Council for Library Resources. An initial project for this Panel would be to review the basis for establishment of this project, to assess the current activity and plans of this project as compared to the objectives desired, to examine the validity of the experiments being conducted and planned, to determine the approach by which the eventual results of this project can be transferred for wide scale use, and to provide consultation to the Council for Library Resources and to Project INTREX management in planning future work.

There are potential sources of guidance for evaluation of INTREX-type projects and subsequent computer-based information systems that the Panel may be called on to examine. These case studies may be found in the experience being gained in limited environments by corporate technical information systems such as those operated by IBM and BTL, both of which are organizations which are aggressive in applying new technology and highly competent in computer system technology. Another current activity which may contain guidance on practical problems and the behavior of people who need information support in their daily work is the computer-based experimentation and operations for information and library support to the staff of Time-Life, Inc.

It should be highly beneficial for the work of the Panel to relate the pioneering ideas and exploration of information system research and experiments to these operating systems providing real information support to real people.

RLW:me

To: Warren House

New Interest in Privacy Heartens Rep. Gallagher

By a CW Staff Writer

WASHINGTON, D.C. – A recent increase in public concern about the social implications of computers has made Rep. Cornelius E. Gallagher, D-N.J., "hopeful that we can control machines, rather than being dominated by them."

"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," he said.

Only three years ago, when the Special Subcommittee on Invasion of Privacy focused nationwide attention on computer privacy by holding hearings on the suggested National Data Bank, there was almost no academic or other attention being paid to this crucial question, Gallagher said. Now, 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, he said.

"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," Gallagher said.

It is also a source of deep satisfaction, Gallagher said, that three extremely influential groups are directing their attention to the impact of the computer on American values. The groups are: the Harvard Program on Technology and Society, the American Academy of Arts and Sciences' Working Party on "The Social Implications of the Computer," and 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," he said. "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."

Resurrection of SICSIC Is Sought

(Continued from Page 1)

'Code of Ethics' issue," he wrote.

of SICSIC. They sent a letter to the *Communications* deploring the dissolution of the committee and calling on fellow members

Now!!!

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APR 7 REC'D

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Research and Development

April 4, 1969

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RLW:me

Educ + Data Agencies

OCDE

ORGANISATION DE COOPÉRATION
ET DE DÉVELOPPEMENT ÉCONOMIQUES

OECD

ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT

DIRECTION DES AFFAIRES SCIENTIFIQUES
DIRECTORATE FOR SCIENTIFIC AFFAIRS

Téléphone : 870 76-00

2, rue André-Pascal, Paris-16e

Télégrammes : DEVELOPECONOMIE

Telex : PARIS 22033

Référence : DAS/SPR/69.208
HG/ehm/638

20th March 1969

Dear Professor Oettinger,

This year the Directorate for Scientific Affairs is carrying out a study on computer utilisation in Member countries. We plan to study some quantitative problems of computer usage with a view to carrying out a comprehensive user oriented survey perhaps next year. In addition we want to study the problems of introduction of management information systems into the administration of Member governments, and also the planning and implementation of data banks in the public sector and their consequences on the social environment. This latter part will concern itself with the problem of protection of privacy of individualised data stored in public data banks.

We are already co-operating with the IFIP-IAG Group (Professor Doyverman) and the ICA (Intergovernmental Council for ADP).

I am now planning a trip to the United States and will be in Washington from the 21st to 23rd April and in Boston on the 24th and 25th. I should like to take the opportunity of visiting you in order to learn about your interest in this field and to discuss our study. You will recall that I tried to contact you on your last trip to Paris when you were staying at the Trianon Hotel but, unfortunately, was unable to do so.

I should appreciate it if you would let me know if we could meet and if so, when it would be convenient for you to see me.

Yours sincerely,

Hans Gassmann

Professor Anthony Oettinger
Aiken Computation Lab.
Harvard University
Cambridge, Mass. - 02138
USA

(copy also sent to: Prof.Oettinger
National Academy of Sciences
2101 Constitution Ave.,
Washington, D.C.)

cc: US Delegation

on line . . .

. . . baubles, bangles, and beads

One of the funny things about computer statistics is you can never compare them. One source says there are 65,000 computers in use, another proclaims that the computers in use are worth $20 billion, a third prophesies that there will be 100,000 computers installed by the end of 1970. Which is right? Which is more accurate?

Obviously, the computer statistician wants to avoid measurement by some objective standard, so he selects a manner of presentation which requires both interpretation and interpolation. For the only way the "experts" can exist, is by trading on their self-promoted notion that they have esoteric information, secure in the knowledge that because there are no methods of checking, no-one can prove them right or wrong.

In an environment where there are no standards for acquiring, establishing, and reporting figures, and one has to depend upon the source's word for his accuracy, the field is pretty much of a seller's market. And a very lucrative seller's market at that.

But if you think steep price is an indication of the material's worth, guess again. We randomly opened one "expert's" document to the listing for Honeywell. We added the figures and obtained a sum of approximately 4000, which indicated the company's total installations and orders. Yet, we have a Honeywell press release in our file dated January 9, which indicates that there were approximately 5000 Honeywell computers installed or on order. Now we submit that an error of 25 percent is just too gross to talk away.

Still curious, we turned to another "expert's" publications for facts on Honeywell. In a midyear 1968 issue, our expert "estimated" there were approximately 3500 Honeywell computers installed or on order. Six months later in a December issue he *reduced* his count to 3400. Now does this make sense? We invite you to make these same comparisons yourself.

Thus, we advise, if you have to pay for statistics via subscriptions to specialty services, be wary. Also, when the terms, "by 1970," or "our estimate," or "$20 billion" are used, be wary, the compiler *may* be using an escape hatch because he has nothing positive to offer now. He is predicting—safe in the knowledge that he'll never be proven right or wrong.

m. n.

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

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

March 27, 1969

Professor William F. Miller
Computer Science Department
Polya Hall
Stanford University
Stanford, California 94305

Dear Bill:

I am writing to amplify the thoughts you and I exchanged over the phone concerning the Board's effort for NSF. Recent developments have, I think, made this effort all the more critical especially since the degree of confusion and incomprehension seems to be increasing rather than decreasing.

The findings of your preliminary rounds of inquiry as bolstered by whatever follow-on we decide upon at our April Board meeting should, it seems to me, be supported by a background document designed to explain the history and current state of this complex of problems to the policy-making laymen.

As I mentioned to you on the phone, I have a graduate student named Maury Hepner, whose work although aimed in the large in a somewhat different direction, does in the small intersect with this problem in a way that might prove synergistic. His thesis research outline, which is enclosed, envisages looking at the general problem of educational technology on the university campus from a technical, pedagogical and political point of view. This study was originally designed as a follow-on to the work I have done under Harvard's Program on Technology and Society on the question of educational technology in elementary and secondary schools. In that study I took little or no account of developments in military and industrial education or training, and Hepner's paper dated January, 1969, which is adjoined to this letter, is essentially a journal record of his explorations of that area. I then asked him to look at the computer situation as a case study of the political and economic factors which govern the adoption of new technology on the campus independently of the technical readiness or pedagogical value of various forms of technology. His paper dated March 10, "Computers on the Campus", are the rough notes he produced after a couple of weeks of exploration of this question.

With some additional guidance from you and me, I think that Hepner could expand that March 10 paper into the background piece I feel would be needed for your panel's work. At the same time, he would gain valuable first-hand experience and have a better case study for his thesis. Hepner's background

is in solid state physics and quantum mechanics. He spent some time in the Peace Corps and has since become interested in questions of education and public policy and has, for a year now, turned his back on physics. He is a first-rate student, reasonably clear headed and objective, and he writes tolerable first drafts and very good term papers.

If agreeable to you, I would suggest that we ask him to pull together the background issues which he has begun discern in his March 10 paper in order to produce over the next couple of months a coherent document accurate in substance and intelligible to the layman. By copy of this letter I am asking Joel Cohen, who is by now quite familiar with the totality of the Board's activities and who is also here in Cambridge, if he would lend a hand in steering Hepner.

As I mentioned to you on the phone, I'll be bringing Hepner to Washington on April 8 prior to our evening Board meeting so that you and I may meet with him during the afternoon to give you an opportunity first to determine whether or not he indeed could be of material assistance, and second, if so, to help him get underway.

It also occurred to me that it might be well for the two of us to talk with Rosser and Pierce and incidentally have Hepner present as well. I am therefore sending a copy of this letter and the attachments to both John and Barkley. My proposal would be that they plan to be in Washington in time perhaps for a 6:00 p.m. dinner prior to the 8:00 p.m. meeting of the Board. I think that their advice and comments on our situation prior to a full discussion with the Board would be extremely helpful, and I hope that they can both make it.

I should appreciate it if you and all those receiving copies of this letter would let Warren House know whether or not they can make the schedule I have proposed above. In all cases, I would suggest coming to Warren House's office at the Joseph Henry Building, Room 536. Many thanks!

Sincerely yours,

Anthony G. Oettinger

js
Enclosures

cc: Joel Cohen
John Griffith
Warren House
John Pierce
J. Barkley Rosser

Educational Technology

~~Computers~~ on the Campus

A Research Outline
by Maury P. Hepner
March 10 '69

Case

A. History of computers on the campus

1. Growth factors: public policy and fiscal integrity

(a) Expense

(b) Support

(c) Staffing

(d) Use

2. Distribution -- a flow model

(a) Research/education

(b) Schools and students

3. Present reality (A cross-sectional study) -- result of past constraints and decisions

(a) Study of present constraints in various kinds of schools

(b) Facilities — centralization/decentralization

(c) Access and availability

B. Environment for educational use

1. Military (training/ed)

(a) Development of technology

(b) Development of criteria

2. University education

(a) Goals of science education

(1) Technology used to implement these goals

(2) Reflexive nature of technology to redefine these goals

(b) Learning theory

(1) Implication of theory for media use

(2) Implication of media upon learning theory

(c) Examples of research and present classroom utilization

(1) Reasons

(2) Means (technology)

(3) Results

(d) Examples of classroom patterns

3, Secondary Education

(a) Philosophies and goals

(1) As reflected in new curriculum projects

(2) As dictated by "technological age"

(b) Present utilization of technology

(1) Influenced by educational goals

(2) Influenced by economics, personnel, developments

4. Industry? Adult Education?

C. The University and the Secondary School

1. Qualitative or quantitative difference between philosophy, goals, and the classroom of each

2. College courses reflecting developments from "new" curricula

3. University as environment for development of media for secondary schools

   (a) Financial

   (b) Schools of education

   (c) Subject matter professors

   (d) Social action

4. Harvard?

   (a) Interest in secondary education?

   (b) Interest in university education?

CORPORATE HEADQUARTERS
8100 34TH AVENUE SOUTH, MINNEAPOLIS, MINNESOTA 55440 / 612-888-5555

13 March 1969

CONTROL DATA

Professor William F. Miller
Stanford University
Computer Sciences Department
Stanford, California 94305

Dear Bill:

It was a pleasure to talk with you this morning regarding the study that you are conducting for the National Academy of Sciences regarding the impact of industrial and financial support of computer-related activities for educational institutions (I refer to Anthony Oettinger's letter of January 21, 1969, to William C. Norris, President of CDC.).

I am enclosing two copies of CDC's PRACTICE AND PROCEDURE FOR SPONSORED RESEARCH (revised 11/22/68) that best states CDC's objectives, policies and procedures for sponsored research.

As I mentioned to you this morning, two years ago CDC changed its policy with respect to grants to universities and other non-profit research institutions from a policy of granting discounts in prices on computer systems to a policy where we will quote only full list prices on computers to education and research institutions, and at the same time consider the sponsoring of research programs by which CDC pays the qualifying institutions for research work to be done on programs of interest to CDC and/or which CDC believes have unusual merit. We have specifically concentrated in the past two years on grants re hospital/medical and CAI, as well as the development of specific new softwares and applications.

I believe this generally answers the question raised by Dr. Oettinger's letter.

I will look forward to seeing you at the time of your forthcoming trip to Minneapolis to view the 7600 computer and STAR. I would also appreciate the opportunity to schedule you to see some of our systems directed toward some of our business management data systems in line with Stanford University's interests.

Very truly yours,

CONTROL DATA CORPORATION

James G. Miles
Vice President

JGM:fah
encls.

IBM International Business Machines Corporation

Armonk, New York 10504

Office of Vice President
and Chief Scientist

February 19, 1969

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

Dear Tony:

Your letter of January 21, on behalf of the Computer Science and Engineering Board of the National Academy of Sciences, inquires into the nature of IBM support of computer-related activities of educational institutions. First let me point out that IBM's educational support program is not restricted to computer-related activities, and an increasingly large portion of our support is, in fact, unrestricted. Nevertheless, I will attempt to provide meaningful answers to the questions asked in your letter:

1. What needs in the educational institutions does your company believe it is meeting?

IBM's program of support to educational institutions falls generally into the following categories:

Unrestricted Support:

Because unrestricted support is the most useful to a college president, IBM is tending toward more unrestricted grants. Such grants should be of assistance in helping the institutions to cope with their over-all financial problems, including those which may be associated with computer-related activities.

Special Program Support:

A good example of this type of grant is IBM's support of the Harvard University Program on Technology and Society.

While it is not directly computer-related, the effects of technological developments, which include the computer, are under study in this program.

Another example is a grant made to one university to assist in the development of an engineering design curriculum. Other examples would be support toward the development of a PhD program in computer science or toward the improvement of undergraduate mathematics teaching.

Equipment Education Allowances:

One traditional method of support is IBM's educational allowances, applying to a variety of equipment.

Graduate Fellowships:

IBM maintains a regular program of fellowship support to leading graduate schools. The selection of fellows is made by the institutions and their schools or departments.

Post-doctoral Fellowships:

IBM awards a small number of post-doctoral fellowships directly to institutions each year. In addition, some faculty members are provided the opportunity for post-doctoral research in IBM laboratories.

Visiting Professors:

IBM encourages professional personnel exchanges between faculty members and its professional employees. Several IBM scientists are engaged in full-time teaching and research on work assignments, and a large number contribute through part-time teaching.

Negro Educational Support:

IBM provides both unrestricted and program support to a number of historically Negro colleges. In addition, IBM supports several fellowship programs for black students in other institutions.

Contract Support:

At any given time, IBM, through its divisions, sponsors specific research tasks through contractual relationships and joint studies. The scope of this activity ranges from applied technology to software development.

2. What direct or indirect returns do you expect for your company or for the computer industry in such areas as manpower training, research and development, or sales?

Since most of IBM's financial support is in the form of unrestricted grants or program support aimed at specific institutional needs, any returns we would receive would be very indirect and not easy to measure. The benefits accrue more to the institutions than to us, although obviously we, as others, are dependent upon the output of colleges and universities in terms of educated manpower and basic and applied research. In cases of specific research sponsorship, however, in the category described above as "contract support," IBM anticipates a direct return commensurate with our investment.

3. What facets of federal government policy such as taxation, research support, or research administration influence the type or level of industrial support?

We have been unable to identify any federal government policies relating to taxation, research support, or research administration which have any specific influence on the type or level of IBM support to educational institutions.

We are delighted that this study is being made. We hope that its results will encourage broader support on the part of all segments of industry not only for computer-related activities but for higher education generally.

Sincerely,

Manuel

E. R. Piore
Vice President and Chief Scientist

ERP:mk

STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94305

COMPUTER SCIENCE DEPARTMENT

Telephone:
415-321-2300

March 25, 1969

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

Dear Tony:

Enclosed is the brief summary report on the progress of the NSF Support of Colleges and Universities panel. I shall bring more to the next meeting and I think a discussion there of the next course of action would be appropriate.

Best regards,

W. F. Miller
Professor of Computer Science

WFM:cv

copies to: Warren House
Milton Rose

Interim Report on Patterns of Industrial Support

W. F. Miller
March 24, 1969

We have received written responses from IBM and CDC and an oral interview with the representative of SDS (Spinrad). Letters attached.

It is clear that each company has different motives in their support of colleges and universities. According to their responses, SDS is the most goal-directed, CDC is goal-directed, but less than SDS, and IBM seems to have the most general goals.

Control Data Corporation seems to have the most formal procedures. At any rate they have a clearly-stated policy in their guide "Practice and Procedure for Sponsored Research". The company does not give educational discounts on equipment but makes R and D awards instead. The company, according to Mr. Miles, establishes a fixed budget annually for such awards.

It is interesting to note that CDC made a deliberate change from a discount policy to R and D awards two years ago. Miles said that there were two reasons: (1) several universities told them that they could not very well take advantage of a discount and (2) they found that the discount policy lead them, in their minds, to a price cutting competition with their competitors.

All companies have invited more explicit responses and we should take advantage of that invitation. The discussion of the work to date should be put on the agenda for the next committee meeting. I expect to have a set of additional questions to propose at that time. One difficulty we are encountering is that, apparently, the support policy is not very firm in any of the companies. The most revealing information would be quantitative data in either absolute or relative terms. One symptom of the lack of clear goals is the uncertainty about the future support. All companies decline to suggest any continuing policy.

March 4, 1969
W. F. Miller

Summary of Interview with Dr. Robert Spinrad
Vice-President, Programming
Scientific Data Systems

1. SDS does not make grants to universities or colleges.

2. Academic Discounts are on the basis of field experience. SDS views universities and colleges as a source of business (like any other source of business). Field experience means that SDS follows the lead of larger companies such as IBM and CDC.

3. Research and Development Contracts to colleges and universities are mostly on a services rendered basis. Spinrad described this support as "enlightened self-interest". The R and D contract may not call for an immediate payoff, but SDS does not engage in very much (if any) speculative R and D.

4. SDS has a summer student program intended to introduce students to SDS and to computing research and development. It has as a secondary goal the support of students.

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: $23,559

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 Resource and Function aspects. By Resource 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. Function 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. It is not the intent of the meeting to provide detailed curricula, but rather to suggest goals and directions of educational 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 Resource and the Function 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 Resource and Function. The conference is to be organized similarly to one on "software engineering" held in Munich in October, 1968 and sponsored by NATO. The topic of that conference, attended by 50, dealt only with the subject of software engineering. The conference, whose report will be issued shortly, was unanimously considered by the attendees to be a success. 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 (Function--Working Group A and Resource--Working Group B), 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	Introduction	Working Sessions	Special Lectures
Tuesday	Working Session	Working Session	Special Lectures
Wednesday	Plenary Session Report of Working Group A	Plenary Session Report of Working Group B	Working Session
Thursday	Working Session	Preparation of Draft Report	
Friday	Plenary Session Reading of the Draft Report		

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

-Of the reasonably large number of graduate department 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 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 intermidate 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 (resource and function), a chairman and two younger recording secreataries 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 invitees have been chosen so that membership will be provided for small working groups within the two major groups.

Working Group A

Group I - Universities

1.1 Users of People: Alec Mood, Will Dixon

1.2 People Generators: G. Forsythe, Tuhey, Brooks

1.3 Administration: Tom Jones, Andrew Schultz

Group II - Industry

2.1 Manufacturers

2.1.1 Software: Humphreys, Richard Jones, Tom Cheatam

2.1.2 Hardware: Tanaka, Chu

2.2 Users: Rowe, Ramo, Colvin, Zipf

Group III - Government Use: Grosch, Giese, Gilbert, Hopper

Group IV - Economics: Gilchrist, Hamblen, Sharpe, Rowan

Group V - Funding Agencies: Cunningham

Group VI - At Large: Walter Carleson, Alan Perlis

Working Group B

Group I- Research: McCluskey, Knuth, Hartmanis, Arden

Group II - System: Spinrad, Corbato, Schwartz, Vissotsky, Climis, Graham

Group III - Applications:

3.1 Scientific & Engineering: Hass, Missler, Lazarus

3.2 Non-Scientific (Administrative): Althoff, Davis, Campaigne

Group IV - Teaching: Gruenberger, Andree, Rosen, Hamming, DeCarlo

Group V - Support: Bauer, a representative from a commercial data processing school, a representative from industry, and a representative from education.

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	8,000
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	1,934
TOTAL	$ 23,559

Diary Note 4/2/69

(1)

U.S. DEPARTMENT OF COMMERCE

Bureau of International Commerce
Director: Mr. Lawrence A. Fox 189-5261

Office of International TradePromotion

Divisions: (does not correspond exactly to organizational chart attached)

1. Trade Missions

Sponsors 2-30 trade missions of business men abroad each year.

2. Export Strategy Group

Sets targets for broad product category groups - i.e. food processing equipment, data processing equipment

3. Export Market Identification
Contact: Mr. Norton Horton 189-3845

Refines findings of Export Strategy Group; uses market research studies to determine export potential for specific products and equipment. Currently in process of drawing up long-range plans for promotion of a number of U.S. industries abroad, including data processing industry. Projecting sales goals by country and by specific product. Long-range plans still in beginning stage, not ready for distribution external to Commerce.

4. Commercial Exhibits Programs
Director: Mr. Edward J. Krause 189-5125

Sponsors several U.S. trade exhibits in trade fairs throughout the world, or arranges for "solo exhibits for U.S. products. Cooperates with Trade Centers Program (see below).

5. Trade Centers Program
Contact: Mr. John O'Neill 189-4388 (Asian area)

Sponsors 6 trade centers abroad; five in W. Europe, one in a lesser developed country - Bangkok. Are now experimenting with a type of program for transferring information to LCD's - are organizing product exhibitions in conjunction with week-long technical seminars or workshops. The Bangkok center has had one workshop on Materials Handling (drew 300+ from Thailand, 75-80 from other countries), and will have one on Data Processing in June, 1969 (see below) and has one on Aluminum Fabricating planned.

Data Processing Sales Exhibit and Technical Seminar, June, 1969, Bangkok
Staff Person in Charge: Joseph Miller, 189-5148 (press release & agenda attached)

Plan 5-day seminar on computer technology and applications in LCDs. Will include applications in medicine, engineering applications, etc. Approach in organizing was as follows: market research done in Thailand by Trade Center staff questionnaire (drawn up by Commerce with aid of Information Systems Corporation, a local Washington firm) sent to 14 other Asian countries, excluding Japan. Distributed by U.S. missions to 25 government and industrial leaders in each of 14 countries. Received 180 responses. Questionnaire determined needs, interests of countries, and willingness of respondees to attend Exhibit, under own support. 60% replied affirmative. Commerce will follow up with personal contacts by field reps. to this group in May. U.S. data processing hardware and software firms, and technical expers invited to participate, at own expense. Plan on 30 speakers, at technical session in connection with exhibit.

UNITED STATES DEPARTMENT OF
COMMERCE
NEWS
WASHINGTON, D.C. 20230

EXPORT SALES
PROMOTION
ANNOUNCEMENT

BUREAU OF INTERNATIONAL COMMERCE exhibits of U. S. products at international fairs and in U. S. Trade Centers abroad offer U. S. firms opportunities to introduce their products in new markets, support the efforts of their overseas representatives, or identify prospective agents and distributors in areas abroad where they lack and need representation.

FOR REIEASE
WEDNESDAY, FEBRUARY 12, 1969

ASIAN INTEREST WHETTED FOR U.S. DATA PROCESSING EQUIPMENT AND TECHNIQUES

U.S. data processing experts will bring their technology and equipment to Asian nations about to enter the computer age in a U.S. Department of Commerce sponsored data processing sales exhibition and seminar at the U.S. Trade Center in Bangkok, Thailand, June 23-27, 1969.

The show and seminar will put U.S. makers of computer hardware equipment and software services on the ground-floor of a large potential market. Data processing equipment and techniques are in growing demand in Asia to keep pace with rapid economic and industrial expansion.

Commerce's Bureau of International Commerce (BIC), sponsor of the program, recently completed a survey of 300 Asian firms and government offices in 12 nations that indicated a widespread desire for more information about data processing techniques and applications. Asian government officials and business leaders have voiced enthusiasm and given their support for the Bangkok Trade Center events.

The show will feature American data processing hardware and software skills and services. Equipment, films, graphics, and mock-up models designed to improve the viewers' understanding of data processing and its applications will be on display.

A comprehensive five-day seminar will run concurrent with the Trade Center exhibit, covering topics suggested by Asian businessmen surveyed for BIC. Emphasis will be on workshop sessions and small discussion groups to encourage direct exchange between American experts and Asian visitors.

Asian participants will have an opportunity to discuss data processing with top U.S. computer experts and representatives of major U.S. firms; see how computer techniques can aid Asia's economic and social development; and discuss the application of U.S. products and services to their particular problems.

Exports of data processing equipment to various countries of the world are listed under the broad category of office machines. This includes calculating and accounting equipment, statistical machines, and electronic

computers. According to Commerce Department Market Share Reports for these classifications, the total value of this type of equipment exported to 11 of the 12 countries surveyed reached $15.3 million in 1966. (No figures are available for Laos.)

U.S. manufacturers supplied approximately $5.3 million, almost one-third of the total imports in this broad category of office equipment in 1966. Later and more detailed statistics on computer imports are not available, but BIC research has indicated a rapidly growing market with promising sales potential. According to the recent survey, U.S. firms are the major supplier of data processing equipment and services in the area and can expect to continue to hold a large share of the market.

Markets in the area surveyed range from the Philippines, importing approximately $3.6 million worth of office equipment and Malaysia/Singapore with imports totaling nearly $3 million, according to 1966 Market Share Reports, to Burma which imported $64,000 in these categories. Middle markets are India ($1.8 million), Thailand ($1.6 million), and Indonesia ($1.3 million).

Sales potential for data processing equipment in Asia is wide ranging, from small computers to sophisticated large-scale installations. For example, a firm in Hong Kong needs a computer to process on-line reservations while a company in Indonesia wants to replace its present computer with a more advanced machine for use in foreign exchange administration. An industrial firm in Manila has forecast need for a computer in 1970 for inventory control and production management. A petroleum company in Singapore is interested in linear programming, critical path and production control and scheduling; several companies in Ceylon have expressed interest in sharing the use of a computer; and a consulting firm in Pakistan needs a computer for sales analysis and job costing.

Other equipment reported in demand in Asia includes analog and digital computers; card punching, sorting, and tabulating machines; film readers; input devices such as magnetic ink readers, optical scanners, and paper tape readers; printers; control panels; discs and random access devices; and other related equipment.

The program will attract key representatives of government and business who are potential users and purchasers of U.S. products. Already more than half the 300 firms polled by BIC have expressed interest in attending the show and seminar, and a market development officer will travel throughout the region to follow up on this expressed interest by extending personal invitations.

The last workshop/trade show --on materials handling--held at the Bangkok Center drew more than 70 leaders from nine Asian countries who joined approximately 400 Thais to hear American businessmen talk about their products and services.

U.S. manufacturers of data processing equipment and firms providing computer services who are interested in taking advantage of this unique opportunity may obtain additional information from the U.S. Department of Commerce (BIC-918), Washington, D.C. 20230 (telephone: area code 202 - 967-5148) or from any of Commerce's Field Offices.

PROPOSED SEMINAR AGENDA

DATA PROCESSING SEMINAR/EXHIBITION

BANGKOK, THAILAND

June 23-27, 1969

Monday, June 23

0900 - 1015 The Computer is Here
(This opening presentation will include introductory and welcoming remarks as well as a discussion on the social/economic impact of the computer)

1045 - 1200 The Computer in Your Organization
(This discussion will emphasize the implications of the computer on the existing organization and the personnel involved, discuss organizational alignments, the facilities required for the computer, and controls and supporting responsibilities)

1200 - 1400 LUNCH

1400 - 1700 Tutorial Session
(This session will present an historical prospective of the computer and discuss some of the basic machine concepts and the terminology associated with the computer industry. The role of programming, system analysis, and operations research will be put into proper prospective in relation to the computer. A brief description of the characteristics of the various computer components will be identified (i.e. optical character readers, printers, random access devices, magnetic tapes, keypunch, key-to-tape devices, etc.) A discussion of the general purpose computer languages that currently are available will be presented such as COBOL, FORTRAN, etc.)

Tuesday, June 24

0900 - 1015 Choosing the Right Computer
(This discussion will identify the methods and techniques for defining the types of problems in an organization and relate the techniques for evaluating various computers in light of these requirements.

1045 - 1200 Selecting and Training Your Data Processing Staff
(Identification of the various levels and types of skills and personnel required for a data processing staff will be discussed as well as the techniques to fill positions, both through recruitment within and outside the organization. Various training programs will be discussed)

1200 - 1400 LUNCH

1400 - 1600
(Application Workshop A)
( )
(Application Workshop B) Will run concurrently
( ) in separate sessions
(Application Workshop C)
( )
(Technical Workshop A)

Wednesday, June 25

0900 - 1015 Selecting an Outside Service Organization
(This discussion will highlight the methods for identifying and defining the problems which can be best solved by outside service organizations. The methods of evaluating, selecting, controlling and communicating with outside service organizations will be discussed)

Wednesday, June 25 (contd)

1045 - 1200 Financing the Purchase of U.S. Equipment and Services
(Local American and Thai bankers and U.S. Embassy officials will discuss the specific mechanics for acquiring loans for the purchase of U.S. equipment and services)

1200 - 1400 LUNCH

1400 - 1600 (Application Workshop D
(
(Application Workshop E
(
(Application Workshop F
(
(Technical Workshop B
Will run concurrently in separate sessions

Thursday, June 26

0900 - 1015 Evaluating the Effectiveness of Your Computer Operation
(This topic deals with the utilization of personnel, e.g. programmers and system analysts, as well as the computer itself. Consideration will be given to such problems as multi-shift operations, computer languages used, projects chosen for automation and other aspects of computer usage)

1045 - 1200 Data Processing and the Future
(Starting with data processing today, this discussion will discuss the role of the computer in the future. Such topics as computer utilities, procedure-oriented languages, and satellite communication and other advanced concepts will be discussed)

1200 - 1400 LUNCH

Thursday, June 26 (contd)

1400 - 1600	(Application Workshop G ((Application Workshop H ((Application Workshop I ((Technical Workshop C	Will run concurrently in separate sessions

Friday, June 27

0900 - 1200 Summary and Review
(This session will summarize topics presented during the week and will provide a roadmap for implementing these ideas. The discussion will highlight the methods for accomplishing the installation of a data processing system. An earlier session may be repeated during this period if there is sufficient demand.)

NOTE: The Application Workshops (A through I) scheduled for Tuesday, Wednesday, and Thursday afternoons will discuss applications of the computer in such areas as: Accounting and Payroll; Financial Control; Inventory Control; Management Information; Production Control; Hospital/Medical Systems; Transportation; Education; Utilities; Engineering.

The Application Workshops will discuss the role the computer plays in specific applications, the methods of installation, the problems involved, the benefits from the use of the computer in a particular application, a potential plan for accomplishing the entire system, and a discussion of the packages or systems that already exist to accomplish these activities.

The Technical Workshops (A through C) scheduled for Tuesday, Wednesday, and Thursday afternoons will discuss such subjects as: Data Base Design; Computer Graphics; Project Costing; Systems Analysis.

RELATION OF BOARD MEMBERS TO
BOARD ACTIVITIES

Data Base Panel

Chairman: Dr. Sidney Fernbach
Vice Chairman:
Board Participants:
Members: Dr. William Raub
Dr. John Hamblen
Mr. Joseph Kasputys
Mr. Paul Armer
Mr. Don Madden
Mr. Patrick McGovern
Mr. Chris Shaw
Miss Margaret Fox
Mr. Charles Philipps
Miss Ann Lamb

CS&E Education Summer Study

Chairman: Dr. Alan Perlis
Vice Chairman:
Board Participants:
Members: Prof. Juris Hartmanis
Prof. Edward McCluskey
Dr. Robert Spinrad
Dr. Bruce Gilchrist

Export Panel

Chairman: Dr. Donald Ling
Vice Chairman:
Board Participants: Dr. Sidney Fernbach
Prof. Anthony Oettinger
Dr. John Meyer
Members: Mr. Rudd Canaday
Dr. William Ridgway
Dr. Joseph Berliner
Mr. Warren House

National Programs Panel A

Chairman: Dr. Launor Carter
Vice Chairman: Prof. David Evans
Board Participants: Dr. J. Licklider
Prof. J. Rosser
Members: Dr. Bruce Gilchrist
Dr. Sullivan Campbell
Dr. Butler Lampson
Mr. Samuel Morgan
Mr. James Rowe

NSF Study

Chairman: Prof. William Miller
Vice Chairman:
Board Participants:
Members:

Privacy Study

Director: Dr. Alan Westin

Advisory Panel

Chairman:
Vice Chairman:
Board Participants:
Members:

National Programs Panel B

Chairman: Mr. Jerrier Haddad
Vice Chairman:
Board Participants:
Members:

Information Systems Planning Group

Chairman: Ron Wigington, CAS
Vice Chairman:
Board Participants:
Members:

Standards Planning Group

Chairman: Mr. Walter Hoffman (Wayne State)
Vice Chairman: Mr. Willis Ware (Rand)
Board Participants:
Members:

Data Communications Planning Group

Chairman: Mr. Lewis Billig
Vice Chairman:
Board Participants:
Members:

91ST CONGRESS
1ST SESSION

H. R. 7012

IN THE HOUSE OF REPRESENTATIVES

FEBRUARY 18, 1969

Mr. MOORHEAD (for himself and Mr. MCCLORY) introduced the following bill; which was referred to the Committee on Rules

A BILL

To establish a Legislative Data Processing Center and to coordinate the development of automatic data processing facilities and services in the legislative branch of the Government, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

ESTABLISHMENT OF LEGISLATIVE DATA PROCESSING CENTER

SECTION 1. There is established within and for the legislative branch of the Government the Legislative Data Processing Center, hereinafter referred to in this Act as the "Center".

FUNCTIONS

SEC. 2. (a) The Center shall assist the two Houses of Congress, their officers, committees, joint committees, Members, and supporting services in the performance of their respective functions by making available to them automatic data processing services.

(b) The Center may not be used for the support of partisan political activity.

ADMINISTRATION

SEC. 3. (a) The Center shall be under the supervision and control of the Director of the Legislative Data Processing Center, referred to hereinafter in this Act as the "Director".

(b) The Director and all other personnel of the Center shall be chosen without regard to political affiliations and solely on the basis of their fitness to perform their duties.

(c) All functions conferred on the Center are vested in the Director, with authority to delegate those functions to such personnel of the Center as he may deem appropriate.

(d) The Director shall be appointed and may be removed by the Speaker of the House of Representatives and the President pro tempore of the Senate on the recommendation of the Joint Committee on Legislative Data Processing. Unless sooner removed, he shall serve for a term expiring upon the commencement of the Congress succeeding the

Congress during which he was appointed, except that he may continue to serve until he has been reappointed or until his successor has been appointed. The Director shall receive compensation at an annual rate equal to that provided under title 5 of the United States Code for positions at level III of the Executive Schedule.

(e) Subject to the availability of appropriations, the Director shall acquire such equipment and facilities and shall appoint and fix the compensation of such analysts, programmers, operators, and other personnel as may be necessary to carry on the functions of the Center.

JOINT COMMITTEE ON LEGISLATIVE DATA PROCESSING

SEC. 4. (a) There is established the Joint Committee on Legislative Data Processing (hereinafter referred to in this Act as the "Joint Committee") which shall consist of five Members of the House of Representatives appointed by the Speaker of the House of Representatives and five Members of the Senate appointed by the President pro tempore of the Senate. The party representation on the Joint Committee shall as nearly as may be feasible reflect the relative membership of the majority and minority parties in the Senate and House of Representatives. Vacancies in the Joint Committee shall not affect its powers. The Joint Committee shall select a chairman and vice chairman from among its members.

(b) Except as otherwise provided by law, the Joint Committee may appoint and fix the compensation of a clerk and such experts and clerical and other assistants, on a temporary, intermittent, or permanent basis, as it deems desirable. The expenses of the Joint Committee shall be paid from the contingent fund of the House of Representatives upon vouchers signed by the chairman or the vice chairman.

FUNCTIONS OF JOINT COMMITTEE

SEC. 5. The Joint Committee shall maintain continuing surveillance over automatic data processing facilities and services used in or by or available to the legislative branch of the Government, for the purpose of bringing to the attention of responsible authorities instances of duplication, incompatibility, or other impediments to full utilization of facilities, and for the purpose of bringing to their attention potential applications of automatic data processing which could result in significant improvements in the services available to the two Houses, their committees, and Members. The Joint Committee shall make an annual report to the Congress, setting forth such recommendations as it may deem appropriate.

ADVISORY BOARD

SEC. 6. (a) There is established the Legislative Data Processing Advisory Board, referred to in this section as the "Board", which shall consist of eight ex officio and four appointive members. The ex officio members shall be the

Director, who shall be chairman, the Librarian of Congress, the Comptroller General of the United States, the Public Printer, the Secretary of the Senate, the Clerk of the House of Representatives, the Legislative Counsel of the Senate, and the Legislative Counsel of the House of Representatives. The appointive members shall be private citizens who have a broad knowledge of the field of automatic data processing in applications relevant to the needs and activities of the Congress. Two such members shall be appointed by the Speaker of the House of Representatives, and two by the President pro tempore of the Senate, to serve as such until the expiration of the Congress during which they are appointed, and thereafter until they have been reappointed or their successors have been appointed.

(b) The Board shall advise the Director on the policies and development of the Center. The Board shall make recommendations to the Joint Committee as to any matters referred to it by the Joint Committee.

(c) The Board shall meet at least once in each calendar quarter. Appointive members of the Board shall be compensated at a daily rate equivalent to the annual rate provided under title 5 of the United States Code for positions at level IV of the Executive Schedule, and shall be paid travel expenses and per diem in lieu of subsistence in accordance with section 5703 of title 5 of the United States Code.

APPROPRIATIONS

SEC. 7. There are authorized to be appropriated such sums as may be necessary to carry out the purposes of this Act.

Rowland Evans and Robert Novak

Nixon Advisers Seeking Reform Of Regulators' Decision Methods

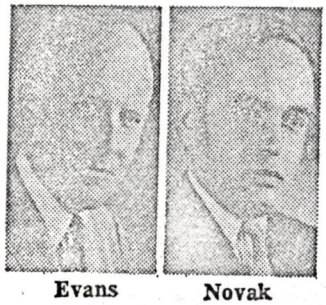
THE NIXON White House is taking a first, cautious step toward badly needed reform in the regulatory agencies by moving the President out of direct involvement with airlines in the award of rich international air routes.

What has been drafted in the White House is scarcely the long overdue general reform of the obsolete, jerry-built regulatory system protected from change by the unhealthy alliance of powerful Congressional chairmen and lobbyists. Rather, it is limited to modest revision of one aspect of one agency's work: dividing the *selection* of international routes by the Civil Aeronautics Board from their *award* to airlines.

But that step discloses what President Nixon's advisers have in mind on a broader canvas. They want a more precise or "scientific" method of arriving at regulatory commission decisions to replace the present messy system where the commissions get their information from contesting lawyers and where politically influential lobbyists are all powerful.

Even without over-all reform, this first step would at least save President Nixon from an embarrassing repetition of the wretched transpacific case. Marring the final weeks of the Johnson Administration, that case found politically well-placed agents of the airlines—"rainmakers" — scrambling for routes to Hawaii and the Orient worth $500 million a year.

When airlines loaded with rainmakers close to the Johnson White House (most notably Braniff) captured the richest transpacific prizes, lobbyists swarmed around the Nixon White House to reopen the case. The new President did just that, though with misgivings, and now faces a Solomonic decision sure to incur more anger than praise.



Evans Novak

WITH THE HISTORY of the transpacific case still fresh, Nixon aides have drafted still secret plans to separate the determination of international routes and the naming of airlines to fly them. An advance briefing of the proposal is being given to major airlines in Washington and word has seeped into the industry. In essence, the Nixon plan boils down to three steps:

Step No. 1: The Transportation and State Departments would sit down with the CAB at the beginning of a major case to establish criteria for setting the routes —building an objective groundwork not now present in contests between the airlines. This is what is meant by "scientific" decision-making.

Step No. 2: Using these criteria as guides, the CAB would hold hearings and make decisions strictly on routes to be awarded—but not the airlines to fly them —thereby splitting what is now a single process. Because these are international cases, the President would then review the route selections for foreign policy implications.

Step No. 3: With the routes thus selected, the airlines would go before the CAB to make their claims. But—and this is the heart of the matter—once the CAB made its awards, the case would be closed without presidential review; no President would have to reconsider capabilities of individual airlines as both Mr. Johnson and Mr. Nixon were forced to do in the transpacific case.

This new procedure cannot affect the transpacific case, where a decision by Mr. Nixon is expected in May. It would, however, provide orderly framework for disposing of lucrative routes to Europe in the CAB's impending transatlantic case.

Beyond that, the White House is thinking of eventually broadening their separation policy to apply to *all* air route cases, foreign and domestic, and perhaps to other regulatory agencies, such as awarding television channels by the Federal Communications Commission.

Washington regulatory lobbyists and their friends on Captiol Hill who crushed relatively modest reforms proposed by President Kennedy, almost surely would oppose such broadscale attempts to curb their wheeling-and-dealing.

But surprisingly, this first step of reforming international air route procedure is getting a friendly reception from the aviation industry. Indeed, a major voice in the industry—Wayne W. Parrish of Washington, publisher of aviation trade journals—proposed in a March 19 speech to the Wings Club in New York a plan strikingly similar to Mr. Nixon's.

This is in part a reaction to slovenly procedures followed in the transpacific case. Incredibly, for example, there is no written record of the Transportation Department's views on the controlling question of whether or not the CAB's Far Eastern route awards provided too much competition. Alan Boyd, then Secretary of Transportation and a former CAB Chairman, presented his position, still unknown, orally to Mr. Johnson. It is the view of the Nixon White House that too much money and threat of scandal is at stake for such back-room procedures.

Russia Found Still Lagging Industrially

By Eric Wentworth
Washington Post Staff Writer

For a half-century, the Soviet Union has looked to science to take the country to the forefront of the modern industrialized world.

For all their solid achievements on the space and military frontiers, the Russians today still suffer a chronic technology gap in countless other, important sectors of their vast and cumbersome economy. Indeed, by one definition, the Soviet Union still falls short of being an industrialized nation.

In an exhaustive new treatise dissecting Soviet science policies and programs, the Paris-based Organization for Economic Cooperation and Development finds the Russians are turning to Western approaches in some cases in hopes of improving their system.

When the Soviet leaders once decide to assign top priority to some technological program, the soon-to-be-published OECD report concludes, they can marshal their resources effectively and usually achieve results on a par with anything the United States accomplished.

See RUSSIA, A17, Col. 1

Soviet Industry Still Lagging

RUSSIA, From A1

But such crash efforts are limited, and the Russians lag well behind their American rivals in the crucial computer and chemical industries and in almost all consumer products. Rigid, centralized planning, and unwieldy bureaucracy, limited research support, failures to follow up research with development and frequent resistance to innovation on the factories have all contributed to this Soviet gap.

"The centralized planning system in its present form," a summary of the 738-page OECD report suggests, "imposes definite limits on the efficiency of Soviet research and development."

In terms of sheer manpower, the Soviet education system has been turning out masses of scientists, engineers and technicians. As of 1965, for example, an estimated one-third of the 4,891,000 citizens with higher-level schooling were engineers and technicians. By another estimate, between 1,655,000 and 2,291,000 persons—accurate data are elusive—were engaged in research and development work in 1966.

However, the OECD study finds "reasons for believing, that with the possible exception of the high priority sectors a lower level of equipment and other facilities per scientist means that the 'productivity' per man of R and D is lower in the U.S.S.R. than in the United States."

A knottier factor in the Russian technological lag appears to be frequent failure to develop laboratory achievements aggressively into practical, assembly-line use.

Soviet sources according to the OECD opus have claimed development spending in their country is less than 50 per cent of the total R and D budget against 65.5 per cent in the United States. While questioning these specific figures, the OECD experts don't quarrel with the basic contention.

They report running across numerous complaints about skimping on provision of testing facilities, production of prototypes and construction of pilot plants. In addition, they relate, "The Soviet press frequently publishes accounts of the failure to introduce new products 635and processes, once developed, into large-scale production, and of the slow rate at which new products and processes, even when they are fully introduced into production, replace existing products and processes.

Bureaucratic barriers within the Soviet governmental hierarchy and between the academic and industrial worlds are one cause of the lag but more basic still is the stubborn resistance to change built into the present Soviet system.

Thanks to traditional industrial planning that sets arbitrary output targets for factories and their parent ministries with limited budgets available to attain them, harried factory managers and officials have been prone to reject any innovations that might cause current production to break stride or divert available funds from existing needs.

Aware of their system's failings, the Russians in the past few years have been undertaking some remedial steps with what the OECD analysts view so far as mixed results. They are experimenting, for example, with "factory centers," "research complexes" and "research corporations"—patterned to some extent on United States structures and designed to bring laboratories and assembly lines into common harness.

Borrowing further on Western approaches, the Soviet leaders have moved toward financing research work through contracts and have accepted the idea of fostering competition among research groups.

Beyond that, they are beginning the use of bonuses to inspire scientists, designers and factory workers engaged in research and development toward faster, more effective work—with the size of the reward related to the economic return from what they produce.

The OECD experts consider this last a healthy step but not a panacea. "It seems certain," their summary observes "that successful innovations in the West cannot entirely be explained in terms of the higher profit margins obtainable from innovation."

At the same time, they add, "Soviet efforts in the next few years to measure and reward the economic return on research and development are nevertheless likely to be relevant and interesting to Western countries."

The 22-nation OECD's analysts recognize that despite its shortcomings, the Soviet Union has made immense strides toward becoming a modern society over the past 40 years. But by one OECD definition they conclude that Russia, with more than 30 per cent of its labor force still on the farm and reportedly producing more than 20 per cent of its national income, cannot yet be classified as an industrialized nation.

March 3, 1967

To: Dr. Nathan Goldfarb, Director
Hofstra Computer Center

From: Robert Hart, New College

Re: Computer use in the New College Physical Sciences Course, PGP N13 (4 s.h.)

Rather belatedly, here is the account I said I would give you of the use of the computer in the New College PGP Physical Science course.

This course is part of the first year of the core program (Prescribed General Program) taken by all students. It is quite comparable to the Natural Sciences 1 course on the Hofstra main campus, also worth four semester hours. It lasts six weeks and occupies half the students' time.

New College being humanistically oriented, about 75% of the students are in the humanities and the social sciences. The main aim of the course is to explore the nature of physical science and its relation to other human activities. However, the only way to understand these, I feel, is to do some science and not just talk about it. Accordingly, the rise of astronomy

and dynamics --- the Greeks through Newton --- is covered in a moderately technical manner.[1] This limited but vital piece of physics parallels the intellectual history of the Western world, and provides numerous excellent pegs on which to hang such questions.

My principal reason for using the computer in the course is that as computers penetrate into every corner of life, they are becoming part of the knowledge of an educated person: Games theory helps determine national policy; artificial intelligence is of interest to biologists, psychologists, and theologians; legal decisions are predicted with their aid; and they are used as sophisticated and flexible teaching machines - a list which could be extended indefinitely. In general, routine mental tasks are being eliminated, as the industrial revolution eliminated routine manual tasks. Just as an acquaintance with machines and their potentialities would have been desirable then, so an acquaintance with computers by educated people is desirable now. However, you are the last person to whom I need belabor this.

A related reason for using the computer is that it continues the Frankenstein theme touched on in the course. The view is advanced that certainly the first, and perhaps the main, step in bringing Frankenstein's monsters under control is understanding them. Computers have been assigned this role

about as much as anything these days. It is, therefore, interesting to show the students what a relatively large measure of control and usefulness results from a small investment of knowledge and understanding.

Another reason for introducing the computer is that it sometimes catches student interest, mostly for the wrong reasons: it is glamorous, the lights flash (the "pinball effect"), and a mad feeling of power comes from having all those cores doing your bidding. Nevertheless, student enthusiasm is rare and precious enough that one takes it wherever one finds it.

In addition, the computer provides something of a laboratory experience in a course which is otherwise without it, and in which a laboratory would be difficult to imagine because of the course's brief duration and large number of students - particularly inept ones at that. Also, this introduction to the computer serves as the beginning of computer instruction for the science concentration students, instruction which is continued in their General Physics course. Last but not least, there is my personal interest and experience with computers.

As to the mechanics of the course, two one-and-a-half hour lectures are given, the first describing the role of computers in the modern world, the second covering FØRTRAN programming. The second lecture is a kind of "instant FØRTRAN": the minimum needed to get numbers into the machine, carry out computations with them, and get the results out. In fact, the

sample program developed in the lecture merely adds two numbers. The points are stressed, however, that programs hardly more complex than this can have considerable sociological significance, and that the framework of this program provides the framework of much more complicated programs.[2] This year these lectures were given in the middle of the six weeks of the course; in future years they will be given at the beginning.

The programming lecture is self-contained. As a supplementary reference, a technical report by G. L. Pawlicki[3] was suggested. Next year this will be assigned as a text, costing about 50¢. This booklet is about the best beginner's FØRTRAN instruction manual I have seen: clear, explicit, and only covering a subset of FØRTRAN, which is in the "instant FØRTRAN" spirit. Nevertheless, it is not ideal for the present course, since it treats a different dialect of FØRTRAN[4] and a different computer installation, and is not sufficiently geared to the "instant FØRTRAN" approach. I am still looking for a better.

In addition to the lecture and the Pawlicki booklet, the students receive a set of procedural instructions (enclosed), and on the bulletin board is posted a complete "case history" of a program: the coding form with program and data written onto it, exactly as it would go to the keypuncher; the cards which would come back from the keypuncher; and the computer output resulting from using these cards as input. A list of error

messages is also posted. The students can also obtain programming advice at the course's problem sessions, at our weekly computer sessions, and from fellow students. The last is actually a significant source of advice. Most questions are basic, frequently answerable by students who have written a few programs, as have many of the science concentration students in preceding classes. Having students teach students, in this class and in others, is part of New College's attempt to involve students actively in the educational process.

At the optional weekly computer sessions, students could learn how to keypunch their own programs and watch them being run on the computer. (A copy of our "instant keypunch" instructions is enclosed.) The computer experiment counted five percent of the grade.

The results, I think, were reasonably successful. Somewhat more than half our approximately ninety students completed the assignment of writing one simple computer program that ran and checking that it had indeed produced the correct results, and a greater number attempted it. For most of these people, I think my principal object of "breaking the ice" was attained. What began as mysterious ended as something which could easily be made to do what was asked. I would expect results in later years to be more successful: This was New College's (and, I believe, also Hofstra's) first attempt to use the computer in a liberal-arts course, and the first year I taught the course.

It seems to me, that these results suggest the pedagogical feasibility of introducing all Hofstra students to the computer, New College students being a pretty representative cross-section. Whether this would be desirable or possible taking other considerations into account, I don't know, but should you seek to move in that direction, I think this experience would support the idea.

About the only difficulty I recall with the Computer Center was that some students misunderstood or ignored the instructions about coding programs onto the coding forms. This led the key-punchers to ask me on several occasions whether programs should be returned unpunched, or punched as best as possible. My feeling is that our students should be handled like everyone else, and that familiarizing themselves with a computer center's procedures is part of learning to program. Accordingly, my response tended toward "What would you do normally?" The answer to that tended to be that there was no "normally" --- that this was the first time this had been done. So some of the difficulties which may have been encountered (of which this is the only specific one of which I am aware) may perhaps be chalked up to growing pains on the Computer Center's part as well as ours. In any event, the students will be given yet more explicit instructions about coding next year. I would appreciate any comments about other difficulties or suggestions for next year.

I also enclose two laboratory write-ups from the New College General Physics Course. These show how the above introduction to computers, which everybody receives in the PGP Physical Science Course, is continued for the students concentrating in science. The General Physics Course (N. Sc. N21, 6 s.h.) begins half-way through the six-week Physical Sciences Course and lasts twenty weeks, occupying about half the students' time.

These write-ups are straightforward. The first merely instructs the student to write another program more complex than that written for the Physical Sciences Course, preferably related to either his physics or calculus course. The second is a numerical integration of a simple harmonic oscillator, which lends itself naturally to the computer, though its use is not required.

Finally, I also enclose a copy of a letter I wrote to Alfred Bork, at Reed. There has recently been considerable interest in the use of the computer in physics teaching, from a variety of viewpoints[5]: the straight teaching and use of programming in physics classes and laboratories; computer consoles in the physics laboratory to carry out data analysis; computers as demonstrators (simulators) of physical phenomena; and the use of the computer as a flexible and sophisticated teaching machine to teach physics. In any event, Bork, Chairman of the Committee on Mathematics in Physics Education of the American

Association of Physics Teachers, recently solicited[6] information about physics courses using computers. I thought you might be interested in what I wrote about the New College courses.

FOOTNOTES

1. The course uses as text, and follows closely, G. Holton and D. H. D. Roller, Foundations of Modern Physical Science (Addison-Wesley Publishing Company, Inc., Reading, Massachusetts, U. S. A., 1958), Chaps. 1, 2, and 4-15.

2. "Instant FØRTRAN" is, I believe, the proper way to begin teaching FØRTRAN programming, even when the subject is to be explored in greater depth. FØRTRAN is peculiarly amenable to self-study: one learns FØRTRAN programming by writing programs, and this should be started with the first lecture. Despite this, no really satisfactory "instant FØRTRAN" text is known to me.

3. G. S. Pawlicki, "An Introduction to 704 FØRTRAN," technical report ANL-6542 (March 1962, corrected November 1963) of Argonne National Laboratory, Argonne, Illinois, U.S.A.

4. We are presently using NCE (Newark College of Engineering) FØRTRAN, a stripped pedagogical language with free-style input and output. This may change shortly, when our 20K IBM 1620 (no magnetic drums or tapes) is replaced with two IBM 1130's.

5. This is evidenced, for example, by a number of articles in the American Journal of Physics, and by a session on this topic at the recent meeting of the Americal Physical Society and the American Association of Physics Teachers in New York. A good article on this, and certainly the most amusing, is by D. L. Shirer in Am. J. Phys. 33 (1965).

6. A. M. Bork, Am. J. Phys. 34, 1199 (1966).

(Reprinted September 20, 1967, without change, except correction of typographical errors.)

PROPOSAL: LIBERAL-ARTS COMPUTER INSTRUCTION

Robert Hart
New College
Hofstra University
Hempstead, New York, U.S.A.
September 22, 1967

PROBLEM

Computers and their attendant disciplines are becoming increasingly important in all phases of modern life: (a) Games theory helps determine national policy. (b) Artificial intelligence is of interest to biologists, psychologists, and theologians. (c) Legal decisions are predicted with the aid of computers, and they have been proposed as a substitute for juries. (d) Radical changes are taking place in libraries, as their traditional data-retrieval function makes use of the memory and speed of computers. (e) Their scientific uses in our technically-oriented world are too numerous to mention; suffice it to say that whole areas of science would be impossible without computers. (f) They are used as sophisticated and flexible teaching machines - indeed, within a decade or two this is expected to be their major use. (g) Their social impact, as they eliminate routine mental tasks, causing unemployment and shifting patterns of employment, is comparable to the impact of the Industrial Revolution.

The problem, then, is how to give liberal arts students a literacy in computation - not the knowledge of a professional

computer programmer, but an acquaintance with computers and their potentialities - the sort of knowledge, in brief, which it would have been desirable for an educated person at the time of the Industrial Revolution to have of machines and their potentialities.

The present proposal seeks to accomplish this in a way which may be widely applicable because it fits easily into the conventional educational framework: using the sort of facilities now widely available at small-college computation centers and fitting easily into the conventional and existing structure of courses. (See also the Appendix.)

PAST EXPERIENCE

This proposal is an outgrowth of experience in New College during the 1966-1967 year. It thus seems appropriate to begin by describing this. The attached memorandum (Attachment A) of March 3, 1967 to Dr. Nathan Goldfarb, Director of the Hofstra University Computer Center, does this, and the more relevant parts of this experience are given below.

New College is an experimental, humanistically-oriented, semi-autonomous college within Hofstra University. The Physical Sciences course in which the computer was used is part of the core program taken by all students, about 75% of whom are in the humanities and social sciences.

Two one-and-a-half hour lectures were given, the first describing the role of computers in the modern world, the second on FØRTRAN programming. The second lecture is a kind of "instant FØRTRAN": the bare minimum required to get numbers into the machine, manipulate them, and get the results out. Getting students onto the machine as quickly as possible to run real, if very simple, programs seems to me the right approach, and the one most likely to engage their interest.

The results, I think, were reasonably successful. Somewhat more than half our approximately ninety students completed the assignment (counting five percent of the grade) of writing one simple computer program than ran and checking that it had indeed produced the correct results, and a greater number attempted it. For most of these people I think my principal object of "breaking the ice" was attained. What began as mysterious ended as something which could easily be made to do what was asked. This was the first attempt at Hofstra or New College to introduce the computer into a liberal-arts course, and the first year I taught the course.

POSSIBLE APPROACH TO THE PROBLEM

It seems to me that this ecperience suggests a pattern, possible of wide applicability, for giving liberal arts students a literacy in computation.

Suppose a school's computer center makes available to any instructor or course chairman desiring it a small "package" of computer instruction, similar to that which I gave, which may be included in his course. The "package" would provide the lecturer, computer operators, and administration of student records. This "package" would be especially appropriate for inclusion in the science courses most schools offer for liberal-arts majors, a point I discuss below.

Such a set-up would have a number of advantages. No knowledge of computation would be required by the course instructors. It could be put into operation quickly and with minimum administrative blither, since it fits into conventional and existing courses: only the assent of individual instructors or course chairmen is needed. It also uses conventional, widely available computer facilities.

There are several possible objections to such a package: (a) If put into courses for liberal-arts students it misses the science students who need it most. (b) The acquaintance with computation provided by the package is inadequate. (c) A better way than conventional batch processing, of driving home the importance of computers, is by the man-machine interaction of computer-assisted instruction and time-shared remote terminals.

The response to the first objection is that this package is

not principally intended for science students. In a sense, they present no problem. Conventional semester-long computer courses fit well the needs of science students, and are being increasingly recommended or required as part of science programs. The problem is with liberal-arts students, for whom a semester course would be harder to justify, and whose aim of understanding the human and social implications of computers, is not well met by the conventional computer-programming course.

However, although it is intended mainly for liberal-arts students, it may be worth pointing out that this "package" is very flexible. Where science programs are so benighted that a computer course is not required, this package included in science courses for science majors, would be better than nothing. It would also provide an opening wedge: such a demonstration of the feasibility and utility of introducing all students to computation might be the most convincing argument to a science department, in favor of requiring a computer course of all their students. In addition to this, a taste of programming can be addicting, and exposure to this package might induce science students to take computer courses as electives.

The remaining two objections are linked. More knowledge

of computers than provided by this package would certainly be desirable. One might reasonably argue that all students could profit from a one-semester course on the humanistic and social implications of computers. However, instructors for such courses are hardly to be found - they are the students of today - and fitting a new course in a new discipline into the curriculum is slow and painful. Again, the present package would be an opening wedge: an excellent argument for such a course would be the success of the present program.

Similarly, it can hardly be denied that the man-machine interactions of time-sharing systems would be better than my use of conventional batch processing, in convincing students of the immediacy of computers. Again, however, remote consoles and computer-assisted instruction are still in the experimental stages; one of the best arguments for a school's getting them when they become routinely available would be the prior success of a program such as I am suggesting.

In summary, then, this pattern emphasizes the immediate and practical. It is a quick and dirty way of using existing facilities and course structures to plug some of the gap in the computer education of liberal arts students; and one which might pave the way to better methods.

In regard to these points, see also the Appendix.

PROPOSAL

Several circumstances combine to make it easy to explore this pattern at Hofstra: the availability of an appropriate group of 150 additional students to work with, the availability of experienced student computer personnel, and the availibility of computer time and facilities for such a relatively large project at our newly-expanded and very cooperative computer center.

The last two of these will be discussed under Personnel and Facilities. The 150 additional students are those in the Hofstra main campus Natural Sciences 1-2 course. ("Main campus" means the main part of Hofstra, as distinct from New College, which is semi-autonomous.) This course is the physical science course offered to liberal-arts students to satisfy their requirement for a year of science. Dr. Esther Sparberg, the Natural Sciences course chairman, would like to have me present my "package" of computer instruction to her students. I would thus be playing the role in her course of the lecturer and administrative staff provided by the computer center.

This group of students is especially appropriate for several reasons: (a) The content of Dr. Sparberg's course is quite similar to that of my course, and thus there would be a maximum carryover of experience from last year. (b) It is the better liberal-arts students who take Dr. Sparberg's course

(the worse ones tending toward the main campus' liberal-arts biology course to satisfy their science requirement), so this would be a cautious place to start. (c) After last year's experience with approximately ninety students, an additional 150 would be about the right number to progress to.

The principal objectives of the proposal are: (a) During the Spring 1968 semester, to test the feasibility of the pattern suggested in the preceding Section, using the approximately 240 students of the two classes. (b) Based on this experience, to write, during the Fall 1968 semester, a text booklet suitable for this computer instruction "package" and to generally take stock of and evaluate the package. (c) During the Spring 1969 semester, to present the package to the two classes with the new text, with changes suggested by the preceding year's experience, and with extended or improved evaluation procedures.

In addition, there are several possible fringe benefits: (a) One is an interesting demonstration of how an experimental unit, like New College, within a larger university can generate and "spin off" programs of interest to the whole university. (b) Dr. Eugene Kaplan, who teaches the main campus' liberal-arts biology course taken by about 500 students, has expressed some interest in having the package included in his course, if the omens from the present 240 students are favorable. Should

this work out, then essentially all Hofstra students would receive an introduction to computers, as all New College students do now. (c) Dr. Nathan Goldfarb, Director of the Hofstra University Computer Center, is tentatively designing a one-semester course on the humanistic and social implications of computers. One possibility which we have discussed is to use my "package" as the skeleton of this course, at least initially. My lectures on the role of computers in the modern world and on "instant FØRTRAN" would come at the start. This would allow the students to program during the rest of the semester, while Hofstra faculty from a variety of disciplines lecture on the impact of the computer in their fields, thus filling out the introductory lecture on computers in the modern world. At the end would come a summarizing lecture or lectures.

The evaluation and the need for a text mentioned among the objectives perhaps deserve further comment. The latter first: I am convinced that "instant FØRTRAN" is the right way to begin teaching FØRTRAN. By this I mean giving the students the minimum required to get numbers into the machine, carry out the simple manipulations, and get numbers out; and getting the students onto the machine as quickly as possible. I think this is the right way to start, even if FØRTRAN is to be explored in greater depth, and in our case this bare minimum is as deep as we get.

Despite this, there is really no satisfactory "instant

FØRTRAN" text: clear, explicit, and minimal. Not only could we use such a text now that our students will increase two- or three-fold, but I think that the need will become general as more people are given the kind of computer literacy I am aiming at.

Accordingly, I would like to write such a text during the Fall 1968 semester, to have available for the students in Spring 1969.[1]* I think this is well within our capabilities, since I have a good idea from last year of what is needed, and since we want to produce a booklet, not a book. There are a number of good books available which give complete treatments of FØRTRAN, but completeness is precisely what we do not want. In writing this text I would probably be assisted by Mr. Rosenstock (see Personnel).

The two handouts given last year's students are attached. Attachment B, "Operation of the Keypunch," is slight, but perhaps it conveys the explicit and direct flavor I would hope to give the text. Using it, students were able to operate the keypunch after one supervised run-through of the instructions.

Attachment C, "Computers," is principally procedural.

New College's intimate set-up, with all students and faculty in the same building, made for an easy feedback of student questions - extremely desireable for such an experiment. By

*Numbered footnotes appear at the end of this proposal.

the same token, however, these were clarified by personal contact and by notices on the bulletin board which all students passed several times a day, rather than by additional materials. Thus, these two handouts are all that I have to offer.

For the more impersonal set-up envisioned in the future additional material is obviously desirable; it is to this need that the proposed text is addressed. As I see it now, the text will principally consist of an introduction to FØRTRAN closely following that given in my lecture, and a "case history" of a program like that which last year was posted on the bulletin board. The introduction to FØRTRAN will be a step-by-step development of an exceedingly simple program, stressing, however, that programs hardly more complex can have considerable sociological significance, and that the framework of this program provides the framework of much more complicated programs. The "case history" will be a coding form with the same program (and data) written on to it, exactly as it would go to the keypuncher; the cards which would come back from the keypuncher (in a pocket); and the computer output resulting from using these cards as input. The text would also have a section on debugging, again proceeding by example. In addition, students would receive procedural instructions similar to Attachment B, a list of error messages, and a time schedule for student tutors and the Computer Center.

As to evaluation: The amount of evaluation we can meaningfully do is limited by the brevity and aims of the package. However, despite this, the imminent mushrooming of all-student introductions to the computer appears to make it desirable that we milk the package for the modest amount of information on its effectiveness that it can yield. We are fortunate in that Dr. Harold Yuker, formerly Director of Instructional Research at Hofstra, now Director of Hofstra's Center for the Study of Higher Education, is interested in doing this. A copy of Dr. Yuker's resume appears as Attachment F.

Regarding the difficulty of evaluation, recall that the aim of the package is to give students a "literacy" in computation - an awareness of the possibilities and limitations of computers - not to make them computer programmers. Accordingly, what we would primarily be interested in doing would be something like evaluating their increased comprehension of the humanistic and social implications of computers, rather than the more straightforward job of evaluating their ability to program. (I will test their ability to program, incidentally, but more to evaluate the students than the package.)

Despite these difficulties, we would like to devise modest pre- and post-tests of about a dozen items each. Sample question: "Can a computer which has been programmed to play checkers beat the person who programmed it?"

In brief, then, the proposal seeks principally computer time and supporting services, time for student assistants and tutors, and support for preparing the text and for evaluation.

DISSEMINATION AND COPYRIGHT OF TEXT

I would like to publicize this pattern fairly widely. At this stage it seems to me that the way to do so may be to send a copy of the text booklet together with appropriate covering material (possibly the final report) to potentially interested persons. These would include, for example, (a) the "Pierce Report"[2] panel members, (b) the members of the Committee on Uses of Computers of the NAS-NRC which produced the "Rosser Report,"[3] also quite favorable to all-student introductions to the computer, (c) the participants in the Irvine Conference on the Uses of the Computer in Undergraduate Physics Instruction,[4] and the directors of a selection (perhaps half) of the approximately four hundred academic computer centers in the U.S.[5]

This strikes me as somewhat cumbersome, but perhaps this is not entirely bad. I suspect it is a sign that we are doing what we should be doing - exploring a new field - and part of this is that the channels of communication are not yet well established.

I would also seek to publicize this in such journals as might be appropriate. I would plan to write a letter to the American

Journal of Physics, the journal of the college and high school physics teaching community. Physicists are among those most active in computer education,[4] and this, together with their frequent involvement in teaching science courses to nonscience majors, has made them perhaps the leaders in introducing the computer into such courses.[6] The American Journal of Physics has, for example, recently begun a special department on "Instructional Uses of the Computer."

Among other journals which should be looked into would be, for example, The Journal of Chemical Education, The Science Teacher, and School Science and Mathematics.

Another obvious way to publicize the scheme is by contacting others active in the field. As reasonable estimates (though these might not be the precise trips undertaken), I have included the expenses of a trip to the National Science Teachers Association College Conference on Establishing Goals for Scientific Literacy in Jacksonville, Florida, and to the Center for Computer-Oriented Research in the Humanities and Social Sciences at the University of Pennsylvania.

Production of the text would be handled by the Hofstra University Bookstore. Their routine procedure for producing lab manuals, lecture notes, and similar course materials includes designing, typing, offset printing, assembling, and simple binding; it would cost a dollar per copy for the 20-25 page booklet envisioned.

As to copyright, it seems desirable in a new and changing field that other users of the booklet be fairly free to adapt and modify it in light of their own experience and needs. At the same time, copyrighting seems desirable in order to retain some knowledge of and control over these modifications. I propose to copyright the booklet, and include in the copyright notice a statement that permission to adapt and modify may be freely obtained by contacting the authors.

PERSONNEL

The principal personnel are myself, Dr. Esther Sparberg, Mr. Jeffrey Rosenstock, Dr. Nathan Goldfarb, and probably a student aide in addition to Mr. Rosenstock.

I have been Assistant Professor of Physics at New College since January 1966. A copy of my resume appears as Attachment D. The most relevant point here is that publications Nos. 2-8 and 10, pp. 6-7 of the resume, deal with the applications of computers to molecular structure and molecular quantum mechanics.

Dr. Esther Sparberg, Assistant Professor of Chemistry at Hofstra, is the course chairman of the Hofstra main campus Natural Science course in which my computer instruction "package" would be inserted. She has eight years experience teaching this course, and is active as a teacher and as a researcher; a copy of her resume appears as Attachment E.

Mr. Jeffrey Rosenstock is an undergraduate New College student. Last year he very capably, and with little assistance from me, ran the student sessions at the computer in my course, and tutored students in programming. He is thus well-prepared to do the same this coming year. In addition, being familiar with my approach to computer instruction, he can contribute meaningfully to the proposed text - certainly by providing the important criticism from the student viewpoint, and perhaps in doing some of the writing and editing.

Dr. Nathan Goldfarb has been Director of the Hofstra Computer Center since its inception. A copy of his resume appears as Attachment G.

FACILITIES

The principal facility is the Computer Center. This past year they had a 20K IBM 1620, and the course consequently used NCE (Newark College of Engineering) FØRTRAN, a stripped pedagogical language without batch-processing capabilities.

This IBM 1620 has been replaced by two IBM 1130's, each of which is twenty times as fast, and which have FØRTRAN II and batch-processing capabilities, the latter especially useful for pedagogical applications such as ours. Both of these IBM 1130's have been delivered and are in routine operation.

The Computer Center's supply of keypunches available for student use has not kept pace with its growth. Accordingly, funds for renting extra keypunches are included in the proposal.

Perhaps the most important point about the Computer Center is that it is extremely cooperative. Their flexibility and willingness to go along with our needs made last year's program possible despite equipment that was less than optimal; and would be an important factor in successfully meeting new problems arising from an expanded program this coming school year.

In this regard, perhaps it is worth mentioning that Dr. Goldfarb, Director of the Hofstra Computer Center, sees a liberal-arts computer instruction "package" as complementary to, rather than competitive with, conventional computer courses at Hofstra.

A detailed list of the equipment at the Hofstra University Computer Center is as follows: (a) two IBM 1130 Computer Systems, each with 8K of core memory and one 500 K disk drive, and each consisting of one 1132 Printer, one 1442 Card Reader, and one 1131 Central Processing Unit; (b) ten IBM 029 Keypunches; (c) one IBM 056 Verifier; (d) one IBM 082 Sorter; (e) one IBM 514 Reproducer; (f) one IBM 085 Collater; and (g) one IBM 407 Printer (Tabulator).

BUDGET

First Phase - Spring 1968 Semester

Salaries:

1)	Robert Hart, 25% of $9500 per year base pay	$1187.50
	Fringe Benefits at 13%	154.50
2)	Senior Computer Center man at computer during lab sessions, 1/8 of $10,000 per year base pay for 4 months	416.67
	Fringe benefits at 13%	56.17
3)	Student lab assistant at computer, $2.50 per hour, 5 hours per week, for 15 weeks	187.50
4)	Student grader and/or office assistant, $1.25 per hour, 5 hours per week, for 15 weeks	93.75

Expendable Equipment and Supplies:

5)	Forms for IBM 407 Printer and IBM 1130 Computer, one box	15.00
6)	Paper, ditto masters, and duplicating fluid for student handouts, figured at 10 pages of handouts, 300 copies each, at 88¢ per ream	5.28

Other Direct Costs:

7)	Keypunch rental, two keypunches for four months, at $60 per month each	480.00
8)	Computer time, $35 per hour, 5 hours per week, for 15 weeks	2625.00
9)	Keypunching for those students who do not keypunch their own, figured at 500 programs of a dozen cards each, at 7¢ per card	420.00
	FIRST PHASE DIRECT COSTS - TOTAL	$5641.37

Second Phase - Fall 1968 Semester

Salaries:

1)	Robert Hart, 16-2/3% of $9500 per year base pay	$791.67
2)	Jeffrey Rosenstock, $2.50 per hour; 5 hours per week for 15 weeks	187.50

Travel and Subsistence (figured in accord with Hofstra University's standard travel policies):

3)	*Philadelphia, round trip coach fare ($49.04) plus three days per diem at $20 per day	109.04
4)	*Jacksonville, Florida, round trip coach fare ($110.46) plus three days per diem at $20 per day	170.46

Publication and Related Costs:

5)	Text Booklet, 750 copies at $1 each	750.00

Other Direct Costs:

6)	*Evaluation, Hofstra University's Center for the Study of Higher Education	1000.00

SECOND PHASE DIRECT COSTS - TOTAL $3008.67

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* Starred items may-be expended in part during the other phases.

Third Phase - Spring 1969 Semester

The Third Phase incurs essentially the same expenses as the First Phase. Further expenses are required only for the final report: its typing, paper, and dissemination.

Salaries, Expendable Equipment and Supplies, and other Direct Costs:

1) - 9)	Same as in First Phase	$5641.37

Publication and Related costs:

10)	Additional secretarial help for typing and disseminating final report, $2.50 per hour. 5 hours per week, for 20 weeks	250.00
11)	Paper and reproduction costs of final report, 500 copies, 30 pages each, figured at 1¢ per page	150.00
12)	Envelopes and postage for 350 final reports and text booklets, at 25¢ each	87.50

THIRD PHASE DIRECT COSTS - TOTAL $6128.87

TOTAL DIRECT COSTS FOR ALL THREE PHASES $14,778.91

Indirect Costs, figured at 55% of salaries (salaries for all three phases = $5421.35)	$2,981.74
FINAL TOTAL--Direct and Indirect Costs for all three phases	$17,760.65

APPENDIX

The present proposal is based heavily on the preliminary version.[7] Since writing the latter I have become aware of the "Pierce Report."[2] This is the report of the Panel on Computers in Higher Education, of the President's Scientific Advisory Committee. The Pierce Report comes out heavily in favor of some acquaintance with computation for essentially all undergraduates; in particular, it strongly favors extending the "all-student" introduction to computers given by a very few front-rank schools, to virtually all undergraduate institutions. It thus would appear to lend considerable weight to this proposal. Indeed, the identity of views is so striking that to quote the Report at length would be redundant. A few quotes, therefore, will suffice to give its flavor.

On the desireability of some knowledge of computation for all:

> . . . we find ourselves compelled to believe that within a decade essentially all university and college students will require some basic understanding of digital computation. . . . .
>
> In short, we believe that the computer and computing are rapidly coming to have an impact on the life of practically every member of our society. Most people educated beyong the high school level will have occasion to make use of these tools, and all will need sufficient understanding of their possibilities and limitations realistically to appraise the new opportunities now available for information processing. (Ref. 2, p.28.)

Clearly some acquaintance with digital computers will be as essential to the next generation as is now familiarity with the automobile and the radio. For college and university students the time required to get such familiarity may be about that to learn to drive a car. Unfortunately, parents can't teach about computers so the colleges and universities must. Ref. 2, pp. 28-29.)

We believe that undergraduate college education without adequate computing is deficient education, just as undergraduate education without adequate library facilities would be deficient education. At present, deficiency in computing is widespread. We believe it to be vital to the national interest as well as to the welfare of the individual student to remedy this deficiency quickly. How can the deficiency be remedied and what will the remedy cost? (Ref. 2, p. 10.)

On the remedy:

In 1965 less than 5 percent of the total college enrollment, all located in a relatively few favored schools, had access to computing service adequate for these educational needs. . . .

We recommend that colleges and universities in cooperation with the Federal Government take steps to provide all students needing such facilities with computing service at least comparable in quality to that now available at the more pioneering schools.

2. One of the major problems in providing the necessary educational computing is the cost. . . . It is beyond the capabilities of our colleges and universities to bear all of this cost in this time period.

We recommend that colleges be encouraged to provide adequate computing through government sharing of the cost. . . . (Ref. 2, p. 4.)

The remedy seen by the Pierce Report is principally that of extensive Federal support for educational computing. The emphasis is toward providing the hardware and software required for remote consoles, multiprogramming, and man-machine interactions (Ref. 2, pp. 11, 16, 34-36, and 44-45).

As noted in the main body of this proposal, such systems are indeed excellent, but they are also expensive and still under development. The present proposal makes something of an end run around the cost and availability problems of these systems by achieving an "all-student" introduction to computation using conventional batch-processing, while at the same time paving the way for institutional acceptance of more sophisticated techniques when these become routinely available. Right now, batch-processing is the bread-and-butter of the great majority of computer centers, and for many would remain so for quite a few years, even if the recommendations of the Pierce Report were fully implemented.

In this connection, another point about the Pierce Report is perhaps worth noting. Despite the considerable emphasis it places on introducing all students to computation, and in particular on extending such introductions from a few front-rank institutions to the common run of schools, no cases are mentioned where this has been done. As far as I know, New College is unique in this respect. Thus it would seem that interest may attach to our efforts, the more so since our use of conventional computer facilities, minimum faculty retraining, and minimum administrative fuss might be an appropriate pattern for similar schools.

FOOTNOTES

1. First classroom instruction is planned for February 5, 1968. An earlier decision on this proposal would be most helpful in planning, but not vital.

2. Panel on Computers in Higher Education of the President's Scientific Advisory Committee, chaired by J. R. Pierce, Computers in Higher Education (U.S. Government Printing Office, Washington, D.C. 20402, February 1967).

3. Committee on Uses of Computers of the National Academy of Sciences-National Research Council, chaired by J. B. Rosser, Digital Computer Needs in Universities and Colleges (National Academy of Sciences-National Research Council, Washington, D.C., 1966). On "all-student" introductions to the computer: "The broad-scale reliance of our increasingly technical society on computer systems, formal languages, and the related problem-solving procedures will eventually mean that every citizen should have a basic nontechnical understanding of the field, much as every citizen is now expected to understand something of history, arithmetic, biology, etc." (p. 123.)

Further: 'Many have come to realize that these applications

[of the computer] have the potential of profoundly affecting our socio-economic structure, our institutions, and our standard of living. Even the well-educated man, however, thinks of the computer as a magical box, and of its use as incomprehensible. There is almost no widespread understanding of the prospects or problems in the use of computer systems.

"It will be important to the social well-being of our country that the educated citizen understand computer science at least as well as he now understands medicine or mechanics." (p. 124.)

4. The Computer in Physics Instruction, Report of the Conference on the Uses of the Computer in Undergraduate Physics Instruction, sponsored by the Commission on College Physics, at the University of California at Irvine, November 4-6, 1965.

5. Listed, for example, in the "Roster of School, College, and University Computer Centers" appearing in each annual (June) directory issue of Computers and Automation.

6. A. M. Bork, Am. J. Phys. 34, 926 (1966).

7. R. Hart, "Prospectus Proposal: Liberal-Arts Computer Instruction," New College, Hofstra University, Hempstead, New York, U.S.A.

Agendas

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

COMPUTER SCIENCE AND ENGINEERING BOARD

13th Meeting Sheraton Plaza Hotel

Boston, Massachusetts

AGENDA - EXECUTIVE SESSION

8:00 P.M.	The final report and recommendations of the FCC (Data Communications Interface) planning group to the Board regarding the task to be undertaken for the FCC and the longer-term prospects L. S. Billig, Chairman, Planning Group
9:00 P.M.	Progress Report on Elements of a National Computer Policy The Chairman, Mr. Jerrier Haddad
9:30 P.M.	The Chairman's Option Review of "Hoover Commission" draft Review Relationship of Board Members to Board Activities Chart - decide distribution

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

COMPUTER SCIENCE AND ENGINEERING BOARD

13th Meeting — Boston, Massachusetts

The Foyer — Sheraton Plaza Hotel

DAY SESSION - AGENDA

9:00 A.M.	Status of the work of the Planning Group for the Information Systems Area
	Mr. Ron Wigington, Chairman, Planning Group
	The Chairman, CS&E Board
9:30 A.M.	Special Report on the Study on Privacy, National Data Banks and Computers
	Dr. Alan Westin
10:00 A.M.	Special Report on the status of the NSF Survey of Computer Support Patterns in Educational Facilities
	Dr. William Miller
10:30 A.M.	Special Report on the program to put a little computing into every student's life at the New College of Hofstra University
	Professor Robert Hart
11:30 A.M.	Presentation of an OECD program in fundamental research in the information sciences
	Professor Caracciola di Forino, consultant to OECD

LUNCHEON

Choice of Yankee Pot Roast, Jardiniere

or

Poached Salmon, Egg Sauce

1:30 P.M.	Regular reports on the status of the work of:
	National Programs Panel "A" work
	Dr. Launor Carter, Chairman
	Data Base Panel work
	Dr. Sidney Fernbach, Chairman
	Education Panel's Summer Conference
	Dr. Alan Perlis
	Export Panel's Summer Conference Plans
	The Chairman, CS&E Board
	Status of the work of the Planning Group to outline the role of the Board in the Standards area
	The Chairman, CS&E Board
2:30 P.M.	Chairman's Options
3:00 P.M.	Administrative
	-No. 2 Man for each Panel
	-Hotel Reservations
3:30 P.M.	Other
	Regularized reporting by all operating Panels on work done to support progress reports to the Board's major sponsor
	The Secretary

Executive
Session

APR 21 Rec'd

Xerox to WH
Bernie Strassburg (FCC)
Lew Billig (Mitre)

WHO LEAKED?

Re: NAS 5/7

Started by president Errol Payne, a physicist, July of last year, the firm now has patent protection, a working prototype, and a half dozen models of the display in the works. The prototype has a 2' by 2' flat screen, made of a honeycomb thermoplastic material. A scanner bar moves across this surface, taking about 10 seconds for a round trip. In one direction it erases the numbers, words or pictures on the screen; in the other it deposits thousands of tiny particles to form the images. The information to be displayed is stored digitally in computer core and transferred over standard telephone lines. Speed is limited by line rates—and this appears to be the main drawback, since it takes up to two minutes to change the display. With wideband service, this time would be much less.

The unit doesn't generate heat and needs no high voltage; 5-volt logic is used. And unlike other display methods now in use, the cost only goes up linearly. This opens up such markets as outdoor advertising, airline terminal displays, and so forth, plus the possibility of home use since only a phone is needed.

An added note on the low cost: the company has set up a subsidiary to produce a toy called Graph-A-Magic using the same principle and selling retail for about $5.

IBM's ROUND HOLE PUNCH CARDS PEGGED FOR JULY

Guess what? IBM's little 3.7 computer system with the round-hole punch cards is now due out in July, presumably after any separate pricing announcements. We hear IBM will try to avoid the mammoth systems engineering effort always needed for small, small-system users by providing "model" applications packages for quick implementation. Language: RPG. Going to the other extreme, the 360/85 I, or whatever the 85 successor will be called, is reported to have a freon cooling system as opposed to the water cooling systems of the 85 and the 90 series. Maintenance charges for the latter systems are so high, explains one quipster, because it involves "six plumbers and a CE." One of three super computer projects at IBM is somewhere within Federal Systems Division, where a parallel processor is being designed.

GROUP TO EVALUATE ATTACHMENT TALKS

The FCC reportedly has asked the Computer Science & Engineering Board of the National Academy of Science—headed by ACM ex-president Tony Oettinger—to evaluate upcoming discussions concerning foreign attachments. The Board is reportedly interested in acting as interpreter at discussions, which would include AT&T, the commission's common carrier bureau, and communications users.

The talks may get under way this month, after the bureau issues a public notice specifying ground rules; several working groups will be set up, and different foreign attachment problems will be assigned to each. Bureau officials are said to be "sympathetic" to BEMA's suggestions that the bureau issue a progress report after the talks have been under way for awhile, that written records of the deliberations should be maintained, and distributed to all participants, and that any participants should be able to sit in on any group's discussion.

Members of BEMA's DPG/telecommunications committee, who hammered out the association's basic

(Continued on page 281)

position on FCC matters, are apparently devoting appreciable time to hammering each other. Representatives of IBM and Honeywell are reportedly fighting the others. We are told that the argument got so heated at one point recently that a majority was on the verge of asking chairman Wally Dowd of IBM to resign. IBM and Honeywell don't want to fight AT&T on foreign attachments "because their ability to market communications hardware isn't as well developed as the other manufacturers," says a member of the opposition camp.

UCC's FASBAC: MODIFIED T-S

Although it's currently tied to the 1108—considered by industry savants as a poor time-sharing machine—ever-resourceful University Computing has figured out a way to offer T-S thru its computer "utility" network.

The Dallas cowpokes have hooked up a modified PDP-8 (multiplexer) to a modified PDP-9 and a Fastrand drum to allow on-line use of new software; text editing, calculator languages and output reports. Coming: file manipulation. The T-S system will be linked thru the drum to the 1108, allowing remote batch entry of large jobs to the big beast, after the multiplexer converts the T-S ASCII code. Each multiplexer will handle 28 simultaneous terminals; they're planning up to four multiplexers per T-S system.

Named FASBAC, the system is now in field test in Dallas and El Segundo, should be available soon.

NEW T-S TERMINAL DOFFS WRAPS AT SJCC

A new San Antonio firm, Computer Terminal Corp., will show its initial product at the SJCC. It's a self-contained, solid-state/keyboard crt terminal aimed at the time-sharing market, and compatible with all T-S services using Teletype terminals. The keyboard has a 64-character set, and the crt can accommodate up to 1800 characters at one time in its 25-line/72 character-per-line format, with a data transmission rate of up to 600 bps standard. Optional: 4800 bps, mag tape memory, ten-key adder keyboard and hard copy printer. Gerald Mazur is chairman of the board of the new firm. Phil Ray, president, and Austin Roche, vp, formerly were with General Dynamics Dynatronics division.

FEDS PAVE WAY FOR INDEPENDENTS' PERIPHERALS

GSA plans to release an RFP this month that will give independent peripheral makers their first opportunity to bid directly on Federal ADP systems. The details have been worked out in extensive discussions between GSA and peripheral makers the past several weeks. Bryant Computer Products' Dick Caveney was among the participants; his incessant nagging is largely responsible for convincing GSA to give the independents a chance.

The procurement covers a system to be operated by the Commerce Department in parallel with an existing installation—either a 360/30 or /40—acquired entirely from IBM. Hopefully, the parallel buy will show whether acquiring independently made peripherals is more cost effective than buying them from the mainframe maker.

Four tape units, a disc, card reader/punch, and printer, are among the peripherals needed. Peripheral bids will be accepted from mainframers as

← FOR ALLEN-BABCOCK CIRCLE 126 ON READER CARD

(Continued on page 283)

Haddad

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

NATIONAL COMPUTER POLICY ITEMS

Notes From The Meeting of the Board - March 11, 1969

1. R&D in Computer Hard and Software.
2. Education and training of Personnel.
3. Use, Misuse and Application of Computer in Education & Weather, etc. (National Uses)
4. The structure of the computer industry as an element of the economy.
5. The Patent Law as affected by computers.
6. The Copyright Law as affected by computers.
7. International relationships - ie. export
8. The structure of computing in the government (including misuse) and operation.
9. Impact of technology on feasibility of computer networks.

USES--
Scientific -- ie. Weather
Military
Industrial
Commercial
Education
Public Administration

Specific Opportunities in Government where not now recognized or used adequately.

Legislative & Judicial Cases
Personnel Managements
Education, teaching & Administration
Manpower Information Systems
Medical Information Systems
Law Enforcement
Administration of Welfare
Defense
Post Office
National Labor Systems
Physics
Weather - ie. International watch
Intelligence

BOARD ACTIVITIES

Data Base Panel

Chairman: Dr. Sidney Fernbach
Vice Chairman:
Board Participants:
Members: Dr. William Raub, National Institutes of Health
Dr. John Hamblen, Southern Regional Education Board
Mr. Joseph Kasputys, Department of Defense (DDR&E)
Mr. Paul Armer, AFIPS
Mr. Don Madden, ACM
Mr. Patrick McGovern, International Data Corporation
Mr. Chris Shaw, System Development Corporation
Miss Margaret Fox, National Bureau of Standards
Mr. Charles Philipps, BEMA
Miss Ann Lamb, Bureau of the Budget
Mr. McClure, Southern Methodist University

CS&E Education Summer Study

Chairman: Dr. Alan Perlis
Vice Chairman:
Board Participants:
Members: Prof. Juris Hartmanis, Cornell University
Prof. Edward McCluskey, Stanford University
Dr. Robert Spinrad, Scientific Data Systems
Dr. Bruce Gilchrist, AFIPS

Export Panel

Chairman: Dr. Donald Ling, Bell Telephone Laboratories
Vice Chairman:
Board Participants: Dr. Sidney Fernbach
Prof. Anthony Oettinger
Dr. John Meyer
Members: Mr. Rudd Canaday, Bell Telephone Laboratories
Dr. William Ridgway, Bell Telephone Laboratories
Dr. Joseph Berliner, Brandeis University
Mr. Warren House

National Programs Panel A

Chairman: Dr. Launor Carter
Vice Chairman: Prof. David Evans
Board Participants: Dr. J. Licklider
Prof. J. Rosser
Members: Dr. Bruce Gilchrist, AFIPS
Dr. Sullivan Campbell, Graphic Sciences Corporation
Dr. Butler Lampson, Berkeley Computer Co.
Mr. Samuel Morgan, Bell Telephone Laboratories
Mr. James Rowe, Union Carbide Corporation

NSF Study

Chairman: Prof. William Miller
Vice Chairman:
Board Participants:
Members:

Privacy Study

Director: Prof. Alan Westin

Advisory Panel

Chairman:
Vice Chairman:
Board Participants:
Members:

Policy Issues Coordinator

Mr. Jerrier Haddad

Information Systems Planning Group

Chairman: Mr. Ron Wigington, Chemical Abstracts Service
Vice Chairman:
Board Participants:
Members:

Standards Planning Group

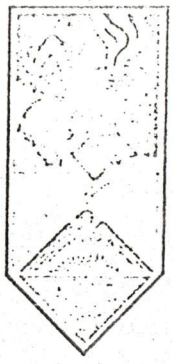
Chairman: Dr. Walter Hoffman, Wayne State University
Vice Chairman: Mr. Willis Ware, RAND Corporation
Board Participants:
Members:

Data Communications Planning Group

Chairman: Mr. Lewis Billig, MITRE Corporation
Vice Chairman:
Board Participants:
Members:

Day Session

Ronald L. Wigington, Director
Research and Development



CHEMICAL ABSTRACTS SERVICE
A DIVISION OF THE AMERICAN CHEMICAL SOCIETY

April 4, 1969

Professor Anthony G. Oettinger
Aiken Computation Laboratory
Room 200
Harvard University
Cambridge, Mass. 02138

Dear Tony:

Enclosed are some notes I have prepared as a result of our visit with Dr. Baker and a subsequent telephone conversation with John Griffith. I am interested in your reaction to these points and suggestions for improvement. I would intend to use such notes as "pump priming" to get the planning group started.

I am still considering the selection of individuals to invite to participate in the planning group and/or the final panel. I have more than enough names to consider already, and I expect to receive some additional recommendations from Ken Lowry and John Griffith.

The minimum categories of knowledge that I think should be represented on the final panel are:

1) A Librarian competent in application of computers.
2) Someone from BTL, because of their traditional "systems approach" and habit of economic evaluation.
3) An information science researcher.
4) A man-machine experimentation expert.
5) A person employed by a computer manufacturer, preferably with both hardware and software competence.
6) A practical information system designer or operator.

I am undecided about a government employee but tend, at this time, not to include one as a panel member, but use observer invitations as suitable.

I will be in touch with you shortly to discuss individuals to be invited.

Sincerely yours,

Ron

Ronald L. Wigington

RLW:me

cc: Mr. John Griffith
Mr. Warren C. House

Concepts of Formation For

Information Systems Panel of

Computer Science and Engineering Board

National Academy of Science

Draft Scope

The purposes of this Panel are:

1) To assess the application of computer science and engineering to national needs for information systems of all types and to determine the extent to which present activities are sufficient or deficient to provide the basic principles and information processing capabilities on which future information systems can be built.

2) To identify the primary roadblocks to the more rapid employment of computer science and technology to solve critical information problems,

3) and thus, to focus national attention on where resources should be directed to assure the development of the needed principles and capabilities in a form that can be widely used.

Some Points of Guidance

There are, and have been, a great many activities directed at study or development of techniques and systems for specialized segments of the overall national information problem. There are library-oriented views, traditional scientific discipline-oriented publication activities, man-machine interaction experiments, various business information services, specific mission orientations, etc. However, the total picture has no real coherence.

There have been many study groups, coordinating committees, and evaluation task forces which have struggled with various aspects of the information problem, and the use of computer-based systems to solve it, with various end purposes in mind. It will be essential for this Panel (and its planning group) to become generally familiar with those results and their context. However, in order to be successful and effective, the activities of this Panel must quickly identify a few key areas needing attention and delve into them in depth so that concrete contributions can be made in concentrating national attention on truly important and productive endeavors.

It will not be the purpose or power of this Panel to directly control or manage any endeavor or to have effect other than by force of argument based on competent analysis. Further, it cannot take any partisan position. It must express opinion only based on scientific principle and technical judgement. It certainly is not the purpose of this Panel to push or counter any special interest. If anything, its purpose should assist special interests in cooperating for fulfillment

of national needs by identifying and expressing scientific and engineering principles which must be known and observed in order that national progress can be made.

Mechanism of Formation

A small planning group, 2 or 3 persons, plus the Panel chairman, will meet to develop the statement of scope and initial panel projects for submission to the CSEB for approval. The planning group will lay out tentative plans for approximately the first year's work of the Panel with specific attention to the first one or two studies in depth. The final program of work of the Panel will be subject to revision when the full Panel is formed and is subject to the guidance of the parent CSEB. The full size of the Panel will be of the order of seven. Tenure of appointment should be two years.

Initial Action and Sources of Technological Guidance

A project, conceived as a pioneering effort in applying advanced computer and information handling technology to library systems for development of advanced information transfer systems, is Project INTREX. It is conducted in the midst of the vigorous and highly developed computer system research environment of MIT and has the vigorous backing of the Council for Library Resources. An initial project for this Panel would be to review the basis for establishment of this project, to assess the current activity and plans of this project as compared to the objectives desired, to examine the validity of the experiments being conducted and planned, to determine the approach by which the eventual results of this project can be transferred for wide scale use, and to provide consultation to the Council for Library Resources and to Project INTREX management in planning future work.

There are potential sources of guidance for evaluation of INTREX-type projects and subsequent computer-based information systems that the Panel may be called on to examine. These case studies may be found in the experience being gained in limited environments by corporate technical information systems such as those operated by IBM and BTL, both of which are organizations which are aggressive in applying new technology and highly competent in computer system technology. Another current activity which may contain guidance on practical problems and the behavior of people who need information support in their daily work is the computer-based experimentation and operations for information and library support to the staff of Time-Life, Inc.

It should be highly beneficial for the work of the Panel to relate the pioneering ideas and exploration of information system research and experiments to these operating systems providing real information support to real people.

RLW:mc

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

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

April 14, 1969

Dr. Alan F. Westin
Department of Political Science
Columbia University
Fayerweather Hall
New York, New York 10027

Dear Alan:

Like every other member of the Board, I was very sorry to learn of your child's illness, and I very much hope that everything is under control now.

Following my telephone conversation with you regarding some of the questions John Coleman raised, I drafted the enclosed reply. The Board reviewed the draft at the meeting which you missed. The draft was adopted unanimously.

I have therefore taken the liberty to have the reply typed in final form and enclosed it with this letter for your review. If you find it reflects your understanding as well, I should be grateful if you would merely put it in the stamped, addressed envelope that is also enclosed with it and send it on to John Coleman. Do not hesitate, however, to return it to me if there is any sin of omission or commission which you would like me to avoid. Best regards.

Sincerely yours,

Anthony G. Oettinger

js

cc: Warren House
John Pierce

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

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

April 17, 1969

Mr. John Coleman
National Academy of Sciences
2101 Constitution Avenue
Washington, D. C. 20418

Dear John:

I have discussed the questions raised in your letter of February 26 with Alan Westin and with the Board. I believe that the following statement reflects a firm consensus of the Board.

We are all aware, Alan Westin more than anyone, that the subject of his proposed study is of the greatest sensitivity and that, therefore, it is of the utmost importance that this study be conducted in an atmosphere favoring the highest degree of scholarly objectivity, free from undue pressures or biases yet, on the other hand, free from compromises made solely to avoid controversy.

It has been made abundantly clear in the proposal that an advisory panel will be created that will "insure that major viewpoints and contrasting positions on the basic issues involved in data banks would be brought into the deliberative, research and reporting operations of the project". The names listed on page 13 of the proposal clearly reflect the Board's appreciation of the need for balanced representation on this panel. The Russell Sage Foundation shares these concerns with the Academy and has suggested men like Charles DeCarlo and Frederick Mosteller as candidates for the advisory group.

It is clearly essential that the advisory panel be so organized as to assure the objectivity of the study both in substance and in appearance. I anticipate no difficulty in selecting a group of men of sufficient stature and integrity and broadly representative enough to meet this goal so far as it is humanly possible to do so.

Westin and I have both spoken to Herb Simon to assure that his views and those of NRC's Division of Behavioral Sciences are fully taken into account and to help us assure that the questionnaire to be used in Westin's study will meet the highest standards of objectivity and professional competence.

We are aware, of course, of the fact that members of Academy Boards or Committees do not receive fees for their services except, as you state, under very special circumstances. The precedent of paying fees to people who devote a substantial portion of a summer to intensive studies for the Academy suggests that the present case falls quite safely within these guidelines: Professor

Westin will spend a substantial portion of his time over a period of 26 months planning and executing the study and managing its staff.

Indeed Professor Westin called this problem to my attention from the earliest days of our conversations regarding this project, repeatedly urging that matters might be simpler if someone else were to direct it. I felt, and the management of the Russell Sage Foundation obviously agreed, that Professor Westin is so uniquely fitted by background, abilities and interest to direct this project, that his assumption of the directorship would be essential to its success. I therefore prevailed on him on several occasions to persevere, feeling that he could make outstanding and unique contributions both as a member of the Board and as director of this project.

It is clearly essential that Professor Westin abstain from any Board vote concerning the management or review of the project. Given this stipulation and the further mechanism of the special advisory panel, I am convinced that complete assurance can be given of the integrity of the review and management process for this study.

I strongly feel a need for the Board to establish a firm precedent in such matters. We are already and will continue to be concerned with a variety of issues of the greatest sensitivity. By the very virtue of their selection for stature, competence and broad representation, some members of our Board are bound to be parties in one way or another to matters that come before the Board. We cannot afford the luxury of disqualifying a man entirely from the Board's work because of possible involvement as a party in some facet of this work. Instead, as you know, the Board has been carefully selected for breadth of representation and special care has been exercised in other sensitive areas, like our export panel and the data communications planning group, to assure a full and free expression of contending professional points of view.

I should add further that Professor Westin has no financial interest in this project beyond what is specified in the budget as approved by the Board, the Council of the Academy, and the Russell Sage Foundation. It is noted in Dr. Brim's letter of February 25 that "the formal report resulting from the study be issued by the National Academy of Sciences and that Russell Sage Foundation reserve the right to possible publication and copyright of the volume that Dr. Westin will write". It is my understanding that the Russell Sage Foundation will follow for this volume its usual practice of pricing the book for break-even sales, and that the question of royalties to anyone therefore does not even arise.

Sincerely yours,

Anthony G. Oettinger

Chairman
Computer Science and
Engineering Board

cc: Warren House
John Pierce

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

May 5, 1969

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

Dear Tony:

Your letter of April 17, 1969 to John Coleman has answered the principal questions posed in his February 26, 1969 letter to you concerning the study on privacy and due process issues in computer data banks. There does not appear to be any reason why the Computer Science and Engineering Board should not proceed with the study under the conditions you have outlined.

Since the results of the study will almost certainly have public policy implications, discussions should be held with OCSPUP (in the first instance with Bob Green) concerning the sequential review which the draft and final reports must receive prior to their issuance and/or release to the Russell Sage Foundation.

Sincerely yours,

C. E. Sunderlin
Special Assistant to the
President

cc: Messrs. Coleman
Green
√ House

NEWS RELEASE

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

FOR RELEASE UPON DELIVERY THURSDAY MORNING, May 8, 1969

GALLAGHER DISCLOSES CENSUS BUREAU REFUSAL TO DIVULGE NAMES AND ADDRESSES OF JAPANESE-AMERICAN CITIZENS AFTER PEARL HARBOR.

In testimony before the House Subcommittee on Census and Statistics this morning, Congressman Cornelius E. Gallagher disclosed that the Bureau of the Census had resisted strong pressures to reveal the names and addresses of Japanese-American citizens shortly after Pearl Harbor. "To its everlasting credit, the Bureau of the Census demonstrated a higher devotion to the Constitution than did many of those who were responsible for the creation of detention camps for our fellow citizens who happened to be of Japanese ancestry. One must conclude that the abuses which have aroused justifiable fears of invasion of privacy in other areas of the Federal establishment do not exist at Census," the Congressman declared.

Testifying for the third time in the subcommittee's continuing investigation of the 1970 Census, Gallagher opposed the use of jail sentences for failure to comply. "The threat of imprisonment to gather information which is so vital to our Nation seems to me to escalate a subtle urging toward good citizenship into outright coercion," Congressman Gallagher continued.

Noting that several Congressional investigations had caused Federal agencies to assume a more responsive position, Congressman Gallagher concluded, "The Congress must continue to insist upon a balance between protecting Americans from unwarranted invasions of personal privacy and the need for legitimate information necessary to understand and lead our complex society."

TESTIMONY ATTACHED

Gentlemen:

The testimony can be obtained if desired.

W. C. House

DRAFT PROPOSAL ON A STUDY OF "Computer Research and Utilization in Universities and Colleges" conducted by the Computer Science and Engineering Board of the National Academy of Sciences

(Draft prepared by W.F. Miller, 5/7 /69)

CONTENTS

I. The Charge

A succession of reports have addressed themselves to various aspects of the needs and uses of computers in universities and colleges. The first of these, the Rosser Report, "Digital Computer Needs in Universities and Colleges", Publication No. 1233, National Academy of Sciences, 1967, addressed itself to particular needs and uses of computing in universities as well as the history of both within the universities. The second report was the Pierce report entitled, "Computers in Higher Education", Report of the President's Science Advisory Committee, The White House, Washington D.C., February 1967. This second report addressed itself to the computation facilities for universities, the use of computers in teaching and the educational needs of colleges and universities. The third report, the COSRIMS report, National Academy of Sciences, 1968, addressed itself to needs for support of research in the mathematical sciences. This report made a special appeal for increased support in the area of research for computer science. These three reports have been very helpful in guiding national policy in a very general way. There is a great need now for a report more directed toward the style considerations, man power considerations, and organizational and financial considerations for the research and teaching programs as well as for the institutional service programs in the universities. None of the previous reports addressed itself to the institutional service programs, that is, the use of computation in the administrative areas, the libraries, student records, and so forth. There are a number of important questions to be answered on the basis of current investigations. All of these are connected with how to better utilize available resources. Should colleges and universities find small, de-centralized computation centers,

should they join in regional networks, should they join in big brother relationships, what are the factors that will contribute to the success of any one of these kinds of programs? There is a variety of experience now available to draw on in each of these areas, and a national study that could provide guidelines for government policy and for guidance of the universities and colleges would be of immense importance at this time.

II. Plan of Attack

This proposal is for a 12-month study into the needs and opportunities of universities, colleges, and junior colleges in the area of computers fo (1) their educational programs, (2) their research programs, and (3) their institutional services (administrative, etc.) programs. The proposal is not intended to carry out research in these areas, but is intended to accumulate and interpret information that is now available or may become available.

This study would address itself to such questions as:

1. What segment of the educational programs are receiving the most attention in colleges and universities, and what segments are receiving relatively little attention?
2. What will be the impact of the deficiencies uncovered above?
3. What are the experience factors of the colleges and universities in terms of the amount of computer time or money needed per student per unit of instruction for various types of courses, what kind of faculty attention is required, what kind of manpower and computer systems are available to provide these services?
4. What factors would contribute most to the success of a regional network shared by a number of colleges and universities? What factors would contribute most to the utilization of small, independent computers?

5. What are the needs and current plans of universities and colleges in the institutional service programs, that is the administrative data processing, libraries, etc.? What cost data is available on these programs, what threshold has to be obtained for the success of these programs? What other factors might contribute to the success or failure of institutional service programs involving use of computers?

The study group would plan to utilize the information that is being accumulated at a number of universities engaging in their own self-study as well as the information accumulating at regional centers and a number of other institutions that have achieved success with one style or another of computer utilization. It would also look into what factors contributed to the failure of certain styles of utilization in institutions where this is known to have occurred.

III. Budget

The budget is for a project from August 1, 1969 to July 31, 1970.

BUDGET

Direct Costs

1.	Project Head	
	Full-time one month August 1969 Full-time one month July 1970 No charge for remaining 10 months	$ 5,000
2.	Executive Director	
	Full-time 14 months	26,000
	Overhead and benefits	?
3.	Three student assistants at 1/2-time, 3 months each (or 1/4-time for 6 months)	
	One on Teaching Requirements	1,000
	One on Research Requirements	1,000
	One on Institutional Service Programs	1,000
4.	One student assistant 1/2-time for 6 months	2,000
5.	One secretary full-time for 12 months	6,600
6.	Materials and Services (including telephone)	4,000
7.	Travel	5,000
	Subtotal	$ 51,600
	Academy Expenses - Overhead (?)	+ (?)
	TOTAL	

May 7, 1969

DRAFT Report of NSF Survey Panel
W. F. Miller, Chairman

Introduction: The Charge

The panel was charged with the investigation of patterns of support from the computer industry to the colleges and universities of the country. The panel undertook the survey of a few companies in the computing industry and a number of the officers of colleges and universities. Our approach was to see on the basis of a quick sample whether we could identify any changing patterns of support and whether it was necessary and/or useful to go into a second phase. The companies and universities sampled and interviewed are listed in the appendix with the written replies from their representatives.

Academic Discounts

One of the forms of support to colleges and universities that has been most prevalent until recently has been the academic discount (or educational allowance, as it is sometimes called) for computing equipment. The usual form of such support was a discount by the manufacturer for either the purchase or the rental of equipment. There have been some restrictions on the utilization of the equipment so acquired but the form of these restrictions has also changed over the years.

Before 1962 the IBM educational allowance agreement prohibited the use of the discounted machine for "sponsored research". Sponsored research here referred to work done by faculty and/or students on a federal government contract or grant. In 1962, IBM changed the nature of this restriction

to prohibit classified research or research not done as a part of the academic mission of the university or college. Their decision to change was based on the idea that they could not police source of funds but could better judge on other criteria such as openness and the association with faculty and students.

A second restriction imposed is if the equipment is resold within a five-year interval after purchase, the educational institution must rebate to the manufacturer a pro-rated amount of the discount.

The amount of discount made available to the colleges and universities has been decreasing over the last several years. There are a number of forces clearly moving in the direction of the elimination of this form of support to colleges and universities. In the mid-1950's the discount was often as high as 60 percent; that is, the college or university would pay 40 percent of the listed price of equipment.[1] This discount would apply either to the purchase of equipment and subsequently to the equipment maintenance contract, or to the rental (including maintenance). In the case of the rental contracts it was common for the university or college to pay 40 percent of the first shift rental and be permitted to utilize the equipment on as many other shifts as possible with no additional charge. Discounts have been decreasing[2] in percentage until currently they are about 20 percent average over the whole line of equipment for IBM and either about 20 percent, or in many cases nothing,[3] from other manufacturers.

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1. Reference will be to a specific contract still being identified.

2. G.S.A. reference (1966)

3. Letter from James G. Miles, Vice President, Control Data Corporation, to W. F. Miller, Stanford University, 13 March 1967.

In the opinion of the panelists and the representatives of academic institutions surveyed, the academic discount was a very important form of support in the early years. It contributed immensely to the growth of the computing industry in the country. The computing industry grew in its most spectacular growth "from the ground up". When the colleges and universities began to graduate engineers, scientists, business school graduates, etc., who had been introduced to computing through introductory courses (and often had taken advanced courses in computing), they began to introduce computer methods into their respective businesses. This in turn stimulated the great demand for computers and the spectacular growth of the computer industry in the early and mid-1960's. There is no doubt that the colleges and universities who first introduced large teaching programs in computing would not have been able to support these educational courses on such an extensive scale without the benefit of the academic discount.

Before the so-called Carnegie decision[4] the colleges and universities were able to treat the academic discount as a gift and utilize that contribution solely for support of their educational and unsponsored research programs. This practice was eventually disallowed. Also academic discounts began to decrease in percentage contribution. Colleges and universities now have to look to other sources of support for their computing equipment to carry out their educational programs.

It is quite clear to the panel that this form of support will soon be very small or completely eliminated. Control Data Corporation[3] has

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4. Carnegie Institute of Technology (1964) ASBCA No. 4299, 1964 BCA 4026. Credits against computer rental - A non-profit institution contractor using an IBM 650 computer for sponsored research could not include the full rental for the computer as a research cost under a cost-reimbursement contract since it was allowed a 60-percent deduction in rental payments for a so-called educational contribution regardless of whether or not the prerequisite to the taking of the deduction was fulfilled.

completely eliminated the academic discount. It does support research at the coll
the colleges and universities in areas of interest and/or unusual merit. The IBM Corporation[5] has indicated that their tendency is toward unrestricted grants of a general type. In the interview with Dr. Spinrad of Scientific Data Systems he made it clear that the academic discount was utilized only when necessary to keep them competitive and that they followed the lead of the larger companies in this area.

There is an additional force that will very likely contribute to the vanishing academic discount. In the anti-trust suit of the U. S. Government against the IBM Corporation,[6] the IBM Corporation is charged with the utilization of the academic discount as a means of affecting a monopolistic position. It is clear that the recommendation will be to enjoin IBM to cease and desist the offering of the academic discount. In the civil suit of the Control Data Corporation against the IBM Corporation,[7] CDC also charges IBM with damaging them through use of special pricing mechanisms to control the market. These pressures will certainly encourage IBM in the direction of the elimination of the academic discount whether or not the Control Data Corporation and the Justice Department suits are successful. It is clear from the letter of Dr. Piore that IBM is tending in that direction anyway.

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5. Letter from E. R. Piore, Vice President, IBM Corporation, to A. G. Oettinger, Harvard University, 19 February 1969.

6. Civil Action No. 69 CIV.200, U. S. District Court for the Southern District of New York, Filed: January 17, 1969. See COMPLAINT § 20(d) and PRAYER § 4.

7. Civil Action No. 3-68-312, Filed December 11, 1968, in the District Court of the United States for the District of Minnesota Third Division. COMPLAINT § 23(f) PRAYER FOR RELIEF § (2).

Other Support

Aside from the area of the academic discount, the trend for support of research and teaching seems to be taking two different turns. IBM on the one hand is tending to turn toward a general university support and in the form of funds that may be used at the discretion of the president of the university and may not necessarily be directed toward computer research or computer education. Control Data Corporation and Scientific Data Systems on the other hand are emphasizing support of relatively specific research projects that might be aimed at advancing the capabilities and techniques of the computer industry. These two tendencies are leaving a widening gap in the area of general educational support of the universities and colleges. These institutions are having to turn to other sources of funds, both internal and external, for their teaching and general educational programs. The support of Scientific Data Systems and Control Data Corporation[8] is normally aimed at those facilities which have acquired their company's machines. In any case, there seems to be no indication that there are very large amounts offered in support of research although we are unable to get precise quantitative data.

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8. "Practice and Procedure for Sponsored Research", Control Data Corporation, Minneapolis, Minnesota, March 22, 1968.

Draft of letters to be sent to educational institutions.

Dear Mr.

The Computer Science and Engineering Board of the National Academy of Sciences is conducting a census to assess the impact of industrial support on computer-related activities in educational institutions. This study is being carried out under a contract from the National Science Foundation. We believe that the results of this study will be invaluable to the Board in its deliberations and recommendations concerning support for computers and computer science.

We are initially interested in determining the internal and external factors which impact the nature and effectiveness of industrial support. We would like to inquire:

1. In what forms do you now receive industrial support for computing from equipment manufacturers, software companies, or user companies such as banks, oil companies, and so forth? By forms of support we would include equipment discounts, unrestricted grants, value received research contracts, or other.

2. Can you fully take advantage of this support or are there auditing or government research administration policies that are detrimental to this end?

3. Do you have any policies within your own institution that restrict the form in which you can receive industrial support?

We should like to set up an informal interview between the appropriate person in your institution and Professor W. F. Miller of Stanford University who is chairman of the Board panel that is conducting this study.

Would you kindly let me know at your earliest convenience the person to whom we may speak on the topic.

Respectfully,

Anthony G. Oettinger
Chairman, Computer Science and
Engineering Board

Mr. Lyman Spitzer, Chairman
University Research Policy Committee
Princeton University
Princeton, New Jersey 08540

Professor James G. Brophy
Vice President for Academic Affairs
Illinois Institute of Technology
Chicago, Illinois 60616

Mr. W. F. Miller
Associate Provost for Computing
Stanford University
Stanford, California 94305

Professor A. G. Norman
Vice President for Research
University of Michigan
Ann Arbor, Michigan 48104

This is a draft of a letter to be sent to the manufacturers and software houses for the NSF study on patterns of industrial support. There will be one each for IBM, Control Data Corporation, Scientific Data Systems, and UNIVAC. The addressees are listed below.

Dear Mr.

The Computer Science and Engineering Board of the National Academy of Sciences is conducting a census to assess the impact of the industrial support of computer-related activities for our educational institutions. The study is being carried out under a contract from the National Science Foundation. We believe that this information will be of great importance to the Computer Science and Engineering Board in enabling it to make its recommendations on national programs.

We are principally concerned with the internal and external factors which contribute to policy of the industry. In particular, we should like to determine:

1. What needs in the educational institutions does your company believe it is meeting?

2. What direct or indirect returns do you expect for your company or for the computer industry in such areas as manpower training, research and development, or sales?

3. What facets of federal government policy such as taxation, research support, or research administration influence the type or level of industrial support?

We should like to set up an informal interview between the appropriate officer of your company and Professor W. F. Miller of Stanford University who is chairman of the Board panel that is conducting this study.

Would you kindly let me know at your earliest convenience the person to whom we may speak on the topic.

Respectfully,

Anthony G. Oettinger
Chairman, Computer Science and
Engineering Board

Dr. E. R. Piore
Vice President and Chief Scientist
IBM Corporation
Armonk, New York 10504

Mr. Max Palevsky, President
Scientific Data Systems
1649 Seventeenth Avenue
Santa Monica, California

Mr. R. McDonald, President
UNIVAC
Box 8100
Philadelphia, Pennsylvania

Mr. William Norris, President
Control Data Corporation
8100 34th Avenue South
Minneapolis, Minnesota

Mr. Fletcher Jones, President
Computer Sciences Corporation
1901 Building, Suite 1900
Century City, Los Angeles 90067

March 4, 1969
W. F. Miller

Summary of Interview with Dr. Robert Spinrad
Vice-President, Programming
Scientific Data Systems

1. SDS does not make grants to universities or colleges.

2. Academic Discounts are on the basis of field experience. SDS views universities and colleges as a source of business (like any other source of business). Field experience means that SDS follows the lead of larger companies such as IBM and CDC.

3. Research and Development Contracts to colleges and universities are mostly on a services rendered basis. Spinrad described this support as "enlightened self-interest". The R and D contract may not call for an immediate payoff, but SDS does not engage in very much (if any) speculative R and D.

4. SDS has a summer student program intended to introduce students to SDS and to computing research and development. It has as a secondary goal the support of students.

SPERRY RAND
CORPORATION

UNIVAC
DIVISION
EXECUTIVE OFFICES
P.O. BOX 8100, PHILADELPHIA, PA. 19101 • TEL. (215) 646-9000

January 24, 1969

Mr. Anthony G. Oettinger, Chairman
Computer Science & Engineering Board
Aiken Computation Lab.
Harvard University
Cambridge, Mass. 02138

Dear Mr. Oettinger:

Your letter of January 21, 1969 to Mr. McDonald has been turned over to Mr. Frank D. Sweeten, Vice President of Personnel, for response. Mr. Sweeten is currently out of the country and will not be back until February 3. As soon as he returns, your letter will be called to his attention.

Sincerely,

J. R. Stahl, Director
Employee Benefits

JRS:dmh

CC-F. D. Sweeten

ILLINOIS INSTITUTE OF TECHNOLOGY
CHICAGO 60616

OFFICE OF THE VICE PRESIDENT

January 28, 1969

Mr. Anthony G. Oettinger,
Chairman, Computer Science
& Engineering Board,
Aiken Computation Laboratory,
Harvard University,
Cambridge, Mass. 02138

Dear Mr. Oettinger:

A relatively small fraction of our financial support for IIT's computer related activities is derived from industrial sources, with the exception of educational allowance for equipment purchases. We will, however, be pleased to meet with Professor W. F. Miller to discuss our situation at his convenience. Prof. Miller should make arrangements for his visit with my office (312/225-9600, Ext. 521-522) for I feel he should meet with me as well as Professor P. G. Lykos, Director, IIT Computation Center.

We are most pleased to participate in this effort of the Computer Science and Engineering Board.

Very truly yours,

James J. Brophy
Academic Vice President

JJB/dla

cc: Professor P. G. Lykos

THE UNIVERSITY OF MICHIGAN
ANN ARBOR, MICHIGAN 48104

A. G. NORMAN
Vice-President for Research

January 28, 1969

Dr. Anthony G. Oettinger, Chairman
Computer Science & Engineering Board
Aiken Computation Laboratory
Harvard University
Cambridge, Massachusetts 02138

Dear Dr. Oettinger:

In reply to your letter of January 21, we will, of course, cooperate in supplying your committee the information requested, though frankly we are becoming a little tired of responding to sub-contracted questionnaires from the National Science Foundation. You are, of course, aware of the very extensive one handled by the Southern Regional Education Board last year.

I believe that as far as the University of Michigan is concerned the answer to the specific questions you pose are:

(1) There is very little industrial support for computing, direct or indirect, other than that which may be present in setting leasing rates or purchase prices to educational establishments generally.

(2) & (3) There are no constraints that would inhibit acceptance of support

For more detailed information, I would suggest that Professor Miller get in touch with Dr. Robert Bartels, Director of the Computing Center (area 313) 764-2412.

Yours sincerely,

A. G. Norman

AGN/mg

cc: Dr. Robert Bartels

NAS

CORPORATE HEADQUARTERS
8100 34TH AVENUE SOUTH, MINNEAPOLIS, MINNESOTA 55440 / 612-888-5555

13 March 1969

Professor William F. Miller
Stanford University
Computer Sciences Department
Stanford, California 94305

Dear Bill:

It was a pleasure to talk with you this morning regarding the study that you are conducting for the National Academy of Sciences regarding the impact of industrial and financial support of computer-related activities for educational institutions (I refer to Anthony Oettinger's letter of January 21, 1969, to William C. Norris, President of CDC.).

I am enclosing two copies of CDC's PRACTICE AND PROCEDURE FOR SPONSORED RESEARCH (revised 11/22/68) that best states CDC's objectives, policies and procedures for sponsored research.

As I mentioned to you this morning, two years ago CDC changed its policy with respect to grants to universities and other non-profit research institutions from a policy of granting discounts in prices on computer systems to a policy where we will quote only full list prices on computers to education and research institutions, and at the same time consider the sponsoring of research programs by which CDC pays the qualifying institutions for research work to be done on programs of interest to CDC and/or which CDC believes have unusual merit. We have specifically concentrated in the past two years on grants re hospital/medical and CAI, as well as the development of specific new softwares and applications.

I believe this generally answers the question raised by Dr. Oettinger's letter.

I will look forward to seeing you at the time of your forthcoming trip to Minneapolis to view the 7600 computer and STAR. I would also appreciate the opportunity to schedule you to see some of our systems directed toward some of our business management data systems in line with Stanford University's interests.

Very truly yours,

CONTROL DATA CORPORATION

James G. Miles
Vice President

JGM:fah
encls.

OECD Report

OCDE

ORGANISATION DE COOPÉRATION
ET DE DÉVELOPPEMENT ÉCONOMIQUES

OECD

ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT

DIRECTION DES AFFAIRES SCIENTIFIQUES
DIRECTORATE FOR SCIENTIFIC AFFAIRS

Téléphone : 870 76-00

Référence : DAS/CSI/HR/69.40

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23rd April, 1969

Dear Professor Oettinger,

I am writing you to explore the possibility of having Professor Caracciolo di Forino, a consultant to the OECD, and possibly others, come to Washington to address your Computer Science and Engineering Board about an OECD programme in fundamental research in information sciences - particularly programming theory and man-machine communication tools.

From your correspondence with Professor Caracciolo di Forino, you are undoubtedly aware of the general outlines of this programme. In addition, you and I had a brief telephone call on this matter when I was in New York in February. Let me, if I may, refresh your mind as to what it is we are doing and why.

The Committee for Science Policy of the OECD started last year to undertake a study of the situation in fundamental research in a few interdisciplinary subjects within the Member countries of the OECD. The Committee set up a sub-committee under Professor Aigrain (France) to examine which subjects should be selected for study, and to develop a methodology of such a study. The Aigrain group selected three subjects for a first study, one of which is fundamental research related to information sciences and linguistics. The title of the subject to be examined, as well as its content, has changed somewhat from discussion to discussion and a precise definition has not yet been agreed. A tentative listing of what we are

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Etats Unis.

c.c. United States Delegation to OECD
Professor Caracciolo di Forino

concerned with might be called fundamental research in information sciences with the following major research areas:

i) General linguistics or semeiotics;
ii) Programming theory;
iii) Man-machine communication tools;
iv) Information processing system design, specification, implementation, documentation and evaluation.

We are specifically not concerned with the historical development of natural language, the relation between languages, thought, and behaviour in human beings. We are also not directly concerned with computer hardware.

The objectives of these studies are first to give science policy makers, particularly in the European Member countries of OECD, an appreciation of the present situation in a new multi-disciplinary field such as fundamental research in information sciences. The situation means: How many people are working in the field? In what institutional arrangements do they do their work? What is the mobility of the workers? How do they communicate with each other? To what extent is their productivity limited by funds, administrative structures, equipment, availability of jobs, etc? What is the rate at which students are being produced, and what are the opportunities for such students? as well as problems that may be more specific to the field under concern such as, possibly, the distortion produced in fundamental research by the demand for applied research.

A further objective of the study is to provide some guidelines to governments on steps the governments might take to improve the present situation. In particular, if a government wishes to see this field grow faster than it is presently growing, what are the steps it might take? For example, a government may wish to set up a government industry patronat group to mastermind development operating out of some government bureau, or it may foresee such desirable steps as creating new university chairs, encouraging the setting up of a research council sub-group, or supporting the creation of a journal, or a Gordon conference, or setting up a large size institute. In addition, there are a series of steps that might be taken by a number of interested governments, such as an international fellowship scheme, or an international matching fund, or developing applied research projects in an international development scheme that might aid the field to develop.

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The study itself will be guided by Professor Caracciolo di Forino, Professor Nivat, Dr. Nygaard. Dr. Schutzenberger, Dr. Landin, and Professor Samelson. These gentlemen will consult with their colleagues in the field, particularly within the European countries, and will visit some 20 laboratories or centres, both in Universities and in industrial establishments, to determine what are the bottlenecks for growth in the field.

Although the study is primarily aimed at the situation in Western Europe, it would be extremely desirable if the United States, Canada and Japan, who are the non-European Members of the OECD, participated in this study. The delegates from these three countries to the OECD indicated a considerable desire on their governments' part to take part in such a study, if the role of these non-European countries could be clearly spelled out. In particular, Dr. Ivan Bennett, representing the U.S.A., indicated that the U.S. was examining its position in order to see who might coordinate such studies within the U.S. I have had personal correspondence with Dr. Charles Falk of the National Science Foundation who indicated to me that N.S.F. might be prepared to carry out a parallel study in the U.S. corresponding to the European studies, if and when the N.S.F. is convinced as to the practicality of doing so in such a large country as the U.S.A. Dr. Falk is awaiting a definition fromme of the fields under study, as well as a more detailed plan of the modus operandi, before he proceeds to see whether the N.S.F. is prepared to join.

We strongly feel here that a U.S. study would be extremely valuable to the overall examination of the development of fundamental research in information sciences, because it would give a comparison of the problems being faced in the U.S.A. with those seen in Europe, as well as some ideas of the relative magnitude of the efforts underway. I personally think such a study in the U.S. would also very strongly benefit the U.S. science authorities in their decisions about the allocation of funds for their programmes.

I am therefore writing to you in advance of any decision by the U.S. to actively participate in this basically European focused programme in order that we may explore the value of Professor Caracciolo discussing these matters before your Computer Science and Engineering Board of the National Academy of Science. It would seem to me that it might be very useful for the OECD study if Professor Caracciolo di Forino were to gain some advice from your Board on the problems and conditions to look for within the European study. Reciprocally the

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exposure to the ideas brought forth by Professor Caracciolo di Forino might stimulate the members of the Board to examine the value to be obtained by a similar study in the U.S. I would imagine that something between one and one and a half hours devoted to a speech and questions would give adequate time for your Board to deliberate on this matter for a first time.

When we spoke in February you indicated that your Board might meet in May at which time it might be desirable to hear about the OECD programme. If my suggestion is acceptable to you, would you kindly answer me fairly promptly in order that Professor Caracciolo di Forino, and possibly others, may arrange to be in Washington on the appropriate date.

I enclose some information which may further explain what it is we are trying to do.

Thank you in advance for your consideration,

Yours sincerely,

H Roderick

Hilliard Roderick

Head of the Division for International Cooperation in Science.

ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT

RESTRICTED

Paris, 17th December 1968

SP(68)18

Scale 2 Or. Engl.

COMMITTEE FOR SCIENCE POLICY

PROBLEMS AND PROSPECTS OF FUNDAMENTAL RESEARCH IN SELECTED SCIENTIFIC FIELDS

(Note by the Secretariat)

At its 7th Session on 2nd and 3rd July, the Committee decided to appoint a Working Group to establish the objectives and scope of the studies in selected scientific fields, /SP/M(68)2, C.IX(i)/.

The following document sets out a proposed programme of work for the "state of the art" studies designed to assess the present situation of fundamental research in selected scientific fields and to indicate ways of promoting the development of research in these fields. It is proposed that these studies will be undertaken in three multi-disciplinary fields:

brain and behaviour research (interaction of nervous system with external environment);

materials research;

research on language and information processing applied to natural and artificial systems.

The objectives of these studies are to provide national science administrators and policy makers with information and recommendations on how to stimulate the growth of fundamental research in these fields above that normally to be expected in the next 5-10 years. The fields have been especially chosen because it it believed that new basic knowledge can be foreseen to be of use to the solution of important problems of national or governmental interest.

In order that the studies may be effectively carried out, Member countries will have to play an important part in them. Each of the three studies will differ in detail from the others

but a general plan has been drawn up, involving the participation of the Committee for Science Policy and its Working Group chaired by Professor Aigrain, as well as national coordinators, who will be individuals appointed by member countries desiring to participate in the study. The plan calls for consultations with national science research councils, or equivalent bodies, and scientists at laboratories working in the three fields, by a small number of senior experts in each field who will be engaged as consultants to the OECD. The plan is designed to provide reports to the Committee for Science Policy on a time scale consistent to be in time for the next Ministerial Meeting on Science.

ACTION:

The Committee is invited to:

(i) APPROVE the attached programme of work;

(ii) PROVIDE the Secretariat, by the 7th March 1969, with the names of national coordinators who will have the responsibilities set out in paragraphs 23 and 28 of this document.

PROBLEMS AND PROSPECTS OF FUNDAMENTAL RESEARCH IN SELECTED SCIENTIFIC FIELDS

Programme of Work

I. BACKGROUND

1. Following the recommendations of the 3rd Ministerial Meeting on Science, the Committee for Science Policy decided at its 7th Session on 2nd and 3rd July 1968, to appoint a Working Group to establish the objectives of, and procedures for collecting the necessary information for, the so-called "state of the art" studies designed to assess the present situation of fundamental research in selected scientific fields and to indicate ways of promoting the development of research in these fields.

2. These "state of the art" studies are part of the broader line of attack endorsed by the Committee on the problems of the promotion and organisation of fundamental research, which includes:

(a) studies aimed at improving the organisation and financing of research activities inside and outside the universities;

(b) a preliminary examination of the feasibility of a mechanism for the selection and financing, on an international co-operative basis, of research programmes in certain new and important multi-disciplinary fields.

3. These studies should be considered in the perspective of the organisation of higher education systems and research institu[illegible]he Member countries - a problem which will be one of the [illegible]in preoccupations of the scientific and education committees and bodies of the Organisation in the next two years.

4. The original proposal for these studies called for reports on the situation in Europe of fundamental research in the broad, traditional disciplines of physics and chemistry. These reports, by summing up the present state of knowledge and by critically analysing prospects for the next five to ten years for significant results in a given discipline, were to serve as the basis for recommendations for national and international actions to improve the conditions for fundamental research work in Europe in the disciplines concerned.

5. The Working Group, chaired by Professor Aigrain and composed of Professors Böttcher, Caglioti, Engstrom, Hochstrasser and Liquori (replacing Professor Caglioti), met for the first time in Paris on 1st October, 1968.

6. Upon examination, it appeared to the members of the Group that such "state of the art" surveys in physics and chemistry would be of relatively limited value to science policy-makers, because the state of knowledge and near-future scientific prospects in traditional physics and chemistry in Europe is not likely to be greatly different from that in the U.S., where the National Academy of Science reports* have already been published on these subjects, summing up the scientific situation and near-term prospects. Moreover, the disciplines of physics and chemistry are well developed in Europe and involve a great many university centres and practitioners. Any comprehensive survey of the "state of the art" in these disciplines in Europe would involve a major effort upon the part of the participating Member countries, and a relatively large-scale involvement of consultants and funds by the OECD. Furthermore, it is not clear how the resulting reports would be used by the individual Member governments to improve the varying situations in either the many branches of physics or chemistry, or the varying situations in the many institutions of a given country.

7. In these circumstances, the Group considered that it would be of greater value for national science administrators, and of more immediate benefit for the development of fundamental research in Europe, if attention were focussed on new fields of research at the borderline of traditional disciplines. Action is necessary in most European countries in such "multi-disciplinary" fields for the following reasons:

(a) this is where science is likely to be growing fastest and can be expected to do so in the next decades; nevertheless the growth in particular subjects may not be rapid enough to meet the expected need for new knowledge or the required number of scientists for fundamental or applied research;

(b) this is where the need for the adaptation of traditional research institutions appears to be most acutely felt by the practitioners. In particular, universities have more difficulty in accommodating multi-disciplinary research into

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* "Chemistry: Opportunities and Needs", a Report on Basic Research in U.S. Chemistry by the Committee for the Survey of Chemistry, National Academy of Science, National Research Council.

"Physics: Survey and Outlook", A Report on the Present State of U.S. Physics and Its Requirementsd for Future Growth by the Physics Survey Committee, National Academy of Science.

their structures than they do with the traditional disciplines;

(c) multi-disciplinary research is likely to require more government support and funding than traditional disciplinary research since it tends to be relatively more expensive than the individual specialities involved and to involve larger teams of scientists. Further, because of the organisational difficulties mentioned in (b) above, it is often difficult to fund multi-disciplinary research through existing channels, and governments may need to create new funding mechanisms.

8. It was agreed that the Secretariat should nevertheless make a survey of studies already carried out in Member countries in traditional disciplines.

II. OBJECTIVES

9. In the light of the foregoing considerations, the objectives of the exercise were defined as follows: to provide national science administrators and policy-makers with information and recommendations on how to stimulate the growth of oriented fundamental research above that normally to be expected in the next five to ten years in new multi-disciplinary scientific fields, and especially in those where new basic knowledge can be foreseen to be of use in the solution of important problems of national or governmental interest.

III. CHOICE OF SCIENTIFIC FIELDS TO BE EXAMINED

10. The Working Group considered the problems raised by the choice of a first set of scientific fields for examination. It was decided to list subjects according to the following criteria:

(a) the field should be well defined and multi-disciplinary;

(b) it should have a fast rate of growth but be at an early stage of development;

(c) its potentiality is unsufficiently recognised by the scientific community;

(d) research results in the field will possibly have important social and/or industrial applications;

(e) there is therefore a need for government encouragement and support of research effort in the field;

(f) there is a need for a critical evaluation of the quality and of the extent of the work pursued in the field.

11. Seventeen suggestions were considered, and the three following subjects finally selected:

(i) Brain and behaviour research (interaction of nervous system with external environment);

(ii) Materials research;

(iii) Research on language and information processing applied to natural and artificial systems.

In the event of special difficulties in one of these fields, it was agreed to examine research related to bio-medical engineering as an alternative subject.

12. Each member of the Working Group accepted responsibility for overall supervision of one of the studies.

Brain and behaviour research (interaction of nervous system with external environment)	- Professor Böttcher Netherlands
Materials Research	- Professor Aigrain France
Research on languages and information processing applied to natural and artificial systems	-(Professor Liquori (Italy (Professor Hochstrasser (Switzerland
Research related to bio-medical engineering (in reserve)	- Professor Engstrom Sweden

IV. GENERAL OUTLINE OF THE REPORTS

13. The studies to be undertaken in the three fields would each result in a report to be submitted to the Committee for Science Policy and through it to the next Ministerial Meeting on Science.

the report would be made up of three parts:

(i) The definition and description of the scientific content of the field;

(ii) a major part surveying the present situation in Europe including a comparison, if possible, with the situation in the U.S., Canada and Japam;

(iii) recommendations to governments for both national and international action.

Definition and description of the content of the field

14. Depending on the degree of public recognition of the existence of the field, the description would be more or less brief. It would include the research under way, the theoretical

basis for this research and the foreseeable applications of the knowledge to be gathered through the research. This part of the report would be written by one or more of the senior consultants hired by OECD as experts in the field. Because the fields under consideration are in their early development, it may be difficult to define the limits of the field and the consultants may wish to meet with experts from the participating Member countries before writing this part of the report. In one or more of the cases, it may be necessary to have a short technical description of the field prepared by a specialist.

The present situation in Europe

15. This part of the report will require the gathering of facts on the factors which determine the future growth of the particular field. Prior to the start of this study it is assumed that the eight factors that follow are important in determining the future of the field. There may be other factors of greater importance which it is hoped will be determined by the study:

(a) Scientific manpower and research centres

The number and type of scientists involved in this research as well as the location of centres carrying out the research.

(b) Training facilities

The facilities for training new scientists in the field. Here one examines for indications of such training, the existence of university courses, summer and special training courses, the number of graduate students entering research at the university in the field, and the number finishing their thesis per year in the field.

(c) Communications

We are concerned here with the extent to which research workers in a few field are aware of the existence of other research workers, their ideas and the specialised equipment. Possible indicators of such communications are publications, number of visitors to the laboratory each year, the number of post-doctorate fellows working in the laboratory coming from other places, meetings and the existence of scientific societies in the field.

(d) Scientific recognition

A very important element in the establishment of a new field is its recognition by the scientific community as a whole and particularly by other academic faculties in the same university. Indicators of such reconnition are the existence of Chairs in the field, university courses being given, new institutes set up, either within universities or outside,

to work in the field, government funding practices which set aside funds specially for the field, national research councils which contain committees with special responsibility for the field, scientific journals in the field, and regular appearance in newspapers and other public media of accounts of research being undertaken in the particular field.

(e) Availability of jobs

It is obvious that the development of any new field is to some extent dependent upon the possibility that practitioners will find jobs that allow them to carry out research in it, and that students entering the field have a hope of finding a professional career upon graduation. An indicator of the degree to which jobs are available is not only the existence of jobs for practitioners in the field, but also jobs for scientists to apply the results to other fields.

(f) Applications of the fundamental research

The new knowledge brought about through fundamental research may lead to applications of this knowledge to many practical uses. The existence of such applications can be expected to be a stimulus to the growth of fundamental knowledge. Indications of such applications in industry and government, and possibly other university research, would be sought in the study. In particular the relationship between fundamental research and governmental or industrial need would be sought in terms of either the use of the fundamental scientists as consultants to industry or the support of the fundamental research in the university by industrialists, as well as the extent to which industry is carrying out research in the field.

(g) Research Productivity in the Field

The fact that undertaking research in a particular field has a greater probability of yielding publishable results is another important spur to attracting people to the field. We would hope to get an appreciation of some of the factors influencing the yield of publishable results per scientific man year of effort. These factors might be expected to include:

(i) Size, composition, and organisation of research teams considered most suitable to solve various types of multi-disciplinary research problems;

(ii) Availability of specialised workshop facilities and equipment, particularly equipment that speeds data taking and processing;

(iii) Use made of technicians and post-graduate students in the construction and operation of experimental apparatus.

(h) Funding of research

The availability of funds for a particular field probably affects all the factors mentioned above in a variety of ways. Indications would be sought of the extent to which growth is being limited by restrictions on funds, as well as which growth factors are most sensitive to the availability of funds. In addition, the various funding mechanisms in use would be examined to see if some are more suited than others to siimulating the growth of the field.

16. The study will examine the situation in the eight factors mentioned above, not only at the present time but as it was three years ago, and it will ask the respondents to offer their opinion about the situation as it will be three years from now. Gathering this information as to the variation in time of the situation in the field should give some indication as to the growth rate of the field as well as to other aspects of the changing situation.

Special reports from the U.S., Canada and Japan

17. It would be extremely useful to have reports on the situation in each of the chosen fields from the U.S., Canada, and Japan, because these countries are very active in these new multi-disciplinary fields. In addition, there would be value in comparing the situation in countries differing in size and general background from that of Western Europe. However, because of the great expanse involved in travel it might not be possible to initiate an eztensive series of visits in these countries. It would be hoped that these countries would each appoint a national coordinator and carry out the questionnaire distribution and replies as part of the general study. It may be that the national research councils or equivalent bodies in these countries would be prepared to provide an overall report of the situation in their country which could then be examined along with the report prepared by the consultants.

Recommendations to governments

18. In order to make recommendations to governments as to how the field might grow more rapidly than would normally be expected, it is necessary that the consultants analyse and state what they consider to be a desirable state of affairs for the field, say five years from now. This means that, in the light of the need for new knowledge by both industry and society, the consultants will make an estimate of what a desirable situation will be in fundamental research in the field in Europe in order to meet that need. Then, by comparing with the expected growth of the field if nothing further is done by governments, they will be able to estimate what should be done. The rest of the report will contain detailed suggestions as to what steps are necessary to move from normal growth to the desired state of affairs. The consultants will examine each of

the eight factors mentioned above as being part of the present situation and will say what steps should be taken, particularly to change these factors, in order to spur the growth. Their recommendations will contain suggestions as to what should be done both nationally and internationally.

19. At the present time it is not of course possible to say what the nature of these suggestions will be, but they may involve such actions as suggestions for re-organisation of universities, the setting up of inter-university laboratories and institutes, the issuance of research contracts and the initiation of concerted actions in the particular field. It is further expected that the recommendations will be closely related to the general recommendations coming out of (a) the parallel study on funding mechanisms for fundamental research in universities and, (b) the study of an international scheme for financing fundamental research in particular fields.

V. PROPOSED PROCEDURE FOR CARRYING OUT THE STUDIES

20. In order that the studies may be effectively carried out, Member countries will have to play an important part in them. Each of the three studies will differ in detail from the others, but a general plan has been envisaged. The plan involves the participation of the Committee for Science Policy and its working group chaired by Professor Aigrain, as well as a group of national coordinators who will be individuals appointed by Member countries desiring to participate in the study. In addition, scientific research councils, or equivalent bodies, from these countries would be called upon to assist in the study. Finally, the Secretariat of the OECD will participate in the study through its own staff and by means of a small number of senior experts for each field, who will be engaged as consultants to the OECD. Described below is a suggested procedure for each of these bodies.

21. The Committee for Science Policy has initiated the next study. It will be called upon to approve the procedures for the study and when the reports prepared by consultants are available they will be submitted by the working group for review by the Committee for Science Policy and possible submisiion to the Ministerial Meeting on Science.

22. The Working Group has suggested fields to be studied and will review and approve the detailed description. This Group will review and approve procedures for each study. It will also review the questionnaires to be sent to major laboratories active in each field in the participating Member countries. Finally, it will review the reports prepared by the consultants and submit them to the Committee for Science Policy.

23. Each participating country will nominate a national coordinator who will have responsibility for all three studies to be undertaken in his country. His position will differ from

country to country, but most likely he will be an individual attached to the national research council or an equivalent body. He will have the following responsibilities:

(a) He will take contact with scientific research councils, or equivalent bodies , and with their help prepare a list of scientists and major research laboratories active in the field under study in his country.

(b) He will be responsible for the distribution of the OECD questionnaire to the active scientists and major laboratories.

(c) He will be responsible for the gathering of the replies to the questionnaires and their submission to the OECD.

(d) He will reply to questions submitted by the OECD concerning statistical data, methods of funding, availability of fellowships, etc, which are pertinent to the particular field and may be contained in the central science policy headquarters.

(e) He will arrange for visits by the OECD consultants to the major laboratories in the field.

(f) He will be responsible for checking the correctness of the survey of the situation prepared by the consultants as part of the total report.

24. For each field under study the OECD, with the help of members of the Working Group, will seek and engage 4 or 5 consultants who are experts in the particular field and who will have the principal responsibility for preparing the report. Their specific tasks will be as follows:

(a) to define and describe the field;

(b) to prepare a summary or review of the present scientific state in the field, as well as foreseeable applications in the next 5-10 years of the knowledge expected to be gained through fundamental research;

(c) to prepare a list of some of the scientific leaders of the fields in the various Member countries, in order that they may be consulted as appropriate;

(d) to prepare a detailed plan for the study;

(e) to prepare a questionnaire, which will be replied to by research centres in the field. It will also be their responsibility to analyse the replies;

(f) to consult with scientific research councils or equivalent bodies and then to visit and interview scientists in some of the major centres in the participating countries;

(g) to write and edit the report as described above.

VI. THE TIME-SCHEDULE FOR THE PROPOSED STUDIES

25. A flow sheet indicating the time-schedule of the proposed actions is attached. It may be noted that the action involves three stages: a planning stage, an observation stage, and a writing and editing stage. The detailed actions to be undertaken in each stage are indicated below:

(i) In the planning stage it is necessary to:

(a) find experts willing to undertake the study with the aid of the Aigrain working group;

(b) draw up a detailed plan of the study;

(c) define the field and list known scientists and major research institutions in the field;

(d) prepare a questionnaire to be sent to the active laboratories;

(e) have the Member countries appoint national co-ordinators and meet with them to discuss the procedure.

(ii) In the observation stage it is necessary that:

(a) the questionnaire be distributed through the national coordinators to the laboratories and that a reply be received through the national co-ordinators in time for it to be of benefit to those preparing to visit the laboratories;

(b) visits of the consultants be arranged by the national coordinators to the research laboratories.

(iii) In the final writing and editing stage it will be necessary that:

(a) the consultants write a three-part report, i.e. the state of research, the situation in the field and the recommendations for action;

(b) the situation in the field is checked through the national coordinators by the laboratories that participate in the study;

(c) the entire report is reviewed by the Working Group and then submitted to the Committee for Science Policy.

VII. SIZE OF REPORT AND ESTIMATED EFFORT INVOLVED

26. In advance of undertaking the studies, it is estimated that the reports might each be expected to be some 20-50 typewritten pages long and require a total time of each national coordinator of a minimum of 20 working days and a total time of consultant experts from 20-60 working days.

OUTLINE GUIDE FOR VISITS TO LABORATORIES BY O.E.C.D. CONSULTANTS

Proposed Objectives of the Visit of the OECD Consultant are:

1. Become informed about the scientific situation of the laboratory. Find out what are the major experiments underway and what these are expected to prove.

2. Observe if there are any unusual developments or innovations in management, organisation, services, arrangements or equipment of the laboratory which might usefully be brought to the attention of governments or other laboratories in the field.

3. Discuss with the laboratory people possible action steps that governments may take to increase the rate of growth in the field in order to have their views as to the need, desirability and feasibility of these steps.

Possible Methods to be Employed in the Visit

1. Meet with the laboratory director and discuss research, work organisation, and operation of the laboratory. Discuss possible government action steps with the Director to learn his views.

2. With his consent, visit laboratory sites and briefly discuss the research experiments with the individual staff member responsible for each experiment.

3. With his agreement, have him arrange a round table of some of the staff members to obtain their views on the possible government action steps.

Attached is an outline of some 20 action steps that governments may take to increase the rate of growth of a new field. Along with these possible steps a few questions are indicated in relation to each step which may be of use to the

visitor in guiding the discussion. Obviously, the consultant will suggest questions as appropriate from the discussion. It is not expected that the consultant will discuss all of the 20 steps proposed here, but may choose judiciously among them and may suggest other steps as the conversation develops.

ACTIONS IN THE FORM OF CONCRETE STEPS THAT GOVERNMENTS MAY TAKE
TOWARDS INCREASING THE RATE OF GROWTH OF A NEW FIELD OF FUNDAMENTAL RESEARCH

Government Step	Effects Factors in Growth	Nat.	Int.
	(? = Recognition C = Communication J = Jobs F = Funds T = Training A = Applications R = Research Productivity) $\frac{dN}{Ndt}$ = ? C J F T A R		
1. Set up Government-Industry patronat group (an interested pressure group with secretariat in government bureau to mastermind development)	J F A	n	
2. Creation of university chairs How many people left your laboratory in the past (1,3,5) years? to carry out further research in the same field? to do what? where? in what capacity?	C J T	n	

Government Step

Effects Factors in Growth Nat. Int.

How many people left your laboratory in the past (1,3,5) years? to carry out research in some other field? to do what? where? in what capacity?

How many people left your laboratory in the past (1,3,5) years? to work outside scientific research? to do what? where? in what capacity?

Are those who moved still in contact with you profesionally? (exchange of reprints, consultation, etc.)

Evaluation:

On the whole (but base impression on facts) were thee moves satisfactory from the point of view of the individual careers of the people who moved? from the point of view of the utilization of their knowledge and experience in the field (please expand)?

How would you assess the career possibilities in general in your field and your country

Government Step	Effects Factors in Growth	Nat.	Int.
3. Encourage the setting up of research council sub-group	C F		n
How many of the group, or laboratory sit on governmental, or research council committees?			
Evaluation of Funding			
4. Provide special contract funding (action concerté)	J F R		n
Are funds adequate for present work? Is the existing system flexible enough to take account of changes of needs in the course of research?			
Is the existing system of funding flexible enough to cater to the needs for entirely new lines of research?			
Does it ensure reasonable planning ahead? Full-time employment under reasonable conditions (so that senior, junior researchers do not have to complement income by moonlighting)?			

Government Step	Effects Factors in Growth	Nat.	Int.
5. Support the development or the import and the purchase of special equipment (perhaps share)	R	n	
6. Encourage flexible administration by university or government laboratory in their encouraging different faculties and departments to share the same services and facilities, to use common space, and for common funding of work. Make, if possible, comparisons with other places known to you at first hand.	C F T A	n	

Evaluation of common cooperation meetings

What outside individuals, or groups, carry out research which particularly interests you, even if the interest is not reciprocal?

How useful would increased reciprocal relations with outside groups be, and in what ways would it be useful?

Evaluation of organization

Who decided in the laboratory who should work on what?

Government Step	Effects Factors in Growth	Nat.	Int.
For each project, who determined the resources that would need to be made available (whether from general funds or from a special project grant)?			
WHich, of the present members of the staff, if they had an idea for a new piece of research, would be able to initiate a project?			
Are groups, unit as a whole, authoritarian (definite hierarchy exercised in research), democratic (groups of peers, formal hierarchy, informal peership), laisser faire (unlikely in work groups, possible in unit as a whole)?			
7. Encourage development of theory and independent thinking by special fellowships for theoreticians, by providing sabbatical periods for reflection and special grants to write and publish summary articles.	T R n or i		
What, in your opinion, have been the most important findings in this field, over the past ten years?			

Government Step	Effects Factors in Growth	Nat.	Int.

Who has been responsible for these major findings?

In what problem/problems do you foresee any really significant breakthroughs of a theoretical kind in the next (5,10,20) years?

Do you have any idea who might make such a breakthrough?

Do you believe that your work may have theoretical implications for other fields?

Difficulties due to problems of communication with people in different fields. Reasons, no common language, no common framework, career interests.

Government Step	Effects	Factors in Growth	Nat.	Int.
8. Support super salesman lectures (lectures by outstanding experts to encourage best scientists in related disciplines to enter field)	C	R	n or	i
What people, or groups, outside the field of your own work have shown a particular interest in your research, even if their work does not interest you?				
What outside professional groups have asked you to give lectures, or have asked you to act as consultant?				
What individuals, or groups, outside the field have you asked to visit for lecture (or other similar) purposes, or have you consulted?				
Evaluate opportunities for consultation within/outside unit, within same/other fields, Expand...				
Evaluate willingness to be consulted as above.				
9. Support creation of a journal	C	T		i

Government Step	Effects Factors in Growth			Nat.	Int.
10. Support Gordon conferences and summer schools.	C	T	R	n or i	

Can you name the scientists whose work has most influenced the development of your activities?

Who working in the same field as yourself, would you say had been particularly influenced by your findings?

Who else, inside Europe and outside Europe, is working in the same area as you and your colleagues?

For those of the other groups in the field about which you are sufficiently informed could you list ten Europeans who should be invited to a Gordon conference. If open to Americans list ten who should be invited.

11. Support popular talks on T.V. in press for potential students.

Government Step	Effects Factors in Growth/	Nat.	Int.
12. Encourage and support laboratory directors to meet regularly, discuss problems and, hopefully, share work	C J R	n or	i
Do these people (working in the same area) try to work on related and complementary parts of the field; or is there a great deal of overlap between the work of different units? (If overlap), is this due to lack of information about work done elsewhere, or to competitiveness?			
Who in the field, but outside your own institute or laboratory regularly consults you?			
13. Support the creation of an international professional society	C		i

Government Step	Effects Factors in Growth	Nat.	Int.
14.a) Support international fellowship prize scheme (for those under 35) with international scientific jury	C J T R		i
b) Support international visiting fellowship scheme with international scientific jury	C J T R		i
Evaluation of visiting: general contribution, whether purpose research, study or necessary because nnsatisfactory local condition (salary, equipment, distractions, etc.)			
15. Create institute above critical size (perhaps 10 people) with hope that it becomes leading centre in country	J F R	n	
16. Set up international matching fund with agreed research programme and international steering committee or scientific jury same as that in international fellowship scheme above	C J F T R		i

Government Step	Effects Factors in Growth	Nat.	Int.
17. Set up applied research projects related to field In what problem/problems do you foresee any significant breakthroughs of industrial or social importance in the next(5,10,20)years? Do you have any idea who might be responsible for such a breakthrough? Do you believe that your work may have practical applications? Is this recognised by the potential users?	C J F A	n or i	
18. Create complex of university-institute and user bodies doing development work	J F T A R	n	
19. Link complexes in international development scheme	C		i

Government Step	Effects Factors in Growth	Nat.	Int.

20. Laboratories visited will be encouraged to suggest other possible useful steps

Are you basically satisfied with the way your field is advancing?

Do you intend to stay in the field?

Do you think there is anything that could, or should, be done to help the field to develop in your own country?

Is there anything which should be done internationally?

Any restraints preventing people from doing what they want?

Absence of certain important functions (theory, synthesis, etc.) due to.....

One-sidedness in work due to excessive influence of .....(independent)
absence of (special university department, etc.)

* Recognition occurs through every government action step and is therefore not indicated in the table.

NOTE: Not all steps are likely to be taken by a government and certainly not all in the order shown here.

Many of the steps can be imagined to be taken in parallel

Prof. Hart's
Report

PROPOSAL: LIBERAL-ARTS COMPUTER INSTRUCTION

Robert Hart
New College
Hofstra University
Hempstead, New York, U.S.A.
September 22, 1967

PROBLEM

Computers and their attendant disciplines are becoming increasingly important in all phases of modern life: (a) Games theory helps determine national policy. (b) Artificial intelligence is of interest to biologists, psychologists, and theologians. (c) Legal decisions are predicted with the aid of computers, and they have been proposed as a substitute for juries. (d) Radical changes are taking place in libraries, as their traditional data-retrieval function makes use of the memory and speed of computers. (e) Their scientific uses in our technically-oriented world are too numerous to mention; suffice it to say that whole areas of science would be impossible without computers. (f) They are used as sophisticated and flexible teaching machines - indeed, within a decade or two this is expected to be their major use. (g) Their social impact, as they eliminate routine mental tasks, causing unemployment and shifting patterns of employment, is comparable to the impact of the Industrial Revolution.

The problem, then, is how to give liberal arts students a literacy in computation - not the knowledge of a professional

computer programmer, but an acquaintance with computers and their potentialities - the sort of knowledge, in brief, which it would have been desirable for an educated person at the time of the Industrial Revolution to have of machines and their potentialities.

The present proposal seeks to accomplish this in a way which may be widely applicable because it fits easily into the conventional educational framework: using the sort of facilities now widely available at small-college computation centers and fitting easily into the conventional and existing structure of courses. (See also the Appendix.)

PAST EXPERIENCE

This proposal is an outgrowth of experience in New College during the 1966-1967 year. It thus seems appropriate to begin by describing this. The attached memorandum (Attachment A) of March 3, 1967 to Dr. Nathan Goldfarb, Director of the Hofstra University Computer Center, does this, and the more relevant parts of this experience are given below.

New College is an experimental, humanistically-oriented, semi-autonomous college within Hofstra University. The Physical Sciences course in which the computer was used is part of the core program taken by all students, about 75% of whom are in the humanities and social sciences.

Two one-and-a-half hour lectures were given, the first describing the role of computers in the modern world, the second on FØRTRAN programming. The second lecture is a kind of "instant FØRTRAN": the bare minimum required to get numbers into the machine, manipulate them, and get the results out. Getting students onto the machine as quickly as possible to run real, if very simple, programs seems to me the right approach, and the one most likely to engage their interest.

The results, I think, were reasonably successful. Somewhat more than half our approximately ninety students completed the assignment (counting five percent of the grade) of writing one simple computer program than ran and checking that it had indeed produced the correct results, and a greater number attempted it. For most of these people I think my principal object of "breaking the ice" was attained. What began as mysterious ended as something which could easily be made to do what was asked. This was the first attempt at Hofstra or New College to introduce the computer into a liberal-arts course, and the first year I taught the course.

POSSIBLE APPROACH TO THE PROBLEM

It seems to me that this ecperience suggests a pattern, possible of wide applicability, for giving liberal arts students a literacy in computation.

Suppose a school's computer center makes available to any instructor or course chairman desiring it a small "package" of computer instruction, similar to that which I gave, which may be included in his course. The "package" would provide the lecturer, computer operators, and administration of student records. This "package" would be especially appropriate for inclusion in the science courses most schools offer for liberal-arts majors, a point I discuss below.

Such a set-up would have a number of advantages. No knowledge of computation would be required by the course instructors. It could be put into operation quickly and with minimum administrative blither, since it fits into conventional and existing courses: only the assent of individual instructors or course chairmen is needed. It also uses conventional, widely available computer facilities.

There are several possible objections to such a package: (a) If put into courses for liberal-arts students it misses the science students who need it most. (b) The acquaintance with computation provided by the package is inadequate. (c) A better way than conventional batch processing, of driving home the importance of computers, is by the man-machine interaction of computer-assisted instruction and time-shared remote terminals.

The response to the first objection is that this package is

not principally intended for science students. In a sense, they present no problem. Conventional semester-long computer courses fit well the needs of science students, and are being increasingly recommended or required as part of science programs. The problem is with liberal-arts students, for whom a semester course would be harder to justify, and whose aim of understanding the human and social implications of computers, is not well met by the conventional computer-programming course.

However, although it is intended mainly for liberal-arts students, it may be worth pointing out that this "package" is very flexible. Where science programs are so benighted that a computer course is not required, this package included in science courses for science majors, would be better than nothing. It would also provide an opening wedge: such a demonstration of the feasibility and utility of introducing all students to computation might be the most convincing argument to a science department, in favor of requiring a computer course of all their students. In addition to this, a taste of programming can be addicting, and exposure to this package might induce science students to take computer courses as electives.

The remaining two objections are linked. More knowledge

of computers than provided by this package would certainly be desirable. One might reasonably argue that all students could profit from a one-semester course on the humanistic and social implications of computers. However, instructors for such courses are hardly to be found - they are the students of today - and fitting a new course in a new discipline into the curriculum is slow and painful. Again, the present package would be an opening wedge: an excellent argument for such a course would be the success of the present program.

Similarly, it can hardly be denied that the man-machine interactions of time-sharing systems would be better than my use of conventional batch processing, in convincing students of the immediacy of computers. Again, however, remote consoles and computer-assisted instruction are still in the experimental stages; one of the best arguments for a school's getting them when they become routinely available would be the prior success of a program such as I am suggesting.

In summary, then, this pattern emphasizes the immediate and practical. It is a quick and dirty way of using existing facilities and course structures to plug some of the gap in the computer education of liberal arts students; and one which might pave the way to better methods.

In regard to these points, see also the Appendix.

PROPOSAL

Several circumstances combine to make it easy to explore this pattern at Hofstra: the availability of an appropriate group of 150 additional students to work with, the availability of experienced student computer personnel, and the availibility of computer time and facilities for such a relatively large project at our newly-expanded and very cooperative computer center.

The last two of these will be discussed under Personnel and Facilities. The 150 additional students are those in the Hofstra main campus Natural Sciences 1-2 course. ("Main campus" means the main part of Hofstra, as distinct from New College, which is semi-autonomous.) This course is the physical science course offered to liberal-arts students to satisfy their requirement for a year of science. Dr. Esther Sparberg, the Natural Sciences course chairman, would like to have me present my "package" of computer instruction to her students. I would thus be playing the role in her course of the lecturer and administrative staff provided by the computer center.

This group of students is especially appropriate for several reasons: (a) The content of Dr. Sparberg's course is quite similar to that of my course, and thus there would be a maximum carryover of experience from last year. (b) It is the better liberal-arts students who take Dr. Sparberg's course

(the worse ones tending toward the main campus' liberal-arts biology course to satisfy their science requirement), so this would be a cautious place to start. (c) After last year's experience with approximately ninety students, an additional 150 would be about the right number to progress to.

The principal objectives of the proposal are: (a) During the Spring 1968 semester, to test the feasibility of the pattern suggested in the preceding Section, using the approximately 240 students of the two classes. (b) Based on this experience, to write, during the Fall 1968 semester, a text booklet suitable for this computer instruction "package" and to generally take stock of and evaluate the package. (c) During the Spring 1969 semester, to present the package to the two classes with the new text, with changes suggested by the preceding year's experience, and with extended or improved evaluation procedures.

In addition, there are several possible fringe benefits: (a) One is an interesting demonstration of how an experimental unit, like New College, within a larger university can generate and "spin off" programs of interest to the whole university. (b) Dr. Eugene Kaplan, who teaches the main campus' liberal-arts biology course taken by about 500 students, has expressed some interest in having the package included in his course, if the omens from the present 240 students are favorable. Should

this work out, then essentially all Hofstra students would receive an introduction to computers, as all New College students do now. (c) Dr. Nathan Goldfarb, Director of the Hofstra University Computer Center, is tentatively designing a one-semester course on the humanistic and social implications of computers. One possibility which we have discussed is to use my "package" as the skeleton of this course, at least initially. My lectures on the role of computers in the modern world and on "instant FØRTRAN" would come at the start. This would allow the students to program during the rest of the semester, while Hofstra faculty from a variety of disciplines lecture on the impact of the computer in their fields, thus filling out the introductory lecture on computers in the modern world. At the end would come a summarizing lecture or lectures.

The evaluation and the need for a text mentioned among the objectives perhaps deserve further comment. The latter first: I am convinced that "instant FØRTRAN" is the right way to begin teaching FØRTRAN. By this I mean giving the students the minimum required to get numbers into the machine, carry out the simple manipulations, and get numbers out; and getting the students onto the machine as quickly as possible. I think this is the right way to start, even if FØRTRAN is to be explored in greater depth, and in our case this bare minimum is as deep as we get.

Despite this, there is really no satisfactory "instant

FØRTRAN" text: clear, explicit, and minimal. Not only could we use such a text now that our students will increase two- or three-fold, but I think that the need will become general as more people are given the kind of computer literacy I am aiming at.

Accordingly, I would like to write such a text during the Fall 1968 semester, to have available for the students in Spring 1969.[1*] I think this is well within our capabilities, since I have a good idea from last year of what is needed, and since we want to produce a booklet, not a book. There are a number of good books available which give complete treatments of FØRTRAN, but completeness is precisely what we do not want. In writing this text I would probably be assisted by Mr. Rosenstock (see Personnel).

The two handouts given last year's students are attached. Attachment B, "Operation of the Keypunch," is slight, but perhaps it conveys the explicit and direct flavor I would hope to give the text. Using it, students were able to operate the keypunch after one supervised run-through of the instructions.

Attachment C, "Computers," is principally procedural.

New College's intimate set-up, with all students and faculty in the same building, made for an easy feedback of student questions - extremely desireable for such an experiment. By

*Numbered footnotes appear at the end of this proposal.

the same token, however, these were clarified by personal contact and by notices on the bulletin board which all students passed several times a day, rather than by additional materials. Thus, these two handouts are all that I have to offer.

For the more impersonal set-up envisioned in the future additional material is obviously desirable; it is to this need that the proposed text is addressed. As I see it now, the text will principally consist of an introduction to FØRTRAN closely following that given in my lecture, and a "case history" of a program like that which last year was posted on the bulletin board. The introduction to FØRTRAN will be a step-by-step development of an exceedingly simple program, stressing, however, that programs hardly more complex can have considerable sociological significance, and that the framework of this program provides the framework of much more complicated programs. The "case history" will be a coding form with the same program (and data) written on to it, exactly as it would go to the keypuncher; the cards which would come back from the keypuncher (in a pocket); and the computer output resulting from using these cards as input. The text would also have a section on debugging, again proceeding by example. In addition, students would receive procedural instructions similar to Attachment B, a list of error messages, and a time schedule for student tutors and the Computer Center.

As to evaluation: The amount of evaluation we can meaningfully do is limited by the brevity and aims of the package. However, despite this, the imminent mushrooming of all-student introductions to the computer appears to make it desirable that we milk the package for the modest amount of information on its effectiveness that it can yield. We are fortunate in that Dr. Harold Yuker, formerly Director of Instructional Research at Hofstra, now Director of Hofstra's Center for the Study of Higher Education, is interested in doing this. A copy of Dr. Yuker's resume appears as Attachment F.

Regarding the difficulty of evaluation, recall that the aim of the package is to give students a "literacy" in computation - an awareness of the possibilities and limitations of computers - not to make them computer programmers. Accordingly, what we would primarily be interested in doing would be something like evaluating their increased comprehension of the humanistic and social implications of computers, rather than the more straightforward job of evaluating their ability to program. (I will test their ability to program, incidentally, but more to evaluate the students than the package.)

Despite these difficulties, we would like to devise modest pre- and post-tests of about a dozen items each. Sample question: "Can a computer which has been programmed to play checkers beat the person who programmed it?"

In brief, then, the proposal seeks principally computer time and supporting services, time for student assistants and tutors, and support for preparing the text and for evaluation.

DISSEMINATION AND COPYRIGHT OF TEXT

I would like to publicize this pattern fairly widely. At this stage it seems to me that the way to do so may be to send a copy of the text booklet together with appropriate covering material (possibly the final report) to potentially interested persons. These would include, for example, (a) the "Pierce Report"[2] panel members, (b) the members of the Committee on Uses of Computers of the NAS-NRC which produced the "Rosser Report,"[3] also quite favorable to all-student introductions to the computer, (c) the participants in the Irvine Conference on the Uses of the Computer in Undergraduate Physics Instruction,[4] and the directors of a selection (perhaps half) of the approximately four hundred academic computer centers in the U.S.[5]

This strikes me as somewhat cumbersome, but perhaps this is not entirely bad. I suspect it is a sign that we are doing what we should be doing -- exploring a new field - and part of this is that the channels of communication are not yet well established.

I would also seek to publicize this in such journals as might be appropriate. I would plan to write a letter to the American

Journal of Physics, the journal of the college and high school physics teaching community. Physicists are among those most active in computer education,[4] and this, together with their frequent involvement in teaching science courses to nonscience majors, has made them perhaps the leaders in introducing the computer into such courses.[6] The American Journal of Physics has, for example, recently begun a special department on "Instructional Uses of the Computer."

Among other journals which should be looked into would be, for example, The Journal of Chemical Education, The Science Teacher, and School Science and Mathematics.

Another obvious way to publicize the scheme is by contacting others active in the field. As reasonable estimates (though these might not be the precise trips undertaken), I have included the expenses of a trip to the National Science Teachers Association College Conference on Establishing Goals for Scientific Literacy in Jacksonville, Florida, and to the Center for Computer-Oriented Research in the Humanities and Social Sciences at the University of Pennsylvania.

Production of the text would be handled by the Hofstra University Bookstore. Their routine procedure for producing lab manuals, lecture notes, and similar course materials includes designing, typing, offset printing, assembling, and simple binding; it would cost a dollar per copy for the 20-25 page booklet envisioned.

As to copyright, it seems desirable in a new and changing field that other users of the booklet be fairly free to adapt and modify it in light of their own experience and needs. At the same time, copyrighting seems desirable in order to retain some knowledge of and control over these modifications. I propose to copyright the booklet, and include in the copyright notice a statement that permission to adapt and modify may be freely obtained by contacting the authors.

PERSONNEL

The principal personnel are myself, Dr. Esther Sparberg, Mr. Jeffrey Rosenstock, Dr. Nathan Goldfarb, and probably a student aide in addition to Mr. Rosenstock.

I have been Assistant Professor of Physics at New College since January 1966. A copy of my resume appears as Attachment D. The most relevant point here is that publications Nos. 2-8 and 10, pp. 6-7 of the resume, deal with the applications of computers to molecular structure and molecular quantum mechanics.

Dr. Esther Sparberg, Assistant Professor of Chemistry at Hofstra, is the course chairman of the Hofstra main campus Natural Science course in which my computer instruction "package" would be inserted. She has eight years experience teaching this course, and is active as a teacher and as a researcher; a copy of her resume appears as Attachment E.

Mr. Jeffrey Rosenstock is an undergraduate New College student. Last year he very capably, and with little assistance from me, ran the student sessions at the computer in my course, and tutored students in programming. He is thus well-prepared to do the same this coming year. In addition, being familiar with my approach to computer instruction, he can contribute meaningfully to the proposed text - certainly by providing the important criticism from the student viewpoint, and perhaps in doing some of the writing and editing.

Dr. Nathan Goldfarb has been Director of the Hofstra Computer Center since its inception. A copy of his resume appears as Attachment G.

FACILITIES

The principal facility is the Computer Center. This past year they had a 20K IBM 1620, and the course consequently used NCE (Newark College of Engineering) FØRTRAN, a stripped pedagogical language without batch-processing capabilities.

This IBM 1620 has been replaced by two IBM 1130's, each of which is twenty times as fast, and which have FØRTRAN II and batch-processing capabilities, the latter especially useful for pedagogical applications such as ours. Both of these IBM 1130's have been delivered and are in routine operation.

The Computer Center's supply of keypunches available for student use has not kept pace with its growth. Accordingly, funds for renting extra keypunches are included in the proposal.

Perhaps the most important point about the Computer Center is that it is extremely cooperative. Their flexibility and willingness to go along with our needs made last year's program possible despite equipment that was less than optimal; and would be an important factor in successfully meeting new problems arising from an expanded program this coming school year.

In this regard, perhaps it is worth mentioning that Dr. Goldfarb, Director of the Hofstra Computer Center, sees a liberal-arts computer instruction "package" as complementary to, rather than competitive with, conventional computer courses at Hofstra.

A detailed list of the equipment at the Hofstra University Computer Center is as follows: (a) two IBM 1130 Computer Systems, each with 8K of core memory and one 500 K disk drive, and each consisting of one 1132 Printer, one 1442 Card Reader, and one 1131 Central Processing Unit; (b) ten IBM 029 Keypunches; (c) one IBM 056 Verifier; (d) one IBM 082 Sorter; (e) one IBM 514 Reproducer; (f) one IBM 085 Collater; and (g) one IBM 407 Printer (Tabulator).

BUDGET

First Phase - Spring 1968 Semester

Salaries:

1)	Robert Hart, 25% of $9500 per year base pay	$1187.50
	Fringe Benefits at 13%	154.50
2)	Senior Computer Center man at computer during lab sessions, 1/8 of $10,000 per year base pay for 4 months	416.67
	Fringe benefits at 13%	56.17
3)	Student lab assistant at computer, $2.50 per hour, 5 hours per week, for 15 weeks	187.50
4)	Student grader and/or office assistant, $1.25 per hour, 5 hours per week, for 15 weeks	93.75

Expendable Equipment and Supplies:

5)	Forms for IBM 407 Printer and IBM 1130 Computer, one box	15.00
6)	Paper, ditto masters, and duplicating fluid for student handouts, figured at 10 pages of handouts, 300 copies each, at 88¢ per ream	5.28

Other Direct Costs:

7)	Keypunch rental, two keypunches for four months, at $60 per month each	480.00
8)	Computer time, $35 per hour, 5 hours per week, for 15 weeks	2625.00
9)	Keypunching for those students who do not keypunch their own, figured at 500 programs of a dozen cards each, at 7¢ per card	420.00

FIRST PHASE DIRECT COSTS - TOTAL $5641.37

Second Phase - Fall 1966 Semester

Salaries:

1)	Robert Hart, 16-2/3% of $9500 per year base pay	$791.67
2)	Jeffrey Rosenstock, $2.50 per hour, 5 hours per week for 15 weeks	187.50

Travel and Subsistence (figured in accord with Hofstra University's standard travel policies):

3)	*Philadelphia, round trip coach fare ($49.04) plus three days per diem at $20 per day	109.04
4)	*Jacksonville, Florida, round trip coach fare ($110.46) plus three days per diem at $20 per day	170.46

Publication and Related Costs:

5)	Text booklet, 750 copies at $1 each	750.00

Other Direct Costs:

6)	*Evaluation, Hofstra University's Center for the Study of Higher Education	1000.00

SECOND PHASE DIRECT COSTS - TOTAL $3006.67

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* Starred items may be expended in part during the other phases.

Third Phase - Spring 1969 Semester

The Third Phase incurs essentially the same expenses as the First Phase. Further expenses are required only for the final report: its typing, paper, and dissemination.

Salaries, Expendable Equipment and Supplies, and other Direct Costs:

1) - 9) Same as in First Phase $5641.37

Publication and Related costs:

10) Additional secretarial help for typing and disseminating final report, $2.50 per hour. 5 hours per week, for 20 weeks 250.00

11) Paper and reproduction costs of final report, 500 copies, 30 pages each, figured at 1¢ per page 150.00

12) Envelopes and postage for 350 final reports and text booklets, at 25¢ each 87.50

THIRD PHASE DIRECT COSTS - TOTAL $6128.87

TOTAL DIRECT COSTS FOR ALL THREE PHASES $14,778.91

Indirect Costs, figured at 55% of salaries (salaries for all three phases = $5421.35)	$2,981.74
FINAL TOTAL--Direct and Indirect Costs for all three phases	$17,760.65

APPENDIX

The present proposal is based heavily on the preliminary version.[7] Since writing the latter I have become aware of the "Pierce Report."[2] This is the report of the Panel on Computers in Higher Education, of the President's Scientific Advisory Committee. The Pierce Report comes out heavily in favor of some acquaintance with computation for essentially all undergraduates; in particular, it strongly favors extending the "all-student" introduction to computers given by a very few front-rank schools, to virtually all undergraduate institutions. It thus would appear to lend considerable weight to this proposal. Indeed, the identity of views is so striking that to quote the Report at length would be redundant. A few quotes, therefore, will suffice to give its flavor.

On the desireability of some knowledge of computation for all:

> . . . we find ourselves compelled to believe that within a decade essentially all university and college students will require some basic understanding of digital computation. . . . .
>
> In short, we believe that the computer and computing are rapidly coming to have an impact on the life of practically every member of our society. Most people educated beyong the high school level will have occasion to make use of these tools, and all will need sufficient understanding of their possibilities and limitations realistically to appraise the new opportunities now available for information processing. (Ref. 2, p.28.)

Clearly some acquaintance with digital computers will be as essential to the next generation as is now familiarity with the automobile and the radio. For college and university students the time required to get such familiarity may be about that to learn to drive a car. Unfortunately, parents can't teach about computers so the colleges and universities must. Ref. 2, pp. 28-29.)

We believe that undergraduate college education without adequate computing is deficient education, just as undergraduate education without adequate library facilities would be deficient education. At present, deficiency in computing is widespread. We believe it to be vital to the national interest as well as to the welfare of the individual student to remedy this deficiency quickly. How can the deficiency be remedied and what will the remedy cost? (Ref. 2, p. 10.)

On the remedy:

In 1965 less than 5 percent of the total college enrollment, all located in a relatively few favored schools, had access to computing service adequate for these educational needs. . . .

We recommend that colleges and universities in cooperation with the Federal Government take steps to provide all students needing such facilities with computing service at least comparable in quality to that now available at the more pioneering schools.

2. One of the major problems in providing the necessary educational computing is the cost. . . . It is beyond the capabilities of our colleges and universities to bear all of this cost in this time period.

We recommend that colleges be encouraged to provide adequate computing through government sharing of the cost. . . . (Ref. 2, p. 4.)

The remedy seen by the Pierce Report is principally that of extensive Federal support for educational computing. The emphasis is toward providing the hardware and software required for remote consoles, multiprogramming, and man-machine interactions (Ref. 2, pp. 11, 16, 34-36, and 44-45).

As noted in the main body of this proposal, such systems are indeed excellent, but they are also expensive and still under development. The present proposal makes something of an end run around the cost and availability problems of these systems by achieving an "all-student" introduction to computation using conventional batch-processing, while at the same time paving the way for institutional acceptance of more sophisticated techniques when these become routinely available. Right now, batch-processing is the bread-and-butter of the great majority of computer centers, and for many would remain so for quite a few years, even if the recommendations of the Pierce Report were fully implemented.

In this connection, another point about the Pierce Report is perhaps worth noting. Despite the considerable emphasis it places on introducing all students to computation, and in particular on extending such introductions from a few front-rank institutions to the common run of schools, no cases are mentioned where this has been done. As far as I know, New College is unique in this respect. Thus it would seem that interest may attach to our efforts, the more so since our use of conventional computer facilities, minimum faculty retraining, and minimum administrative fuss might be an appropriate pattern for similar schools.

FOOTNOTES

1. First classroom instruction is planned for February 5, 1968. An earlier decision on this proposal would be most helpful in planning, but not vital.

2. Panel on Computers in Higher Education of the President's Scientific Advisory Committee, chaired by J. R. Pierce, Computers in Higher Education (U.S. Government Printing Office, Washington, D.C. 20402, February 1967).

3. Committee on Uses of Computers of the National Academy of Sciences-National Research Council, chaired by J. B. Rosser, Digital Computer Needs in Universities and Colleges (National Academy of Sciences-National Research Council, Washington, D.C., 1966). On "all-student" introductions to the computer: "The broad-scale reliance of our increasingly technical society on computer systems, formal languages, and the related problem-solving procedures will eventually mean that every citizen should have a basic nontechnical understanding of the field, much as every citizen is now expected to understand something of history, arithmetic, biology, etc." (p. 123.)

Further: "Many have come to realize that these applications

[of the computer] have the potential of profoundly affecting our socio-economic structure, our institutions, and our standard of living. Even the well-educated man, however, thinks of the computer as a magical box, and of its use as incomprehensible. There is almost no widespread understanding of the prospects or problems in the use of computer systems.

"It will be important to the social well-being of our country that the educated citizen understand computer science at least as well as he now understands medicine or mechanics." (p. 124.)

4. The Computer in Physics Instruction, Report of the Conference on the Uses of the Computer in Undergraduate Physics Instruction, sponsored by the Commission on College Physics, at the University of California at Irvine, November 4-6, 1965.

5. Listed, for example, in the "Roster of School, College, and University Computer Centers" appearing in each annual (June) directory issue of Computers and Automation.

6. A. M. Bork, Am. J. Phys. 34, 926 (1966).

7. R. Hart, "Prospectus Proposal: Liberal-Arts Computer Instruction," New College, Hofstra University, Hempstead, New York, U.S.A.

March 3, 1967

To: Dr. Nathan Goldfarb, Director
Hofstra Computer Center

From: Robert Hart, New College

Re: Computer use in the New College Physical Sciences Course, PGP N13 (4 s.h.)

Rather belatedly, here is the account I said I would give you of the use of the computer in the New College PGP Physical Science course.

This course is part of the first year of the core program (Prescribed General Program) taken by all students. It is quite comparable to the Natural Sciences 1 course on the Hofstra main campus, also worth four semester hours. It lasts six weeks and occupies half the students' time.

New College being humanistically oriented, about 75% of the students are in the humanities and the social sciences. The main aim of the course is to explore the nature of physical science and its relation to other human activities. However, the only way to understand these, I feel, is to do some science and not just talk about it. Accordingly, the rise of astronomy

and dynamics --- the Greeks through Newton --- is covered in a moderately technical manner.[1] This limited but vital piece of physics parallels the intellectual history of the Western world, and provides numerous excellent pegs on which to hang such questions.

My principal reason for using the computer in the course is that as computers penetrate into every corner of life, they are becoming part of the knowledge of an educated person: Games theory helps determine national policy; artificial intelligence is of interest to biologists, psychologists, and theologians; legal decisions are predicted with their aid; and they are used as sophisticated and flexible teaching machines - a list which could be extended indefinitely. In general, routine mental tasks are being eliminated, as the industrial revolution eliminated routine manual tasks. Just as an acquaintance with machines and their potentialities would have been desirable then, so an acquaintance with computers by educated people is desirable now. However, you are the last person to whom I need belabor this.

A related reason for using the computer is that it continues the Frankenstein theme touched on in the course. The view is advanced that certainly the first, and perhaps the main, step in bringing Frankenstein's monsters under control is understanding them. Computers have been assigned this role

about as much as anything these days. It is, therefore, interesting to show the students what a relatively large measure of control and usefulness results from a small investment of knowledge and understanding.

Another reason for introducing the computer is that it sometimes catches student interest, mostly for the wrong reasons: it is glamorous, the lights flash (the "pinball effect"), and a mad feeling of power comes from having all those cores doing your bidding. Nevertheless, student enthusiasm is rare and precious enough that one takes it wherever one finds it.

In addition, the computer provides something of a laboratory experience in a course which is otherwise without it, and in which a laboratory would be difficult to imagine because of the course's brief duration and large number of students - particularly inept ones at that. Also, this introduction to the computer serves as the beginning of computer instruction for the science concentration students, instruction which is continued in their General Physics course. Last but not least, there is my personal interest and experience with computers.

As to the mechanics of the course, two one-and-a-half hour lectures are given, the first describing the role of computers in the modern world, the second covering FØRTRAN programming. The second lecture is a kind of "instant FØRTRAN": the minimum needed to get numbers into the machine, carry out computations with them, and get the results out. In fact, the

sample program developed in the lecture merely adds two numbers. The points are stressed, however, that programs hardly more complex than this can have considerable sociological significance, and that the framework of this program provides the framework of much more complicated programs.[2] This year these lectures were given in the middle of the six weeks of the course; in future years they will be given at the beginning.

The programming lecture is self-contained. As a supplementary reference, a technical report by G. L. Pawlicki[3] was suggested. Next year this will be assigned as a text, costing about 50¢. This booklet is about the best beginner's FØRTRAN instruction manual I have seen: clear, explicit, and only covering a subset of FØRTRAN, which is in the "instant FØRTRAN" spirit. Nevertheless, it is not ideal for the present course, since it treats a different dialect of FØRTRAN[4] and a different computer installation, and is not sufficiently geared to the "instant FØRTRAN" approach. I am still looking for a better.

In addition to the lecture and the Pawlicki booklet, the students receive a set of procedural instructions (enclosed), and on the bulletin board is posted a complete "case history" of a program: the coding form with program and data written onto it, exactly as it would go to the keypuncher; the cards which would come back from the keypuncher; and the computer output resulting from using these cards as input. A list of error

messages is also posted. The students can also obtain programming advice at the course's problem sessions, at our weekly computer sessions, and from fellow students. The last is actually a significant source of advice. Most questions are basic, frequently answerable by students who have written a few programs, as have many of the science concentration students in preceding classes. Having students teach students, in this class and in others, is part of New College's attempt to involve students actively in the educational process.

At the optional weekly computer sessions, students could learn how to keypunch their own programs and watch them being run on the computer. (A copy of our "instant keypunch" instructions is enclosed.) The computer experiment counted five percent of the grade.

The results, I think, were reasonably successful. Somewhat more than half our approximately ninety students completed the assignment of writing one simple computer program that ran and checking that it had indeed produced the correct results, and a greater number attempted it. For most of these people, I think my principal object of "breaking the ice" was attained. What began as mysterious ended as something which could easily be made to do what was asked. I would expect results in later years to be more successful: This was New College's (and, I believe, also Hofstra's) first attempt to use the computer in a liberal-arts course, and the first year I taught the course.

It seems to me, that these results suggest the pedagogical feasibility of introducing all Hofstra students to the computer, New College students being a pretty representative cross-section. Whether this would be desirable or possible taking other considerations into account, I don't know, but should you seek to move in that direction, I think this experience would support the idea.

About the only difficulty I recall with the Computer Center was that some students misunderstood or ignored the instructions about coding programs onto the coding forms. This led the key-punchers to ask me on several occasions whether programs should be returned unpunched, or punched as best as possible. My feeling is that our students should be handled like everyone else, and that familiarizing themselves with a computer center's procedures is part of learning to program. Accordingly, my response tended toward "What would you do normally?" The answer to that tended to be that there was no "normally" --- that this was the first time this had been done. So some of the difficulties which may have been encountered (of which this is the only specific one of which I am aware) may perhaps be chalked up to growing pains on the Computer Center's part as well as ours. In any event, the students will be given yet more explicit instructions about coding next year. I would appreciate any comments about other difficulties or suggestions for next year.

I also enclose two laboratory write-ups from the New College General Physics Course. These show how the above introduction to computers, which everybody receives in the PGP Physical Science Course, is continued for the students concentrating in science. The General Physics Course (N. Sc. N21, 6 s.h.) begins half-way through the six-week Physical Sciences Course and lasts twenty weeks, occupying about half the students' time.

These write-ups are straightforward. The first merely instructs the student to write another program more complex than that written for the Physical Sciences Course, preferably related to either his physics or calculus course. The second is a numerical integration of a simple harmonic oscillator, which lends itself naturally to the computer, though its use is not required.

Finally, I also enclose a copy of a letter I wrote to Alfred Bork, at Reed. There has recently been considerable interest in the use of the computer in physics teaching, from a variety of viewpoints[5]: the straight teaching and use of programming in physics classes and laboratories; computer consoles in the physics laboratory to carry out data analysis; computers as demonstrators (simulators) of physical phenomena; and the use of the computer as a flexible and sophisticated teaching machine to teach physics. In any event, Bork, Chairman of the Committee on Mathematics in Physics Education of the American

Association of Physics Teachers, recently solicited[6] information about physics courses using computers. I thought you might be interested in what I wrote about the New College courses.

FOOTNOTES

1. The course uses as text, and follows closely, G. Holton and D. H. D. Roller, Foundations of Modern Physical Science (Addison-Wesley Publishing Company, Inc., Reading, Massachusetts, U. S. A., 1958), Chaps. 1, 2, and 4-15.

2. "Instant FØRTRAN" is, I believe, the proper way to begin teaching FØRTRAN programming, even when the subject is to be explored in greater depth. FØRTRAN is peculiarly amenable to self-study: one learns FØRTRAN programming by writing programs, and this should be started with the first lecture. Despite this, no really satisfactory "instant FØRTRAN" text is known to me.

3. G. S. Pawlicki, "An Introduction to 704 FØRTRAN," technical report ANL-6542 (March 1962, corrected November 1963) of Argonne National Laboratory, Argonne, Illinois, U.S.A.

4. We are presently using NCE (Newark College of Engineering) FØRTRAN, a stripped pedagogical language with free-style input and output. This may change shortly, when our 20K IBM 1620 (no magnetic drums or tapes) is replaced with two IBM 1130's.

5. This is evidenced, for example, by a number of articles in the American Journal of Physics, and by a session on this topic at the recent meeting of the Americal Physical Society and the American Association of Physics Teachers in New York. A good article on this, and certainly the most amusing, is by D. L. Shirer in Am. J. Phys. 33 (1965).

6. A. M. Bork, Am. J. Phys. 34, 1199 (1966).

(Reprinted September 20, 1967, without change, except correction of typographical errors.)

Regular Panel
Reports

Draft

INTERIM REPORT

Data Base Panel

Covering the Period January 1-April 30, 1969

As outlined by the Board, the aim of this panel is to provide a data base on the computer industry from which the Board and its panels can operate. The mission is therefore - "to develop knowledge and data on the present status of the computer industry, identify the gaps or areas in which information or data is inadequate or unsatisfactory and make recommendations on what action should be taken."

The panel with a few associated Board members, has a direct line into many information and data sources. Therefore, a major amount of time has been devoted to learning about the types of data and information thus available, on such subjects as numbers, types, etc. of computers, capital and operating costs involved, manpower availability and manpower needs, training programs, etc.

Preliminary presentations have been made by:

Dr. John W. Hamblen	Southern Regional Education Board
Dr. Bruce Gilchrist	American Federation of Information Processing Societies
Miss Josephine Walkowicz (for Miss Margaret Fox)	National Bureau of Standards
Mr. Patrick J. McGovern	International Data Corporation

In the meantime, a large number of individual references have been submitted or procured, some general, some related to specific subjects, such as manpower, software services, etc. Several surveys of government involvement are available and more are forthcoming from the Bureau of Standards, Bureau of the Budget, Census Bureau, etc.

Present activity centers around trying to decide how to handle and evaluate all this information. As a start the data available on the status of the industry is being assembled for general analysis and study by the Panel.

The Panel membership is as follows:

Dr. Sidney Fernbach, Chairman

Mr. Paul Armer
Dr. John Hamblen
Mr. J. D. Madden
Mr. Patrick McGovern
Miss Margaret Fox

Mr. Charles Phillips
Mr. Joseph Kasputys
Miss Ann M. Lamb
Dr. William Raub
Mr. Chris Shaw

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DEPARTMENT OF STATE

17

AIRGRAM

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FROM : AmEmbassy MOSCOW

DATE: April 19, 1969

SUBJECT : Minsk-32 Computer

REF :

An article from Sovetskaya Belorussiya of March 16 describes the Minsk-32 computer, a new model in the Minsk series which is compatible with the Minsk-22M. It is an all-purpose computer of medium productivity and differs greatly from its predecessor, the Minsk-22M, in having eight times the internal memory of the earlier machine and a memory-access time measured in terms of fractions of microseconds. Up to 136 peripherals can be linked to the new model, and the computer operates both in binary and in decimal modes. It is produced by the Ordzhonikidze plant in Minsk.

BEAM

Enclosure:
"The Memory and Reliability of the Minsk-32 Computer"

APR 21 In 5 41

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Contents and Classification Approved by: Economic Counselor/RELindstrom

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THE MEMORY AND RELIABILITY OF THE MINSK-32 COMPUTER

By A.Stroganov

As a rule, the new model of a computer is produced only in several years after its design which essentially becomes outmoded. Minsk cyberneticians have decided to considerably reduce this period. The Minsk-32 all-purpose computer of medium productivity developed by them was tested only last November and in December the Ordzhonikidze plant in Minsk already turned out the first computers of this type.

The new computer differs greatly from its predecessor--the Minsk-22M. Usually information which has no room in the computer's main brain, is stored in external memory units--on the magnotic drum, the magnetic tape and special discs. Their access-time sometimes is measured in minutes. In the Minsk-32 the capacity of the main memory is eight times more, and its access-time is measured in terms of fractions of microseconds. Hence, its speed is much higher.

Computers of previous models solve problems in succession. Some of their devices stand idle while others are overloaded.

For example, the central calculator is solving the problem, while the printer stands idle. On the other hand, during information output the calculator stands idle. The Minsk-32 computer is devoid of this drawback. It can simultaneously solve three-four problems with a full and more uniform loading of all of its units.

I would like to mention one more advantage of the last representative of the family of Minsk computers. With the aid of special commutators up to 136 external units can be linked to the new model: information inputs and outputs from punch-cards and punch-tapes, additional accumulators on the magnetic tape and drum, various devices for information transmission from telegraph and telephone channels and special data sensors. This makes it possible to solve a wide range of engineering, economic and informational problems in contrast to the "purely engineering" Minsk-22M computer. Besides, the new computer can operate both in binary and decimal calculation systems.

And finally another advantage: all the programmes compiled for the Minsk-22M are suitable for the Minsk-32. If it is necessary to accelerate the solution of problems, the new model can operate jointly with other computers.

(Sovietskaya Belorussia, March 16)

NINETY-FIRST CONGRESS

Congress of the United States

House of Representatives

GOVERNMENT ACTIVITIES SUBCOMMITTEE
OF THE
COMMITTEE ON GOVERNMENT OPERATIONS
RAYBURN HOUSE OFFICE BUILDING, ROOM B350-B
WASHINGTON, D.C. 20515

FOR IMMEDIATE RELEASE
April 18, 1969

HEARINGS SLATED ON BROOKS' BILL TO USE COMPUTERS IN CONGRESS

WASHINGTON, D.C.— Citing the billions in possible savings of tax funds, Congressman Jack Brooks (D-Texas) announced hearings on legislation to provide for coordinated use of computers in Congress. The hearings on Brooks' bill, H. R. 404, and similar measures will begin Wednesday, April 23, 1969, at 10:00 a.m., in Room 2247 of the Rayburn House Office Building, at which time the Subcommittee will hear from the Comptroller General and the Bureau of the Budget.

Brooks, Chairman of the House Government Activities Subcommittee stated, "The state of the art in data processing and information handling has reached the point of development that they can be of material assistance to the Congress in coping with the constantly increasing complexity and volume of data inherent in the legislative process.

"The time has come for us to make full use of these new capabilities. In Congress every day we witness increasingly serious symptoms of the inadequacies of traditional information handling techniques to meet present and future demands."

Brooks continued, "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 5 percent increase in efficiency in handling budget and appropriation matters, the annual saving under present budgetary levels would exceed $4 billion annually."

Under Brooks' proposal, responsibility is given the Comptroller General of the United States to develop and maintain the computer capacity required by the House and Senate and the subordinate offices of the Congress. "In addition," Congressman Brooks explained, "the Comptroller General will cooperate with the Director of the Bureau of the Budget in developing a uniform computer system to support the budget and appropriations cycle in the Legislative and Executive Branches of the Government.

This uniform approach to the computer needs of the Legislative and Executive Branches in the area of fiscal data will not only significantly improve the efficiency and effectiveness of the overall system, but will also avoid costly wastes and duplications which otherwise would occur were systems for this purpose developed independently by the Congress and the Executive Branch."

Other Members of the Subcommittee, in addition to Brooks, are Congressman William S. Moorhead (D-Pa.), John C. Culver (D-Iowa), Floyd V. Hicks (D-Wash.), Ogden R. Reid (R-N.Y.), John H. Buchanan, Jr., (R-Ala.), and Lowell P. Weicker, Jr. (R-Conn.). The Subcommittee is part of the House Government Operations Committee, chaired by Congressman William L. Dawson (D-Ill.).

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M.I.T. Group Assails Computer Plan

By JOHN H. FENTON
Special to The New York Times

CAMBRIDGE, Mass., May 6 — In a peaceful protest demonstration, members of the Science Action Coordinating Committee urged opposition today to a projected computer facility for research in the behavioral sciences at the Massachusetts Institute of Technology.

Under a bright sun a crowd of more than 200 at Kresge Plaza heard speakers on both sides of the issue present their views with scarcely a heckling note — and little applause.

During the hour-long discussion, the coordinating committee, which is dedicated to opposing academic research for the benefit of the military-industrial complex, asserted that the computer would be useful to tne Pentagon for amassing data to be employed in suppressing popular movements. The committee is composed of M.I.T. students and faculty members.

Cities Analytic Role

But administration representatives, who had prepared an 82-page report outlining the possible uses of the facility, insisted that it was not designed to support research projects individually, but rather to afford unclassified computer analysis and modeling in behavioral sciences on a time-sharing basis with other scholars outside M.I.T.

Kresge Plaza is a grassy plot situated at the west end of the M.I.T. campus. The speakers stood on a platform formed by broad steps leading to a student center. The institute's maintenance engineers provided a microphone and two public address loudspeakers.

The computer concept, called the Cambridge Project, was the work of more than 50 behavioral scientists in this university city over the last several months. Two of the prime movers were Dr. Licklider and Prof. Ithiel de Sola Pool, a political scientist.

Last month, the group applied to the Behavioral Sciences Division of the Advanced Research Projects Agency, an arm of the Department of Defense, for a grant of $1.5-million for the first year of a five-year program. The total estimated cost would be $7.6-million. The application is under study.