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COMMENTS ON THE REPORT OF THE AD HOC
PANEL ON ELECTRONIC DIGITAL COMPUTERS
OF THE RDE COMMITTEE ON BASIC PHYSI-
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COMMENTS ON THE REPORT OF THE AD HOC PANEL ON ELECTRONIC DIGITAL
COMPUTERS OF THE RDB COMMITTEE ON BASIC PHYSICAL SCIENCES

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COMMENTS ON THE REPORT OF THE AD HOC PANEL ON ELECTRONIC
DIGITAL COMPUTERS OF THE RDB COMMITTEE ON BASIC PHYSICAL SCIENCES

1. The Panel Report

The Panel which studied digital computers for the RDB Basic Physical Sciences Committee consisted of three unusually capable men with prior experience in Government and industrial research activities. They conducted their investigation in a very capable way and such as to inspire confidence in their ability. Most of the general recommendations of the report are excellent. The report shows that the Panel was probably short of time and were unable to make really careful detailed investigations of the various specific projects. As a result, the parts of the report relating to projects and specific computer activities is not as complete as those relating to general aspects.

2. Emphasis on Faults

The Panel has undertaken to discover faults needing correction in the Military Establishment sponsorship of digital computer work. This of course is their primary purpose and their obligation. The report, however, stresses faults and difficulties to the extent that there is real danger of its shaking confidence in the field and a real probability that it will work against the general recommendations in the report for strengthening the digital computer program. The overall attitude in the general parts of the report is very positive, while the overall attitude regarding specific projects seems to be unnecessarily negative.

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3. Technical Competence

The Panel has stressed the relations between the Military Establishment and the contractors. As a result, it has not given a comprehensive or detailed attention to the technical status and the prospects of various projects. The investigation of projects appears to have been rather superficial and, in the report, does not show exploration into the factors which will make any particular project successful or unsuccessful. The Panel does not seem to have gone far enough into the technical competence or the management of the various projects.

4. Simulation

The Panel recognizes the importance of real-time applications of digital computers but makes almost no mention of the important future applications to military simulation. Simulation can be a powerful design tool for physical equipment and will be the initial proving ground for the application of digital computers to real-time tactical problems.

5. Study of Real-Time Problems

The Panel has stressed the need for laboratories to carry on scientific computation. It has also stressed the importance of computers in real-time tactical applications. There seems to be nowhere any mention of the importance of research and development laboratories for carrying on the studies that will be required to make real-time computing successful.

6. Duplication of Machines

The Panel's recommendation against the duplication of non-existing machines and against the contracting for duplicates before the completion and test of a prototype are stressed on pages 9 and 35. This seems like a

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very sound recommendation, but the Panel is not consistent in its application of the principle. The only projects censured for this duplication are those revolving around the Institute for Advanced Study. It would seem to apply equally well where the duplicates of non-existing machines are contracted to a single manufacturer. For example, the Panel appears to look with favor on the contracts for duplicate machines at Raytheon and makes no particular mention of some of the duplicate machines on contract with the Eckert-Mauchly Corporation. The Panel goes even further on page 43 and recommends that the Harvard Mark III machine is ready for copying even though it does not meet the Panel recommendations of having passed operating tests. If mere existence is a criterion for copying, then the Eckert-Mauchly BINAC would qualify, though it is probably certain that even the designers would not so recommend. If the machine must qualify by passing successful operating tests, the Harvard Mark III has not yet reached that point, and may require substantial changes before it is the type of machine that should be duplicated. It must be remembered that not yet has any large scale digital computer been built which is really suitable and of which a second model is required. Probably the closest approach are the two relay machines which were built for Bell Laboratories, though it can be presumed that no more of these will be constructed.

7. Status of the Computing Field

The Panel seems to give entirely too much attention to computing machines as final products which can with assurance be purchased to specifications at closely estimated costs. Underlying many of the Panel comments and recommendations is the theme that computers can be purchased

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like completely developed commercial hardware items. This is not true. No large scale electronic digital computer has as yet operated in a satisfactory, trouble-free manner. So long as this is true, the field must be looked upon as being in the research and development stage. Many of the difficulties which are now encountered in the field of digital computers can be traced to this feeling that they are already developed items ready for particular forms of final packaging and product engineering.

This concentration on the final product shows up on insistence for detailed specifications whose possibility of successful realization is still in doubt. It also shows up in some of the recommendations for handling component research separately from computer development laboratories and in the suggestion for standardizing input-output procedures and machine coding. Parts of the report seem to presume that Government groups for coordination and direction of computer development/^{can} be assembled with high competence in the field to take over the detailed direction of the work, the setting of specifications, etc. This is rather unlikely since few such persons are available anywhere and even fewer are to be found in the Military Establishment. The Panel should recognize the great dependence which the Military Establishment must place on the ability, character, and honesty of the contractors they select for this work. In a field involving new and unknown aspects, the contracting agency is highly dependent on the attitude of the contractor and mutual confidence and sympathy must exist. Again, this is unlike the circumstances where items can be purchased to rigid specifications and tests.

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8. Component Research

Among the general recommendations of the report, one might disagree most strongly with the Panel's recommendation on component research. The Panel recommends separation of component development from machine design and construction. This would be possible only if the Panel is willing to accept a still slower pace of computing machine development than now exists. For reasonably rapid progress the separation of components is not a workable system. Realistic specifications cannot be set. Continuity between research activity, development activity, and final design is lost. More important, the motivation for the development is reduced. In the past it has been possible to await component development in other fields and adapt these components to computing machines. Even, however, in relay computers, where relays are well developed in the telephone industry, it was found necessary at Harvard to design the relays before building the Mark II computer. Present computers rely heavily on components such as crystals and delay lines which were developed for use with radar during the war. However, there are few examples of components used principally in digital computers being developed anywhere except in connection with machine design. Unrelated development may be unrealistic and be done to inadequate specifications.

Separated component development will lack motivation even more than separated theoretical research which the Panel treats on page 21. Specifications for components are really part of a system study and probably cannot in general be established apart from the machine. It would be a rather

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unusual industrial procedure to have the component developed quite separately from the final product. The automotive company usually sponsors its own engine and hydraulic transmission research. The telephone company develops its own relays and long distance amplifying equipment.

These comments, of course, do not relate to purely basic research in the field of computing machine components. The main purpose of basic research is to find new ideas. For example, the work at the Mellon Institute in searching for new fundamental types of storage phenomena can be done independently of machines and must be done where a competent individual is available. This is, however, the most basic of fundamental research and probably not what the Panel means by component development.

The Panel suggests that an experienced manufacturer of cathode ray tubes could develop special tubes for high speed memories. The history of storage tubes shows the reverse. Government supported storage research at Dumont, RCA, the Electronic Tube Corporation, Raytheon and General Electric has not resulted in computer tubes. Three electrostatic storage tubes are now promising: The Selectron, has been developed privately by RCA; the MIT storage tube has been developed by an organization new to the field of vacuum tube work; the F. C. Williams tube is the product of an electrical engineering professor's laboratory. Individual persons are more important than the general experience of the organization. Manufacturers may put their better men on commercial projects, such as television, to the detriment of Military Establishment development.

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Except by integrated component development, financial support and cost can not often be justified. Doing good component development is more expensive than commonly realized. Failure in the above mentioned vacuum tube projects can probably be traced to insufficient and discontinuous support of the work by the Military Establishment. Only if the work is an integrated part of a program leading to final equipment can the proper continuity and support for component development be accomplished.

9. Contractual Difficulties

The Panel overlooks some of the important difficulties which have been encountered by various projects. One might cite the very difficult conditions which the Military Establishment has imposed on the Eckert-Mauchly Corporation. The Military Establishment has demanded machines to final specifications built on fixed cost contracts with unrealistic delivery dates. The Company is, of course, a party to accepting any such contract but had it insisted on realistic conditions it would have certainly been rejected by the contracting agencies. Here, as elsewhere, the insistence has been on machines as final products rather than first starting with a sound basic program that can eventually lead to the proper results.

10. Institute for Advanced Study

The Panel criticizes the reporting of work at the Institute for Advanced Study. It appears that the Panel may be over optimistic about the technical status of the actual machine and equipment designs there. However, the Panel is rather unjust in not recognizing the very excellent reports

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which the Institute for Advanced Study has written in its field of greatest competence. The Institute for Advanced Study has made a major contribution in the general field of machine logic and the theory of digital machine application. It is unfair to them not to recognize this. Most digital computers being developed at the present time show the imprint of their thinking in one way or another. The present staff of the Institute for Advanced Study has had a major influence on the logical characteristics of the serial type computers as well as parallel type computers.

11. University of Illinois

The Panel questions the wisdom of proceeding with work on the University of Illinois ORDVAC computer. Before disrupting such a program it might be well to make another more careful investigation of the engineering capabilities of each group. There is a possibility that the University of Illinois copy might be completed before the original.

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