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Memorandum M-1444

Digital Computer Laboratory
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SUBJECT: TIME SCHEDULE FOR WWII COMPUTER

To: J. W. Forrester

From: N. H. Taylor

Date: April 3, 1952

The following schedule outlines the plan to obtain a WWII computer in the minimum amount of time - January 1, 1955 - and gives the dates on which certain decisions must be reached in order to guarantee that we can achieve such a result.

This proposal assumes that the machine will consist of the following:

- 1) Magnetic memory
- 2) Vacuum-tube arithmetic element
- 3) Magnetic shifting-register type of control
- 4) Magnetic drum terminal equipment

Six groups will have to be formed, each with a definite specification:

Group I - Memory
Group II - Arithmetic Element
Group III - Control
Group IV - Terminal Equipment
Group V - Logical Design and Systems
Group VI - Mechanical Design

Group I - Memory

The first group (Memory) is reasonably well-formed and can probably meet this objective more easily than any of the others. By adding a few junior engineers to the existing nucleus, the program, as indicated on the schedule, can probably be met.

Group II - Arithmetic Element

The second group (Arithmetic Element) represents more of a compromise. By June 1, 1952, a decision on the transistors and magnetic materials must be made. A negative decision will necessitate resorting to vacuum-tube technique.

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Two problems will immediately arise:

(1) The specification of such a unit by the logical design people will have to be finished by this June first date in order that the electronic circuit people may have some definite specification toward which to work. Just what this means to the logical design group will be covered later.

(2) The present personnel working on arithmetic type of circuitry are 100% new, inexperienced people and find themselves without any of the WWI circuit background. The major problem will be that of teaching these designers the pitfalls with which one is confronted when thinking in terms of vacuum-tube circuitry.

Group III - Control

This group has a somewhat more difficult problem.

First, there is no one in the group.

Second, the logical design activity has not matured to a point where we can intelligently decide just what sort of control we need to handle both the internal workings of the computer and the external functions of the terminal equipment.

Group IV - Terminal Equipment

Another list of problems.

First, there is no group.

Second, the problem cannot be well-defined until a little more experience is gained from the Cape Cod experiment.

Third, the logical design group is just beginning to be introduced to the nature of the problem as far as terminal equipment is concerned.

Group V - Logical Design

Since the general specifications for all of the above activity must emanate from this logical design section, it is evident that the activity in this area must reach a point of decision ahead of any of the other groups. The group is in its formative stage with only one WWI engineer training the others. This fact leaves the burden of making decisions as to the type of orders, machine speed, machine capacity, and general lay-out of the system to others in the Digital Computer Laboratory not associated with the Logical Design group.

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Decisions which will have to be made certainly by the end of this summer are the following:

How large an internal memory do we want?

How complicated an arithmetic element should we build from vacuum tubes?

What kinds of arithmetic operations should the computer be able to do?

What provision should be made for communications within the computer between elements?

How large a control switch should be provided - 64-position, or larger?

Is the present concept of program timing plus special commands for each order the optimum solution for the WWII system?

Is the shift-register type of control as good as it seems on a first investigation?

How much buffer memory will we need in the terminal equipment?

Should any arithmetic operations be associated with the terminal equipment, or should one arithmetic element do the full job?

Group VI - Mechanical Design

At present this is non-existent. It should be formed as soon as we can find the personnel.

General Comments:

As it will be impossible to make all of the above decisions at the same time and difficult to make them soon enough to allow the design of the hardware to be frozen by, let us say, June, 1953, it will probably be necessary to incorporate enough generality and flexibility in the arithmetic element, control, and terminal equipment sections of the machine to allow for considerable change in specifications as the nature of the problem develops. For these reasons, it is rather apparent that some of the decisions along the line will have to be rather arbitrary in nature. Optimum or not, June, 1953 is a deadline for all decisions, with the preliminary, which affect the actual circuitry, made by June or July, 1952.

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Conclusions:

This program is feasible if five things can be done:

- 1) Provide a group leader for the Control Group III,
- 2) Provide a group leader for the Terminal Equipment Group IV,
- 3) Help the Logical Design Group V to make decisions on the questions raised above,
- 4) Form a Mechanical Design Group with a strong, experienced designer as its leader,
- 5) Carry out the Procurement Drawing and Construction phases of the effort in the one-year period allotted.

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