Digital Computer Laboratory
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SUBJECT: WWII BLOCK DIAGRAMS MEETING OF APRIL 10, 1952

To: WWII Planning Group

From: W. A. Hosier

Abstract: This report summarizes the discussion for the benefit of those who may wish to trace the development of thought on this subject.

Present: D. R. Brown, G. R. Briggs, S. H. Dodd, R. R. Everett, J. W. Forrester, H. R. J. Grosch, W. A. Hosier, R. C. Jeffrey, J. Jacobs, R. P. Mayer, W. Ogden, I. Reed, N. H. Taylor

N. Taylor remarked in opening this meeting that he, Jeffrey, and Reed had been discussing the general problem of symbolic logical analysis of computer components by methods set forth in Jeffrey's report E-458. Although not agreeing to part of the group's working full time in this direction, Mr. Forrester conceded that it would be a good idea to subject operations and components to such analysis from time to time, as they come up in the group's discussions.

Mr. Taylor also called attention to the exposition of the air defense problem to be given by R. Walquist at the WWII meeting April 11.

The major part of this meeting was given over to an exposition and discussion of the "single register" computer by R. Mayer and J. Forrester. Their conception of such a machine is set forth in detail, with traffic diagrams of the principal orders, in Mayer's report E-459.

By "single register", they mean "single flip-flop register" or "single vacuum-tube register" in this case, since all modifications discussed did have other "registers" (e.g. Program Counter, Accumulator, Shift Counter) which were nothing more than special registers of the magnetic memory, selectable by the control switch without going through the storage switch.

Both modifications discussed incorporated the same magnetic memory (switching time assumed 2 microseconds) with destructive readout and rewrite (Mr. Mayer had prepared, but did not present, a similar discussion

of a machine with non-destructive readout). Also, both were distinguished by introducing as storage selection matrix a switch of the type proposed by K. Olsen (see M-1282), the essential virtue of which is that once set up for read-out by the flip-flop of the storage switch, rewriting (or read-in of a new word to the selected address) can be accomplished with a single pulse to the selected memory register at leisure, after the flip-flop is cleared or re-set. Finally, both made use of magnetic stepping registers to do the actual issuing of command pulses; these registers, once triggered by the control switch, automatically maintain the sequence of command pulses and complete the order without further need for the control switch.

The two modifications differed mainly in that one had a separate flip-flop register for its "selection register" (combination of control switch and storage switch); the other had a common flip-flop register both for selection and for arithmetic operations, making use of a gate generator or pulse stretcher to store an instruction briefly between flip-flop and selection matrix and thus free the flip-flop for earlier clearing. With a clock-pulse rate of 1 megacycle, the operations ca and ts require 12 and 13 microseconds, respectively, in both systems; "multiply" becomes quite lengthy and probably justifies additional equipment.

It was pointed out that the delay introduced by the pulse stretcher in the second machine could equally well have been placed on the read-out side of the memory.

Two or three other questions were raised at the end of the meeting:

I. Reed proposed, as an illustration of the application of Boolean methods (symbolic logic) to computer design, that a computer could be built using only 4 orders: "subtract", "transfer to control" (analogous to cp or sp), "transfer back to memory and shift right", and "halt". It was suggested that he present this in greater detail.

H. Grosch suggested a survey of what might be called "clever arithmetic techniques" such as the multiplication method used in some machines and known as "criss-cross"; further, that a student might profitably be assigned such a survey as a thesis subject.

N. Taylor pointed out that two or more relatively simple registers might be profitably substituted for one elaborate "universal register" in some cases.

SIGNED W. A. Hosier

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WAH/cp