

LCM

Digital Computer Laboratory
Massachusetts Institute of Technology
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SUBJECT: GENERAL NATURE OF WORK INVOLVED IN USING A DIGITAL COMPUTER AS A CONTROL ELEMENT IN PHYSICAL SYSTEM

To: Candidates interested in applications work

From: David R. Israel and Robert A. Nelson

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Abstract: The use of a high-speed digital computer as the control element in a physical system involves information processing rather than complex mathematical computations. The work particularly requires an appreciation for physical systems and equipment.

The computer applications work in which we now have openings at this Laboratory involves the use of a digital computer as the control element in a large physical system. This type of application does not make use of a computer for complex mathematical operations; rather it uses the high speed of the machine and the machine's ability to do logical operations to permit it to act as an information-processing element. The computer receives information relative to the state of a physical system and uses this information, together with its stored instructions and data, to determine what instructions must be given to other elements of the system so that the desired course of action is achieved.

An essential characteristic of a digital computer for this type of application is extremely high speed, since the results of the machine's computation or data processing are useful only if they can be applied immediately in the determination of the behavior of the external system. This requirement of high speed is an important reason why the field is an entirely new one, for only recent engineering advances have made it possible to build digital machines with the necessary high speeds. Machines with high speeds and adequate internal memories, such as Whirlwind I, are now being considered for use in situations which have previously come under control of human operators as well as in systems in which the relatively slow speed of human or manual data processing has not previously permitted adequate operation. In both cases, the use of a computer requires an extensive study of the desired system characteristics and the means of obtaining the desired results consistent with the machine's capabilities.

To use a digital computer in a physical system — such as might be typified by civilian air traffic control — one must decide what functions are to be accomplished, decide how these functions will be carried out, and then synthesize a satisfactory system consistent with these decisions. The resulting system must be broken down from its initial expression to a flow diagram showing system operation in a logical-choice form, and then to the basic 32-order code by which the computer is ultimately instructed.

This work requires little or no formal or theoretical mathematics. Much more necessary is an understanding and feeling for a physical system, physical equipment, and physical conditions. Common sense, ingenuity, imagination, and enthusiasm are among the most valuable attributes required. These are doubly important since the work at this Laboratory is experimental, and all work quickly undergoes actual tests on the Whirlwind Computer.

We can use Bachelors, Masters, or Doctors. Experience with computers is unnecessary, since the Laboratory will provide training in computer principles and related subjects.

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