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Memorandum M-1468

Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BOUNDARY CONDITIONS FOR WHIRLWIND II DESIGN

To: Whirlwind II Logical Planning Group

From: Jay W. Forrester

Date: April 29, 1952

At the last meeting of the group it was suggested that a set of minimum boundary conditions and relative values of machine parameters be set to guide logical planning. I have done this as well as possible in a brief time, with the help of Wieser and Israel. Tabulated below are various machine characteristics for the present Whirlwind I followed in the next column by the poorest acceptable performance limits for a Whirlwind II machine. In succeeding columns we have improved performance in steps of equal value to the air defense application. Moving right in any one row (a particular characteristic) gives an equal unit of improvement for each new column entered. In other words, moving from any one box to the adjacent box to the right is estimated to be of value equal to a similar move from any other box.

Note that the two left columns each describe one machine, WWI and a minimum WWII. However, each of the three right columns represents several possible machines since any one, two, etc. up to all six improvements in a column may be chosen. There is only one restriction: in arriving at final characteristics of a machine, values should not be picked in columns more than two units apart. In other words, it will be necessary to move all values into the second WWII column before using any values in the fourth WWII column. This is to prevent a gross unbalance in machine characteristics.

The column headed "Poorest Acceptable Performance" represents the maximum (or minimum) permissible for each quantity. A machine built to these limits would be a useful machine but would not handle the job we desire to handle nor be available as soon as we need it.

The greatest departure between Whirlwind I and the minimum WWII limits lies in reliability and time for completion. In the last column, for example, reliability is ideal. All these figures stress reliability and early completion relatively more in comparison to speed and storage than the standards previously used by the planning group.

The objective is to start thinking of a machine meeting the poorest acceptable performance requirements and to make improvements along any row in a way which gets the greatest accomplishment for the least effort. The figures will be reviewed by the Air Defense group as they get new information and they will be revised as necessary in the future. They provide an adequate set of specifications for present planning work.

JWF/tcw
cc:
Wieser, Israel and Dodd

CHARACTERISTICS	WHIRLWIND I	WHIRLWIND II			
		Poorest Acceptable Performance	Improvement in Steps of Equal Value		
1. Reliability					
a. Scheduled Maintenance time	2* hours	< 1 hour	1/4	1/8	0
b. Unpredicted Down Time	1* hour	< 1/2 hour	1/4	1/8	1/16
2. Completion Time for Operating Prototype	72 months	< 42 months	36 mo.	30 mo.	24 mo.
3. Speed	55μsec per order	< 40 μsec	30 μsec	20 μsec	10 μsec
4. Storage Registers	1000 registers	> 2000	4000	8000	16,000
5. Order Code	As is	Same as WWI	**	**	**

* This is S. H. Dodd's estimate for the maintenance and down time which the computer would require in the future after installation is complete and not including storage difficulties. With the present machine we have 11 1/2 hours of scheduled maintenance per day and 2.4 hours of unpredicted down time.

** These three may be filled by the following three quantities in any sequence:

(a) Trignometric orders plus square root

(b) Provision of a B-box

(c) Automatic orders for correlation