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Memorandum M-851

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Project Whirlwind
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, PART II, May 13, 1949
TO: 6345 Engineers
From: Jay W. Forrester

6.0 BLOCK DIAGRAMS

(R. R. Everett)

A firm decision has been reached as to the orders to be built into WWI. The official orders are listed in E-235 and were derived by slight changes and omissions from previous unofficial lists.

All new serious programing should use only the orders listed in E-235. Every effort will be made to retain these orders without modification. All programs conforming to E-235 should always be useful to WWI.

Since only 22 out of the 32 possible orders have been assigned, new orders may be added in the future. These new orders may simplify later use of the machine but will not change the validity of programs using E-235.

The only exceptions to the official list are the special orders being designed by Adams for use with test storage.

(J. M. Salzer)

The inclusion of ES and of the In-Out Element in the WWI system as well as the change to constant-frequency restoration necessitated several changes. The Clock Pulse Control and the interconnections are affected to the greatest extent. E-235 and M-846 deals with these questions in detail.

A block diagram of the Input-Output Element (B-37178) has been issued. This drawing includes In-Out Control, the

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6.0 BLOCK DIAGRAMS (continued)

In-Out Register and the Comparison Register. It incorporates the latest changes; specifically the registers shift to the left rather than to the right as first planned. Incidentally, this change did not affect the discussion of Input Output Checking, E-225 in any important respect.

(R. P. Mayer)

Five block diagram sketches have been drawn for Electrostatic Storage. These drawings represent present suggestions only, but the final decisions are likely to be in close agreement. The numbers are as follows:

- 800 Electrostatic Storage SB-37186
- 108 ES-TS Selector. SB-38183-1
- 810 ES Control. SB-37185
- 820 ES Deflection SB-37182-2
- 830 ES Sections SB-37184

Final timing diagrams for the accepted orders for WWI are being drawn up, along with a chart showing connections for the Control Matrix Output Gates. These drawings will not include connections for ES at this time, but they are influenced by the designs for ES and have been held up until the ES block diagrams could be completed. The Timing Diagrams for all the accepted orders are on drawing SB-37181, while SB-37180 includes the Timing Diagrams for temporary orders to be used with TS, etc.

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7.0 CHECKING METHODS

(G. C. Sumner)

A meeting of the checking and trouble location group was held May 2. The two most important things that were discussed were as follows:

1. It was agreed that it is probably worth while to provide a special checking order to compare a given number with a computed number placed in the check register. The main advantage is that by using this order the arithmetic element would not be required to check itself.

2. The possibility of providing a check on voltage variation was discussed. If such a check is needed, it was concluded that it could be obtained by extending the variation so that an error was sure to occur. The failure to receive an error signal in this range would indicate faulty operation of variation equipment.

(C. W. Adams)

A rough draft of a list of variable voltage lines, showing every tube affected by each line, has been completed. Since corrections and revisions will be in order for some time to come, no final form is planned at this time. The rough draft, on 17 A-sized ozalid prints, can be obtained from C. Adams.

While work on an overall block schematic has been suspended, block schematics of the entire control switch and matrix and of toggle switch storage have been made by combining and augmenting existing schematics, and a similar drawing will be made of the master clock when the flurry of changes subsides. Marked up drawings indicating the variable voltages on each tube in these schematics are contemplated.

(G. Cooper)

The exhaustive investigation of test "operation zero" has been discontinued. Although this particular sequence will undoubtedly be quite useful, it is felt that the basic approach involved is not a very fruitful method of analysis. For, it essentially requires a knowledge of all possible failures of a large portion of the computer in order to determine those faults which will be detected by a given sequence. Nevertheless, the work done has not been wasted, for it is now known that operation of (program timing only) will indicate certain faults, regardless of whether faults in those parts of the computer not investigated will be detected.

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7.0 CHECKING METHODS (Continued)

The last stages of this investigation considered the possibility of coding qt as operation 31 or operation 1. It was quite unrealistic to think of using operation 0 for qt, since this code has been reserved for ri in WWI. The use of operation 31 seemed to offer advantages inasmuch as we might start by setting most flip-flops to one by use of the computer complement line. Unfortunately, it would not be possible to take advantage of this feature, because some of the control flip-flops (e.g., multiply control, divide control, etc.) would be placed in an abnormal state. In order to avoid this, we are led to use a selective complementing, in which the only advantage would be that arising from the fact that the control switch is given more of a workout by reading all ones into it. This is not of major importance at all. The use of operation 1 seems preferable, for this will be the code for the rs operation in WWI. The only difference between the proposed rs and qt is that rs will perform the additional function of stopping the reader-recorder. It seems only logical to take advantage of this situation.

The approach to be tried now is based on marginal checking. The assumption being made is that the variation of the voltage on a particular line will cause failures to appear only in equipment affected by that line. The remainder of the computer is assumed to be operating correctly. A program is then devised to check for any of the limited number of failures occurring in that equipment.

As a starting point, the lines affecting the step counter are being considered. It appears that failures occurring here will generally manifest themselves by incorrect counting. The results of incorrect counting. The results of incorrect counting will be either an end-carry after an incorrect number of steps, or no end-carry at all. If an end-carry is not obtained a prolonged stop-clock will result, which may be indicated as proposed in E-225, pp 12-13. If the end-carry is present, it will mean an incorrect number of steps have been performed. By judicious use of the qt operation in conjunction with the qc operation (checking through use of the check register), it should be possible to determine the number of steps performed, provided they do not exceed a certain amount. Further thought must be given to the case in which this limit is exceeded. The complete details have not been worked out yet.

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8.0 MATHEMATICS

(P. Franklin)

A report on the use of film input for the multiplication of two large matrices has been completed.

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9.0 FACILITIES AND CENTRAL SERVICE

9.1 Publications

(J. N. Ulman, Jr.)

The following material has been received in the Library, Room 217, and is available to 6345 Personnel.

6345 Reports

<u>No.</u>	<u>Title</u>	<u>Clas- sified</u>	<u>No. of Pages</u>	<u>Date</u>	<u>Author</u>
SR-17	Summary Report No. 17	Conf.	16	2-49	
R-147	The Pulse Standardizer	-	10	4-11-49	R.R. Rathbone
E-230	Research Tube RT50-1: Construction and Processing	-	1	4-25-49	M. Florencourt
E-231	Purpose and Operation of Research Tube RT51	-	4	4-28-49	H.E. Rowe
E-232	Results of Tests on RT47, RT47-1 and RT50, Beam-Analyzer Tubes	-	9	5-2-49	J.H. McCusker
E-233-1	Status of Vacuum Tube Studies	-	6	5-9-49	H.B. Frost
E-236	Storage Tube ST87: Construction, Processing and Initial Testing	-	2	5-3-49	M. Florencourt
E-237	Storage Tube ST88: Construction, Processing and Initial Testing	-	2	5-3-49	M. Florencourt
M-829	Glossary of Storage-Tube Terms and Addition to Glossary of Computer Terms	-	12	4-6-49	{S.H. Dodd {M. Florencourt
M-840	A Preliminary Discussion of the Possibility of Using Transistors in High-Speed Computers	-	8	4-26-49	R.L. Sisson
M-841	Bi-Weekly Report, Part I, 4-29-49	Restr.	15	4-29-49	
M-842	Bi-Weekly Report, Part II, 4-29-49	Restr.	15	4-29-49	
M-843	Glass-Sealing Procedures for Storage Tubes - No. 2	-	5	5-4-49	W.E. Pickett
M-844	Display Unit	-	1	5-4-49	H. Fahnestock
M-845	Master's Thesis Research Proposal: Servomechanisms	-	5	5-10-49	J.E. Pierson
A-42-2	Bi-Weekly Reports	-	6	5-10-49	J.W. Forrester
A-85	Library Organization	-	8	4-28-49	V. Andry
A-86	Production Engineering	-	2	5-3-49	H. Fahnestock

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Reports and Publications (Continued)

<u>No.</u>	<u>Title</u>	<u>Author</u>
<u>Library Files</u>		
.004	European Scientific Notes, March 15, 1949	London, ONR
47	Technical Information Pilot, Number 2761-3080	Lib. of Congress
173	Project Hermes Report No. 49A0508; The Design and Operation of a Waveguide-Type Absorption Modulator	G. E. Company
180	Document Office Bulletins, April 12 and 26	(Research Lab of { Electronics, MIT
205	Interim Engineering Report on Daylight Viewing; Presentation; Period 1-30 June, 1948	(Airborne { Instruments Lab Cornell Aero Lab
217	The Flight Signal Decoder, January, 1949	
237	Project Rand; U.S. Air Force; A Statistical Theory of Target Detection by Pulsed Radar; 12-1-47	Rand Corp.
269	Amplitude Errors Resulting from Speed Differences Between the Recording and Reproducing of Frequency-Modulated Sub-Carriers; 12 April 1949	(Naval Air Missile { Test Center NAMTC
270	Telemetering of ASM-N-2 (Bat); 30 March 1949	
271	Investigations for Design of Digital Calculating Machinery; Computation Laboratory; Progress Report No. 1	Harvard Univ.
272	Skylark Project; Survey of Activities; October - December, 1948	Fairchild Corp.
273	Summary of Characteristics: Magnetic Drum Binary Computer; 30 November 1948	(Engr. Research { Assoc. Inc.
274	Publications of the Jet Propulsion Laboratory, February 1949	Calif. Inst. Tech.
559	Technical News Bulletin, April, 1949	Nat. Bur. of Stand.
<u>Books</u>		
	Smithsonian Physical Tables	F.E. Fowle

9.2 Standards, Purchasing and Stock

(H. B. Morley)

Standards - At the last Standards Committee meeting it was decided that components peculiar to Electrostatic Storage construction for WWI should be included in the Standards Book. This will entail numerous revisions and additions, which will be prepared as information becomes available.

New Standards issued and/or assigned:

S7.411-11 Control Switch Matrix Panel
 S7.412-3 Test-Storage Switch Matrix Panel
 S7.413-4 Standardizer Amplifier Panel
 6.195-3 Filament Transformer, Storage Tube, WWI

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9.2 Standards, Purchasing and Stock (Continued)

(C. W. Watt)

Consideration is being given now to the additions necessary in the standards book to take care of the special requirements of the storage tube circuits. Ceramic capacitors, high-voltage capacitors, certain tubes, and some special connectors and transformers are now being considered. Sample filament transformers for ST filaments (6.3 v, 3A; 7500 v D.C. test), Spec. No. 6.195-5, have been requested, and quotations are being obtained. A 26 v, 10A transformer for 715 tubes is also being quoted on. Special high voltage connectors have been ordered from IPC. An attempt will be made to eliminate the 7.0 series of component spec sheets for WWI components, and to consolidate these "preferred" parts with a "WWI Preferred Parts List". This will simplify usage and maintenance of the standards book.

(H. B. Morley)

Purchasing - Tentative specifications have been written and bids requested for the Storage Tube Filament Transformer. Case size, mounting dimensions, and terminal arrangement will be similar to the standard WWI filament transformer.

Small quantities of ceramic disc capacitors in 1000 and 5000 mmfd. sizes have been procured for experimental stock.

Investigation is being made of small iron-core RF chokes with a view to supplementing the present standard series of small size chokes.

9.3 Construction

(H. F. Mercer)

Production Report - Since April 29 we have received the following panels (Production Units) from Sylvania:

- 3 B-Register/In-Out Registers (complete)
- 10 Control Pulse Output Units (complete)
- 6 Control Pulse Output Mounting Panels (complete)
- 6 Filament Transformer Panels (complete)
- 6 Flip-Flop Storage Registers (complete)

With receipt of the above panels, all outstanding orders on Sylvania for WWI Panels were completed.

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9.3 Construction (Continued)

The following units have been completed here since April 29:

Control Switch Matrix Panel
Toggle Switch Storage Output Panel
29 Voltage Variation Panels

(A. Taylor)

WW construction is on schedule with the exception of TSS Switch. This will be about one week late.

(L. Prentice)

Machine Shop - The work load has been light up to the first of this week. We have completed punch and die sets for 6 + 10 prong Jones plugs and the set for the 12 prong Jones plug is nearly complete.

Punch and die sets are complete for 3/4 and 5/8 tube sockets.

Drawings are nearly complete for a collet chuck and most of the small parts are machined.

Work now in progress consists of three small jigs and a frame for rubber model. All machine work for prototype storage tube mount is complete.

Sheet Metal Shop - Work in progress consists of the Alarm Circuit panels, duct work to connect up, 2 precipitrons in storage tube inspection room and the prototype storage tube mount.

We have nearly completed the aluminum and phenolic panel and rework requested by the storage tube test group.

(A. R. Curtiss)

A TV sweep adapter and a pulsed test load for power supplies was constructed and additional work was done on the 10 mc. RF amplifiers.

The following units were breadboard assembled:

Gating Flip-Flop
HVC and HGG Driver Panel for WWI.

A high voltage power supply for WWI, is now being breadboard constructed.

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9.4 Drafting

(A. M. Falcione)

Work Load - Since the last Bi-Weekly report the work load has increased considerably due to change notices, storage tube circuit schematics, and block diagram revisions. Thesis drawings have been completed and delivered to respective engineers. It is expected that the work load will increase within the next few months. The return of Mrs. Sheahan from her three week illness will help considerably. It is also expected that Miss Brunswick will be available on or about June 15th. She has been working at Bldg. 32 for the past 6 months.

The drafting room vacation schedule is distributed over a two month period starting July 5th.

9.6 Time Schedules

(R. A. Osborne)

All detailed time schedules and summaries have been posted through the end of April and copies distributed to interested persons.

A new schedule form C-34063 has been drawn up. This covers the period from July 1949 through June 1950. This form is available in either A or C size.

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