

6345  
Memorandum M-568

Page 1 of 17

Project Whirlwind  
Servomechanisms Laboratory  
Massachusetts Institute of Technology  
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, PART II, AUGUST 6, 1948

To: 6345 Engineers

From: Jay W. Forrester

6.0 MATHEMATICS

(A. Orden)

Began work on coding a WWI program for solution of simultaneous equations.

(C.W. Adams)

Binary-to-decimal conversion programming continued. Preserving accuracy in converting integer binary scale factors to integer decimal scale factors greatly increases the programming required.

(Edgar Reich)

Completed the memorandum on successive approximation methods in linear systems, and presented three lectures on this subject before meetings of the mathematics group.

(Alan J. Perlis)

Gave a seminar on numerical methods of solving integral equations. Have extended iteration methods to the more involved equations of the first kind.

(J.W. Carr)

Continued work on two-register (or multi-register) coding methods as applied to complex numbers and to various vector manipulations such as dot and cross-products, etc.

UNCLASSIFIED  
RESTRICTED

6345  
Memorandum M-568

Page 2

6.0 MATHEMATICS (cont.)

(C.W.Adams & R.P.Mayer)

Three tables useful in decimal-binary conversions have been compiled and ditto'd. The tables are:

- (1) Table of Powers of Two from -20 to 51.
- (2) Table of Binary Equivalents from 1 to 1,000,000 (in convenient steps).
- (3) Table of Binary Equivalents (to 40 places) from .00001 to 1.00000 (in convenient steps).

(P. Rabinowitz)

Investigating Nystrom adaptation of Runge-Kutta method for solving systems of second-order differential equations with view to simplifying coding procedure.

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## 7.0 INPUT AND OUTPUT

### 7.1 Eastman Kodak Recorders

(H.R. Boyd)

R. D. O'Neal, T. Cochran, and perhaps A. W. Tyler of Eastman will visit the laboratory during the week of August 23 to discuss the film units, particularly the electronic sections.

Two copies of the Eastman Progress Report #1, entitled "Photographic Digital Reader-Recorder" have been received in the laboratory. One copy will be in the library shortly, and I have the second copy.

No new schedules have been received from Eastman yet for the period of July '48 to July '49.

### 7.4 Magnetic Recording

(G. Cooper)

A study of the equipment required for the Magnetic Recording Research was made by E. S. Rich. The unit previously referred to as the Gate Generator will be used to generate the actual signal which is to be recorded. It will be actuated by the timing signal (obtained by reading it off the tape) and will feed directly into the recording head. The work on the breadboard model of this unit is complete. It is believed that the unit as it exists will be satisfactory for this application.

The device for generating the signal to be recorded on the timing track was considered next. The recording unit will be operated by this timing signal indirectly. It will be read off the tape and passed through an amplifier and shaper before being fed to the recording unit. The initial source of signal is the synchroscope. Its output trigger will be part of the timing signal and will serve to synchronize the sweep and also generate the remainder of the timing signal. This will be accomplished by using two Gate & Delayed Trigger Generators in cascade to produce a delayed gate from the initial trigger. The timing signals will consist of a series of triggers occurring at an adjustable repetition rate for the duration of the gate.

For this purpose, a "ringing" circuit in conjunction with a pulse-shaping circuit was considered. It was found that the required range of repetition frequencies could not be covered with any readily available physical components. As a result, the Gated Free Running Multivibrator was devised for this purpose. This unit has been designed and a breadboard is now being constructed.

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7.4 Magnetic Recording (cont.)

(E. S. Rich)

A system layout for the pulse-recording investigations has been worked out. It is intended to use a separate recording channel for timing signals. This will permit a study of the possibility of altering or erasing a single pulse in a group of recorded pulses. G. Cooper is designing the necessary circuits for producing the timing signals.

The adjustable head mountings which allow the spacing between the head and the tape to be accurately set are being constructed in the machine shop and should be completed in a few days.

7.6 Output Printers

(F.A. Foss)

Several life tests have been performed on different modifications of the model input and output devices. During continuous printing operation, approximately 40,000 machine operations have been obtained per error. A survey is being made of different teletypewriter applications such as the Bell Laboratories relay computers.

RESTRICTED

6345  
Memorandum M-568

Page 5

**8.0 STORAGE TUBES****8.1 Tube Construction and Testing****8.1.1 Tube Construction and Processing**

(E.S. Prohaska)

Final testing of the thermocouples in an evacuated envelope has been postponed because the oven schedules are filled for the next week.

The 0.015 inch dia. Kovar has been received. A check test on the Kovar-Tungsten thermocouple will be run next week. Preliminary design computations on a new oven are being made.

(R. Shaw)

Two signal plates have been prepared with sharply-defined beryllium mosaic surfaces. The thickness and uniformity of the beryllium was not considered satisfactory for storage tube use. It is believed, however, that sufficient time for evaporation, and an evaporating tube structure that will maintain proper alignment will eliminate these difficulties. It is possible that useable surfaces will be available the week of August 9. If so, these will be assembled into large storage tubes.

Another large storage tube having a calcium tungstate surface is also scheduled.

(F.H. Caswell, T.F. Clough and P. Youtz)

The principal work of the tube construction and processing group was toward improving our evaporation techniques and producing a mosaic suitable for a large storage tube.

This effort has been successful to the degree that we now have for the first time a well-defined 5" mosaic which indicates the feasibility of our newly-developed method. The mosaic is, however, thinner than is desirable.

UNCLASSIFIED  
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RESTRICTED6345  
Memorandum M-568

Page 6

### 8.11 Tube Construction and Processing (Cont'd)

The method, in essence, consists of a small vapor source evaporation cup, shielded by a mica radiation shield mounted  $3/8$ " about the source. Both RF induction and a unique method of resistance heating have been employed for vaporizing the beryllium. Reproducibility and improved coating thickness will next receive attention.

Evaporation studies using a single sloping wire as a mask have determined that it is possible to evaporate a shadow with the above method when the wire is as much as  $1/8$ " above the surface.

Work on beryllium strip tubes has continued, resulting in a tube being successfully processed and delivered to test.

(H. Klemperer)

Condenser Storage Welder. Assistance was given to procurement, installation, and operation of an adjustable 200 microfarad 3000 volt condenser discharge welding power supply and a welding head, the electrode pressure of which is spring adjusted, independently of the foot pedal. The system is now operating in the dust free room.

### 8.12 Storage Tube Testing

(C.L. Corderman)

Tests on ST 32 have been continued to determine the stability of the surface under different conditions of holding beam density and collector potentials, in order to check more fully the "screening" action of a highly positive collector.

Two units were added to the test setup to improve the testing procedure. These are an RC circuit to vary the rise in signal plate voltage and a d-c amplifier which operates a control relay when the surface switches from cathode to collector potential.

UNCLASSIFIED  
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RESTRICTED

6345  
Memorandum M-568

Page 7

8.12 Storage Tube Testing (Cont'd)

(J.S. Rochefort)

Memorandum M-563, "Holding Gun Stability Tests on ST 32 (June 3 to July 9, 1948)", has been issued. Testing techniques for investigating the "time effect" described in this memorandum have been considered and a possible test procedure has been formulated. It is hoped that tests run on RT 37 will throw additional light upon the results of tests on ST 32.

(J.H. McCusker)

RT 37, a beryllium strip tube, was tested. At  $V_k = -105$  volts, one strip and its D were floating at collector potential, 150V. The potential of the other strip and its D was varied until the floating strip triggered to cathode potential. The floating strip did not trigger until the other strip was below cathode potential.

Then the floating strip was set at cathode potential. The potential of the other surface was increased to about collector potential before the floating strip triggered to collector potential.

It was found, however, that leakage between the strips was responsible for the triggering.

8.13 Storage Tube Demonstration

(H. Klemperer)

Television Readout of Storage Surface. Assistance was given to procurement and adaptation of TV set. Image of storage plate charge distribution appears on TV screen. Adjustments in Video Amplification system are underway to remove undesirable echoes.

(R. Sisson)

A Belmont television set has been adapted so that it may be used to present a picture corresponding to the charges stored on the target of a storage tube.

RESTRICTED

UNCLASSIFIED  
RESTRICTED

6345  
Memorandum M-568

Page 8

### 8.13 Storage Tube Demonstration (Cont'd)

The equipment has been developed to the point where the presentation is clear, and only a few minor defects are yet to be overcome. The equipment is so arranged that it is relatively independent of the Demonstrator itself, and may be used with other equipment where it is desired to see the charged areas of the target in the storage tube.

At present, switching between television scanning and use of the storage tube for writing spots is done manually, but provision could be made so that the television scanning would switch off automatically when reading or writing on the target surface.

### 8.2 Storage Tube Research

#### 8.24 Holding Gun Design

(H. Klemperer)

Life test was set up and started. Nothing to report during first 250 hours.

### 8.3 Unclassified

(M.I. Florencourt)

A memorandum on resistance tests made on beryllium-evaporated surfaces is in preparation.

Storage tube drawings are again being held up by removal of a draftsman from the work.

Polishing of aluminum targets before anodizing has introduced problems in cleaning them. The emory cloth used evidently leaves particles embedded in the soft aluminum and they are difficult to remove. The particles brought up by the hot NaOH do not dissolve in  $\text{HNO}_3$ , but must be wiped off with cotton before cleaning can be completed.

UNCLASSIFIED  
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6345  
Memorandum M-568

Page 9

8.3 Unclassified (continued)

(S. H. Dodd)

Work is progressing on the preparation of time schedules. They should be completed by the end of next week.

Block diagrams are being prepared for automatic read-write equipment for higher prf storage tube testing. This equipment will be all electronic and will supplement the relay equipment.

8.4 Deflection Circuits

(L. J. Nardone)

The deflection-voltage generator has operated continuously for the past two weeks. Several troubles have developed and investigations are being made to locate the causes. Only short interval shut-downs have been required.

At present, the "single-pulse operate" is erratic and sensitive to slight drifts in the timing pulses from the test equipment. Re-timing of pulse sequences temporarily corrects this trouble.

Other trouble is encountered in the horizontal deflection-voltage generator. When the unit is turned on each morning, the horizontal deflection positions are not evenly spaced. However, as the unit warms up, these variations decrease and the horizontal deflection positions slowly drift into equally spaced intervals.

UNCLASSIFIED  
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RESTRICTED

6345

Memorandum M-568

Page 10

10.0 TRAINING

10.1 Seminar Series

(E. Blumenthal)

On Wednesday, July 28, another block diagram seminar was held in the basement lecture room. E. Blumenthal discussed the mechanization of WWI orders.

On Wednesday, August 4, F. Foss described the application of teletype equipment to the input-output system of a parallel computer.

UNCLASSIFIED  
RESTRICTED

UNCLASSIFIED  
RESTRICTED

6345  
Memorandum M-568

Page 11

11.0 FACILITIES AND CENTRAL SERVICE

11.1 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>No. of Pages</u>	<u>No. of Drwgs.</u>	<u>Date</u>	<u>Author</u>
R-139	Vacuum-Tube Life	43	35	6-1-48	(D. R. Brown (M. H. Hayes (J. J. O'Brien
E-126	Scope Synchronizer	3	1	7-21-48	R. L. Best
E-131	Testing of B-Register/In-Out Register, Digit Panel	9	3	6-29-48	R. H. Gould
E-136	Testing of Bus Driver Panel Prototype	4	7	7-29-48	R. H. Gould
M-465	Proposal for Restorer-Pulse Distribution	3	1	7-7-48	G. G. Hoberg
M-478	Circuit Schematic Component Serial Numbers	1	-	6-15-48	A. M. Falcione
M-547	Design of RT34 Holding Gun	5	1	7-21-48	H. Klemperer
M-548	6345 Personnel	3	-	7-22-48	
M-549	Comment on the Two-Register Method	4	-	7-22-48	C. W. Adams
M-551	Visit to Power Equipment Company, July 2 & 12, 1948	3	-	7-22-48	H. R. Boyd
M-552	Bi-Weekly Report, Part I, July 23, 1948	16	-	7-23-48	
M-553	BiWeekly Report, Part II, July 23, 1948	17	-	7-23-48	
M-554	Eastman Conference of July 13, 1948	4	-	7-27-48	H. R. Boyd
M-555	Demonstration of the Transistor at Bell Telephone Laboratories	2	-	7-27-48	E. S. Rich
M-556	Electronics Group Meetings, June 25, July 2, 9, & 16	2	-	7-27-48	J. J. O'Brien
M-557	Material Requisition Sheet	1	1	7-28-48	C. W. Watt
M-558	Installation of Permanent Fixtures for WWI	2	-	7-29-48	C. W. Watt
M-559	Bus Driver Production Release	1	-	7-29-48	H. Fahnestock

RESTRICTED

RESTRICTED

6345  
 Memorandum M-568

Page 12

6345 Reports (continued)

<u>No.</u>	<u>Title</u>	<u>No. of Pages</u>	<u>No. of Drwgs.</u>	<u>Date</u>	<u>Author</u>
M-560	Clock Pulse Control Lay-out Authorization	1	-	7-29-48	H. Fahnestock
M-561	Register Driver Type II Lay-out Authorization	1	-	7-29-48	H. Fahnestock
M-562	Voltage Variation Panel, Prototype Approval	2	-	7-30-48	C. W. Watt
M-563	Holding Gun Stability Tests on ST32 (June 3 to July 9)	8	12	7-29-48	J. S. Rochefort
A-70	Procedure for DIC Employees Wishing to Register as Special Students for the Fall Term	2	-	8-4-48	R. A. Nelson

FB Reports

88296	Focussing of Electron-beams by Means of Ions	2	-	9-3-46	Dr. J. J. Verschuur
85520	The Use of the Angular Transformation in the Statistical Treatment of Error Frequencies	13	-	9-1-47	P. M. Fitts
89071	Storage Tube Screens (MOS T.R.D.I.(b)) Interrogation Report No. 689	2	1	9-26-47	Dr. R. Müller

Library Files

.004	European Scientific Notes, June 15, 1948				
52	Progress Report for WVI Electronic Digital Computer, June 19 - July 2, 1948				Sylvania
126	Interim Engineering Report on the Study of Voltage Regulator Electron Tubes. Period of Report, August 1-31.				A. E. Jost F. C. Todd H. R. Nelson
127	Visual Design Laboratory Report to Steering Committee				R. F. Nicholson
128	Interim Engineering Report on the Thermionic Emission of Various Materials				L. J. Rueger, V. F. Ragni, V. S. Paccione, F. C. Todd

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Library Files (continued)

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|-----|---|------------------|
| 129 | Spurious Signals Due to Noise in Triggered Circuits, Dec. 10, 1947  | D. Middleton     |
| 130 | Cathode Ray Tube Tester TV-1/U  | Rowe Engr. Corp. |
| 131 | Abstracts Listed under Servomechanisms in the <u>Index to Bibliography of Scientific and Industrial Reports</u> , Vol. 4, Jan. 3 to Mar. 28, 1947 | P. Travers       |
| 133 | Conversion of Binary Pulse Code to Voltage Amplitude (Master's Thesis, 1948)  | E. W. Sard       |

11.3 Purchasing - Stock

(H. B. Morley)

An order is being prepared for an additional quantity of Hipersil cores, to insure ample supply for completion of WWI and test equipment requirements.

The special dials manufactured for us by Waltham Horological have been redesigned with stainless steel dial skirts to eliminate deformation by clamping with dial locks. The new types are being manufactured and will become standard stock items.

Much valuable material has been added to the catalog reference files, and will be indexed and cross-referenced as soon as a replacement clerk-secretary is obtained to do this and other routine office functions.

(R. Fairbrother)

The past two weeks have been spent completing the inventory of "SM" property and rearranging the stockroom to take care of recent changes in the Standards Book.

Some time has also been put into completing the list of tubes used in test equipment, and this list is now nearly complete.

11.4 Electronic Construction

(R. H. Murch)

The following jobs and units are in the Electronic Laboratory for construction:

RESTRICTED

11.4 Electronic Construction (continued)

1. Twenty-five d-c power strips. Nine of these units have been completed.

2. Multiply shift control WWI. This unit is about 35% complete.

3. Divide error and sign control WWI. This unit is about 40% complete.

4. Fifty d-c patch cords.

The work load in the Electronic Laboratory is as follows:

2 WWI prototype technicians have work scheduled for 8 weeks.

5 technicians have a work load of about 2 weeks.

(Al Taylor)

Test equipment now under construction includes Gate and Delay Units, Register Panels, Coders, Gate Panels, Pulse Mixers. The Voltage Calibrator and Pulse Standardizer prototypes have been constructed.

Work is continuing on the Panel Selection unit.

(F. H. Caswell)

The electrolytic tank has been moved from Room 226 and set up in the storage tube area in the basement in Room 026.

A high current, low voltage power supply has been constructed for resistance heating evaporation tubes.

A T.V. sweep adapter has been assembled for use with the T.V. unit in storage tube tests.

Marinite heat shields were installed on Vac. systems 1 and 2 and on the portable annealing oven.

One d-c outlet channel for a 36" relay rack is partially completed.

Two benches are being wired for standard d-c voltages.

One trigger mixer is under construction

Technician work load continues to be heavy.

RESTRICTED  
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6345  
Memorandum M-568

Page 15

11.5 Drafting

(A. M. Falcione)

With the change from development to the construction on WWI, the mechanical drafting load has increased. It was found that the present mechanical drafting standards were not adequate to meet the requirements. Mr. A. Lofgren was assigned the task of writing new standards. With the view in mind of using the revised standards for both laboratories, a meeting was held on Wednesday, 28 July, to discuss policies and procedures to be incorporated in the standards. The meeting included the following: F. Hutchinson, J. Aitken, H. R. Boyd, C. Watt, A. Lofgren, and the writer.

Results of the meeting were as follows:

- a. Standards Form SL-40 will be used for this work.
- b. J. Aitken for Bldg. 32 and A. Falcione for Barta were appointed for dual approval for all standards to be used. Mr. Hutchinson will be the third member of the mechanical standards committee.
- c. The Standards will be subdivided into 3 main sections as follows:

Class 2.00 Drafting Instructions

Class 2.20 Standard Practices

Class 2.40 Reference Information.

It is expected that the first draft will be started during the next week.

Word has been received from Spaulding Moss Co. that Dry Photo Black paper has been discontinued because of difficulties encountered in obtaining certain quality chemicals required for processing this paper. The only other similar paper available is in a Sepia tone. Samples will be requisitioned for trial. If this paper is not adaptable for our needs, some thought will have to be given to other methods for duplicating illustrations.

11.6 Unclassified

(A. Taylor)

The machine shop is now working on the manufacture of storage tube parts and miscellaneous electronic hardware. Parts are being

RESTRICTED

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6345  
Memorandum M-568

Page 16

11.6 Unclassified (continued)

made for the magnetic recording equipment. The backlog contains about 28 hours of work.

The sheet metal shop has been manufacturing chassis for test equipment and WWI prototypes. Also in the sheet metal shop are orders for various parts for the WWI installation. The backlog contains about 11 hours of work.

UNCLASSIFIED

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~~RESTRICTED~~6345  
Memorandum M-568

Page 17

12.0 GENERAL

(H. R. Boyd)

New Non-Staff Personnel:

Stanton East is a temporary Junior Technician. He graduated from high school in Patchogue, New York, and attended the University of Michigan. He has worked for the John Shields Company and Grumman Aircraft. He will be working for the Installation Group.

Edward Karaian is a temporary laboratory assistant A who graduated from Weymouth High School and attended Radio Technical Training School in Cambridge. He served in the U.S. Army. He will also be working for W. S. Rogers in Installation.

Charles C. Park is a temporary student technician who has attended Rochester Institute of Technology and M.I.T. He served for three years in the Army Air Forces and worked at the Gleason Works for several years.

William H. Smith is a temporary laboratory assistant A working for the Installation Group. He graduated from Brighton High School and attended Coyne Electrical and Technical School. He previously worked for Bethlehem Steel and the Boston Safe Deposit Trust Company.

Terminations:

Mrs. Patricia Farrell  
Russell Lawton  
William E. Delmerchi  
William S. Rawlings.

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