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Memorandum M-531

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Project Whirlwind
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, PART II, JULY 9, 1948

To: 6345 Engineers

From: J. W. Forrester

6.0 MATHEMATICS

(P. Franklin)

Worked on numerical integration. Organized program for the summer by the temporarily enlarged mathematics group, M-519.

(Edgar Reich)

Am writing a memorandum on the lectures presented at the "Symposium on Numerical Methods of Analysis in Engineering" at the Illinois Institute of Technology on May 7th.

(P. Rabinowitz)

Studying classical and modern existence and uniqueness theorems for systems of differential equations.

(C. W. Adams)

Study of decimal to binary conversion concluded. Binary to decimal conversion will be reviewed briefly.

(Alan J. Perlis)

The application of an iteration scheme, analogous to Newton's, to the solution of functional equations is being studied.

(John W. Carr)

Completed outline of use of "two-register" floating point method of computing non-simulator problems. Began work on coding Reeves #73 problems.

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6.0 MATHEMATICS (cont.)

(A. Orden)

Formulated automatic subprogram coding for sines and cosines suitable for WWI.

(M. Daniloff)

Memorandum M-395 "Distillation in Vacuo from a Right Cylindrical Toroid" was completed and distributed to Storage Tube and Mathematics groups. Consideration given to solution of systems of differential equations and of integral equations by the method of Newton. Translation of paper by M. Knoll, O. Hackenberg and J. Randner "The Mechanism of Secondary Emission from Ionic Crystals" Z.S.f. Phys. (1944) temporarily held in abeyance because of delays (11 days) in obtaining photostats of the paper.

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7.0 INPUT AND OUTPUT**7.3 Binary to Analog Conversion**

(E. W. Sard)

The thesis report on "Conversion of Binary Pulse Code to Voltage Amplitude" has been written. Typing of the thesis is more than half completed, and all but 4 of the figures have been done. The completed report should be ready early next week.

7.4 Magnetic Recording

(Gerald Cooper)

Work was continued on the development of the gate generator circuit.

7.6 Output Printers

(F. A. Foss)

The output printer equipment has been reassembled in a single rack. The model 19 transmitter distributor has been adapted for reading out of the relay circuits associated with the printing register. This function was previously performed by the Western Union apparatus. The model 19 transmitter distributor can still be used for its original design purpose of tape-reading.

Modification of the sequence timing relay stage has eliminated the need for multipole sequence relays. The operating characteristics of other types of output printer systems are being investigated.

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8.0 STORAGE TUBES**8.1 Tube Construction and Testing****8.11 Tube Construction and Processing**

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

Klamperer's second holding gun tube was constructed and processed satisfactorily. Attempts will be made to reproduce these results in another tube.

Components for another large evaporation tube were constructed and assembled. This tube will be processed next week.

One oven and the associated exhaust system was tied up for over a week with the tests on thermocouples. These thermocouple studies, vacations, sick leave and some work on the 7AK7 tubes reduced the number of tubes constructed during this period.

Leakage resistance between the beryllium and aluminum thru the aluminum oxide was investigated in several new tubes. The results were satisfactory and will be reported in a memo.

Several attempts were made to produce a beryllium strip tube which will simulate our beryllium mosaic tube with leads to each conducting area. The last attempt to produce such a surface was successful and will be put in a tube next week. Similar tubes will be started during the next bi-weekly period.

(R. Shaw)

Most of the inspection equipment ordered for checking tube components has been received.

Drawings have been completed of XT 8 and XT 9, resistance measuring tubes, and ET 54, an evaporation tube. Drawings are in process for ST 35, a new storage tube, and ET 61, an evaporation tube for producing a special mosaic for stability studies.

Preliminary studies have been made of an evaporation tube having a resistance heating element around the cup. By comparison with the type which is heated

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8.11 Tube Construction and Processing (Cont'd)

directly by passage of a current through the cup, this has the advantage that less current flows through the sealed leads. The complexity of the design, and resulting construction difficulties, however, would probably outweigh this advantage.

(E.S. Prohaska)

Tungsten-Molybdenum, Chromel-Alumel, and Iron-Constantan thermocouples have been calibrated up to 590° C against the furnace thermocouple. Plans have been made to carry the calibration to 1100° C in the heat-treatment furnace in Bldg. 32.

A six-point Brown Instrument Chart recorder has been borrowed from another project and is expected to be very useful in recording temperatures automatically while processing the tubes. It has sufficient capacity to record six different temperatures on one setup.

Work has been started on the research tube with eight thermocouples.

8.12 Tube Testing

(S.H. Dodd, J.S. Rochefort, and C.L. Corderman)

Negative stability tests performed on ST 32 during the past two weeks have shown that the dielectric surface changes from cathode to signal grid potential as the holding gun accelerating velocity is increased. This effect was not observed previously, and tests have indicated that the triggering potential is a function of the rate at which the accelerating velocity is increased. At present, an investigation of electrode potentials, test equipment, and test procedures is being made in an effort to determine the cause of this "time effect".

8.13 Storage Tube Demonstration

(S.H. Dodd, J.S. Rochefort, and C.L. Corderman)

Mod 18 is still installed in the Demonstrator and the unit has been operating satisfactorily.

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8.2 Storage Tube Research

8.21 Surface Material Characteristics

(J.H. McCusker and N.S. Zimbel)

RT 27, which has an aluminum oxide target, was tested for its secondary emission characteristics. The secondary emission ratio was a maximum, 2.2, at 450V. The secondary emission ratio decreased slightly with increased collector voltage. At 1950V, the ratio was 1.6.

The secondary emission ratio was greater with a defocused electron beam than with a sharply focused beam. The ratio at sharp focus increased at a lower value of beam current.

RT 27 was initially gassy, but it cleaned up after the tube drew current for several hours.

8.22 Anodizing

(R. Sisson)

6 discs were anodized at a lower voltage (80V) and for 8 hours instead of 5 hours.

4 discs were vacuum fired using equipment in Building 20.

8.24 Holding Gun Studies

(H. Klemperer)

Tube RT 34, incorporating the second holding gun design, as developed from the experiences gained on RT 33, was completed and tested. The test results came up to specifications, so that this development - except for life test, repeatability and procurement questions - may be considered completed.

A memo on the preliminary design (RT 33) was issued and the final report is being prepared.

8.3 Unclassified

(J.H. McCusker and N.S. Zimbel)

Memorandum M-527, which is about the calibration of a 15E Eimac versus pressure, has been written. It was found that seven times the Eimac reading gives the approximate pressure.

(M.I. Florencourt)

A new system for keeping information on the tubes constructed has been inaugurated. As soon as a tube has been assigned a number, it is also assigned a notebook. All work done in connection with this tube is then recorded directly in the notebook as it is done. Where this is impractical or impossible, the work is recorded on interhouse memos and one copy is inserted in the notebook. In this way, all data, drawings, photographs and general information on a particular tube are available in one place, thus facilitating reference work.

Drafting of small storage tubes, research tubes and experimental tubes has been suspended during the draftsman's vacation.

(A.R. Curtiss)

Test runs were made using the pantograph recently installed for use with the electrolytic tank. Ran check of equipotential lines and measured null voltages at probe depths from surface to 3" depth. Additional work needs doing before the pantograph can be used properly.

Considerable time utilized in calibrating thermocouples using vacuum system #2. Bench tests first made with TC hot end in boiling water and cold end on ice. TC's are Tungsten-Molybdenum and Chromel-Alumel. Calibration has been against oven TC which is Iron-Constantan. Curves have been plotted and additional tests are being conducted in Bldg. 32 to obtain calibration points above 600° C.

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8.3 Unclassified (Cont'd)

Routine maintenance continues and work load remains heavy.

4 envelopes were coated July 9, these envelopes assigned numbers ET 37 - ET 40.

8.4 Deflection Circuits

(L.J. Nardone)

The deflection-voltage generator has continued to operate successfully each day from 8:30 A.M. to 5:30 P.M. for the past two weeks. However, slight trouble was encountered in the "single-pulse" operation. The trouble was located as a defective switch and an excessive voltage in the test and display equipment rather than in the deflection-voltage generator. All displays continue to operate properly.

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9.0 SERVOS AND SIMULATION

9.1 Cockpit

9.11 Structure

(E. S. Prohaska)

No further layouts have been made on the cockpit because of vacations. Detailing of parts is continuing.

The report on the cockpit is about 65% completed.

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10.0 TRAINING

10.1 Seminar Series

(R. R. Everett)

On June 30, E. I. Blumenthal continued the series of informal block diagram discussions begun some time ago in the electronics meeting.

The seminar of July 7 was cancelled due to Blumenthal's absence on vacation.

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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>
SR-7	Summary Report No. 7	17		4-48	
SR-8	Summary Report No. 8	17		5-48	
R-137	Life-Testing of Surfaces Suitable for Electrostatic Storage Tubes (Abstract in E-116)	73	24	5-7-48	H. L. Heydt
R-138	Glossary of Computer Terms	12	-	5-48	(J. N. Ulman (G. G. Hoberg
E-114	Characteristics of Standard Flip-Flop Basic Circuit F-FI	8	4	5-21-48	J. M. Hunt
E-121	Gate and Delay Unit	2	1	5-14-48	H. Kenosian
E-129	Tube Life in the Deflection-Voltage Generators	3	-	6-30-48	D. R. Brown
M-395	Distillation in Vacuo from a Right Cylindrical Toroid	15	2	6-9-48	M. Daniloff
M-479	Production Drawings for WWI Units Constructed at MIT	4	1	6-28-48	A. M. Falcion
M-488	Life Tests on Beryllium Storage Surfaces	6	7	6-17-48	H. L. Heydt
M-489	Secondary Emission Measurements on Beryllium Storage Surfaces	5	2	6-17-48	H. L. Heydt
M-501	Holding Gun Stability Tests on ST28-1	7	23	6-16-48	J. S. Rochefo
M-505	Revision in Program Timing	1	-	6-24-48	E. Blumenthal
M-508	Bi-Weekly Report, Part I, June 25, 1948	19	-	6-25-48	
M-509	Bi-Weekly Report, Part II, June 25, 1948	22	-	6-25-48	
M-510	Eastman Conference, June 24th	5	-	6-28-48	H. R. Boyd
M-511	6AG7 Life Tests	1	-	6-25-48	H. Fahnestock
M-512	Trouble Location in a Large Scale Electronic Digital Computer	4	-	7-6-48	G. C. Sumner
M-513	Power Feed to the Control Elements of WWI	2	-	6-28-48	E. Blumenthal

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<u>No.</u>	<u>Title</u>	<u>No. of Pages</u>	<u>No. of Drwgs.</u>	<u>Date</u>	<u>Author</u>
M-514	Frequency Divider Video Layout Correction	1	-	6-30-48	H. Fahnestock
M-515	Operation Matrix Driver Layout Approval	1	-	6-30-48	H. Fahnestock
M-516	WWI Meters	2	-	7-1-48	W. S. Rogers
M-519	Program of Mathematical Objectives	1	-	7-7-48	P. Franklin
M-520	Rack Ground Bus	1	-	7-7-48	H. S. Lee
M-525	Control Pulse Output Unit Production Release	1	-	7-7-48	H. Fahnestock
M-528	Control Switch Drawing Approval	2	-	7-7-48	H. Fahnestock
A-66	Additions to A-34 Procedures	2	-	6-19-48	A. M. Falcione
A-67	Non-Staff Organization Chart	1	1	6-16-48	H. R. Boyd
A-68	Enforcement of Security and Classification Procedures	2	-	6-17-48	H. R. Boyd
A-69-	Whirlwind I Approved Parts and Specifications	3	-	6-23-48	(H. R. Boyd) (H. Fahnestock)
C-54	WWI Seminar # 28: Runge-Kutta Method of Numerical Integration	4	-	5-17-48	P. Franklin
C-55	WWI Seminar # 29: Runge-Kutta, etc.	3	1	5-19-48	P. Franklin
C-56	WWI Seminar # 30: Runge-Kutta, etc.	5	-	5-24-48	P. Franklin

PB Reports

3973	Progress Report on T-R Tubes	10	-	1-11-43	Radiation Lab
81329	Interrogation Report No. 539 - Mr. Bauch re Magnetic Recording	1	-	7-8-47	B. G. Gill

Library Files

.004	European Scientific Notes, May 15, 1948				Naval Research
.004	European Scientific Notes, June 1, 1948				Naval Research
47	Technical Information Pilot #U702-U764				Library of Congress
51	Tracerlog, June 1948				Tracer Lab., Inc.
84	Investigation of Electronic Computer Output Circuits (Master Thesis - 1948)				F. A. Foss
85	Planning of Research and Development Work				D. L. Williams
112	A Trouble-Location Scheme for a Digital Electronic Computer (Master Thesis - 1948)				(G. G. Hoberg) (E. I. Blumenthal)
113	The General Radio Experimenter (June 1948)- Making a Good Instrument Better				General Radio
113	The General Radio Experimenter (July 1948) - A Wide-Range Capacitance Test Bridge				General Radio
114	The Cathode-Ray Tube and Typical Applications				Allen B. Du Mont Labs.
115	Radio-Frequency Performance of Some Receiving Tubes in Television Circuits				R. M. Cohen
116	RCA Television D-C Component				K. R. Wendt
559	National Bureau of Standards - Technical News Bulletin, June				

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Books

Die Oxydkathode - 1. Teil Physikalische Grundlagen
2. Teil Technik und Physik

(Dr. Ing. G.
Herrman
(Dr. Phil. S.

11.2 Standards Committee

(S. R. Abbott)

The following specifications have been approved and distributed:

7.023A	Capacitors - Mica Dielectric - Fixed (Revision)
6.023A	Capacitors - Mica Dielectric - Fixed (Revision)
6.029A	Capacitors - Mica Dielectric - Fixed (Revision)
6.024C	Capacitors - Molded, Paper Tubular (Revision)
7.043	Power Connectors, Multi-Conductor
7.172A	Switches, Toggle
6.181A	Terminal Strips - Barrier Type (Revision)
7.193	Pulse Transformers
6.212D	Single Conductor Wire, Cotton Braid
7.111A	Lacing Cord (Revision)
7.152	Resistors, Fixed Composition (Revision)
6.152A)	
6.152B)	Resistors, Fixed Composition (Revision)
6.152C)	
S7.401-1	WWI Test and Use Specification, Crystal Rectifiers.

The following specifications have been approved:

7.181A	Terminal Strip - Barrier Type (Revision)
S6.503	Wiring Standards
S6.501	Construction Standards
6.115B	Batteries, Dry

The following specifications have been submitted for approval:

7.212D	Single Conductor Wire - Cotton Braid
7.212B	Single Conductor Wire - Glass Braid

11.3 Purchasing - Stock

(H. B. Morley)

In many cases, requests for new or non-standard items have not been received by this department in time to procure the material by the required date. Any advance notification that could be given ahead of the regular channels would expedite the procurement of these special or non-stock items. Procurement of many items is becoming increasingly difficult and this should be borne in mind in scheduling production.

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11.3 Purchasing - Stock (Continued)

Specifications and drawings of the various fabricated cable requirements for WWI have been submitted to three manufacturers for competitive bids.

A shipment of latest specification Hammertone paint has been received and a quantity shipped to Industrial Enameling Company. All materials specifying Hammertone finish will now be in accordance with the latest specification.

The file of instruction manuals of equipment is being revised and also a duplicate file will be set up in the stockroom.

(R. Fairbrother)

During the week ending July 2nd, some of the glass stock of the storage tube group was moved to Fort Heath for storage. Also during the past two weeks a large number of chairs, two desks, and other miscellaneous furniture was transferred to the Fort.

11.4 Electronic Construction

(R. H. Murch)

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

1. Special add memory prototype WWI. This unit is complete except for power plug.
2. Preformed cable boards for WWI.
3. Three holding gun power supplies. These units will be completed by the middle of next week.
4. Twenty-five d-c power strips. One strip has been completed. The balance will be completed as fast as sheet metal work comes in. At least two per day should be completed next week.
5. Point off control prototype WWI. This unit is about 75% complete.
6. Multiply shift control prototype WWI. Layout for this unit is being reworked

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11.4 Electronic Construction (Continued)

7. Wind pulse transformer.
8. Delay line panel breadboard.
9. Engrave panels for panel selection rack WWI.

The work load in the Electronic Laboratory is as follows:

2 WWI prototype technicians have work scheduled for six weeks.

1 WWI prototype technician has work scheduled for seven and one-half weeks.

5 technicians have a work load of about one week.

(A. Taylor)

Work is underway on the Register Panels, Gate and Delay Units, and the Scope Synchronizers. The Clock Pulse Generators are awaiting calibration charts which are to be fastened to the panels.

Prototypes have been completed for the Register Panel, Coder, Pulse Mixer and Voltage Calibrator.

11.6 Unclassified

(A. Taylor)

About 50% of available machine shop time is devoted to manufacture of storage tube parts. The balance of time is being used for special parts for electronic equipment.

About 60% of sheet metal shop time is absorbed by test equipment manufacture. Forty per cent of the time goes to manufacture of special panels and WWI prototypes.

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12.0 GENERAL

(Jay W. Forrester)

New Staff Members

Theodore Clough has recently been transferred to the laboratory staff and will continue assisting Pat Youtz in the storage tube research.

Timothy Leary, who has been with the Servomechanisms Laboratory since 1942, has been given a staff appointment. His present work includes electronic circuit planning, drafting supervision and standards maintenance. Recently he completed the five-year night school course at Northeastern leading to a degree of Associate in Engineering.

Philip Rabinowitz is a new member of the Mathematics Group under Professor Franklin. In June he received a Master's Degree in Mathematics from the University of Pennsylvania.

Robert R. Rathbone has joined the laboratory staff and is working under H. Taylor writing specifications. He received a Master of Arts at Harvard and for the past two years has been teaching at Swampscott. During the war he served as a Communications officer in the Navy.

Norman S. Zimbel, who has been working at the laboratory on a part-time student basis, has accepted a staff appointment, and will continue working on storage tube research with Pat Youtz.

(H. R. Boyd)

New Non-Staff Personnel

Andrew Gordon Lofgren is a temporary mechanical checker. For the past eight years he has been a drafting instructor at Boston Technical High School and is also an instructor at Lincoln Institute. He received his M.A. from Boston University and also studied at Lowell Institute.

Raffaele Belluardo is a student technician. He is a Junior at M.I.T. and attended Lowell Institute previous to serving in the Navy.

Kaspar D. Kasparian is a student technician. He graduated from Boston English High and at present is studying at Northeastern University. He served in the U. S. Army for five years as a rifleman.

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12.0 GENERAL (cont.)

New Non-Staff Personnel (cont.)

Horace U. Ohm is a temporary Jr. Technician, Electronic. He has served in the Merchant Marine for a number of years as a radio operator.

Anne Sullivan is a blueprint operator who will be working in the Print Room. She has had several years of business experience.

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