

6345
Memorandum M-471

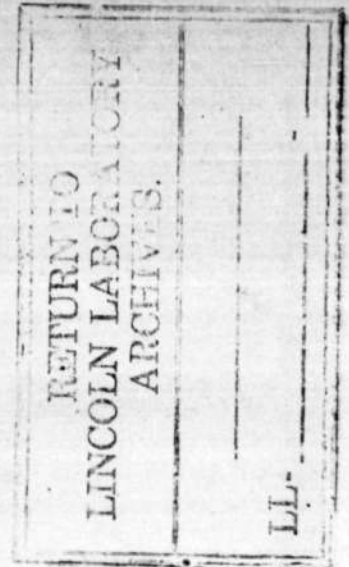
Page 1 of 16

Project Whirlwind
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, PART II, JUNE 11, 1948

TO: 6345 Engineers

FROM: Jay W. Forrester



6.0 MATHEMATICS

(P. Franklin)

Work was continued on coding and on calculations in connection with storage tubes.

(M. Daniloff)

Memorandum M-395 "Distillation in Vacuo from a Cylindro-Toroidal Evaporation Cup" is completed and is in the process of being typed.

(E. Reich)

Some work was done on the problem of how to obtain a uniform deposit on the plate of the storage tube. This leads to a homogeneous integral equation with a known kernel. A necessary and sufficient condition for the equation to have a solution is that the eigen-functions of the kernel (after it is made symmetrical) do not span Hilbert space. Whether or not this condition is satisfied in the case at hand is not obvious.

Work on writing up Professor Franklin's seminar lectures is being continued.

(C. W. Adams)

Coding the conversion of orders and numbers from teletype pentad form to true binary form has been carried out. Preliminary results indicate that the conversion will take slightly less time than will be required by the film reader to get the information into the computer. Storage requirements for input conversion will be of the order of 250 registers. Output conversion and modifications for double length numbers will be considered in the near future.

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~~RESTRICTED~~

6345
Memorandum M-471

UNCLASSIFIED

Page 2

6.0 MATHEMATICS (Continued)

(D. W. Batteau)

Conditions for existence of functions orthogonal to a given function examined and study of series approximation in such cases continued.

UNCLASSIFIED

~~RESTRICTED~~

~~RESTRICTED~~

6345
Memorandum M-471

Page 3

UNCLASSIFIED

7.0 INPUT AND OUTPUT

7.3 Binary to Analog Conversion

(E. W. Sard)

Operation of the plate voltage supply from 400 cp, as mentioned in the last bi-weekly report, reduced the noise considerably.

Because of poor low frequency response, the Ballantine voltmeter amplifier and decade amplifier connected in cascade proved to be unsatisfactory for amplifying a $12\frac{1}{2}$ cp square wave. A d-c amplifier borrowed from the Measurements Laboratory does better, but drifts too much. Another approach to the holding problem using a peak reading voltmeter is being tried.

UNCLASSIFIED

~~RESTRICTED~~

~~RESTRICTED~~

6345
Memorandum M-471

UNCLASSIFIED

Page 4

8.0 STORAGE TUBES

8.1 Tube Construction and Testing

8.11 Tube Construction and Processing

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

Eight tubes were processed during this period and components for several more tubes were prepared.

The storage holding stability tests indicated a need for a tube with a very thin film of beryllium oxide on a thick coating of beryllium. A mosaic of beryllium was prepared and kept cooler than most tubes had been processed in the past. This surface was put in the storage tube ST 32. ST 32 was processed cooler than usual and tested for holding stability while it was on the pumps. Later this tube was given the usual processing to give a good vacuum and sealed off.

One large evaporation tube was prepared and processed.

Several experimental tubes and evaporation tubes were prepared and processed. The purpose of these tubes was to study the effect of our baking cycles on the Al_2O_3 and thin films of beryllium.

(R. Shaw)

All components of the Sylvania 10HP4 electron gun have been detailed.

Evaporation tube no. 45 has been completed and is described in memorandum no. M-469.

Parts will be available for another 5" evaporation tube early in the week of June 14. Three additional sets of parts will be ready the following week.

Parts are now on hand for six 5" signal plate assemblies. Models are being made of assemblies of two new designs.

~~RESTRICTED~~

UNCLASSIFIED

~~RESTRICTED~~

6345

Memorandum M-471

Page 5

UNCLASSIFIED

8.11 Tube Construction and Processing (Continued)

(E.S. Prohaska)

A preliminary study of the problem of putting thermocouples in the target of the storage tube is under way. The tungsten molybdenum combination shows some promise at the present time.

8.12 Tube Testing

(S.H. Dodd)

ST 32, described in section 8.11, was tested for holding stability on the pumps and later after a complete processing. ST 32 is a small storage tube with a 40 mesh .002 Be mosaic and a 40 mesh .002 wire screen. This screen was only spaced 0.005 as compared to 0.012 for ST 28 which is an earlier tube. As described in M-448, the holding stability range was relatively narrow. ST 32 was an effort to increase this range and differed in construction, having a smaller screen to mosaic spacing, a cooler assembly and processing procedure and a different method of applying the willemite to the screen support ring to avoid stray particles of willemite on the mosaic.

Tests of ST 32 both on the pumps and after seal-off give the same results. The lower voltage of the stability range was about 80 volts as compared to 70 volts for ST 28. Tests for the upper stability point on ST 32 were only carried to 800 volts and consequently no upper limit can now be specified. This is certainly a very definite improvement over ST 28, whose upper limit was found to be about 155 volts.

(J.S. Rochefort)

A memorandum describing the tests performed on ST 28 is being prepared.

8.2 Storage Tube Research8.21 Surface Material Characteristics

(M.I. Florencourt)

Surface and front-to-back resistance tests

~~RESTRICTED~~

UNCLASSIFIED

~~RESTRICTED~~
UNCLASSIFIED

6345
Memorandum M-471

Page 6

8.21 Surface Material Characteristics (Continued)

are being made on two small anodized aluminum discs whose front surfaces have beryllium evaporated on them. The resistance tests are being made "on the pumps" at intervals during the regular baking schedule which a storage tube would receive. Definite conclusions can not be drawn until these tests are complete and results are duplicated on similar surfaces.

8.23 Output System Circuits

(C.H.R. Campling)

Copies of the thesis report on output circuits have been completed and distributed.

Some additional experimental work has been done on the clamp circuit, but there are no further improvements to report.

8.24 Holding Gun Studies

(H. Klemperer)

Work was started to design a holding gun for storage tubes.

The design follows the optical arrangement of a Projector, i.e., two lenses are provided to form a wide angle beam after one crossover close to the cathode.

Assembly of the first model was started and instrumentation for a testing place was set up.

8.3 Unclassified

(M.I. Florencourt)

Checking prints of all small storage tubes have been received from the drafting room and are in the process of being checked for content. Drawings of almost all of the research tubes have been completed. An attempt is being made to have sketches of all out-of-the-ordinary tubes made up before the tubes are made, so that there will be construction references.

UNCLASSIFIED
~~RESTRICTED~~

~~RESTRICTED~~

6345
Memorandum M-471

UNCLASSIFIED

Page 7

8.3 Unclassified (Continued)

Work on cross-referencing notebooks is progressing favorably.

8.4 Deflection Circuits

(J.O. Ely)

Both panels of the experimental deflection-voltage generator are now in operation. A control panel and display panel have been installed to permit demonstration of the unit. Types of display which may be secured are:

1. Selection of any one of 1024 deflection positions by means of a rotary-switch decimal-to-binary converter. (Spot appears continuously at position selected.)
2. Selection of any vertical or horizontal deflection value with a sweep applied to the other pair of plates.
3. Operation as a counter, giving either 1024 spots or 32 lines horizontally or 32 lines vertically.

Successful single-pulse operation has not been secured to date because of the p.r.f. sensitivity of the standard gate and delay units used to provide the control sequence timing. If successful single-pulse operation can be achieved, each of the above display types may also be presented single-shot as well as the continuous presentations now available.

Testing of the deflection-voltage generator has been deferred in favor of installation during the past two weeks. The tests will be resumed and carried on as a thesis project during the summer.

UNCLASSIFIED

~~RESTRICTED~~

~~RESTRICTED~~

6345
Memorandum M-471

UNCLASSIFIED

Page 8

9.0 SERVOS AND SIMULATION

9.1 Cockpit

9.11 Structure

(E. S. Prohaska)

Graff is progressing on the layout of the simplified cockpit (or breadboard). Greaves has finished detailing the hydraulic pistons and is now working on the force-measuring lever assemblies. The report of work on the cockpit program is in the "rough-draft" stage.

9.13 Control Force Loading

(C. G. Eaton)

The report on the past year's work on control force loading is still in preparation.

9.2 Sampling Servo Stability Study.

(W. K. Linvill)

A thesis proposal has been written and will be submitted soon. The example worked out in the Radiation Laboratory Servomechanisms Book, Volume 25, has been worked by continuous analysis and is included in an engineering report. The engineering report is complete and a rough draft is being sent to C. R. Wieser. The method of characterizing sampling servos by conventional transfer functions seems very promising. The details of necessary future work are included in the report.

UNCLASSIFIED

~~RESTRICTED~~

~~RESTRICTED~~

6345
Memorandum M-471

Page 9

UNCLASSIFIED

10.0 TRAINING

10.1 Seminar Series

(R. R. Everett)

The first meeting of the new staff seminar was held on Wednesday June 9 at 3:00 p.m. in the basement lecture room. Ed Blumenthal discussed the work he and George Hoberg have been doing on trouble location in WWI.

UNCLASSIFIED

~~RESTRICTED~~

~~RESTRICTED~~

6345

Memorandum M-471

UNCLASSIFIED

Page 10

11.0 FACILITIES AND CENTRAL SERVICE11.1 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-6	Summary Report No. 6	21		3-48	
E-122	Variable Frequency Clock Pulse Generator, Model 2	1	1	5-19-48	H. Kenosian
E-124	Variable Frequency Clock-Restorer Pulse Source	2	2	5-21-48	H. Kenosian
E-125	Clock Pulse Control	6	1	5-27-48	J. A. O'Brien
M-407	Power Supplies for Sylvania Testing	3	6	5-11-48	R. L. Massard
M-422	Power Supply Proposal No. 3	6	-	6-1-48	H. R. Boyd
M-435	Temperature Effects on Cathode Resistance of Aged 6AG7 Tubes	3	2	5-24-48	J. J. O'Brien
M-445	Electronic Tank	3	-	5-27-48	A. R. Curtiss
M-446	Progress Report: An Investigation into the Reliability of the Capacitively-Coupled Flip-Flop	3	3	4-10-48	W. P. Horton
M-447	Bi-Weekly Report, Part I, May 28	14	-	5-28-48	
M-448	Bi-Weekly Report, Part II, May 28	19	-	5-28-48	
M-449	Progress Report: An Investigation into the Reliability of the Capacitively-Coupled Flip-Flop	1	-	4-22-48	W. P. Horton
M-450	Power and Indicator Connections to Panels	2	-	5-28-48	C. W. Watt
M-451	Evaporation Tubes ET36 and ET39	1	-	5-28-48	R. Shaw
M-453	Selection of a Test Equipment Truck for WWI	2	-	6-3-48	R. E. Hunt
M-454	7AD7 Substitution for 6AG7 in WWI	2	1	6-3-48	H. Fahnestock
M-455	Restorer Pulse Generator, Layout Correction	1	-	6-4-48	H. Fahnestock
M-456	Accumulator Prototype	3	-	6-4-48	H. Fahnestock
M-457	Addition to Check Register	1	-	6-4-48	R. P. Mayer
M-458	Pulse Mixer	1	-	6-8-48	C. A. Rowland
M-459	Indicator & Voltage Variation Panel Details	2	-	6-8-48	C. W. Watt

~~RESTRICTED~~

UNCLASSIFIED

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UNCLASSIFIED

<u>No.</u>	<u>Title</u>	<u>No. of Pages</u>	<u>No. of Drawgs.</u>	<u>Date</u>	<u>Author</u>
M-460	Time Schedules	1	-	6-8-48	H. Fahnestock
M-461	Video Cabling Method Approval	3	1	6-9-48	C. W. Watt
M-462	Spare Tubes, Provision for	1	-	6-9-48	H. Fahnestock
M-463	Control Pulse Output Unit Production Drawing Approval	1	-	6-9-48	H. Fahnestock
M-466	Rack Drawing Approval	1	-	6-9-48	C. W. Watt
M-467	Time Pulse Distributor, Counter Panel, Layout Approval	1	-	6-9-48	H. Fahnestock
M-468	A-Register/Program Register Production Release	2	-	6-10-48	H. Fahnestock
A-61	Secretarial Procedures	7	-	5-21-48	H. R. Boyd
C-52	Project Whirlwind Seminar No. 26: Runge-Kutta Method of Numerical Integration	5	-	5-10-48	P. Franklin
C-53	Project Whirlwind Seminar No. 27: Runge-Kutta Method of Numerical Integration	7	-	5-12-48	P. Franklin

Library Files

.004	European Scientific Notes, v. 2, no. 9, May 1, 1948				ONR - London
73	Pre Analyses, May 14 - 19, 1948				Reeves Analysis and Computer Group
74	Air Traffic Control (paper 27-48/00-12, May 12, 1948)				RTCA Special Committee 31
75	Coupling Circuits for a Storage-Tube Output System				C.H.K. Campling
76	Fundamental Research on Raw Materials Used for Electron Emissivity on Indirectly Heated Cathodes (Quarterly Progress Reports, June 1947 - April 1948)				Raytheon Mfg. Co. J. Cardell, Chief Investigator
559	National Bureau of Standards - Technical News Bulletin, May 1948				

Books

Electron Optics in Television (1938)	Maloff & Epstein
Techniques in Experimental Electronics	C. H. Eachus

~~RESTRICTED~~

~~RESTRICTED~~
UNCLASSIFIED

6345
Memorandum M-471

Page 12

Translation

	<u>Pages</u>	<u>Drwgs.</u>	<u>Date</u>	<u>Author</u>
M-452 Theory of the Action of an External Electromotive Force upon a Trigger Circuit (Electronic Relay) - V. V. Vitkevich, Journal of Technical Physics	10	9	6-2-48	M. Daniloff E. Blumenthal

PB Reports

74821 Der Impulstransformator (EC-Bericht Nr. 112)	57	44	3-7-44	Dr. Grasl
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11.2 Standards Committee

(H. R. Boyd)

At the last standards meeting, it was decided that the following changes will be made in standards practice to simplify the numbering system and avoid duplication of numbers:

1. The P and S prefix designations will be dropped since the numbers are self-explanatory.
2. All part numbers will be in class 6 between 6.01 and 6.39.
3. Special parts such as connectors will be designated as 6.043-1 etc., with a new desk number added for each new design.
4. WWI specifications will be in class 7 as formerly.
5. Pulse transformer specifications will be changed to class 6 as this is the inconsistency in the system at present.

To avoid needless changes in drawings, pulse transformers now listed under S7.193 will be identified as 6/S7.193 to indicate that 6.193 is the replacement for this item.

(S. R. Abbott)

The following specifications have been approved and distributed:

Relays, mechanically latching	7.143B revision
D. C. Relay, telephone type	7.143C
Relay, time delay	7.144B
Miscellaneous lugs	6.188A
On-off plate	6.178A
Terminal, insulated feed thru	6.183B
Insulators, thru panel	6.088A
Locks	6.052A
Extensions, potentiometer	6.158A
Snap button hole plugs	6.078A
Connectors, multi-conductor (Jones)	6.043B
Mounting hardware (flexible line clamp)	6.071C

The following specifications have been prepared:

Connector-multi-pin, power (female)	7.043-1
	6.043-1
Connector-multi-pin, power (male)	7.043-2
	6.043-2
Connectors, multi-conductor (Jones)	7.043B
Filament transformer	7.195-2

~~RESTRICTED~~

6345
Memorandum M-471

Page 14

UNCLASSIFIED

11.3 Purchasing - Stock

(R. Fairbrother)

Arrangements have been completed for the use of storage space at Fort Heath, and one small load has been taken there. The remainder is being moved June 11.

Additional storage space has been made available in the Barta Building by the construction of a small room near the basement lecture room.

A considerable amount of excess stock has been set aside, and will be transferred to other Navy sponsored research projects next week.

(H. B. Morley)

Numerous cases have occurred recently of material or services being received or completed without clearing through the receiving room. This results in suspense orders being held open after billing is received from the vendor, and requiring considerable time following up to get receiving papers completed. It is requested that all personnel placing requisitions for material or services take particular care to see that the material is received through the receiving room, or that the receiving room is notified when services are completed.

It appears that summer vacation schedules of some of the vendor companies will probably delay delivery schedules, especially on orders which were not placed well in advance of requirements.

Steel supplies are increasingly shorter, and requirements for items using steel should be drawn up as far ahead as possible.

The WWI filament transformer design has been approved and a requisition for 600 units submitted for approval.

The type of AMP terminals for WWI have been selected and requisitioned.

Two additional companies have been considered for WWI power supplies.

11.4 Electronic Construction

(R. H. Murch)

The following jobs or units are in the Electronic Laboratory for construction.

UNCLASSIFIED
~~RESTRICTED~~

~~RESTRICTED~~

6345
Memorandum M-471

UNCLASSIFIED

Page 15

11.4 Electronic Construction (Continued)

Fourteen DC Bench Outlet Boxes

Four of these have been completed. Balance will be completed when relays to control 4500 volts are received.

Divide Control Proto-type WWI

This unit is about 75% complete.

Sixty DC Patch Cords

Twenty-five of these have been completed. Balance will be completed by the first of next week.

Special Add Memory Proto-type WWI

This unit is about 75% complete.

Preformed Cable Boards for WWI

At least another month's work will be required to complete these.

Delay MV Breadboard for WWI

Modifications To Grounds in Tube Life Test Panels

The work load in the Electronic Laboratory is as follows:

Two WWI proto-type technicians have work scheduled for eleven weeks.

One WWI proto-type technician has work scheduled for seven and one-half weeks which is due to start in about a week.

One man has work scheduled for about one month.

Five men have a work load of about four days.

(A. Taylor)

Five gate and delay units are under construction. One will be delivered to the stockroom tomorrow. Completion of the others will be held up for parts.

Completion of clock pulse generators depends on delivery of panels.

The test equipment program is being delayed by difficulties in procurement from manufacturers.

UNCLASSIFIED
~~RESTRICTED~~

~~RESTRICTED~~

6345
Memorandum M-471

Page 16

UNCLASSIFIED

11.4 Electronic Construction (Continued)

(F. H. Caswell)

Operation of the electrolytic tank has been temporarily held up while accomplishing work of more urgent nature. This will allow partial installation of the new metal pantograph having a 1:1 ratio.

Last week the entire test equipment used in testing storage tubes was dismantled and reinstalled in tube room to allow tests to be carried on while the storage tube was pumping. The gear was then dismantled again and several units have been relay rack mounted. There is much to be done before racks will be complete and flexible enough to move a complete test set-up about the laboratory.

The two section gate and delay units and all single section units plus one four section unit have been modified to eliminate gate collapse at minimum delay when two or more units are used in gate delay hookups.

Construction of another storage tube test rack is under way.

Technician work load continues to be sufficient to keep all technicians very busy.

11.5 Drafting

(A. M. Falcione)

Ozolid Machine

The operation of the ozolid machine is still hampered by low line voltage. It is expected that the installation of separate transformers for the building by the Cambridge Electric Company will remedy this situation.

Work Load

The work load on this department is quite heavy at this time. However, additional personnel have been employed to offset this condition. The video layouts for WWI are progressing quite rapidly.

11.6 Unclassified

(A. Taylor)

Fifty per cent of available machine shop time is being used for the manufacture of tube parts. Twenty-five per cent of the time is being used for experiment parts manufacture. The balance of time is going to the manufacture of special hardware. The backlog contains 32 man-hours of work.

UNCLASSIFIED

~~RESTRICTED~~

12.0 GENERAL

(S. H. Dodd)

Add Section "8.24 Holding Gun Studies" to decimal classification of bi-weekly reports.

(J. W. Forrester)

New staff personnel:

James B. Pickel has joined the laboratory staff for the summer and will be working with the storage tube group. He graduated from MIT in 1946, and is now on summer leave of absence from Washington University in St. Louis, Missouri, where he is an electrical engineering instructor.

Terminations: Howard L. Heydt.

(H. R. Boyd)

New non-staff personnel:

Robert Byram is a student at MIT and will be working here as a technician during the summer. He worked for the Electro-Metallurgical Labs for several years and served in the US Army for three years.

Ernest DiMarzio is a Junior Technician working under Al Taylor. He graduated from Boston Trade School. He was with McElroy Manufacturing Company for six years and served in the US Army for four years.

Stanley Fay is a student in his senior year at MIT and will be working this summer as a technician in the Electro-Mechanical Lab.

Natalie Foss is a Senior Detailer, Mechanical, who will be working for Mr. Falcione. She graduated from Wakefield High and has had a variety of drafting experience, including three years in the MIT Radiation Lab.

Lorraine Graham is a blueprint operator who will be working in the print room. She graduated from St. Clement's School.

George D. Moore is a student at MIT and will be working here for the summer as a technician. He attended Radar Technician School and graduated from Everett High School.

John W. McLellan is a Junior Technician working in the Electro-Mechanical Lab. He attended Northeastern University and served in the US Navy. In addition, he has had a variety of technical experience.

6345

Memorandum M-471

Page 18

12.0 GENERAL (Continued)

William S. Rawlings is a Lab. Helper. He recently graduated from Newton High and expects to enter MIT this fall.

Vincent Savio is a detailer, electronic, working in the drafting room. He graduated from Boston Technical High and attended Northeastern University.

Marilyn M. Spurr is a secretary working for the electronics engineers. She graduated from Swampscott High and has a variety of secretarial experience.

Terminations: Muriel D. Schlesinger & Florence Wolsky.

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