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Memorandum M-1103

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Project Whirlwind  
Servomechanisms Laboratory  
Massachusetts Institute of Technology  
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, Project 6345, September 29, 1950  
TO: Jay W. Forrester  
FROM: Project Whirlwind Staff

1.0 SYSTEMS TESTS

1.1 Whirlwind I System Test

(N. H. Taylor)

The WWI system is being used 12 hours a day testing the storage row. Progress is being made along the row but more time is being used than was anticipated. At present 6 tubes have been tested which are adequate for system work, 2 others will probably be accepted after retest. At the present rate of testing and accepting tubes, it will be possible to try system operation with a full bank of 16 storage tubes in about 2 to 3 more weeks.

A first order improvement in storage tube operation is expected as a result of cleaning up the RF distribution along the storage row. A 2 to 1 discrepancy was found between tubes on the right and left side of the aisle and a second 2/1 change in RF levels from digit to digit. This has been improved by adding a length of cable between the pulser and the digit columns on the right side of the aisle and adjusting the termination of the RF line by reducing the 100 ohm resistors to 80 ohms. The net result of these improvements in RF pulse amplitude will allow an increased RF grid drive on the storage tubes and a decrease in RF gain in the output of some tubes.

In order to speed the tube testing in the system, preliminary tests are being made of all storage tubes before they are installed. These tests have been revised and are more indicative than in the past and good correlation has been established between these results and system tests results.

Significant improvement in the operation of the Eastman Reader-Recorders has been made following a visit by Eastman Kodak engineers during the last period. A new method of reading reference markers on the film will produce better signals and less noise when the equipment is used as a Reader. This reading problem has been difficult to solve, however, these

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1.1 Whirlwind I System Test (Continued)

new improvements should give significant improvement to this type of operation. To properly evaluate just how well these units work it will be necessary to do some extensive testing while the Eastman Kodak units are tied in with the Whirlwind System. This is difficult to do while the storage program is using so much computer time.

(N. Daggett)

Maintenance of the system appears to have reached a point where known weaknesses are fairly well eliminated. Recent troubles have been relatively minor ones occurring so infrequently that it has been difficult to determine their exact cause -- troubles which have so far eluded marginal checking techniques.

Some time will be devoted during the next period to maintenance of power control relays since several failures have occurred recently in this equipment.

Attention will be given to improving the marginal checking equipment and procedures in order to make the routine procedure faster and simpler and to provide for better trouble location in those parts of the system where such location is most difficult, i.e. ES control and In-out control. Cooper, Gould, and Mayer are considering the matter of special test problems and for procedures for this purpose.

(H. F. Mercer)

Component Failures in WWI - The following failures of electrical components have been reported since Sept. 15, 1950:

<u>Component</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reason for Failure</u>
<u>Crystals</u>			
D-358	3	1355	Drift
	5	3200-3600	
<u>Pulse Transformer</u>			
3:1	1	3443	Open
<u>Resistor, variable</u>			
10,000 ohm, 2 Watt	1	946	Shorted

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1.1 Whirlwind I System Test (Continued)

<u>Component</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reason for Failure</u>
<u>Tubes</u>			
3E29	1	4267	Mechanical
7AK7	1	2450	Mechanical
7AD7	3	1300-2000	2 - Change in characteristics, low I <sub>B</sub> .
	7	3400-3700	1 - Mechanical 5 - Change in characteristics, low I <sub>B</sub> . 2 - Mechanical.

In addition to the above 7AD7 failures, the following were found as a result of a faulty relay whose contacts were fused together causing +250 volts to remain on the screens of the buffer amplifier tubes of all 16 Gun Driver panels, when all other voltages were removed from the panels.

It should be noted, however, that the characteristics of the majority of these tubes were below WWI specifications when installed in the panels.

<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reason for Failure</u>
23	1200-1650	18 - Change in characteristics, low I <sub>B</sub> . 4 Mechanical 1 Gassy

1.2 Five-Digit Multiplier

(E. A. Guditz)

Error free operation has been obtained from the multiplier since September 16th.

On September 18th an unsoldered connection was found at the grid of a gate tube in the step counter. This was discovered by tapping the panel.

The following have been replaced during the period as a result of marginal checking:

1	7AD7	14,510 hours
1	"	14,101 "
1	"	18,054 "
2	IN34 crystals (Sylvania)	
1	D-358 crystal (Sylvania)	
1	D-358 crystal (Kemtron)	

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## 2.0 CIRCUITS AND COMPONENTS

### 2.1 Circuits by System Number

#### 820 ES Deflection

(R. L. Best)

The sweep generator mentioned in the August 4 report has been returned to the shop for modification, and should be finished next week.

Testing is almost complete on the breadboard of the new ES Deflection Output Panel, which will drive the storage tube deflection line as a capacity, rather than as a terminated line. It will have more stability over a wider range of output voltage, and considerably less stand-by power dissipation.

### 2.5 Tubes and Components

(H. B. Frost)

A collection is being made of all available material pertaining to the special tubes being developed under the ARINC program. These tubes are a series of high-quality ruggedized miniatures. A description of the ARINC program is contained in the September issue of Electronics, p. 68. It appears that use of ARINC tubes wherever WWI is now using standard 6AK5 and 6AL5 tubes, is definitely advisable.

The life test racks have been restarted, with the conditions of some of the tests changed to determine the effects of changes in operating duty cycles. Bulb temperatures of type 5687 and 6AN5 tubes have been determined to check some of the life data, in particular on 5687's. Correlations with some poisoning effects will be attempted.

Computational work on an analysis of crystal failures in the multiplier is now being done by Miss Mackey. The failure patterns will be studied to determine the most unfavorable operating conditions.

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### 3.0 STORAGE TUBES

#### 3.1 Construction

(P. Youtz)

Five tubes, RT169, RT170, RT171, RT172 and RT173 for WWI were processed this period. These tubes were identical with the 100 series storage tubes for WWI except the mosaics were lined up with the deflection plates and the mica spacer was redesigned to give uniform spacing between screen and mosaic surface. In two of the tubes, RT170, and RT171, the mosaic was prepared in our demountable system.

One research tube, RT167 to investigate the effects of finer collector wire on spot growth, was processed. RT167 was a stubby storage tube with a closely spaced collector screen made of 100 mesh .001 diameter wire.

#### 3.2 Test

(R. Shaw)

The modified 5U electron gun for use in RT176 was inspected for deflection-plate spacing and alignment. In spite of the fact that the deflection plates were assembled by hand with the aid of the simplest possible gauges, the accuracy of the spacing was only slightly inferior to that of the factory-made guns we normally use.

An alternate design of the glass-annealing oven is in preparation. In order to reduce cost, we have reverted to the original proposal of laying the heating elements on the bottom of the oven. This will eliminate need of an elaborate support structure. It has also been decided that it is no longer necessary to make the oven and its controls into a self-contained, portable unit. This will permit further simplification.

(C. L. Corderman)

A test set-up has been designed and constructed to allow pulse testing of storage tube high-velocity guns with a minimum of idle equipment. Research work on new gun designs and extended tests with different gun conditions will be carried out with this equipment to examine, and control if possible, the factors which affect the level and stability of high-velocity gun emission.

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### 3.0 STORAGE TUBES (continued)

#### 3.2 Test (continued)

(M. F. Mann)

Sections B, C and K of tests outlined in M-1077-3 are to be carried out in the television demonstration unit now; these tests will be called "pretest" and will replace the previous "transfer" tests. Storage tubes pretested and passed were ST154, ST156, ST161, ST166, and ST176. Two tubes pretested were rejected, ST144 on the basis of insufficient HV  $I_k$  at 0 bias and ST139 on the basis of surface nonuniformity and the high holding  $V_{hg}$  required ( $> 125v$ ). ST162 was passed marginally, one spot requires more charge for writing than the rest of the surface.

Two research tubes received standard tests. These tubes are identical with 100-series tubes except for the fact that their mosaics are aligned with the deflection plates instead of being  $45^\circ$  out. RT168 was passed, but RT169 was rejected - the cathode current from the HG decreased with use, but reactivated if the gun was biased off sufficiently long; there were several areas with shorted mosaic squares and the low collector spacing (.005 to .009") would have meant radically different readout signals.

(H. B. Frost)

A number of storage tubes with various amounts of age were examined to determine if formation of cathode interface resistance was limiting the beam current. In no case was any interface observed; however, the sensitivity of the measurement did not preclude that small (and unimportant) amounts may be present. Interface was found when checking the G<sub>1</sub>-K assembly of two tubes as a diode. This is to be expected from the cathode material used in these tubes. As near as can be determined, however, interface does not limit the beam current under usual operating conditions.

Static tests of RT167 were initiated. Since a rather peculiar fault was immediately apparent, no extensive tests were made. In this tube the collector is 1 mil 100 mesh nickel screen, spaced 0.006" from the mica target. The usual collectors are 2 mil wire spaced 0.010 or more, although some have been made with closer spacings. However, the combination of close spacing and small wire proved to have inadequate strength in RT167. This is evidenced as a sudden snapping of the screen into contact with the target surface as the  $V_{hg}$  is increased above 60 volts. This was first suspected as a result of the change in television picture, and was tentatively confirmed by Q-meter measurements of the capacity.

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3.0 STORAGE TUBES (continued)

3.2 Test (continued)

(H. J. Platt and H. B. Frost)

During the last period, extensive tests were run on the activation and deactivation response of the high velocity gun cathode of ST146 under pulsed conditions. The factors varied were filament voltage and duty factor. Some runs were made against time watching the time response of the pulsed current to a change in filament voltage. A test of pulsed current vs. duty factor is in progress. Since it sometimes takes an hour or more for a current restabilization to occur the time involved for a single run may be days.

A new gate amplifier was built so that the  $W^+$  and  $W^-$  gates in a second digit column may be operated independently.

(A. R. Tanguay)

A new test setup has been constructed to study the high-velocity gun cathode activation. The equipment includes a metering and switching panel for monitoring and controlling gun currents and voltages. It also includes a power control unit to provide constant or variable heater voltages, provide the usual line switches and fuses, and serve as an assembly unit for all high-velocity gun and holding gun electrode voltages. Both units have been incorporated into a working "tester" by C. L. Corderman.

A Miller type linear sawtooth generator, built at the end of the summer, is now being checked out preliminary to its installation in the restoring current tester.

(A. Stein)

Joined Storage Tube Staff on September 26th. Working on Storage Tube Testing; standard tests on Television Tester under the supervision of Margaret Mann. I am attempting to understand the testing program as an integral part of WWI operation.

4.0 INPUT-OUTPUT EQUIPMENT

4.1 Eastman Kodak Film Units

(J. A. O'Brien and D. Hageman)

Dr. Tyler and Mr. Cochran of Eastman Kodak Company visited the project on September 25th and 26th to aid us in correcting the difficulties being experienced with the film units. By building a new light source to scan the reference marks on film with a light beam perpendicular to the film, we were able to get much more reliable triggering of the sweep circuits. They also decided that our exposures were not dense enough, and by increasing the intensity of the trace we obtained recordings that appeared to give much better output digit pulses.

We are engaged at present in trying to improve the response of the reading phototube circuits.

4.3 Typewriter and Tape-Punching Equipment

(R. E. Hunt)

Data needed for maintenance and test specifications for the Tape Reader and Tape Punch is nearly complete. Some further data is needed on the reader sensing pin adjustments, as determined by maximum tape life and reliability.

Tape life tests are inconclusive so far; but results indicate that we can tolerate Reader adjustments that will give a tape life of at least 300 readings.

Tape Output Unit has been completed by the construction shop and is being tested on the bench at the present time.

4.4 Input-Output Planning

(E. S. Rich)

Study is continuing on the details of an integrated system of terminal equipment. Emphasis is being placed on working out the block diagram for this system particularly the in-out switch, in-out registers, and in-out control. Thought is being given to a proposal to eliminate the comparison register from the in-out element. Checking of transfers to and from terminal equipment then would have to be done by computer subprograms. It is also proposed that subprograms be used to perform such functions as breaking 16-digit words into smaller groups of digits as required by paper tape and magnetic tape equipment, combining groups of digits from tape into 16-digit words, generating identification codes for recording on magnetic tape, etc. This would greatly simplify the design of control circuits for the various pieces of terminal equipment but will require use of some storage for the necessary subprograms.



5.0 INSTALLATION AND POWER

5.2 Power Supplies and Control

(J. J. Gano)

D-C Power Supplies: Two engineers representing the manufacturer of the supplies and another representing the manufacturer of the thyratrons visited for a discussion. The new cushioning circuit on the +250 supply satisfies the recently introduced requirement that the product of rate of inverse voltage application and rate of current decay not exceed a specified value. The measured product on the +150 supply is about twice this value, but since the magnitude of the inverse voltage is also a factor to be considered and is relatively low on the +150, the cushioning circuit will not be revised unless the frequency of tube failures increases.

A list of possible spare parts, comprising mostly transformers and chokes, specially designed for these supplies, was compiled. When price information arrives from the factory, the list will be reviewed to determine the parts to be stocked.

D-C Plate Supply Alternator: Drawings of the circuit schematics have been completed. Relocation of the contactor and conduit revisions will be undertaken on Saturdays, starting at once.

5.3 Video Cabling

(T. Leary)

A number of cables need to be built to make temporary changes into permanent ones, but there are no cables needed in any great hurry at the moment.

Larry Holmes has finished untangling the cabling in rack AD, and we are now in a position to issue up-to-date register-driver assignment drawings. These will be B sheets, one for each driver, and will replace the Sylvania drawing (W60K081) which had the assignments for all seven A-row drivers on it.

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6.0 BLOCK DIAGRAMS

(J. M. Salzer)

A great deal of consideration was given to the possible modification of the in-out element, and the in-out orders to work with an integrated WWI input-output including an in-out switch. Representative codes were written to get an estimate of the lengths of subprograms which would work with the least amount of specially built in-out equipment.

(R. P. Mayer)

A "composite traffic schedule" has been drawn but is not generally available. It shows "at a glance" all that happens at any time pulse, at any register, on the bus, etc. It is not useful for showing how each order works. It shows only those commands which originate at CPO Units. A drawing showing all commands and pulses, in space-time form, might be useful. Any suggestions will be welcomed.

A new up-to-the-minute drawing, showing timing diagrams for all orders, is nearly completed.

Recent changes in timing of the computer provide for no transfer check on information going into storage. This can be shown to be no great disadvantage.

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7.0 CHECKING METHODS

7.1 Test Program

(J. M. Salzer)

Engineering Note E-357, Test Program Number VII,  
Alarm Circuits Check, has been issued.

## 8.0 MATHEMATICS AND PROGRAMMING

(C. W. Adams)

During the past two weeks, inquiries from outside people about three new possible applications of WWI have been taken under advisement. These are (1) a Monte Carlo type problem paralleling actual experiments in group intercommunication, (2) optical ray tracing, and (3) solution of systems of eigenvalue problems arising in atomic structure. Of these the first and the third look particularly promising. The first is going to be programmed by one of the interested parties. The greatest difficulty appears to be the generation of sufficiently random numbers for use in Monte Carlo process. Numerical methods for the third are being worked out by Professor Kopal and will then be coded here if it appears to be possible to perform the calculation with 256 storage registers.

A new DIC staff member and three undergraduates working here part time are new members of the general application group. After some familiarization, they will work first on interim input and output programs. Much work remains to be done on such things as automatic handling of floating-point, double-precision and complex numbers, and on techniques for using the machine to assist in routine kinds of coding and in locating errors in programs. Work also remains to be done on a basic subroutine library (editing already partially completed on function-evaluation, on solution of algebraic equations and on quadrature).

Porter and Helwig are finishing up their work on Papiian's problem as far as it can be finished before being run on the computer, and they will be working on some of the problems mentioned above.

(F.C. Helwig and J.D. Porter)

Work has continued on the non-linear partial differential equation, described in Bi-Weekly Report M-1071, that arose in W. Papiian's research.

We have obtained expressions for the growth of round off errors and for the effect upon succeeding values along a row of given change in the estimate of the initial value of that row. Using these expressions we were able to determine an estimate of the maximum error that could be produced by round off.

These results were of course very pessimistic. However, due to the non-linearity of our system it was not possible to obtain better estimates. Since round off in errors cannot in general be predicted they are usually assumed to be random. For this

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8.0 MATHEMATICS AND PROGRAMMING (Continued)

reason some idea of the effects of the round-off error will be determinable from the computed results by making small changes in the size of the lattice steps.

An input tape for the program is now being prepared.

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9.0 FACILITIES AND CENTRAL SERVICES

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>No. of Pages</u>	<u>Date</u>	<u>Author</u>
E-357	Test Program Number VII, Alarm Circuits Check	6	7-28-50	J. M. Salzer
E-367	Construction of a Beryllium-Evaporation Target Assembly	3	8-17-50	J. Palermo
E-369	Construction Technique of Electron Guns for the WWI Storage Tube	11	8-24-50	G. Kaplan
E-376	Preparation of Arms for the Storage Tube Envelope	1	9-7-50	W. Pickett
E-378	Forming Right Angle and U-Bends	2	9-7-50	W. Pickett
E-380	Operation of Interim Tape Reader Equipment	8	9-12-50	C. W. Watt
E-382	Glass Construction of Evaporation Tube Envelope	1	9-25-50	W. Pickett
E-384	An Investigation of the Effect of Angle of Beam Incidence and Beam Deflection on Electrostatic Storage Tube Performance (Abstract of MS Thesis)	2	9-25-50	K. McVicar
E-385	Dynamic Determination of Usable Storage Densities in Storage Tubes (Abstract of MS Thesis)	1	9-25-50	H. B. Frost
M-1075	July 1950 Research and Storage Tube Summary	4	8-9-50	M. Florencourt
M-1096	Bi-Weekly Report, Project 6345, September 15, 1950	18	9-15-50	
M-1097	Modification of Storage Tube Mounts	4	9-19-50	W. Nolan
M-1098	Thesis Proposal: Analysis and Design of a Digital to Voltage Decoder	16	9-19-50	R. Walquist
M-1099	August 1950 Storage and Research Tube Summary	3	9-15-50	M. Mann
M-1101	Storage Tube Drawing List	90	9-28-50	R. Shaw

Library Files

.004 Proceedings of the I. R. E.: September, 1950  
European Scientific Notes: 15 August, 1950

I. R. E.  
ONR/London

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9.1 Publications (Continued)Library Files (Continued)

<u>No.</u>	<u>Title</u>	<u>Author</u>
47	Technical Information Pilot: August 10, August 25, September 6, September 8, 1950	(ONR/Library of Congress
150	Fundamental Research on Raw Materials Used for Electron Emissivity on Indirectly Heated Cathodes Summary Report of Work Accomplished, covering period 1 June, 1947 to 1 July, 1950	(Raytheon Mfg. Co. (J. Cardell (W. Nottingham (I. E. Levy
180	Document Office Bulletin: September 22, 1950	R. L. E., M. I. T.
232	Physics Today : June, August, September, 1950	Amer. Inst. Physics
361	Electrical Communication: September, 1950	I. T. & T.
559	Technical News Bulletin: September, 1950. Including a discussion of NBS Eastern Automatic Computer.	Ntl. Bur. of Standards
698	Physics Abstracts: Section A of Science Abstracts: August, 1950	I. E. E.
921	The ADL Digital Reporter. September 18, 1950	A. D. Little, Inc.
922	On the Method of Kernel Functions	(S. Bergman (M. Schiffer
923	A Coincident-Current Magnetic Memory Unit. M. S. Thesis, 1950	W. N. Papiian
924	Analysis of a One-Person Game. Engineering Research Institute, U. of Michigan. Report No. M720-1 R23. November, 1949	(W. M. Kincaid (W. R. Scott (A. H. Copeland (J. Chover
925	Lecture Notes on the Electrostatic Storage Tube Work in the NBS Electronics Laboratory. Report 12.3-1R, July 6, 1950	(A. W. Holt (Ntl. Bur. of Standards
926	The Indicial Admittance of a Supersonic Rectangular Airfoil. NAVORD Report 1171, NOTS 227. 21 July, 1949	J. W. Miles
927	The Oscillating Rectangular Control Surface at Supersonic Speeds. NAVORD Report 1185, NOTS 241. 4 October, 1949	J. W. Miles
928	The Oscillating Rectangular Airfoil at Supersonic Speeds. NAVORD Report 1170, NOTS 226. 21 July, 1950	J. W. Miles
929	Life-Test, Deactivation, and Reactivation Studies of Oxide-Coated Cathodes. M. S. Thesis, 1950	D. M. Collier
930	Electronic Equipment Construction (New Objectives, New Techniques, New Components). Terminal Report. 1 June, 1950	(Staff of Stanford (Research Institute
931	A Device for Computing Correlation Functions. Naval Research Lab. Report 3679. June 16, 1950	(A. E. Hastings (J. E. Meade
932	Network Approximation in the Time Domain. Air Force Cambridge Research Labs. Report E5048A. October, 1949.	W. H. Huggins

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9.1 Publications (Continued)

Library Files (Continued)

<u>No.</u>	<u>Title</u>	<u>Author</u>
933	Final Report: Engineering Pulse Transformer Research. U. C. L. A., April, 1948	{C. K. Hadlock {I. Goldstein
934	Beryllium Symposium. U. S. Atomic Energy Commission AECD-1803. December 11, 1946	{H. C. Hodge {H. L. Hardy, et al
935	Storage and Reading of a Table of Functions of One Variable by Means of a Passive-Network. Air Force Cambridge Research Labs. Report E5049. October, 1949	{J. D. Dillon {B. O. Marshall
936	Pantograph Radar Tracking: Point Centering Experiments. U. S. A. F. Technical Report No. 5969. September, 1949	{A. Ford {D. Rigler {G. E. Dugan
937	IRE Electronic Computers Committee, Definitions Subcommittee. Third List of Definitions. 50 IRE 8.1 PS1	I. R. E.
938	The Leaky-Condenser Oxide Cathode Interface. Technical Report 2, September 1, 1950	{U. of Missouri {A. Eisenstein
939	Airborne Traffic Control Transponder Utilizing Frequency Variation for Altitude Indication. Hazeltine Electronics Corporation. Report 9329, June 15, 1949	{R. Brunn {L. S. Schwartz
940	Comparison Study of Course Indicator ID-249/ARN and Indicator ID-48/ARN. A. M. C. Memorandum Report MCREE-49-43, 18 September, 1949	{R. R. Davis {Wright-Patterson
941	Air Traffic Control Group AN/FSA-1( ) (NAVASCREEN) A. M. C. Memorandum Report No. ENRNS-1-2. 31 October, 1949	Watson Labs.
942	Determination of x, y, and z Coordinates of Aircraft Position by Means of Four Ground Receiving Stations. A. M. C. Memorandum Report Serial No. MCRR-49-1, July, 1949	{Wright-Patterson {J. R. Rons {A. W. Knisley
943	Investigation of the Utility of an Electronic Analog Computer in Engineering Problems. Project MX-794, UMM-28. U. of Michigan Aeronautical Research Center. April 1, 1949	{D. Hagelbarger {C. E. Howe {R. M. Howe



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## 9.2 Standards, Purchasing and Stock

(F. B. Morley)

### Standards:

New National Military Specifications issued (JAN):  
Armed Services Index of Electro Standards  
JAN-R-22 Rheostats, Wire Wound, Power type, ammendment 4  
JAN-R-27 Resistors, External Meter (High Voltage, Ferrule terminal type)  
MIL-T-27 Transformers and Inductors, ammendment 1

### Procurement and Stock:

Price increases of practically all type of material used in this laboratory have been announced by many suppliers. Delivery time of these materials continues to increase.

An investigation is being conducted concerning the long life tube program as sponsored by the aircraft industry through certain tube manufacturers.

### New Products:

A new miniature precision potentiometer 7/8" dia. is being made by a local company.

We are informed that ceramic disc capacitors will be available up to 1 mfd. Samples have been requested.

## 9.3 Construction

(L. Prentice)

Machine Shop: New fixtures for the tube assembly shop have been completed as fast as the drawings have been received.

Work is underway on a second set of parts for #4 vacuum system.

The parts order for the storage tubes has been increased from 12 to 24. 23 signal plate frames have been received from heat treating and are ready for final assembly.

The turret tool post has been put in service and when equipped with colbalt tools should cut the time necessary to machine the signal plate frame.

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9.3 Construction (continued)

(R. A. Osborne)

Production Report: The following items have been completed and inspected since September 15, 1950:

Modification of Tape Output Unit Remote Control Panel  
1 Low Speed 2<sup>0</sup> Counter  
3 33-wire cables for tape units  
Modification of one 33-wire cable  
7<sup>4</sup> Terminators  
Winding on one special core

9.4 Drafting

(A. M. Falcione)

1. WWI Forms: About a year ago a form file was established in the print room to record all SL forms (Servomechanisms Laboratory) used by the joint Servo Labs. At that time a cross filing system was set up to coordinate with Building 32 so that no duplication of form numbers would occur. It is evident that many forms are now being used to which no SL form numbers have been assigned. It is important that the Print Room be informed of all new forms made, and properly recorded in our file system for the record and future references.

2. Ditto Reproduction Work: It is apparent that Ditto paper will be increasingly hard to obtain because of the present international conditions. Serious consideration should be given to the distribution lists by all concerned.

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10.0 GENERAL

(J. C. Proctor)

New Staff

Mr. John M. Frankovich of Revere is a new staff member who will be working with the mathematics group on applications. He received his Bachelor of Science in Mathematics from MIT in June.

Mr. Hrand Saxenian of Cambridge is a new research engineer working on coding problems for the computer. His experience includes three years with the U.S. Army Signal Corps and one year as a test engineer with the Boston Edison Company. He has a Bachelor of Science in General Engineering from MIT and a Master of Business Administration from the Harvard Graduate School of Business Administration.

New Non-Staff

Mrs. Martha L. King has replaced Alice Monroe, secretary in the administrative office. Her home is in Livermore, California. She is a graduate of Stanford University and the Wright MacMahon Secretarial School of Beverly Hills, California. Martha's husband is in the Harvard Graduate School of Business Administration.

Mr. Donald A. Kadish is a new Laboratory Assistant who will work with the installation and inspection group. Mr Kadish has been working at the Metallurgical Laboratory at MIT for several years.

Four new part time students have joined the project. All four are undergraduate students at MIT. Richard W. Prugh, John T. Gilmore and Donald G. Aronson are working with the mathematics group. Alfred C. Haacke is working with the storage tube group.

Non-Staff Termination

Lyndon B. Haynes