Project Whirlwind
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, March 17, 1950

To: 6345 Engineers

From: Jay W. Forrester

1.0 SYSTEMS TESTS

1.1 Whirlwind I System Test

(N. H. Taylor)

The Storage Bow is undergoing changes in Test Control so that 2 storage tubes can be run simultaneously and automatically checked against each other for errors. This will expedite marginal checking sequences and aid in locating low margins. The 2 tubes have run cyclically together without error for periods of 1 or 2 hours on several occasions. Power switching in Whirlwind causes errors in this type of operation.

Whirlwind testing continues with marginal checking work on all lines taking most of the effort. Some new low margins were found recently when the over-all computer was subject to voltage variation. These margins undoubtedly have caused much of the trouble experienced during switching equipment on and off. They will receive immediate attention.

Testing on the Eastman Unit, connected as a Reader, has progressed very well. Some circuit changes have been made to improve the signal to noise ratio. Work is continuing along this line.

(G. C. Sumner)

System tests were curtailed in the past period. Two days were consumed by demonstration to various visitors. Two and a half days were spent in installation of power wiring for electrostatic storage.

1.1 Whirlwind I System Test (Continued)

The computer is now operating without the program register. The functions of the PR have been assigned to the A-register in addition to its other duties. The change was made according to M-911 to permit the use of the PR for separate testing of electrostatic storage. No difficulties were encountered in making the change.

A new video probe system has been installed. A total of 26 plug-in positions with a central power supply are provided. This system and the new-model metal probe will result in greater efficiency of testing.

A test of allowable supply voltage variations has been made. The allowable variations were reasonable except for the 90 volt supply which was found overly critical to decreases. The data from this test will prove a valuable supplement to other marginal checking data.

(R. Read and C. Rowland)

The first digit column of ES row has been subjected to marginal checking; indications are that operating conditions are on a reliable level. The storage tube was used in cycling operations as a basis for correct operations of ES control, as it was subjected to marginal checking. Although the margins seemed to be adequate, the GT's on the ES Pulse Distributors had +250 installed on their plates, in order to increase their outputs. All GT's drive standardizer amplifiers, so their margins are expected to be high. However, the failure point of the SA at its input is purposely rather sharp -- about 8-10 V on the high-impedance input jack. Using +250 on the GT's preceding the SA channels brings the signal level well above the failure point.

The installation of the second digit column was completed, and almost immediately cycling commenced. Testing of the second and remaining columns awaits incorporation of the PR, which will allow the entire row to be operated. Test control has been modified and checked out for use with the complete system using the PR. It includes equipment for automatically writing any one of several patterns.

1.1 Whirlwind I System Test (Continued)

(H. F. Mercer)

The following failures of electrical components have been reported since March 3, 1950:

CRYSTAL RECTIFIERS	QUANTITY	COMMENTS
D-357	4	3 clamp crystals in Flip-Flop Storage Registers serial numbers 22, 26, and 29, all were replaced after 1896 hours because of excessive drift.
		1 clamp crystal in Flip-Flop Storage Register serial number 6, replaced after 110 hours because of excessive drift. Note: this is the second replacement of this crystal within a month.
D-358	14	13 were clamp crystals and 1 was a switching crystal.
		1 in Flip-Flop Storage Output serial number 10, replaced after 1899 hours because of excessive drift.
		1 in Program Register serial number 31, replaced after 902 hours because of low back resistance.
		1 in Program Register serial number 28, replaced after 723 hours of excessive drift.
		1 in Program Counter serial number 2 replaced after 1000 hours because of excessive drift.
		1 in In-Out Register serial number 25, digit 9, replaced after 1924 hours because of excessive drift and low back resistance.

1.1 Whirlwind I System Test (Continued)

CRYSTAL RECTIFIERS	QUANTITY	COMMENTS
D-358		1 in In-Out Register serial number 29, digit 13, replaced after 1924 hours because of excessive drift and low back resistance.
		1 in Flip-Flop Storage Output serial number 7, replaced after 1924 hours because of excessive drift.
		1 in Flip-Flop Storage Register serial number 4, replaced after 1924 hours because of excessive drift.
		2 -- one was a clamp crystal and the other a switching crystal, in ESD Decoder serial number 2, replaced after 609 hours because of excessive drift.
		2 in Comparison Register Check, replaced after 700 hours because of excessive drift and low back resistance.
		1 in Comparison Register serial number 23, digit 9, replaced after 43 hours because of excessive drift and low back resistance.
		1 in In-Out Register serial number 21, replaced after 1924 hours because of excessive drift and low back resistance.
TUBES		
6Y6G	3	All were Inverter-Amplifiers in Flip-Flop Storage Output panels and all were replaced because of change in characteristics, low plate current.

1.1 Whirlwind I System Test (Continued)

TUBES	QUANTITY	COMMENTS
6Y6G		In serial number 10, the tube was replaced after 2054 hours.
		In serial numbers 4 and 12, the tubes were replaced after 2074 hours.
7AD7	13	All were flip-flop tubes in the following panels:
		2 in In-Out Register serial number 30, replaced after 2022 hours because of change in characteristics, low plate current.
		1 in Accumulator digit 0, replaced after 2786 hours because of control grid to screen grid intermittent short.
		2 in Check Register serial number 12, replaced after 1868 hours: 1 because of control grid to cathode tap short; the other because of change in characteristics, low plate current.
		2 in Flip-Flop Storage Register serial number 2, replaced after 1946 hours: one because of control grid to cathode tap short; the other because of change in characteristics, low plate current.
		2 in Program Register serial number 28, replaced after 2615 hours because of change in characteristics, low plate current.

1.1 Whirlwind I System Test (Continued)

TUBES	QUANTITY	COMMENTS
7AD7		2 in In-Out Register serial number 28, replaced after 2022 hours. One because of control grid to cathode tap short and the other because of an intermittent short between the control and suppressor grids.
		2 in In-Out Register serial number 31, replaced after 2061 hours because of change in characteristics, low plate current.

1.2 Five-Digit Multiplier

(E. S. Rich)

A large number of errors occurred in the multiplier on March 5th. This ended an error-free run of 45 days. Cause of errors was not determined. During the few days following March 5th an intensive investigation of the system was made and 9 crystals and 5 tubes of questionable condition were replaced. In spite of this, an error was recorded on March 12th. The regulated bias supply to replace the motor-generator set was installed on March 13th. It is thought that this motor-generator set may have been responsible for the errors. It will be necessary to observe performance of the regulated supply for a few weeks to determine its reliability.

2.0 CIRCUITS AND COMPONENTS

2.1 Circuits by System Number

400 Input-Output Element

(J. A. O'Brien)

Some part time work is being put into a further investigation of the control for the final input-output element, including the in-out switch and shift control.

602 Alarm Indication

(R. H. Gould)

The "Repeated Alarm" neon indicator light has been connected into one of the spare positions on the alarm indicator panel in test control and has proved useful. Its operation could be improved by increasing the brightness of the light particularly when alarms are repeated but at a slower rate. It seems probable that this can be done simply.

835 ES Drivers

(W. J. Nolan)

A new output transformer has been designed for the RF pulser to permit increasing the output by operating at higher plate voltage. At least 30% more output voltage will be available when operated under pulse conditions with this modification, but the CW output for use with the TV display will be slightly less than with the present circuit. In addition to the installation of the new transformer, other minor changes in components will be necessary in the circuit.

2.5 Tubes and Components

(F. B. Frost)

Forty-nine defective L9B production 7AD7 tubes have been returned to Sylvania for analysis. These tubes resulted from testing of about the first 150 tubes of this production. As mentioned in the last Bi-Weekly, the most common fault appears to be shorts.

2.5 Tubes and Components (continued)

Life tests of two lots of tubes have been started. These are an accelerated test of the above-mentioned L9B production and a standard test of a new lot of 5687 tubes. Data will be available from these tests about the middle of April.

All material on the vacuum tube life report has been turned in to drafting except for one photograph and one graph, which was inadvertently lost. This material will be turned in for final drawings in the very near future.

3.0 STORAGE TUBES

3.1 Construction

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

Three storage tubes with 40 mesh mosaic (ST149, ST150, ST151) for use in WWI were processed.

Three research tubes were processed. The first tube, RT126-2, was the second 100 mesh mosaic storage tube with both guns in one neck. The second tube, RT129, was designed to study the effect of beam incidence angle. It has a movable and rotatable storage assembly which is inclined 14° to the normal position. The high velocity gun is mounted in a neck which is also inclined 14° to the center line of the tube. (RT127-1, a similar tube, was constructed the previous bi-weekly period for this study. This tube had a low surface resistance on its storage surface.)

The third research tube RT128-1 has the storage surface from ST112. This surface had a spot which was unusable after 2239 hours of bombardment (M-982). The surface was sensitized with oxygen and put into RT128-1.

(W. E. Pickett)

Glass Components - The supply of evaporation tube envelopes on hand is sufficient to take us through the next bi-weekly period.

The supply of storage tube envelopes still remains in excellent condition and should last us through the next four weeks if an average construction schedule is held.

An adaptor has been made for the headstock of our glass-working lathe which will allow us to work up to an 11" diameter glass. With this new adaptor an envelope for RT130 will be prepared in the next bi-weekly period.

Work has been started on a small bell jar, liquid air trap and ion gauge assembly to be used for testing the vacuum of system #4.

RT128-2 was completed in the glass room. This is the tube with both guns sealed into a single neck, the envelope being prepared from standard mold-blown cylinders as reported in the last bi-weekly report.

3.1 Construction (Continued)

The gas economizer for the second lathe has been received and installed and is working as well as the gas economizer installed on the #1 lathe. With this installation lathe #2 can be used to do any job that was performed before on lathe #1.

In general, the work in the glass room progressed without difficulties.

(J. S. Palermo)

Mechanical Components - During the past week an ample supply of silvered mica surfaces has been accumulated. Additional mica surfaces will be prepared this week, so that future rejections will not curtail a construction program.

Experiments are now being conducted to mount a glass surface into a storage target assembly. Although the first attempt proved highly successful, several assembling techniques will be tried in order to maintain minimum breakage.

(J. O. Ely)

RT124-1, the first storage tube with both guns in one neck, was retired from test for the following reasons:

1. Appearance of the getter spots indicated either a very slow leak or a high rate of release of gas from something inside the tube.

2. Apparent low holding beam intensity along a portion of the storage surface perimeter gave unsatisfactory storage stability in this area. Although the primary reason for the low holding beam intensity on this particular area is probably distortion of the beam by action of the tilted lens formed by A_2 and A_1 of the holding gun, it appears that the effect is intensified by decentering of the holding beam and possibly by charging of the uncoated glass area between A_2 and A_3.

3. Members of the test group felt that use of the type 3R high-velocity gun imposed the need for considerable readjustment of equipment to secure optimum operation.

This tube may be returned to test later if its internal pressure does not rise too far and if further data on its operation are needed to guide future development work.

3.1 Construction (Continued)

RT126-2, the second of the series of tubes having both high-velocity and holding guns in a single neck, was constructed and processed during the last period. Initial testing of this tube in TV #1 shows that it is more satisfactory than RT124-1 with respect to uniformity of holding beam coverage, but that the effect of holding beam distortion is still noticeable. Further testing will be done in the STRT when time allows.

Work is being continued on the design of structures mounting high-velocity and holding guns in a single neck on an 18-pin stem. Objectives of this work at present are:

1. To get the high-velocity gun on the axis of the tube and thereby reduce distortion due to large angle of incidence of the beam on the storage surface.

2. To improve uniformity of the holding beam coverage over the storage surface.

3. To simplify gun construction insofar as possible.

Although not a specific objective of the present work, all designs so far contemplated will provide possibility of a 3- or 4-fold increase of holding beam density.

A research tube (RT130) to test one new gun design will be constructed next week. This tube will have a type 3R high-velocity gun surrounded by four holding guns, all mounted in a seven-inch CRT bulb which has been re-necked with a 3-1/2" diameter cylinder. A willemite screen on the face of the bulb will provide for visual and, possibly, photometric examination of the holding beam pattern. It also should be possible to determine maximum permissible deflection angles of the high-velocity gun in this tube, using photometric techniques.

Development of evaporation techniques in system #4 has continued. Improved supports were constructed for the tantalum wire used as an internal heating element so that this element may now be operated at temperatures up to 2000°K, or higher. A high-voltage lead-through has been installed in the base plate of the evaporator so that the target end of the evaporation rig may be maintained at high potential with respect to the heating element. It is thus possible to utilize the thermionic emission of the tantalum heater to bombard the surface of the target with high energy electrons for cleaning purposes prior to evaporation of the metallic coating. At present, our silver evaporations appear to be satisfactory. One

3.1 Construction (Continued)

test evaporation of beryllium in a 60-mesh mosaic has been performed. Results of this test were encouraging, although not entirely satisfactory. It has not yet been possible to achieve pressures low enough to be satisfactory for evaporation of beryllium surfaces, and work is continuing on this problem. A 4-1/2" diameter bell jar is being made with a liquid nitrogen trap and an ion gauge tube attached so that ultimate pressure of the pumping equipment alone may be measured. By thus separating the system into two major areas of attack, more rapid progress should be possible.

(R. Shaw)

A considerable time has been spent in checking and extending the index to storage tube drawings. In the future the drawing file by R. Shaw's desk will be kept in numerical order, while that next to P. Youtz's desk will be arranged by subject.

Drawings were made of RT59, an old beam-analyzer tube which had not been drawn previously; an outline sketch of the RCA 7J gun was also made.

The ST drafting group has also worked on modifications of the storage tube with both guns in one neck, and on the new annealing oven.

3.2 Test

(H. B. Frost, H. Rowe and C. L. Corderman)

Storage Tube Reliability Tester - Early in the last period, RT124 (storage tube with both guns in one neck) was found to be gassy, so that no more testing of this tube was possible.

ST118 was tested in its mount for dynamic cycling ranges and delivered to WWI. WWI now has two tubes and mounts tested out and operating. During the next period, the week of March 20-25 has been set aside for the testing of WWI mounts. It is expected that all mounts which are complete with tubes will be tested during this period prior to their installation in WWI.

During the last period, some very considerable changes were made in the Storage Tube Reliability Tester. In the first place, provision was made to operate two tubes simultaneously but independently. In the second place, the control was modified to allow automatic starting of a cycling array with one push button. This expedites testing very considerably. Accompanying these two revisions, provisions were made to compare automatically

3.2 Test (Continued)

the contents of the two tubes cycling. If the contents are not identical, this is indicated on an indicator scope. Lack of coincidence of contents may also be used to stop the cycling operation. All in all, cycling tests may now be done with very little difficulty.

During the past few days, ST136 has been tested intensively in its mount box. A tentative interpretation of the results of these tests has indicated that use of the range of "Read Signal Plate Gate" amplitude as a measure of the operating point stability of a storage tube while cycling may be quite informative. This will be examined for possible application to the thesis investigation of H.B. Frost.

(M. I. Florencourt)

Two 100-series storage tubes were given standard tests. ST149 passed the tests, but ST150 is not quite up to standard. There is a crescent-shaped area along the upper right rim of ST150's storage surface whose capacitance is quite different from that of the rest of the surface. Arcing also occurs occasionally.

ST145 passed static WWI acceptance tests.

Initial tests were run on RT127, a research tube with a tilted (20°), movable storage assembly. The storage surface was imperfect.

A memorandum is being issued on RT128, a 200-series storage tube with the reoxidized storage surface from ST112. The point on the surface of ST112 which had been bombarded by 1500V electrons for 2000 hours no longer would store. The surface was removed from ST112 and reoxidized at atmospheric pressure and room temperature. After oxidation the surface was inserted in RT128, and the tube processed normally. Subsequent tests showed only the slightest trace of the bombarded spot; it would now store under the same conditions as the surrounding areas. The secondary emission ratio of the surface as a whole, however, was lower than normal as evidenced by an upward shift in upper and lower switching voltages and operating limits.

Standard tests were also run on RT126. This is a research tube with the high and low velocity guns in one neck, and with a 100 mesh mosaic. The tube behaves like a normal 2-neck 100 mesh tube; the holding beam covers the storage surface at normal operating voltages.

3.2 Test (Continued)

Three tubes were removed from the life test unit for investigation of the storage surface. ST48 (~ 7500 hours) had just barely enough HV current to get a TV readout picture, not enough current to write without pulsing the control grid positive. Corderman will test this tube further in the video readout test set.

ST73 (~4360 hours), which had been biased partway off, exhibited a maximum in its I_K vs V_B curve for the HV gun. Current gradually built up. Standard tests were run and indicated a decrease in the secondary emission ratio of the surface due to the TV sweep constantly applied to it. There was a dark spot on the surface which corresponded to a "hole" in the emission from the holding gun.

RT105 had been on life test about 200 hours with one spot being bombarded with 1500V electrons. This spot barely stored; its δ was much lower than normal. An unusual picture of the holding-gun cathode emission was obtained with the HG biased partway off.

(K. E. McVicar)

A test setup has been assembled for the beam incidence-angle study using the equipment which was formerly a part of the high-speed read-write unit. A sweep generator was built which produces a linear sawtooth variable between 10 and 2000 microseconds.

A special tube, RT127, was built by the tube construction group for these studies, but the mosaic proved to be leaky during the initial tests. Consequently, another tube, RT129, was constructed and is awaiting tests.

(A. R. Tanguay)

Testing of RT114, the beam analyzer tube with the movable Faraday cage, is being extended to study the beam deconcentration caused by deflection of the beam from the center.

In order to deflect the beam and measure the spot size the cage has to be displaced from the center of the tube. The only way to accomplish this with the present tube is to rotate the tube for about 90° about its axis. This results in both horizontal and vertical displacements of the cage, which complicates the sweeping of the beam across the two vertical slots, and caution must be exercised in interpreting the results obtained.

3.2 Test (Continued)

A desirable refinement would be the substitution of a small circular aperture for one of the long slots. Additional scanning techniques might also be considered.

(D. M. Collier)

The experimental phase of master's thesis research on the problem of deactivation of storage tube cathodes under standby conditions has been completed except for taking of additional data on cathode temperature vs power input to heater and data on grid current in the retarding-potential region. Major effort at present is on analysis of data obtained so far. Preparation of the thesis report also has been begun.

3.3 Storage Tube Development

(H. Klemperer)

An attempt is being made to reduce the deconcentration occuring to the cathode ray beam while being electrostatically deflected. A modified 3RP gun has been designed with a predistorting cylindrical lens which, if connected to a fraction of the deflection voltages, will compensate deflection distortion of the beam, as described by R. Hutter.

4.0 INPUT-OUTPUT EQUIPMENT

4.1 Eastman Kodak Units

(E. S. Rich, D. Hageman)

Attention has been devoted to the phototube and pre-amplifier circuits associated with reading. A plug-in panel was built to facilitate testing of revised circuits intended to (1) eliminate the scanning frequency component in the signal and (2) increase the signal-to-noise (S/N) ratio. The latter is inherently worse during reading because (1) the interruption of the scanning beam by exposed spots in the film is not complete and (2) light passing through clear (unexposed) spots is attenuated. Considerable progress was made although further improvement in S/N ratio is desirable. It is hoped that this can be achieved by using a higher beam intensity during recording. Films of this nature were in the process of preparation on the last day of the bi-weekly period.

Discovered a small defect (possibly peculiar to the unit being tested) in the optical system which causes the amplitude of the pulse corresponding to the first digit to be considerably reduced. This can be circumvented by using a different portion of the reading and recording masks.

4.2 Display

(J. A. O'Brien)

The zero digit circuit of the non-holding decoder for special display has been changed to operate in the opposite direction as compared to all of the other digits in order to take care of the algebraic sign of the numbers to be decoded.

The decoder is not working as well as we hope it will, some work has to be done on the read-in circuits, and there seems to be noise on one of the digit channels. Work on the panel is not being pushed because of the press of other duties of the computer.

4.3 Typewriter and Tape-Punching Equipment

(F. A. Foss)

All of the components needed for the preparation of the corrected self-checking tape have been ordered. The modifications of the checking typewriter, tape reader and tape punch used for this tape preparation have been completed.

A relay breadboard circuit for controlling the number and complement punching operation is now being tested.

4.3 Typewriter and Tape-Punching Equipment (cont.)

(J. S. Hanson)

Relaying circuits for preparation of punched tape from word and complement data placed in the IOR and COR by either the computer or a film reader have been completed. A closed loop system has just been adopted in that the computer and film reader must wait until the tape equipment punches the word and complement, clears the relay registers, and signals completion of the punching operation to the computer or film reader. The tape punch must then wait for a new word. Provision for start and stop signals has thereby been eliminated and provision for standby-operate has been incorporated so that the IOR and COR output may be switched over very quickly to a film recorder at will.

A seventh hole signal in the last half of the last word in a train of blocks signifies the end of the train, after which the tape can be fed out manually bs pressing the feed-out button until the punched portion of the tape clears the tear-off slot.

Relaying circuits for placing data on punched tape in binary form are now being developed.

5.0 INSTALLATION AND POWER

5.1 Power Cabling and Distribution

(C. W. Watt)

The computer was shut down March 8 and March 9 to permit more installation work to proceed. The work done was as follows:

1. All voltages to the Program Register were made non-variable.
2. The Program Register Driver was disconnected from Rack AD electrically, and connected to the voltages in Rack ED.
3. An annoying difficulty in the P-Row fuse indication system was corrected.
4. The video probe power distribution system was completed.
5. Bus covers and transformer covers were installed.
6. About one third of the filament transformers in E-row were adjusted.
7. Various small cleanup jobs were done. The computer was turned back to the system group about noon, March 10.

The computer has also been shut off on Saturdays for installation work. All of the assembly shop personnel has been put on this installation during such shutdowns, and it is expected that they will work on it each Saturday until April 1, and then the whole week of April 5 to April 12. The excellent progress made on the current installation program to date indicates that we will complete the scheduled work well within the allotted time.

5.2 Power Supplies and Control

(R. E. Hunt)

E.S.Power Supply Control - The E.S.Power Supply Control Panel is complete and checked and is ready for installation.

5.2 Power Supplies and Control (cont.)

The E.S.Meter Panel will go to the construction shop on 3-20-50.

All units excepting the E.S.Meter Panel are on schedule and will be ready for installation on April 5.

Power Control Panel - This is in the assembly shop at the present time. This should be finished and checked about 3-27-50. It will be installed during the April 5th shutdown.

Marginal Checking Control Panel - Layout is complete and this panel should go to the drafting room in about one week.

Record and Maintenance Drawings - I am starting work reviewing, obsoleting, and indexing all power supply, control and distribution drawings for WWI, in conjunction with C. Watt and J. Gano.

We hope to evolve a complete set of indexed drawings to be used with the proposed maintenance handbook, suitable for all types of maintenance, and for understanding the complete system.

(J. J. Gano)

Marginal Checking Power Supply - The Regulator and its Power Supply are completed except for attachment to their front panels. The Generator panel is in the process of mechanical construction. Since the amount of electrical wiring involved is small, there should be no difficulty in having this panel ready for installation during the next computer shutdown.

D.C. Plate Supply Alternator - The Silverstat Regulator was found to have poor performance characteristics. The gain of the system was low, a value of 3, and the system was highly overdamped, giving a slow response time, almost one second.

The design of a new regulator is underway. A first step is the rewinding of the exciter field with double the number of turns in order to improve the match to the output stage of the amplifier. This procedure should permit the use of a regulator similar to those used for the Filament Alternator and 115 V - 3ϕ Supply Regulators. The power supply for the regulator will be a duplicate of those used in the other two systems. The cost of rewinding will be more than offset by the savings in the cost of material, since the power supply

5.2 Power Supplies and Control (cont.)

will be about one half the size of that which would have been required and no extra spare parts need be stocked. Furthermore, the design time will be greatly reduced.

The coupling between the motor and the alternator was observed to have considerable backlash, creating extremely fast transients at the output of the alternator when a step load was applied. In order to eliminate this trouble, a Morse silent chain coupling, the same type as used on the filament alternator, has been ordered.

5.3 Video Cabling

(T. Leary)

The shop has finished the remaining Video-Probe cables (1044-1052) and will finish all the remaining miscellaneous cables as of March 20. Next to be done will be a fairly large group of temporary cables, now being designed, to facilitate the use of the Program Register in testing Electrostatic Storage.

6.0 BLOCK DIAGRAMS

(R. P. Mayer)

Timing Diagrams for WWI are being re-drawn. Each operation which contains Program Timing will be shown on an A-sized sheet, without Program Timing. The Program Timing will be drawn on a B-sized sheet in such a way that when all the diagrams are bound the Program Timing will be visible at the same time as any one of the Operation Timing diagrams.

A sketch is being drawn showing all block-diagram connections in the computer (including Test Control) except those that are relatively simple to understand, such as direct reading in and out, shifting, counting, etc. All connections which deviate from what would normally be expected are shown or noted. The main purpose of the diagram is to show the interconnections and interactions between the various control centers -- Central Control, IOC, SSC, ESC, AEC, Test Control, etc.

7.0 CHECKING METHODS

7.1 Test Programs

(J. M. Salzer)

The ideal use of marginal checking in trouble-location work requires that information be sent horizontally when voltages are varied vertically (or vice-versa). In the normal use of the computer, only a few registers transmit information horizontally during shifting and in-out operations. Another way of transmitting signals horizontally is by complementing individual registers or units. If margins are varied at the same time and a suitable problem is used, this scheme might prove to be useful in trouble-location. Several sequences were written for this purpose and their feasibility will be tested some time next week.

7.4 Marginal Checking

(G. Cooper)

The study of the optimum use of voltage-variation in the gate tubes is about 95% complete.

Accumulation of data on the margins available on certain lines for various test programs is continuing. No pronounced trends have as yet developed. There is some evidence to indicate that the test sequences provide a more strenuous check on the operation of specific portions of the computer than a more generalized problem such as Test Programs I and II (which use these same portions of the computer). An analysis to determine the reasons for this difference is being undertaken.

8.0 MATHEMATICS AND PROGRAMMING

(C. W. Adams)

Work on describing the proposed input-output equipment and on writing up an initial conversion program and some of the more obvious standard subroutines is continuing.

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

No.	Title	No. of Pages	Date	Author
M-992	Storage and Research Tube Summary	9	2-28-50	M. I. Florencourt
M-996	February 1950 Research and Storage Tube Summary	2	3-1-50	M. I. Florencourt
M-997	Progress Report: A Coincident-Current Magnetic Memory Unit	2	3-2-50	W. N. Papian
M-998	Bi-Weekly Report, March 3, 1950	29	3-3-50	
M-999	Vacuum Tube Failures During February, 1950	3	3-13-50	H. B. Frost
M-1000	A Proposed Binary to Analog Converter	4	3-6-50	K. McVicar
M-1001	SR-1407 Development: Tests on Lot C-9402	4	3-7-50	E. S. Rich
M-1002	Preliminary Considerations for Adaptation of Raytheon Magnetic Tape Units to the WWI System	4	3-13-50	E. S. Rich J. A. O'Brien

Library Files

	Proceedings of the IRE: March, 1950	IRE
	RCA Review: March and June, 1948	RCA
	Technology Review: February, 1950	MIT
.004	European Scientific Notes: Index, Volume 3, 1949; February 15, 1950	London ONR
47	Technical Information Pilot: September 9, 1949; January 27, February 14, February 16, February 23, 1950	ONR, Library of Congress
113	The General Radio Experimenter: March, 1950	Gen'l Radio Co.
150	Fundamental Research on Raw Materials Used for Electron Emissivity on Indirectly Heated Cathodes: Eleventh Interim Technical Report; and Influence of Migration of Impurities as Related to Indirectly Heated Cathodes in a Diode Structure, Technical Report Number 3	J. Cardell Raytheon Mfg. Co.
180	Document Office Bulletin: March 3, 1950	RLE, MIT
219	Glossary of Guided Missile Terms: 20 September, 1949	Res. & Dev. Bd.
232	Physics Today: February, 1950	Amer. Institute Physics
360	Servomechanisms Laboratory Accessions List: March 1, 1950	MIT Servo Lab.

9.1 Publications (Continued)

Library Files (Continued)

No.	Title	Author
442	Bulletin of the American Physical Society. Programme of the Oak Ridge Meeting, March 16-17-18, 1950. Volume 25, Number 2	American Physical Society
447	Index to Current Releases and Civil Aeronautics Manual Supplements. December 15, 1949	C. A. A.
491	Theoretical Limitations on the Rate of Transmission of Information. Technical Report No. 114	RLE, MIT
492	The Hazeltine Laminar Air Navigation and Anti-Collision System (LANAC). Report No. 2005W-R January 4, 1946	Hazeltine Electronics Corporation
493	Airline Airport Design Recommendations	Air Transport Association of America
494	Automatic Data Posting System for Airway Traffic Control. 1941	Teleregister Corp.
495	Traffic Control Without Pilot Effort -- Four Steps to Efficient Air Traffic Guidance. 1945	Teleregister Corp.
496	Crash Injury Research. Report for Fiscal Year July 1, 1948 to June 30, 1949	Cornell University Medical College
497	Correlation of Bulb Temperature with Ambient Temperature for Subminiature Tubes. Report No. B1/60/48-1. Sylvania Products Company	R. E. Booth M. Feinberg W. R. Wheeler
498	Storage of Small Signals on a Dielectric Surface. Cambridge Field Station Report No. E5045	J. V. Harrington
499	Some Applications of Electronics to Precision DC Measurements and Control. AECD - 1908, (LADC-503) Los Alamitos Scientific Laboratory	H. T. Gittings
500	Electronic Equipment Standards and Suppliers Directory of Requirements for Parts, Materials, and Processes. February, 1950	Air Materiel Command
597	MIT Reports on Research: March, 1950	MIT
641	Teleregister Automatic Aids for Air Traffic Control. Presented for RTCA SC-31, Phase II, October, 1947	Teleregister Corp.
642	Basic Instrument Flight -- Training Manual	C. A. A.
643	Group Coincidence Discrimination. Naval Research Labs. Report No. P-3477	Naval Research Labs.
644	Iron-Cobalt and Iron-Cobalt-Nickel Alloys (the Effect of Annealing in a Magnetic Field Upon) Prepared by Powder Metallurgy. Reprint Transactions AIME, Vol. 188, February, 1950; Journal of Metals -- 287	J. F. Libsch E. Both C. W. Beckman D. Warren R. J. Franklin

9.1 Publications (Continued)

Library Files (Continued)

No.	Title	Author
645	Investigation of Vapor Pressure of Metals and Metal Oxides. Twelfth Quarterly Progress Report, July 1, 1949. Ohio State U. Research Foundation	H. L. Johnston
646	A Symbolic Analysis of Relay and Switching Circuits. AIEE Paper 38-80	C. E. Shannon
648	Development of Magnetic Materials: Progress Report Number 12, November 8, 1948	G. H. Cole
649	A Proof of the Equivalence of the Programming Problem and the Game Problem. January, 1950	G. B. Dantzig
650	Simplex Solution of the Hitchcock - Koopmans Transportation Problem. (Revised Feb., 1950)	G. B. Dantzig
651	Preliminary Analysis of the Efficiency of Air Traffic Control Systems. Report No. 506-1, August, 1946. Air Navigation and Traffic Control Section, Airborne Instruments Lab.	W. D. White E. G. Rubini
652	Surveillance Approach Traffic Control. Bendix Radio Company	H. K. Morgan
653	Errors of Position as Obtained from the Offset Course Computer. Bendix Radio Co., 1947	J. S. Morel
654	Electronics for Omni-Range Navigation. Bendix Radio Company	H. B. Yarbrough
655	Radar as an Interim Aid to New York Air Traffic Control. Report No. 512-1, August, 1946. Air Navigation and Traffic Control Section, Airborne Instruments Lab.	C. A. Fowler H. B. Abajian G. C. Comstock

Books

Theory of Mathematical Machines	F. J. Murray
President's Report: MIT Bulletin, Oct., 1949	MIT
Methods of Operations Research: Operations Evaluations Group Report Number 54	P. M. Morse G. E. Kimball

9.2 Standards, Purchasing and Stock

(H. B. Morley)

Standards - No new or revised standards were issued this bi-weekly period.

A revision of the Armed Services Index of R. F. Transmission Lines and Fittings has been received from the Armed Services Electro Standards Agency.

Procurement and Stock - The physical inventory of laboratory equipment is nearly complete except for Fort Heath, and efforts for the next week or two will be mostly toward locating missing items and correcting records.

The plastic covers for relays have been received and several minor modifications have been worked out with the vendor. Drawings have been submitted to the vendor for estimate on 64 additional units, and an order will probably be placed in the next few days.

Revised drawings for the ST Mount have been received and forwarded to the James Millen Manufacturing Company for construction of sixteen additional units.

A special test is being conducted on a sample group of D-357 and D-358 crystals in an effort to obtain recorded data on the changes in characteristics which take place over a period of time.

9.3 Construction

(R. A. Osborne)

Production Report - The following items have been completed and inspected since March 3, 1950:

11 Video Cables (Video Probes)
31 Video Cables (Miscellaneous)
8 Video Cables (Modified RF Cables)
1 Register Driver Type I
1 ES Power Control Panel
12 Video Probe Attenuators
8 Video Probes
1 Breadboard (Sweep Generator)
Modification of Register Driver Type I Prototype
Modification of Signal Plate Driver Prototype

9.3 Construction (continued)

(D. V. Mach)

Experimental breadboard models of component parts of a simplified decoder have been built to be used in the Storage Tube Laboratory test setups. A final single chassis model has been laid out and work will begin soon.

An ESDD Protective Circuit has been breadboard assembled.

To date 14 ST Mounts have been video aligned and 13 have been R.F. aligned. Due to oversight on the author's part, some of the above mounts will of necessity have to be video realigned.

We plan in the immediate future to modify ST Mounts #23 and #24 to mount 200 series storage tubes. Modification consists of extending one wire on the HVG socket, the purpose being to compare storage and deflection characteristics of 100 and 200 series storage tubes.

9.4 Drafting

(A. M. Falcione)

Drafting Load - The drafting load is quite heavy at this time with WWI Change Notices for:

a) WWI units
b) Block Diagrams and Timing Diagrams
c) Summary Report Drawings
d) Report drawings
e) Drawings for WWI units to be constructed
f) WWI posters (Rathbone)

Priority is being given to items a, b, c, and e.

The library files for Reports, Memos, Engineering Notes, etc., located in the Drafting Room, will be kept up to date for use of all concerned. The former file located in Engineering 2 has been discontinued. Anyone desiring information in these memorandums may use this file for ready reference.

10.0 GENERAL

(H. R. Boyd)

Non-Staff Termination

Hugo Zazzara