Falcons

6345
Memorandum M-1057

Project Whirlwind
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, June 23, 1950

To: Jay W. Forrester

From: Project Whirlwind Staff

1.0 SYSTEMS TESTS

1.1 Whirlwind I System Test

(N. H. Taylor)

Electrostatic Storage is now being integrated with the rest of Whirlwind. This step is being taken to permit storage tube testing to continue on a more thorough basis without limitation as to stored pattern, mode of operation or repetition frequency. The last period has been one of planning for the integration. Three types of programs for initial testing have been studied. They are discussed in Section 6. These programs have been designed to give a maximum of information concerning the source and nature of faults which may develop in the Storage System while it is being tested with the rest of Whirwlind.

The systems and storage groups have been integrated with this storage tie-in and plan to run on a full 2-shift basis. This will improve efficiency considerably and speed the integration of the final system by several weeks. This 2-shift plan will start June 26th. Two technicians and two engineers will work on each shift.

The first tie-in of the Eastman Kodak recorder with Whirlwind during the last 3 weeks was effective in pointing up some weaknesses in the in-out system. In general the tie-in was successful. Film recordings were made under the control of Whirlwind. These were read back after developing and oscilloscope patterns were plotted directly from the film. Trouble with film developing, clutch adjustment, photo-cell signal to noise ratio indicate that further work is necessary to bring the reliability of this piece of equipment to a point where computer operation can be expected. Plans are under way to improve these weaknesses.

1.1 Whirlwind I System Test

(R. Read)

Testing of the ES row using the Temporary test control was terminated on June 15th to prepare for adding ES to Whirlwind. No substantial reliability run had been accomplished at that time. On June 14th, the power supply voltages were varied to determine the overall margins of the system. The results were in general disappointing; on one line (+250) only a 1% variation could be tolerated. However, two important facts indicated that this weakness was due principally to the test equipment. The margins for ES control had been taken just previously, and they were about 15% for the worst lines. A wide variation in input clock pulses could also be tolerated. Pulse amplitudes throughout test control were measured, and were satisfactory. The test system was felt to be particularly susceptible to variations, since a number of long delays were present. It was thought that further ES row testing, with the test equipment a possible weakest link, would be somewhat futile.

Five storage tubes in the row seemed to be quite unreliable. One of these had an area which obviously was bad, since it went positive over an area equal to many spot sizes, when written positive a few times. The HV gun cutoff on one tube seemed to change about 15 volts over a few-day period. It was not a slow drift, but changed rapidly one day, and returned as rapidly a couple of days later. No obvious trouble could be located in the other three tubes. At least one of them did not completely erase a positive array when writing minus over it. Adjusting the parameters to accomplish this erasure left the parameters radically different from those in other digits, and unsuitable for cycling tests.

A sensitivity of the Write Minus gate amplitude to repetition rates was observed, and resulted in a modification of the signal plate driver circuits.

The last week has been used in planning and preparing the ES system for use with WWI.

(E. S. Rich)

Tests with the Reader-Recorder tied into the computer system did not progress as far during the past two weeks as was anticipated. The main objective was to obtain information on the reliability of reading from film, and it

1.1 Whirlwind I System Test

(E. S. Rich)

was hoped that some data could be taken on the use of enlarged film spots and of reader-recorder marginal checking. Difficulty experienced with the film processing machine and also with preparing satisfactory CRT masks which are necessary to produce larger spots on film prevented us from getting much of the data desired.

On June 13th and 14th, Mr. Cochrane of the Eastman Kodak Co. visited the lab to check the clutch adjustment on the film unit and to observe the problems involved in system operation. On June 19th and 20th, Messrs. Kunz and McPherson, also of the Eastman Kodak Co., were present to repair the film processing equipment. Its condition had been such that film developed in it was worthless for reading tests.

Attempts to make masks with larger size apertures failed because of the difficulty in making accurate size reductions from a drawing with the facilities available in the lab. It now appears that the most satisfactory means of obtaining these masks is to order them from the Eastman Kodak Co.

Some significant information on the reading operation was obtained from tests made during the last two days. These tests indicated further weaknesses in the photo-tube amplifier circuits, particularly the reference-marker channel. A redesign of these circuits is planned as the next step.

(G. C. Sumner)

Systems test has mainly been confined to routine maintenance, since most time has been allotted to in-out tests. On June 14th computer margins of power supply variation were measured. In most cases power supply variations of $\pm 10\%$ or greater were allowable before errors occurred on Test Problem 11. This is a considerable improvement over measurements taken two months previous and represents a fairly satisfactory situation, considering the number of cascaded stages involved. Several of the alarms obtained on this test were inactivity alarms. The inactivity alarm circuit was later found to contain a marginal piece of standard test equipment. Thus some of the readings taken are probably pessimistic.

1.1 Whirlwind I System Test

(R. A. Nelson)

Routine marginal checking on the computer proper has been continued on about 125 lines. Exclusive of lines belonging exclusively to ES and Input-Output, there remain about 30 lines to be checked and set.

During the period several relay faults were corrected, and excursions were reset on about 20 lines, to eliminate daily alarms. The practice of taking 10 margins in full manual each day was started; this detects improved margins and allows excursions to be increased.

Some compilation and graphing of marginal checking data from the 5-digit multiplier has been undertaken in the hope that it may reveal tendencies that will help us in establishing the best checking routine for Whirlwind.

(H. F. Mercer)

The following failures of electrical components have been reported since June 9, 1950:

Component	No. of Failures	Hours of Operation		Reason for Failure
Crystals				
D-357	1	1218		Drift
	1	2348		Drift
D-358	16	1000-2000	13	Drift
			3	Low back resistance
	1	2248		Drift
Resistor				
2000 ohms 8 Watt Wire Wound	1	3200		Resistance unstable
Tubes				
7AD7	1	1558		Change in Characteristics
	1	2314		
	1	3551		

1.2 Five-Digit Multiplier

(E. A. Guditz)

Two weeks ago it was assumed that the multiplier was in good operating condition on the basis of marginal checking results.

Errors continued to be made daily, however, from the 8th through the 11th of June and again on the 15th. During this period one 6AS6 gate tube, one 2C51 indicator tube, one 7AD7 trigger tube in a test equipment register panel and two flip-flop clamp crystals were replaced as a result of marginal checking.

On the 16th of June an unsoldered connection was found in a test equipment register panel which had been in operation in the multiplier since December 9, 1948. This connection was supposed to ground the cathode circuit of a trigger tube. It became very intermittent. When the connection was soldered the multiplier operated without error for six days. At the end of this time it had to be shut down because of alteration work going on in the vicinity of the multiplier power supplies in the basement.

2.0 CIRCUITS AND COMPONENTS

2.1 Circuits by System Number

810 ES Control

(R. L. Best)

A new amplifier has been built to drive the deflection plates of the TV tube in ES control, and has been returned to the shop with modifications to give it better linearity and rise time.

820 ES Deflection

(R. L. Best)

The breadboard of the new ES Deflection amplifier has been received from the shop, and is undergoing test.

2.5 Vacuum Tubes

(H. B. Frost)

The lot of SR 1407 tubes referred to in the last bi-weekly has been received from Sylvania, Emporium, Pa. These tubes appear to have the improved cutoff which was necessary for direct replacement with 7AD7 tubes. Pulse test currents are also quite satisfactory. Measurements on these tubes are summarized in M-1056 by E. S. Rich. It is expected that Sylvania will build a much larger sample of these tubes prior to writing the final production specifications. Samples of two lots of SR 1407 tubes are now on accelerated life test to check interface liability.

The perveance and control grid-screen grid μ have been calculated for a large number of the "hotter" pentodes and tetrodes. From this data the plate current, which may be expected when the grid is driven from cutoff by a voltage step, can be calculated. In addition, the perveance of several triodes has been determined.

3.0 STORAGE TUBES

3.1 Construction

(P. Youtz)

The storage tube construction group continued its accelerated construction program to get a complete complement of acceptable storage tubes so that any of the sixteen storage tubes in ES Row can be replaced.

The Barta Building power was shut off in the early morning hours of 16 June 1950. This cut short the construction program for that week. However, we processed this past bi-weekly period eight evaporation tubes to produce beryllium mosaics and five storage tubes with 40 mesh mosaics for use in WWI (ST167, ST168, ST169, ST170-1, ST171).

Only one research tube was constructed this period. This tube was RT151, whose objective was to make a storage tube which had a silvered signal plate and a beryllium mosaic prepared in the demountable system (exhaust system #4). The initial test results from RT151 (see report of C. L. Corderman, section 3.2) indicate that more mosaic surfaces from the demountable system should be tested as soon as possible. Additional surfaces will be prepared by J. O. Ely for this purpose as rapidly as the construction schedule will permit.

(J. O. Ely)

A system is being worked out for stowage of beryllium mosaics under vacuum after removal from the ET in which they are prepared. When this system has proved satisfactory we will be able to keep on hand a stock of beryllium mosaic surfaces without the necessity of storing the rather bulky and fragile evaporation tubes. Evaporation tube components also will be released sooner for reuse.

Seven mica surfaces were silvered on system #4 for use in research and storage tubes during the past two weeks. Experience with surfaces silvered during the previous bi-weekly period indicates that the present setup and processing schedule are satisfactory. It is planned to continue production of these surfaces at a rate equal to the tube construction rate.

A fixture for optically lining up the high velocity gun during sealing into the envelope is being designed and constructed. It is hoped that this fixture will reduce the variation in centering of the high-velocity beam.

3.1 Construction (Continued)

(R. Shaw)

A preliminary survey of deflection plate spacing in 5U guns indicates the existence of considerable variation. Additional measuring equipment has been ordered to permit a more complete check-up. Delivery of this equipment is expected within a week.

The inclinable chuck for the glass lathe has been completely overhauled. After a try-out 23 June 50, other minor alterations were agreed upon. They will be completed before 27 June 50.

A research tube for the study of holding-beam current-density distribution is being designed. It will incorporate four isolated signal plates behind a single beryllium mosaic surface. The problem of making dependable contact to these signal plates without distorting the mica is receiving particular attention.

3.2 Test

(M. I. Florencourt)

Data on gun currents for the six tubes which had been on life test have been plotted. Zero-bias HV-gun cathode current was plotted for various biased-off times and then for the succeeding biased-on (reactivating) times.

For three tubes (ST133, ST123, ST140-R2) the bias sequence was as follows: HV gun off 25 hours, on 47 hours, off 25 hours, on 71 hours, repeated each week for 4 1/2 weeks. The storage surfaces were respectively "positive" (HG disconnected), negative (HG on), and positive (HG on).

For two tubes (ST115-R2, RT105-1) the bias sequence was: off, 25 hours, and on, 143 hours, for 4 1/2 weeks. The surfaces were positive and negative respectively.

For one tube, the HV gun was biased on for 4 1/2 weeks; the storage surface was positive.

Results from the life testing of these 6 storage tubes show that the deterioration rate of the high velocity gun cathodes is dependent only upon the holding gun being left on. It is essentially independent of the time during which the high velocity is biased off and the polarity of the storage surface. A memo describing these life tests and results will be issued shortly by C. L. Corderman.

3.2 Test (Continued)

Four storage tubes (ST163, ST164, ST165, ST166) have passed standard tests; ST167 was rejected because of a spot on the surface whose storage characteristics were incompatible with WWI requirements.

Gun transfer characteristics were run on RT150 and RT151.

(C. L. Corderman and A. R. Tanguay)

The test setup (see M-1047) for directly observing the holding-beam restoring-current curve has been operating properly with quite gratifying results. While the amount of significant data accumulated so far is small, there is a definite indication that the method will give much useful information.

Three equipment limitations have come into evidence during the past week of testing. They are:

a) The holding gun cut-off gate is not of sufficient amplitude to permit raising A_1 of the holding gun above 700 volts. Also, the holding gun is not turned completely on by the pulses occuring during the HG cut-off gate.

b) The HG on pulses are too long. Thus, when a high repetition frequency is used in order to obtain the complete curve on the scope, the HG on pulses appreciably affect the surface potential.

c) The sawtooth of voltage on the signal plate is not linear enough and is of insufficient amplitude for many tests.

These limitations are being removed as quickly and simply as is possible.

Tests the previous week have been carried out on RT150, a 40 mesh RT, which has a second screen placed 7/8" in front of the collector. This additional screen is of 40 mesh 2.2 mil nickel, and is connected to the A_3 dag. In the TV Demonstrator the tube showed no significant differences from standard 40 mesh tubes. The positive and negative restoring currents were both doubled, however, by raising A_3 and the auxiliary screen from 100 volts (normal operating potential of A_3) to 500 volts from the holding gun cathode. Another 40 mesh tube without the second screen must be checked to determine if these increased currents were due to holding beam focusing effects of A_3 or to some other process.

3.2 Test (Continued)

A research tube having 100 mesh 1 mil mica moat, RT149, was tested in the TV Demonstrator. Contrary to expectation, the 1 mil moat mosaic gave a higher maximum operating V_{HG} than previous 2 mil moat mosaics. This tends to exclude surface leakage from the process causing block switching at the maximum operating V_{HG} and supports the theory that the ratio of capacitance between mosaic squares to that between a square and the signal plate is a significant parameter.

The first tube to have both signal plate and mosaic (40 mesh) produced on Exhaust System #4, RT151, was checked on the TV Demonstrator. Although two areas of slightly different capacitance were noted, all operating characteristics of the tube were within the normal range. The change in capacitance may be caused by slight separation of the mica layers during the final (assembled ST) bakeouts since similar variations were noted in ST166. Subsequent tests will ascertain the suitability of RT151 for WWI use.

(H. E. Rowe and H. B. Frost)

Three storage tubes have been tested in the STRT for use in WWI. All were found satisfactory. These tubes were ST155, ST153, and ST156. Since WWI now has a full complement of 16 tubes in place, these tubes will act as spares in case any of the WWI tubes are found to work improperly.

Various tests have been run on RT138, which is a 100-mesh tube with a closely-spaced collector screen. This tube appears to have none of the usual 100-mesh edge effects. Dynamic cycling could not be done because of the large number of spacer beads necessary to hold the proper separation between storage surface and collector screen. However, spot size runs for both positive and negative spots were run. Negative spots remained smaller than positive spots of the same writing time for all writing times out to 640 microseconds. The size of the negative spots seems to be a result of the closely-spaced collector, since in all cases previously tested, negative spots have been bigger than positive spots after about 100 microseconds writing time. Tests could not be run at values of V_{HG} higher than about 85 volts because of the limited write signal-plate gate available.

(K. E. McVicar)

The secondary-emission ratio mentioned below should not be confused with the more usual sense of the expression where it is

3.2 Test (Continued)

defined as the ratio of the number of electrons in the incident beam to the number of emitted secondary electrons. As used here it would be more accurate to speak of the ratio of the output signal obtained when charging the target positive to that obtained when charging negative. Several other quantities enter into the output signal besides the secondary-emission ratio.

Secondary-emission measurements using the gated-signal plate method have been resumed. The measurements taken on RT127 compare closely with those taken by others using different approaches. In addition a definite increase was noted when the angle of incidence was raised from 0° to 40°. However, measurements on RT129 have not been so successful. This can be attributed in part to the considerably lower signal-to-noise ratio obtained with this tube. The result was to decrease the accuracy with which the oscilloscope could be read. Secondary-emission curves taken on RT129 for incidence angles of 0° and 28° showed very little increase for the larger angle. The secondary-emission ratios obtained, however, were reasonable.

Output waveforms from RT93, RT127, and RT129 have been taken again using the signal-intensity measuring set. These waveforms have been photographed to provide a check on the data taken several weeks ago during the study of the signal variation over the target surface. The reproducibility of the test results has been quite high in the case of the more recent waveforms. Some of the early output signals, taken before sufficient familiarity with the equipment had been gained, were more reasonable when retaken at this later date. The data taken by the sweep method checks with that taken under static conditions within the limits of accuracy to be expected from these experimental techniques.

3.4 Unclassified

(C. L. Corderman and A. R. Tanguay)

After reconnecting the bench outlet boxes, all storage tube laboratory test equipment is now in proper operation in the new basement location.

4.0 INPUT-OUTPUT EQUIPMENT

4.1 Eastman Kodak

(J. A. O'Brien, E. S. Rich, D. Hageman)

Mr. Cochran of Eastman Kodak Company spent two days with us to aid us in clearing up some of the troubles mentioned in the last bi-weekly report. He made some re-adjustments of the clutch which improved the drive. During his visit we had trouble with the automatic developing unit that caused dark smears to appear all over the film.

In order to solve this trouble Mr. Kunz and Mr. McPherson came here from Eastman Kodak Company early this week. They found the trouble to be due to leakage of developer foam over the guide rollers into the preceding chamber where it combined with the prehardener solution on the film. It seems that this combination acts as a very fast developer and will over develop the film very quickly. This happened since the combination formed in drops that adhered to the roof of the chamber and wiped the film as it passed under them. A few drops of "anti-foam" solution in the developer cleared up the trouble.

The processing machine was given a thorough going over and it was decided that we were getting as good results with it as it gave while it was on test at the Eastman Kodak Company.

Following the above work we recorded several more samples of film to be used on reading tests. We found that the quality of the recordings had varied somehow during the recording process, so that some of the recordings were useless.

We are at present engaged in reading tests, and although we can achieve some measure of success, such as reading back and displaying the recorded data on the powers of x, we cannot obtain dependable operation. Careful adjustments have to be made for each film and some films will not work at all. The principal difficulty is in the reference marker photo tube circuits.

The new masks, having larger spot sizes, that were mentioned in the last bi-weekly were made and tested, but it was found that the size of the mask had not been calculated carefully enough and would not permit correct operation. No additional work has been done on this as yet.

4.1 Eastman Kodak (cont)

The difficulties mentioned in the last bi-weekly report concerning the marginal checking of the E.K. film units were found to be due to an excessive current drain from the E.K. power supplies to the marginal-checking equipment. No further work has been done on this problem.

4.3 Typewriter and Tape-Punching Equipment

(E. S. Rich)

Construction and installation of the simplified typewriter and punched-tape input and output equipment described in the bi-weekly report for June 9 (M-1053) is scheduled to be completed the first week in August. The equipment for preparing corrected input tapes is already working satisfactorily and work on the system for reading corrected tapes into the computer is at the layout stage and is progressing according to schedule. A few points concerning the design of the output punching and printing equipment still remain to be settled. Because this system is more complicated than that for tape input there may be difficulty in meeting the scheduled completion date. At present, however, work on the output equipment is on schedule.

(F. A. Foss)

The relay panel containing the typewriter and reader relay registers, switch control, register control and punch control circuits, etc. has been constructed. Its completion made possible the successful operation of all elements of the tape preparation unit together. Only minor difficulties were encountered. Clare type "J" relays with 1A1B2C contact assemblies were found to have non-uniform wiring to their bases. Several relay sockets therefore have to be rewired. Only one circuit modification was found to be necessary. An additional "A" contact on the retype relay was used in order to accomplish successive override operations.

The tape preparation unit can process information at the rate of 45 words per minute (270 characters per minute). Marginal checking procedures did not reveal any critical operating margins in the sequenced actions as now performed by the unit. However, the desirability of increasing the release time of the reset relay was indicated. A resistor in parallel with the reset relay coil produces the desired effect.

4.3 **Typewriter and Tape-Punching Equipment (cont)**

(R. E. Hunt)

The last bi-weekly period has been spent in the testing and evaluation of the tape preparation unit.

The table for the unit should be ready about June 30. This will complete the unit except for further time and accuracy tests by an operator.

(C. W. Watt)

Work has progressed on the tape reader. A satisfactory schematic has been achieved and a sketch of the relay panel required has been made. Layout will be started next week. A schedule of all required work on the Reader, the Tape Preparation Unit, and the Output Tape equipment was proposed.

(J. S. Hanson)

In causing a typewriter to print only the words being read off a corrected self-checking tape and to skip over the complements, a scale-of two relay counting circuit is necessary. The inherent disadvantage of using counters is that an initial setting in the wrong position can cause the typewriter to skip words and print only the complements. To eliminate this disadvantage, a new counting circuit has been worked out, with self-contained automatic resetting attained by a "blank" or a 6 hole "nullify" code from either the computer or the tape reader.

5.0 INSTALLATION AND POWER

5.1 Power Cabling and Distribution

(C. W. Watt)

The d-c power to the program register and program register drivers was restored to the condition it was in originally. It had been changed to isolate it from the rest of the system when ES was being tested separately.

Wiring to the storage selection control and storage switch was changed to permit use of either ES or test storage.

5.2 Power Supplies and Control

(R. E. Hunt)

A portion of the last bi-weekly period has been spent writing a report on "Marginal Checking, WWI". This report will include a circuit analysis of the system plus trouble location and operational data.

(J. J. Gano)

Regulator for Plate Supply Alternator - The plate alternator with breadboard regulator was used to feed the d-c supplies for two or three days during the past fortnight and performed satisfactorily. However, some work has yet to be done to filter out more of the noise in the system. The feedback from the tachometer attached to the alternator shaft has cancelled most of the variation in the output voltage due to mechanical oscillation upon application of a step load. Because of poor alignment of the tachometer shaft a low frequency noise was introduced. A bracket with adjustments for mechanical alignment has been mounted and should enable us to reduce tachometer noise when testing is resumed after the addition of another stage of amplification.

A breadboard circuit has been connected to the system to protect for over-and under-voltage.

5.3 Video Cabling

(T. Leary)

During the last two weeks 91 video cables were constructed by the shop. These were mainly cables concerned with (1) ES deflection and (2) the addition of a checking and alarm circuit to ES.

6.0 BLOCK DIAGRAMS

(R. P. Mayer)

Electrostatic Storage (ES) is now being interconnected with the WWI System in final form, as shown on Grade III Block Diagrams, except that the Program Register (PR) is temporarily replaced by the A-Register (AR) for all purposes except ES in and out. The indicated connections provide for automatic selection of ES or TS (Test Storage), based on the address being used, and for a transfer check between the ES Tubes and PR during the ES Read process. Several new connections will be required in order to provide for a thorough initial checking of ES with WWI. Three new modes of operation are being planned and will be described in three Engineering Notes: E-353, ES SLAVE TO TS (TEMPORARY); E-354, DOUBLE-ES CHECKING (TEMPORARY); E-355, START-OVER WITH qf - FILL (TEMPORARY). These three modes are briefly described below.

ES SLAVE TO TS: Both TS and ES are operated, but only TS controls the program. With every reference to storage, ES is compared with TS and an alarm stops computation if a difference occurs. Thus ES must function correctly in order to run the program, and a failure causes an alarm - not undetectable chaos. Any ES digit column checks may be ignored if desired, allowing full testing of selected ES Tubes without interruption of the program. This column-rejection is accomplished by pulsing the CR RESET line just before each ES-TS check, the reset switches having been rewired to either CLEAR or do nothing to thier respective CR digits. The Program Counter and ES Deflection are connected so that the 32 ES registers being compared with TS can be placed in any one of eight different sections of the ES Tube storage surface, as determined by Program Counter digits 8 - 10.

DOUBLE-ES CHECKING: Either ES or TS (not both) is operated as determined by Storage Selection Control. With every reference to ES, two ES registers in different sections of the storage surface are read out separately and compared, sounding an alarm if different. Column-rejection when checking with this system can lead to chaos. Since the program may be controlled entirely by ES, any undetected error in ES can cause an error in the functioning of the program.

START-OVER WITH qf - FILL: Many details of this mode remain to be worked out. In general, the qf order will fill up ES from Test Storage in much the same way as ri fills up ES

6.0 BLOCK DIAGRAMS (Continued)

from In-Out equipment. The engineering note will also discuss ways of using the qf order in conjunction with automatic ES Clear, cycling, 'scope control, etc.

(R. R. Everett)

Mayer, Adams, Cooper, and Everett of the block diagram and checking groups plus Dodd, Fahnestock and Taylor have been considering means for testing ES with the computer when the tie-in is complete. Preliminary block diagrams have been drawn for the following modes of operation:

1) Automatic ES-TS

This mode is essentially the final system. Programs, some of which have already been written, can be put in TS. These programs can store information in ES and remove it later for checking using arbitrary patterns and sequences. The first checkout of ES will be made using this method. The functional correctness of ES can be checked; unfortunately, the possible prf's are low because of the large number of references to TS needed between each ES reference. Orders can be stored in ES but the lack of checking probably makes such a procedure of little value until ES is working very well.

2) ES Slave to TS

In this mode ES operates in parallel with TS which still controls the computer. At each readout ES is checked against TS and the computer stopped in case of an alarm. Maximum prf's and arbitrary sequences are possible. Almost any operating condition possible in WWI can be setup. The programs are necessarily restricted to those fitting into the 32 registers of TS. The 256 registers of ES will be divided into 8 groups of 32 with selection between groups either manual or automatically sequenced.

3) Double-ES Checking

Once ES is operating in all digit columns with reasonable reliability, computer control can be given to it with complete checking using duplicate ES registers. 128 registers will be available, the other 128 provide the duplicate check. The prf will necessarily be different from final operation and computer speed will be halved approximately.

6.0 BLOCK DIAGRAMS (Continued)

4) Fill

Provision will be made to fill ES from TS, 8 identical groups of 32 words being stored. As soon as possible, paper tape filling will be added. Meanwhile the high speed possible with TS filling will be a great advantage in simple testing.

7.0 CHECKING METHODS

7.1 Test Problems

(R. H. Gould)

A sequence for testing the time pulse distributor has been written. It occupies one flip-flop storage register and eight toggle-switch storage registers. This sequence will detect all but two of the possible faults of the TPD which are respectively crystal #69 and crystal #67 in the TPD matrix. These two faults cannot be detected because they cause no computer errors with present timing. The first fault causes the TPD to put out time pulse 5 simultaneously with TP1 as well as at the correct time. All that TP5 does on program timing is to read into the storage switch which is cleared on TP 1 1/2. Thus the spurious TP5 has no effect.

The second fault causes a TP5 to occur with TP6 as well as when it should. This will merely cause the SS to read into itself with no effect.

On the operation ri without program timing TP5 also reads out the program register and reads in the control switch and step counter as well as the storage switch, but it still has no effect if it occurs with TP1 or TP6.

This analysis was made without considering electrostatic storage or input-output equipment which would quite possibly be affected by the two faults described above so that they cannot be ignored completely.

(Q. Cooper)

Work has been completed on the spot-interaction program mentioned in the previous bi-weekly. The desired degree of flexibility could not be attained within the limits of Test Storage, but two separate programs which take care of the cases of interest have been written and do fit into Test Storage. Unfortunately, these programs are not capable of generating the patterns at a sufficiently high repetition rate to yield all the information which may be desired. Some thought has been given to accomplishing this when ES is operating "slave" to TS. It appears as though the speed which can be obtained in this mode of operation will be as great as any which will be encountered in normal operation. However, the flexibility of test conditions in the "slave" mode is somewhat limited.

8.0 MATHEMATICS AND PROGRAMMING

(C. W. Adams)

An informal memo (M-1055) for internal distribution only has been written to describe the June 8th meeting of the Mathematical Computing Advisory Panel.

Programs are being written for use with the proposed preliminary tape-computer transfer devices. A program to be put in test storage will be used to read in characters and their complements from tape, check the character against the complement, single out the desired digits, shift them to the proper places, and thereby form binary words which can then be put into consecutive electrostatic storage registers. In other words the program in test storage will permit the computer to perform all the checking and shifting normally associated with a tape read-in device. A similar program will be used for output. A program for reading in, checking, and converting Flexowriter-coded orders and numbers will also be written.

9.0 FACILITIES AND CENTRAL SERVICE

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
E-346	Measurements on Electron Beams in Storage Tubes (Summary of R-175, a Master's Thesis)	3	6-6-50	J. McCusker
E-348	Winding Tungsten Springs - SA-33325	3	6-9-50	I. Paulsen
E-349	Operation and Maintenance of Polariscope	2	6-9-50	R. Shaw
E-350	Construction of a Silver Evaporation Target Assembly	5	6-6-50	J. Palermo
E-351	Winding Tungsten Heaters - SB-40170	2	6-12-50	I. Paulsen
E-352	Compensation of Deflection Defocusing in Storage Tubes	5	6-15-50	H. Klemperer
M-1039-1	Drawing Preparations for Slides	4	6-2-50	A. Falcione
M-1052-1	May 1950 Research and Storage Tube Summary	4	6-12-50	M. Florencourt
M-1053	Bi-Weekly Report, June 9, 1950	27	6-9-50	
M-1054	Progress Report: An Investigation of the Effect of the Angle of Beam Incidence on Electrostatic Storage Tube Performance	2	5-30-50 to 6-9-50	K. McVicar
M-1056	Development of Type SR-1407 Vacuum Tubes: Tests on Lots D-2 and C-9674	4	6-20-50	E. S. Rich

Library Files

	Proceedings of the IRE: June, 1950	IRE
47	Technical Information Pilot: May 22, 1950	ONR, Library of Congress
361	Electrical Communication: June, 1950	I. T. & T. Corp.
731	Sequence Instructions for Solution of 168 Simultaneous Linear Equations by Gauss-Seidel Iteration: IBM Selective Sequence Electronic Calculator	IBM Corp.
732	Electron Distribution in Electron-Optically Focused Electron Beams. General Electric Co., Wembly, England	L. Jacob
733	Analysis and Design of Trigger Circuits. U. of California, Berkeley	T. H. Meisling, D. R. Brown

9.1 Publications (Continued)

Library Files (Continued)

No.	Title	Author
734	General Theory of Communication: Report on Phase I of the Study of Data Transmission. Microwave Research Institute, Polytechnic Institute of Brooklyn. Report R-208-49, PIB-152	A. E. Laemmel
735	D-C Current Transformers and Magnetic Frequency Doublers. Technical Report Number 63	(Ord. Res. & Dev. Div. (SubOffice (Rocket)

Books

	Theory of Mathematical Machines	F. J. Murray
	President's Report: October, 1949. MIT Bulletin Vol. 85, No. 1	M. I. T.
	Methods of Operations Research. OEG Report No. 54	(Operations Evalutation (Group
	Mathematics of Statistics	J. F. Kenney
	Vacuum Equipment and Techniques	(A. Guthrie (A. K. Wakerling

9.2 Standards, Purchasing and Stock

(H. B. Morley)

Standards - The Laboratory Standards list of electron tubes (6.200) is being revised and brought up to date.

Procurement and Stock - All lab personnel who use equipment from the instrument room are requested to notify the stock clerk of any defective or inoperative equipment when it is returned, so that necessary repairs can be made and all instruments kept in proper operating condition.

General reorganization of the stock and receiving room and transportation facilities is being planned to provide adequate service, as greater efficiency is needed under the present increase of responsibilities and duties of this department.

9.3 Construction

(R. A. Osborne)

Production Report - The following items have been completed and inspected since June 9, 1950:

1 Tape Preparation Relay Panel
2 Shorting Cables
2 Digit Interlock Panels
90 Video Cables
2 Breadboards
16 Spare Coils for S.P. Coupling Units
1 Power Supply for A-2 Lamp

Modifications to 18 Signal Plate Drivers

Modification to Tape Preparation Control Box

(L. Prentice)

Machine Shop - We have started to machine 24 signal plate frames. This is a new operation for us as they were formerly done at Bldg. 32. Much trouble has been experienced due to deformation when the rings were annealed

9.3 Construction (continued)

between the rough and finishing operations. This amounted to approximately .035 of the face and .010 concentrically.

The writer visited the New England Metallurgical Co. and conferred with Mr. Garcia. He was of the opinion that the distortion was due to water quenching and agreed to air quench. Of the ten rings which were air quenched, only three showed distortion and these were less than .010 on the face.

Metal Shop - This shop has been turning out stamped and wire parts for the storage tube group. The work load is light.

9.4 Drafting

(A. M. Falcione)

Drafting Load - At the present time the drafting load is moderate. Any anticipated drafting work to be done should be brought to the attention of the Drafting Supervisor.

A study is being made of the possibilities of reducing the amount of reproduction work on the Ditto Machine through a better distribution system. The possibilities of eliminating dead load files are also under scrutiny.

10.00 GENERAL

(H. R. Boyd)

New Staff

Robert Walquist is a new Research Assistant whose home is in Long Beach, California. He holds a B.S. degree in Electrical Engineering from the California Institute of Technology and has been doing graduate work toward his M.S. in Electrical Engineering at M.I.T. since September.

New Non-Staff

Lowell Bensky is a graduate sutdent technician working temporarily in the construction shop. Bensky received his B.S. in Electrical Engineering from M.I.T. in June and is working toward his M.S. in Electrical Engineering. His experience includes electronic technician work with the Navy and the Eckert-Mauchley Corporation, and student engineering work with the Philco Corporation. Originally from Orange, New Jersey, he is now living with his family in Cambridge.

Miss Nancy Harrison has replaced Alice Monroe. Miss Harrison was graduated in June from Wellesley College and has worked for three summers in the past as a clerk-typist at M.I.T.

Miss Helen Martin is working with Mrs. Galant and Mrs. Berry. She has had secretarial experience in Manchester, New Hampshire, and in Boston.

Mrs. Jane Littmann is secretary to the Air Traffic Group, replacing Mrs. Lassie Ulman. Mrs. Littmann's home is in Butler, Pennsylvania, and her experience includes several secretarial positions. Her husband is a graduate student at M.I.T.

Staff Terminations

Frederic Foss
Hans Klemperer

Non-Staff Terminations

Alice Monroe
Lassie Ulman