PL-KK 120

Division 6 - Lincoln Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: BIWEEKLY REPORT, September 11, 1953

To: Jay W. Forrester

From: Division 6 Staff

CONTENTS

SECTION I - CAPE COD SYSTEM

1.1 Group 61

1.10 General

(C.R. Wieser) (CONFIDENTIAL)

A teletype for picket-ship communication will be installed shortly.

South Truro FPS-3 data is now available on a request basis. Requests for data should be made at least 24 hours in advance. Two tapes of data from the FPS-3 have been recorded.

Modifications of the Track-While-Scan programs have been made and should be completely tested on the computer by the end of the next biweekly period.

A complete NTWS Program (NTWS-1) has operated successfully under a variety of tests. The final NTWS program (NTWS-2) is expected to be ready for testing the weekend of September 19-20.

1.11 Equipment Engineering

(N. Alperin) (CONFIDENTIAL)

Temporary modifications have been made on the five light guns in use and their respective channels to prevent initiation on characters and vectors. This modification depends on increasing the sensitivity of the guns. The amount of sensitivity for non-marginal operation is being investigated.

(H.J. Kirshner) (CONFIDENTIAL)

All wiring of the SDV monitor station has been completed and checking of equipment is now in progress.

The new ground-air voice-communication system is in the process of being checked.

A teletype for picket-ship communication will be installed shortly.

South Truro FPS-3 data is now available on a request basis. Requests for data should be made at least 24 hours in advance of the time data is required in order to cause the least interference with Group 22's shakedown program.

(G.A. Young, B.E. Morriss) (CONFIDENTIAL)

The problems involved in changing the buffer and auxiliary-drum interlaces from 8 to 4 are being investigated.

Manuals describing test procedures for checking the equipment in Room 222 are still in the process of being completed. A list of stops to be placed on spare and unused insertion buttons has been made, and the manuals have been modified to exclude these buttons from the test sequence. It is hoped that the manuals will soon be attached to the consoles in Room 222.

Test programs are being written to aid in checking the output coder.

(J.H. Newitt) (CONFIDENTIAL)

Improvements in the control room are continuing. I have a special illuminated map and writing shelf almost completed. This shelf will fit on the standard 16" scope console.

With the aid of B. Paine's technicians, additional work on the h-v power-supply reliability problem has been undertaken. We feel that we are nearing a solution to this problem.

1.11 Equipment Engineering (Continued)

(J.H. Newitt) (Continued) (CONFIDENTIAL)

Mechanical push-button stops will be applied to all spare and unused positions very soon. The list for this work is complete. Anyone knowing of any late modifications should inform me immediately.

Lighting of the control room and of the panels has been under intensive study and discussion of late. I am sure I have an adequate solution to the panel-illumination problem, and I believe we have an answer to the room lighting. Experiments to demonstrate both techniques (in combination) will be performed within the coming week.

Standardization of all switch and panel nomenclature should be undertaken without delay since, if my prototypes are satisfactory, exact information must be available for generating luminous labels for all switches in the control room. Some thought must be given to compromises between visitor requirements and operator requirements in this respect.

(D. Neville) (CONFIDENTIAL)

A satisfactory test has been made of the operation of the Data Link from coder to aircraft using toggle-switch input and push-button operation of the coder.

Satisfactory results have not yet been obtained in testing the coder with WWI.

1.12 Data Screening

(R.L. Walquist) (CONFIDENTIAL)

Two tapes of data from the FPS-3 at S. Truro have been recorded. The data looks encouraging. However, it is too early to make any comparison of the quality of SDV data from the CPS-6B and the FPS-3.

All of the TWS programs have been recorded on magnetic-tape unit 0. These programs will remain unchanged on the tape unit until all modifications have been thoroughly checked out. Storage of the programs on magnetic tape is proving much more convenient than storage on paper tape. Read-in time for the TWS programs has been reduced from about 5 minutes for paper tape to about 20 seconds for magnetic tape.

Operation with the equipment in Room 222 has indicated that certain display-line changes are desirable. At the present Flight Test Umpire (FTU) position displays of radar data and tracks in trouble are not available. Without these displays it is difficult for the FTU to determine what effect his simulated data is having on the tracking program. These displays should be available shortly.

1.12 Data Screening (Continued)

(R.L. Walquist) (Continued) (CONFIDENTIAL)

As mentioned in the previous biweekly, the Track Monitor displays are not very satisfactory. At present, trouble tracks with their associated numerical information are presented on one 16-inch scope while radar data is displayed on a separate 16-inch scope. Referencing of the trouble tracks to the radar-data display is accomplished by momentarily superimposing a display of the trouble tracks' vectors on the radar-data display. The original reason for the radar-data display being on a separate 16-inch scope was to keep other information from obliterating the recent past-history retention of the scope phosphor. It now appears that the necessary referencing back and forth between the two scopes is too great a burden on the Monitor. An experiment is being made with the trouble-track information and radar data on the same 16-inch scope. Although the past-history retention of the scope phosphor will suffer, the Monitor's job may be simplified. As soon as the buffer drum is available (present expectations are for November), we plan to use the four auxiliary memory fields to store the most recent eight scans of radar data. When this is done single-scope Monitor operation will not interfere with the past-history display since drum storage will replace the scope-phosphor storage.

The previous biweekly mentioned that the first round of major changes is being made in the TWS programs. These changes fall into two categories:

1. Rewrite those programs which are working satisfactorily in order to reduce operation time and the amount of storage space required;

2. Modify those programs which are not working as desired.

Under the first category, two main sections of the program have been rewritten. Both of these sections have been tested and are working satisfactorily.

Under the second category, four main sections of the program are being modified. Coding for these four sections has been completed but the programs have not been tested on the computer. This testing should be completed by the end of the next biweekly period.

(W.S. Attridge, Jr.) (CONFIDENTIAL)

The Master Control Program has been rewritten but not yet tested. A modification for the Smooth and Predict Program has been written to take care of some of the tracking difficulties of turning tracks.

During our operations we have noticed several cases of incorrect transfers from the drum. These errors were noticed because they resulted in computer alarms caused by the incorrect operation of the program after the transfer error. The number of such errors which have gone unnoticed is left to speculation.

1.12 Data Screening (Continued)

(H. Frachtman) (CONFIDENTIAL)

The data on trouble-track frequency recorded by the Air Force shows an expected value of 43% of tracks in some kind of trouble. This is the result of one sequence of 215 scans.

Programs are being written to record some of the TWS track-situation data on tape during flight tests and to analyse it afterwards.

(D. Goldenberg) (CONFIDENTIAL)

Work is continuing on the preparation of the memo on the earth's curvature problem.

(J. Ishihara) (CONFIDENTIAL)

With W. Wolf and H. Seward the Data Analysis and Correlation Programs of the 1953 Cape Cod-TWS have been rewritten and checked out. These programs have been run with the present operational programs and seem to be operating satisfactorily.

Records and program forms have been brought up to date and necessary changes for testing of the revised TWS Program noted.

(J. Levenson) (CONFIDENTIAL)

Two new actions have been programmed for Track Monitors:

1. "Reinitiation - change position" enables the Monitor to change the position of a track in one of eight directions, up to 4.5 miles, in increments of 1/2 mile.

2. "Reinitiation - change speed and heading" enables the Monitor to change the track's speed and heading and not the position.

Both these actions may be accomplished with an activate button and the specified track number, or with the light gun on trouble-track position. These actions do not have to be carried out on uncorrelated data, as did previous reinitiation actions. This is an advantage in making reinitiation easier to perform.

The new Monitor Programs and their parameters are now tapes but have not been checked out.

1.12 Data Screening (Continued)

(H. Peterson) (CONFIDENTIAL)

The Programs mentioned in the previcus biweekly were completed and will be computer tested on September 12, 1953. The remaining time was spent learning to become a Monitor.

(E.W. Wolf) (CONFIDENTIAL)

The Magnetic Tape Storage Program is now fully operational. A set of operating instructions for this program has been written and distributed among the members of the TWS Section.

(W.M. Wolf) (CONFIDENTIAL)

A misleading typographical error occurred in the Biweekly Report August 28, 1953, M-2379, page 7. The final column should have been TRACKS/(RETURN - STATIONARY CLUTTER) not TRACKS (RETURN - STATIONARY CLUTTER).

Satisfactory "positive" overlays have been obtained from the outside vendor via the Drafting Room and have been installed in positions manned by the Tracking Officer, Combat Data Director, and Track Monitor.

Operations in the Radar Mapping Room have continued in conjunction with the operational testing of the TWS program.

The problem remains of informing Track Monitors of the location and extent of the mapped-out areas. W. Clark suggested as a possible solution the slide projection of an overlay with map superimposed on the wall facing the monitors. Slides have been made by L. Sanford and have been partially tested.

1.13 Tracking and Control

(M. Frazier) (CONFIDENTIAL)

A new set of smoothing parameters for NLS-2c has been obtained which is generally faster on initiation and far more consistent than the old set. These have not been checked as regards sensitivity to clutter or crossing tracks as yet, only under conditions of ideal data. They are as follows:

α_1	$\frac{1}{16}$
a_1	$\frac{5}{16}$
α_2	$\frac{19}{64}$
a_2	$\frac{25}{32}$
p_c	1 1/8 miles
R_b	150 miles (sic)

(A. Mathiasen) (CONFIDENTIAL)

Work on the tracking study undertaken for Boeing has been partially completed. Results of a simulated-data program written by W. Lone and myself on linear smoothing with and without height correction have been obtained. The benefit of height correction is, of course, a direct function of height. The figures for two of the flights may prove interesting. The first flight (I) is that of an aircraft flying east at a height of two miles with fourteen miles the nearest approach to the radar (a simulated 30-mile-range radar quantizing in azimuth to 1/256 of a revolution and in range to 1/2 mile). The second flight (II) differs from the first essentially in that the height is six miles. Δx_q and Δy_q are the deviations between predicted and quantized positions, and Δx_a and Δy_a are the deviations between predicted and exact positions. The asterisk indicates that correction for height was employed. The sums are for 33 scans for Flight I and 31 scans for Flight II.

1.13 Tracking and Control (Continued)

(A. Mathiasen) (Continued)

Flight	$\Sigma\Delta x_q^2$	$\Sigma\Delta y_q^2$	$\Sigma\Delta x_a^2$	$\Sigma\Delta y_a^2$
I_*	2.18	1.44	8.23	2.42
I^*	2.16	1.43	6.50	2.65
II_*	4.19	2.57	23.79	28.27
II^*	3.02	1.77	5.78	1.21

While these and similar figures indicate little need for altitude-corrected ranges for low-flying aircraft, there is such a need for high-flying aircraft.

A program to work with live data in a further study of positional tracking accuracy has been written.

Work is being undertaken by some members of this group on a quick appraisal of the merits of a correction to be made the first time a plane is seen after a number of misses. The smoothing equations in this scheme (first proposed by C. Gaudette) become

$$\dot{x}_n = \dot{x}_{n-1} + \frac{a}{m+1} D_x$$

$$\bar{x}_{n+1} = \bar{x}_n + \dot{x}_n + aD_x$$

where m is the number of consecutive misses of the radar. Similar equations hold in y.

(Wm. Lone) (CONFIDENTIAL)

The simulation program to be used by the Flight Test Umpire is being rewritten to include new features. These are the insertion of "misses" in a generated track and double azimuth returns. The data should then more nearly resemble true radar data.

Participation in the daily tests of the TWS section continued.

A program was written which will display the contents of any magnetic-core storage register desired while the TWS programs are operating.

1.14 Weapons Direction

(D.R. Israel) (CONFIDENTIAL)

The first week of this period was spent in further independent tests of the operation of the Weapons Assignment, Weapons Direction, AAA and Height Finding, and Identification Programs. By September 6, each program was operating satisfactorily under a large variety of test situations. On that night the programs were joined together into one complete NTWS Program. The combined Program, to be known as NTWS-1, also operated satisfactorily under a variety of tests.

During this past week, two major exercises were conducted using NTWS-1 with simulated data from the FTU position. During these tests all operating positions were manned and Air Force personnel from Section C, 6520th. AC&W Squadron, were indoctrinated into the various operating positions which they will man during the live-data system tests. To facilitate this, preliminary operating instructions for the Bedford and Otis Intercept Director stations were prepared; these will shortly be revised for general publication.

The results of the two exercises, each of which lasted about one hour, were highly successful in all respects. Critiques were held following each exercise. The services of the FTU position, as organized by P. Cioffi, F. Webster, and B. Davis, were invaluable in the testing and evaluation.

NTWS-1, the combined Program made on September 6, is not the program which will be used in conjunction with the TWS Program for actual system tests. Due to requirements of initial testing and independent programming of each of the component programs, NTWS-1 occupies more than the six drum fields allocated for use by NTWS Section. The whole program uses about 12,000 registers, however, and hence it can be stored in six fields. Furthermore, the number of program and data transfers is highly in excess of those to be used in the final NTWS Program. During the coming week, certain sections of NTWS-1 will be rewritten to effect economies in drum space and drum transfers. These rewrites are largely in the nature of retranscribing programs to new storage addresses; in no case is the logic of the Program being changed. The major rewrites are being done with the Display, Identification, and the Weapons Direction Program. The Display Program has already been rewritten and it is being rechecked out; it is expected that the other programs will be completed and checked out during the week, leading to the preparation and testing of the final NTWS Program (NTWS-2) during the weekend of September 19 - 20.

Daily tests with NTWS-1 will be conducted during the coming week. These tests will be as realistic as the simulated track data permits. During each day, the emphasis will be upon evaluating the operation of an individual station and on the training of the associated personnel. Procedures for recording data, handling weather information, etc., will receive additional attention during this coming week.

1.14 Weapons Direction (Continued)

(D.R. Israel) (Continued)

On September 10, personnel from the Height Finding sites and from the Boston AAOC visited the Direction Center for briefing and indoctrination.

During the past two weeks the operation of the 16-inch scopes has been very satisfactory; the 5-inch scopes, however, still present problems in contrast and intensity which make it difficult for operators to read the characters of the DID's. Temporary steps are being taken to complete the labeling of panels and switches; this does not appear to be a major problem as far as the NTWS Section is concerned. The intercomm system has been used extensively during the recent tests and has proved satisfactory; it has been noted, however, that the telephone buzzers and the audible alarm buzzers are both very loud and have a similar sound.

(O.T. Conant) (CONFIDENTIAL)

The DID Make-Up and Display Programs for the Weapons Assignment, Selected Track (FTU and Visitors), Anti-Aircraft Liaison Officer, and Height Supervisor DID's were completed and checked out during the last period, and are now available in combined form as Tape #2817, mod. 100. For convenience in calibrating the 5" scopes, 2819, mod. 10 (read in after 2817, mod. 100), will cycle through all of the displays providing distinctive symbols to indicate the positions of the DID blocks.

Program copies and flow diagrams for these programs are now being brought up to date for inclusion in the Group 61 Program Record notebooks.

Due to the apparent tightness of both operating time and drum-storage space, the DID programs may have to be modified or rewritten for the Final System; however, the present form should prove satisfactory for the time being.

(M. Brand) (CONFIDENTIAL)

Identification. During this period extensive testing of the Identification Section was carried out. All of the errors in this prototype pre-written system were ironed out. Final tests in this period were very successful both in individual testing and in testing with the complete NTWS System.

In this biweekly period work commenced on rewriting the ID Section to achieve three purposes:

a. Cut down the number of drum registers used.
b. Cut down the number of drum transfers.
c. Incorporate into the system some sophistications the value of which have become apparent during system operation.

1.14 Weapons Direction (Continued)

(M. Brand) (Continued)

Due to the considerable work involved in this rewriting process, the ID Group has been augmented temporarily by C.H. Gaudette, S. Knapp, and F. Heart and permanently joined by S. Hauser.

(J. Cahill, M. Geraghty) (CONFIDENTIAL)

The combined HF-AAA Guidance Program T-2898 m 2 is operating with all other NTWS programs.

Some time was spent this period training Air Force personnel as Height Finder Talkers. Operators from the Height Finder sites and officers from the Anti-Aircraft Operations Center visited the Laboratory on September 10 for indoctrination and a demonstration of the Program.

(S. Hauser) (CONFIDENTIAL)

Two more versions of a Georef display were written and will be soon tested.

Modifications to a calibration program were written and will be tested next weekend.

My future activity will be with the Identification Group which is presently rewriting programs.

(F. Heart) (CONFIDENTIAL)

The major portion of time in the past two weeks was helping to trouble shoot, modify, and rewrite portions of the Identification Program. Some time was spent working on the Intercept Program, particularly on the intercept point display.

A memo was written outlining procedures for input and distribution of wind data to the initial Cape Cod System. This memo has not yet been issued.

Study is being made of pretest, during-test, and post-test reports for various operating stations of the initial Cape Cod Direction Center.

(S. Knapp, C. Gaudette) (CONFIDENTIAL)

The following has been accomplished:

a. The combination of all non-TWS programs has been operated successfully.

1.14 Weapons Direction (Continued)

(S. Knapp, C. Gaudette) (Continued)

b. The scan-by-scan print-out program has been checked out.
c. The dynamic MIV program has been checked out.
d. A program has been written to display each half frame the number of $\frac{1}{16}$ of a second intervals remaining after the non-TWS function has been performed.

(W. Lemnios) (CONFIDENTIAL)

The Weapons Direction Programs are now all operating. Numerous successful interceptions using simulated data have been conducted in the preceding two weeks. Many of these tests were conducted with Air Force personnel at the various positions.

The foldback-type intercept has been slightly modified so that it now takes less time than before.

(L. Murray, F. Garth) (CONFIDENTIAL)

In order to introduce a parity check of all data-link messages, a rewrite of the IND and RO DID Table-Make-Up Program was necessary. There is assurance now that all data-link messages will be sent out within a half second after they have been assembled. This rewrite also provides that a "dropped" indication will be displayed when an interceptor's track has been dropped regardless of its mission, combat patrol, or return to base mode. To make it congruent with this change the IND and RO DID Program has been rewritten.

Proper calibration of the IND and RO 5-inch scopes has proven to be somewhat difficult. A new program which will display complete blocks of o's for the Otis scopes and b's for the Bedford scopes is now provided to aid in the calibration.

(J. Nolan) (CONFIDENTIAL)

The four Weapons Assignment Display and Assignment Programs are operational and married into the present NTWS System. The Calculations Display Make-Up and Display Programs have been rewritten in order to save drum space at the cost of an extra read-in. The rewritten form of these programs is now being tested.

1.14 Weapons Direction (Continued)

(G. Rawling) (CONFIDENTIAL)

The past period has been spent assisting in the training of Air Force personnel in the HF-AA Program. For details, see report under Cahill.

Some time has been spent modifying small equipment in the operations room.

(E.W. Wolf) (CONFIDENTIAL)

The Intervention and Activate Bulletin Checkout Program has been brought up to date to comply with the latest equipment changes. The operating portion of this Program is now being rewritten so as to permit operators at stations without a 16" scope to see their displays on 5" scopes.

(C.A. Zraket) (CONFIDENTIAL)

Most of the past biweekly period has been spent in conducting tests of the Weapons Assignment and Direction Programs using simulated track data. The console positions have been manned by both Air Force personnel and programmers. Initial tests have proved quite satisfactory and will continue on a daily basis. During the next biweekly period the programs will be rewritten for the purpose of conserving storage and time.

1.15 Direction Center Operations

(M. Brand) (CONFIDENTIAL)

The following is a summary of Group 61 computer time:

Track-While-Scan	30 hrs 30 min
Non-Track-While-Scan	60 hrs
Tracking Control	11 hrs
Computer Breakdown	5 hrs
Total	106 hrs 30 min

(P. Cioffi) (CONFIDENTIAL)

Testing of the NTWS section was continued with some increase in the frequency and scope of problems. At various times during this period each of the NTWS functions, i.e., ID, intercept, height finding, were tested individually and combined. These preliminary combined operation tests have been extremely useful in pointing out ways in which these simulated tests may be planned and set up for more meaningful and effective testing.

Results of these tests point out also the need for the relocation of certain plotting boards used in conjunction with the FTU position and the standardization of communications message contents. At the moment, it seems that certain telephone facilities need corrections and possibly additions for better communications.

(F.A. Webster) (CONFIDENTIAL)

Considerable time has been spent operating the FTU position during simulated tests in conjunction with P. Cioffi and R.N. Davis. Some of the previous maps with simulated tracks have been corrected and modified. A new parameter is in preparation which will allow greater variety in the initial position of tracks initiated at the FTU station.

1.15 Direction Center Operations (Continued) (A.P. Hill) (CONFIDENTIAL)

DATE	TIME	SCHEDULED TEST A/C	SCHEDULED TEST Description	TEST ACTUALLY RUN A/C	TEST ACTUALLY RUN Description	REASONS FOR CHANGES OR COMMENTS
9/1	1000-1200	4	Tracking & Coverage	3	Held with 3 aircraft	1 F-89 retured to base due to mechanical difficulty
9/4	1000-1200	4	Tracking & Coverage	-	Cancelled	Used time to run with program without aircraft
9/8	1400-1600	4	Tracking & Coverage	4	Held from 15-1700	One hr. delay waiting for radar data
9/10	1400-1600	4	Tracking & Coverage	4	As scheduled	

* Added to schedule during week of test

1.15 Direction Center Operations (Continued)

(A.P. Hill, P.F. Dolan) (CONFIDENTIAL)

Results of flight tests held:

September 1, 1000-1200; Tracking and Coverage.

Two B-29's and one F-89 were used flying in the areas of Clinton and Derry. Data from the gap-filler radars was satisfactory; however, the data from the CPS-6B had excessive cloud clutter, which made tracking difficult.

September 8, 1400-1600; Tracking and Coverage

Two B-29's and two F-3D's were used for this test. The F-3D's were scrambled from Otis AFB in an attempt to see how soon they were picked up on the Chatham radar. Chatham picked up the F-3D's before they reached 1000 ft. Both Chatham, Clinton, and the CPS-6B operated satisfactorily throughout the test.

September 10, 1400-1700; Tracking and Coverage

Two B-29's and two F-89's scrambling from Bedford were used for this test. Same trouble was encountered with South Truro, Clinton, and Derry data. Chatham was used in place of Derry, which was unable to send data. One F-89 aborted due to mechanical difficulty but the test was continued and favorable results were recorded.

1.2 Group 64

(S. H. Dodd) (UNCLASSIFIED)

A second bank of magnetic-core storage has been installed in WWI; both banks are operating satisfactorily from their own control. This has resulted in an access time for the basic computer orders of less than 50 per cent of their original time.

A Ferranti photoelectric tape reader has now been received, and tests of its operation are being performed.

The reliability of operation of the computer and its terminal equipment has been steadily improving. Although much work still is necessary to insure the ultimate in reliability, the Cape Cod System operation is perfectly satisfactory for use by Group 61.

The program for improving the lighting of Room 222 has been initiated. The proposal will be tested in Room 228 before new changes in Room 222 lighting is attempted.

1.21 WWI System Operation

Magnetic-Core Memory

(N. L. Daggett) (UNCLASSIFIED)

The second bank of magnetic-core storage was installed in WWI on September 5. On September 10, the new core storage control was tied in completely, making the storage cycle independent of ES Control. (Previously the magnetic storage cycle had been slaved to the ES cycle.) The new control reduces storage access time to 9 μsec, making the average time per order approximately 30 μsec instead of the 50 to 60 μsec formerly required.

In the week that the two core banks have been operating, no maintenance has been performed on them other than to measure margins. During this week 3 parity alarms have occurred.

The relatively short time in which this new memory was built and installed is a tribute to the excellent cooperation of the various construction shops, the MTC people, the people who built the memory planes, and the system group. The speed with which production control organized building of the necessary new panels was most gratifying. A number of the systems technicians and engineers worked long hours making necessary changes to receive the new equipment.

1.21 WWI System Operation (Continued)

Marginal Checking

(T. Leary) (UNCLASSIFIED)

A program which will generate the binary-coded decimal forms of the 400 MC line numbers for use with the PMC equipment has been written. The program will also store these PMC-coded MC line numbers on the block reserved for them on drum Group 11. We hope to get this block locked out on Group 11 on the week end of September 12.

As a first attempt at getting all our MC programs on the drum, a program has been written which adds a PMC program and a coded list of MC line numbers to T-2004. This will all be transferred to drum Group 9 after read-in and can thus easily be recovered by starting over at 35 octal. If this is successful, we will probably do the same thing for our other test programs, since this would eliminate the need for using the Flexowriter reader with PMC. Our ultimate aim is still one long tape containing all test programs, lists of MC line numbers, and so forth.

(D. A. Morrison) (UNCLASSIFIED)

The bulk of time was spent in ES maintenance and changeover to magnetic-core storage work.

More lamicoid labels have been received and installed on the MC "swinging door."

Auxiliary Magnetic-Drum System

(H. L. Ziegler) (UNCLASSIFIED)

Push-button resetting of the Auxiliary Drum Group Selection Register has been added to the Monitor in Test Control. This permits complete selection--group, register, and digit-- of Auxiliary Drum information without the use of a short computer program as was previously the case.

On the next installation day the permanent monitoring installation in the Auxiliary Drum cabinet should be completed. This will permit removal of all test equipment, temporary panels, and temporary wiring now in use. A similar "clean up" program is planned for the monitor equipment in Test Control.

1.21 WWI System Operation (Continued)

Auxiliary Magnetic-Drum System

(P. W. Stephan) (UNCLASSIFIED)

MTES was checked and appears to be working satisfactorily.

The permanent power circuit for the Auxiliary Drum is ready to be connected, but we will wait for a hiatus in computer activities.

The rest of the time was spent checking the buffer drum.

Typewriter and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

Two paper-tape verifiers have been received from the production shop for installation on our Flexowriter tables and delivery to the tape room. During testing, a few circuit modifications were found advisable to increase the reliability of the verifiers. One has already been modified and installed in the tape room; the second should be in operation within a week. A third verifier is now in inspection.

1.22 Terminal Equipment

Room 222

(R. H. Gould) (UNCLASSIFIED)

Modifications on the 5-inch scopes and the intensify-gate amplifiers have been finished, and the display has improved. Adjustment of the astigmatism control should further improve some of the 5-inch scopes.

The audible-alarm panels have been modified and operate correctly except with one program. It has not yet been determined whether this is circuit or program trouble.

Thyratron failures in the indicator-light registers were stopped by the last modification of the panel, and operation is satisfactory.

Testing of G-A link is about to commence.

1.22 Terminal Equipment (Continued)

Room 222

(S. Ginsburg, T. Sandy) (UNCLASSIFIED)

This biweekly period was spent mostly in checking out changes made in the terminal equipment in Room 222.

The audible-alarm panels were modified and now work correctly.

Some troubles have been found in the display switches and intervention-register buttons. Most of these troubles have been traced to broken leads. The leads seem to break inside the lugs on the end of the leads.

Character Generator

(F. E. Irish) (UNCLASSIFIED)

Considerable trouble was experienced with the character generator during the past biweekly period. The symptoms were occasional program alarms. The marginal-checking facilities for this unit were inadequate but will be corrected. The trouble was located only after considerable time had been spent probing around in the unit. The source of the trouble was three bad gate-tube plug-in units with gains less than unity.

These gate-tube units were interesting in that two of them had tubes which appeared to be responsible for the malfunctioning of the unit, but these same tubes were retested by the tube shop and said to be usable. It appears that circuit is responsible.

Ferranti Photoelectric Tape Reader

(F. E. Irish) (UNCLASSIFIED)

Two Ferranti PETRs finally have arrived.

Some measurements have been made on the performance of the optical system and the associated electronic amplifiers in these readers. The optical system performs very nicely. A perforation in black tape produces a 25-v signal at the cathode of a 927 phototube which has 90 volts on its annode and a 10-megohm cathode resistor.

The optical system is very insensitive to the kind of tape used. Perforated wax paper produces a 15-v signal.

The existing electronics will be modified so as to use our own tube types.

1.22 Terminal Equipment (Continued)

Magnetic-Tape System

(E. P. Farnsworth) (UNCLASSIFIED)

Unit 0 record circuits have been disabled to protect frequently used programs stored on this unit from accidental erasure. Recordings on this unit are located by means of the rewind button and limit stops consisting of conducting strips of silver micropaint. These recordings will be identified by marking the back side of the tape with a silicone paint being supplied by Dow Chemical. Further recordings can be made on this unit by reconnecting six tagged germanium diodes to the six screw terminals in the reading amplifiers in Rack AX3.

Minnesota Mining and Manufacturing is investigating the availability of1.5-mil mylar tape from the Dupont pilot plant so they can replace the four reels of spliced mylar magnetic tape which were included in our original shipment of twelve and supply us with additional unspliced reels for spares.

Magnetic-Tape Mechanisms

The Magnetic-Tape-Mechnaism Test Panel was completed by the shop and has been installed in TC17 as a preventive-maintenance and trouble-shooting facility.

Magnetic-Tape Print-Out

Inadequate isolation and transposing of audio wiring called for by the drawings for the newly completed relay-transfer panel has necessitated rewiring part of the panel to reduce crosstalk between computer and print-out.

M-2396 was issued covering discontinuance of the delayed print-out old code in favor of the new code which permits automatic selection of punch-out or print-out from the tape recordings.

Buffer-Drum System

Punch-card read-in via buffer drum is being considered as a possibility for WWI, although it appears at the present preliminary stage that the complexity involved may lead to the choice of push-button intervention-type registers as a more practical solution for the immediate future.

1.22 Terminal Equipment (Continued)

Buffer-Drum System

(H. L. Ziegler) (UNCLASSIFIED)

An indicator circuit that has appeared good in the Test Rack setup is now being installed in a small section of the Buffer-Drum System. If this circuit proves satisfactory all drum flip-flop indicator circuits are to be modified accordingly.

(K. E. McVicar) (UNCLASSIFIED)

The memo proposing that we keep the buffer drum with the nicked surface has been circulated to interested parties. To date no adverse comment has been received. In view of this fact we are proceeding with testing and installation of the buffer system on the assumption that it will not be necessary to have the drum resurfaced.

Marginal-checking facilities have been installed in the buffer drum and marginal checking of the various circuits is under way. The margins obtained in early tests have been quite good.

Video cabling of the drum to the computer is complete. The cables between the drum and the terminal equipment will be ordered as soon as sufficient terminal equipment has been installed to permit determination of cable length. The indicator-light wiring for the buffer drum has been finished, and labels for the indicator light panels are in process of construction.

MITE

(R. Paddock, A. Werlin) (UNCLASSIFIED)

One new MITE for the Buffer Drum has been wired into Rack L-8. Pulse tesing of this MITE with the modified layout will begin as soon as power wiring is completed and the full complement of plug-in units has been assigned.

Mass modification of individual plug-in-unit mounting panels for MITE began today; therefore, construction of two more MITE's for Buffer Drum has started and should be completed early next month.

The first eight of the new plug-in Pulse Standardizers have been received from the construction shop; initial tests show their operation to be satisfactory.

1.23 Records of Operation

(F. J. Eramo) (UNCLASSIFIED)

The following is an estimate by the computer operators of the usable percentage of assigned operation time and the number of computer errors for the period August 28 - September 10, 1953:

Number of assigned hours	160
Usable percentage of assigned time	94
Usable percentage of assigned time since March, 1951	85
Number of transient errors	45
Number of steady-state errors	4
Number of intermittent errors	3

Storage-Tube Complement in WWI

(L. O. Leighton) (UNCLASSIFIED)

Following is the storage-tube complement as of 2400, September 10, 1953:

Digit	STM No.	Tubes	Hours of Installation	Hours of Operation
0 B	27	ST-868	15821	552
1 B	18	ST-865-1	15710	663
2 B	21	ST-880	16343	30
3 B	24	ST-877	16267	106
4 B	33	RT-380	13516	2857
5 B	11	ST-836	14617	1756
6 B	44	ST-863-1	15662	711
7 B	17	ST-822	14846	1527
8 B	6	RT-391-1	15370	1003
9 B	38	ST-874	16064	309
10 B	43	ST-864-1	15688	685
11 B	25	ST-753-1	13129	3244
12 B	41	ST-856	15290	1083
13 B	3	ST-870	15895	478
14 B	32	ST-871	15919	454
15 B	16	RT-383	13629	2744
16 B	42	ST-879	16267	106
17 B	26	ST-869	15846	527

1.23 Records of Operation (Continued)

Storage-Tube Complement in WWI

(L. O. Leighton) (Continued) (UNCLASSIFIED)

Digit	STM No.	Tubes	Hours of Installation	Hours of Operation
0 A	30	ST-862-1	15641	732
1 A	20	ST-817	14148	2225
2 A	34	RT-388-R-1	15393	980
3 A	23	ST-802	13411	2962
4 A	39	ST-867	15794	579
5 A	40	ST-525	13389	2984
6 A	28	ST-876	16267	106
7 A	35	ST-800	13340	3033
8 A	45	ST-825	14307	2066
9 A	10	ST-861-1	15641	732
10 A	36	RT-401	15534	839
11 A	12	RT-387	15175	1198
12 A	13	RT-390	15290	1083
13 A	14	RT-381	13581	2792
14 A	29	ST-835	15460	913
15 A	22	ST-875	16267	106
16 A	9	RT-855	15194	1179
17 A	2	RT-382	13629	2744

ES Clock hours as of 2400 September 10, 1953	16373
Average life of tubes in service in Bank B	1046
Average life of tubes in service in Bank A	1514
Average life of last five rejected tubes	1074

Storage-Tube Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following storage-tube replacements were reported during this biweekly period:

ST-821	was rejected after 2041 hours of operation because of arc-over.
ST-845-1	was rejected after 1381 hours of operation because of weak HV gun.
RT-389	was rejected after 977 hours of operation because of weak HV gun.
ST-860-1	was rejected after 626 hours of operation because of weak holding and HV guns.
RT-393	was rejected after 949 hours of operation because of internal short between A_3 and some other element.
ST-872	was rejected after 25 hours of operation because of failure to hold a plus array.

1.23 Records of Operation (Continued)

Component Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following failures of electrical components have been reported since August 28, 1953:

Components	No. of Failures	Hours of Operation	Reasons for Failure
Crystals			
1N38A	1	9000 - 10000	Low R_b
Potentiometers			
10-K, 2-watt, carbon	1	9000 - 10000	Noisy
Tubes			
6145	1	0 - 1000	Short
6V6GT	2	9000 - 10000	1-interface; 1-low I_b
3E29	1	19000 - 20000	Low I_b
5696	15	0 - 1000	9-high tube drop; 6-short
7AK7	1	4000 - 5000	Short
	1	9000 - 10000	Short
	1	19000 - 20000	Short
7AD7	8	8000 - 9000	4-short; 4-low I_b
	1	16000 - 17000	Short
	1	18000 - 19000	Short
	1	19000 - 20000	Short

1.24 General

WWI Power Supplies

(R. G. Farmer) (UNCLASSIFIED)

The -300-v power supply has been changed from a 5-amp supply to a 10-amp supply. The -300-v and -450-v supplies are now permanent in WWI, although they are still mounted in temporary racks.

In these two supplies, type 5681 tubes are being used in the reference circuit and the voltage has no noticeable drift whereas the voltage was found to drift as much as 1% in similar supplies which used OA2's in the reference circuit.

1.3 Group 65

1.31 Storage Tubes

(P. Youtz) (UNCLASSIFIED)

Some of the personnel in the Storage Tube Group were transferred to other groups in the Division this past biweekly period. There will be more personnel transfers over the next few periods. The remaining personnel directed half of their efforts toward the construction and testing of 800-series storage tubes and their installation in ES row.

Work was done and will continue on research tubes for the cathode investigation by H. B. Frost.

Considerable work was done for Group 25. Most of this work was experiments leading toward an electroluminescent direct-view storage tube. There are some commitments to Group 25 which will continue.

Work was continued on the Charactron tube.

1.32 Test

Storage Tube Reliability Tester

(L. B. Martin and R. E. Hegler) (UNCLASSIFIED)

Six storage tubes were tested during this period. Five had very good margins while one was rejected because of a buckled mica-quadrant spacer.

Television Demonstrator

(A. Zacharias) (UNCLASSIFIED)

During this period, five 800-series storage tubes were pre-tested at the TVD; four were satisfactory, and one was marginal. The tubes tested were ST878 through ST882. ST882 was marginal because of a buckled mica spacer.

SECTION II - AN/FSQ-7

2.1 Group 62

Summary and Activities of Group 62

(N. H. Taylor) (CONFIDENTIAL)

The second WWI magnetic-core memory has been completed and installed and is now running in the WWI computer. Operation has been quite satisfactory. It is encouraging to note that a complete memory array can be built and tested in such a short time.

A vigorous effort has been initiated to order the component parts for the plug-in parts associated with the XD-1 computer. The urgency of placing orders has made it necessary to streamline the activity of the component sub-committee of the Central Standards Committee. Accordingly, either Paine or Watt have agreed to be on call in Poughkeepsie at all times during the next four- or five-week period. They will have the authority to accept substitutions in components wherever it is necessary to make a compromise in order to meet some particular schedule.

A study of the plans for layout of the basement in Building A to accept the XD-1 computer indicates a shortage of space. Power supplies and air-conditioning equipment will take much more room than was first estimated. No solution to this problem has yet been proposed.

A study of the outputs of the XD-1 is being conducted by Jacobs with the help of Hopkins and Jeffrey. The rescheduling of the date on which specifications should be completed has been made and now stands at February 1, 1954. This will not delay the delivery of the output drum, but will allow a more reasonable approach to the output problem.

Jacobs will undertake to participate in several studies being carried on by Division 2. Two activities have started: (1) a study of the phone-line intercommunication problem; (2) a study of the automatic height finding as it might apply to the XD-1 computer has reached a vigorous tempo.

An intense effort on the part of IBM to meet the schedules is very evident. It is very necessary that the MIT role of helping to freeze basic circuits keep up with this increased tempo, but it is also important that we minimize suggested modification in the logic of the machine if we are to avoid delaying the IBM activity.

2.11 Systems

Cathode Followers

(B. Remis, A. Heineck) (UNCLASSIFIED)

Cathode-follower bias resistors will not be used for the following reasons:

2.11 Systems (continued)

Cathode Followers (Continued)

(B. Remis, A. Heineck) (UNCLASSIFIED)

1. In the design of cathode followers which must operate satisfactorily with 5965 tubes that vary from +25% to -40% of bogie, bias resistors do not appreciably reduce the bias buildup of the lower d-c level.

2. Bias resistors do not help considerably in equalizing the load when these cathode followers are paralleled.

3. Cathode followers can be marginal checked by dropping the +150-v supply. One slight drawback to this scheme is that a cathode follower supplied from a stiff source may draw about 10 ma of grid current for a few seconds when the plate voltage is lowered.

Input Counters

(C.J. Schultz) (CONFIDENTIAL)

An IBM 8-stage shift register has been tested for operation limits during variations of advance-pulse rise time, amplitude, and length. Minimum operating conditions occur at 0.2- to 1-μsec rise time, 5-amp-turns amplitude, and 2.2-μsec length.

Etched-Circuit Pluggable Unit

(R. Callahan) (UNCLASSIFIED)

Two samples of the pluggable unit mentioned in the last biweekly have been received from the shop. Bob Pitts has constructed an adapter so that these units can be mounted in a standard 19" rack. Etched-type construction of the flip-flop, gate-tube circuit, and cathode follower have been ordered.

Delay-Line Adder

(R. Callahan) (UNCLASSIFIED)

The construction of the delay-line adder has been completed, and initial testing has started.

2.11 Systems (continued)

Marginal Checking

(R. Fallows) (UNCLASSIFIED)

A proposal for the marginal-checking system was reported in IM-46 and discussed in Poughkeepsie on September 2. One variation to the report was introduced at Poughkeepsie when it was agreed that the routine operation of the system should be automatic. The physical location of the M/C relays was undecided — Beeby and Walters of IBM will determine whether they should be in the individual computer frames or in a separate marginal-checking frame.

In order to facilitate the expansion of the marginal-checking work to cover equipment outside the central computer, members of the other groups working on Drums, Display, Input, Output, etc., have been asked to assist.

2.12 Magnetic-Core Memory

Miscellany

(W.N. Papian) (CONFIDENTIAL)

Work is proceeding at a fair pace on the MTC Memory, Mod. II. We are approximately two weeks behind the original schedule on many items.

Agreement was reached on many XD-1 memory questions during joint meetings with IBM, and detailed design work can now go ahead. In many ways the XD-1 memory will resemble that of MTC, Mod. II; in the interest of the time schedule we are trying to use as many existing designs as possible.

MTC II Memory

(E.A. Guditz) (CONFIDENTIAL)

The status of various items for the MTC 64 x 64 memory is as follows:

The memory frames have been completed except for the big strips. These will be added as soon as the lugs are delivered and inserted in the strips.

Wires for the driving lines are stripped and ready to use.

Hardware for assembling the completed planes into a stack is completed.

The memory rack is being painted and will soon be delivered.

Filament panels are assembled and being wired.

The a-c fuse panel is completed.

The d-c power-distribution panel is in construction.

A block diagram of the time-pulse distributor for the XD-1 memory been prepared. Basic-circuit details are being handled by J. Gillette.

A common point of view has been reached with Henn of IBM concerning the construction of the XD-1 memory planes.

Selection-Plane Drivers, MTC, Mod. II

(J.L. Mitchell) (CONFIDENTIAL)

Work on the drivers for the MTC, Mod. II memory is proceeding at a steady rate. All panels are now either in the Drafting Room or in the shop. A good deal of progress has also been made on the transformer-design problem.

2.12 Magnetic-Core Memory (continued)

Selection-Plane Drivers, MTC, Mod. II (Continued)

(J.L. Mitchell) (CONFIDENTIAL)

A two-day meeting with the IBM people was held, and we are now in agreement on most of the XD-1 memory-design problems. We hope to reach agreement on the remainder of the problems in the next two weeks.

Sensing Amplifier, MTC, Mod. II

(W.J. Canty) (RESTRICTED)

Mechanical work for these units is being performer in the shop. Etched wiring is being investigated and looks favorable. Two sensing amplifiers using etched circuits are to be built next week to gain experience with etched circuits.

Digit-Plane Driver, MTC, Mod. II

(W.J. Canty) (RESTRICTED)

These units are now in the wiring shop.

Switch Cores

(A.D. Hughes) (UNCLASSIFIED)

Work is continuing on the evaluation of an equivalent circuit for a switch core. The effects of stray capacitance, air-core transformer action and stray output-coupling reactance were found to be negligible. Some indication of the validity of the equivalent circuit for both voltage-source and current-source square wave was shown.

Work will continue on the equivalent circuit and its use in the design of the magnetic-matrix switch.

2.13 Vacuum Tube Circuits

Memory Pulse Distributor

(J.S. Gillette) (UNCLASSIFIED)

The total accumulative delay error is being investigated. If it is found excessive, a new scheme may be necessary for a pulse distributor.

Delay-Line Drivers

(J.S. Gillette) (UNCLASSIFIED)

I have taken over J. Woolf's work on these drivers. The noise problem resulting from reflections has not been completely solved as yet.

Cathode Followers

(B. Remis) (UNCLASSIFIED)

Marginal checking of a cathode-follower circuit is feasible and can be accomplished by lowering the +150-v supply and observing the fall in the output or cathode voltage. No significant change will be observed until the driving source is called upon to deliver more current to the cathode-follower grid circuit than it can do without itself failing. Until this point is reached, the cathode-follower output is maintained by the 100% negative feedback circuit of the cathode follower. Care must be exercised not to overdissipate the cathode-follower grid during the marginal check.

Selection-Plane Driver, MTC Mod. II

(D. Shansky) (UNCLASSIFIED)

The circuits relating to this unit have been frozen and are presently in the Drafting Room.

Digit-Plane Driver, MTC Mod. II

(D. Shansky) (UNCLASSIFIED)

The schematic diagram of this unit has been completed by the Drafting Room. The print number is C-55947.

2.13 Vacuum Tube Circuits (continued)

Pulse Amplifier

(S. Bradspies) (UNCLASSIFIED)

Tests were run driving the gate-tube panel with the pulse amplifier using Sprague Pulse Transformers. The types employed were 28:7, 30:6, and 32:8, each ratio being tried in tight and loose windings. These transformers were used to drive loads of 8 and 16 gate tubes.

In all cases it was found that tight coupling gave more output than loose coupling.

When the tightly coupled transformers were used, it was found that the 28:7 and 32:8 gave just about the same results; for large input voltages the 4:1 gives more output than the 5:1. For smaller inputs, they are all about the same.

When driving 16 gates, it is not possible to get unity gain (input voltage measured grid to cathode and output measured at the first gate-tube grid).

When driving 8 gates, there is no difficulty in achieving unity gain. With the tightly coupled transformers we get unity gain, or better, in the following ranges of inputs: 28:7 - 15 to 41; 30:6 - 15 to 38; and 32:8 - 15 to 42.

High-Speed Flip-Flop

(Hal Boyd) (UNCLASSIFIED)

I am happy to report that the clear-clear noise suppressor for the high-speed flip-flop has been found logically unnecessary.

The reason is that time must be allowed by the machine for a complete flip-flop transition. The clear-clear noise is always less than the flip-flop's transition time.

Low-Speed Flip-Flop

(Hal Boyd) (UNCLASSIFIED)

Evaluation of the clamped low-speed flip-flop is nearing completion. Some of the more pertinent information is given below:

Input requirements are the same as those of the high-speed flip-flop, except as it presents a lighter load to the trigger source. There is no clear-clear noise encountered in this flip-flop.

2.13 Vacuum Tube Circuits (continued)

The flip-flop was designed to handle 2 ma of AND and OR current, and large capacitive loads. Both outputs can drive 320 μμf per side.

When driving gate tubes that are sensed by 0.1-μsec pulses, the flip-flop can give transfer characteristics equal to those of the high-speed flip-flop by padding the flip-flop output with 160 μμf for each gate tube to be sensed at one time. The padding would consist of other gate tubes and/or additional capacitance. The flip-flop has delays which make it suitable for counting applications.

When driving gate tubes that are sensed by longer (around 1 μsec) pulses, each gate-tube suppressor grid should contain a 4.7-k flip-flop isolating resistor. For larger numbers of gate tubes thus connected (above 4 per side) the effect of the isolating resistance can be neglected, and only the capacitance can be considered in computing rise times.

The rise time of the flip-flop is longer than the fall time and is therefore the determining factor in transition times. The total rise time, R_T, when driving capacitance (including a constant 0.1-μsec delay) can be calculated by

$$R_T = 1.0 + \frac{C_{load}(\mu\mu f)}{80\ \mu\mu F} \quad \mu sec.$$

Complete unbalanced tube data has not yet been taken, although a 70% down (30% off) 5963 (it uses a 5965) allows satisfactory operation of the unit. The most critical resistor has a tolerance of 25% within the allowable trigger-input range. The unit still operates within specs for 50-k diodes and will operate with diodes whose back resistances go lower than 20k.

Memory Sensing Amplifier

(C.A. Laspina) (UNCLASSIFIED)

During the first portion of this biweekly period, the margins of the sense-amplifier prototype were checked and seem satisfactory.

Some time was spent testing a sense amplifier of simpler, but less reliable, design; operation is satisfactory.

High-Speed Gate Tube

(H.J. Platt) (UNCLASSIFIED)

A pulse transformer was decided on after several tests with transformers made by Sprague. The transformer chosen is a 4:1 ratio made with 32 and 8 turns loosely coupled on a Ferramic H 262 core.

2.13 Vacuum Tube Circuits (continued)

Now that the transformer is settled, the gate-tube problem will be cleared up by the optimizing of circuit parameters through marginal checking.

2.14 Memory Test Computer

General

(W. Ogden, W. Hosier, P. Bagley) (UNCLASSIFIED)

Planning continues (and construction has begun) to carry out the program of additions to MTC which were discussed in the August 28 biweekly (Charactron tests, magnetic-drum system, Ferranti reader, 64 x 64 memory). It is also planned to include an automatically operated Fairchild scope camera in the system after the manner of WWI. Some reshuffling of present equipment will be incidental to the additions: e.g., Flexowriter control will be moved to make room for drum control, and this occasion will be seized to modify the equipment for not punching the 7th hole when so instructed.

The "MTC output device" (an IBM electric typewriter operated by a relay matrix) was delivered to MTC by R.A. Whitehorne and H.J. Rottici of IBM's Project High. Originally ordered to provide a printed output in the absence of Flexowriter gear, this unit has a more rational code (from the computer standpoint) than the Flexowriter -- it will handle octal digits directly from their binary representation. Neat and compact, it has given every indication of being reliable as well.

Logic

(P.R. Bagley) (UNCLASSIFIED)

Drum System: A block diagram has been drawn up for the drum system (SD-47012)

Memory-Group Selection: Final decisions on the technique of memory-group selection await a conference of interested parties, probably to occur in the week of 14 September.

Camera Control: A panel for this purpose is under construction.

Ferranti Reader Control: Design work on this has been postponed to see how WWI makes out with the Ferranti Reader which has just been delivered.

2.14 Memory Test Computer

Angular Position Counter

(Hal Boyd) (UNCLASSIFIED)

The three-stage mock-up counter proved the compatibility of the new gate-tube circuit and the high-speed flip-flop. In fact the counter ran at 4 mc (the limit of the test equipment) with an input of 20 volts -- the minimum allowable input as specified by the HSFF specs. It ran with an input of 15 volts at 2 mc. Had not 3- to 5-foot cables been employed for connections the counter would probably run faster, within specs.

As a result of the tests work will be started on the MTC 16-stage counter. It is expected that the counter will be ready for trial by 16 September.

Low-Speed Flip-Flop

(Hal Boyd) (UNCLASSIFIED)

The low-speed flip-flop which was proposed for drum-write applications in the last biweekly report has been tentatively accepted as a basic circuit. See "Vacuum Tube Circuits" of this report.

Charactron Decoder

(W. Hosier) (UNCLASSIFIED)

Tests of a breadboard decoder circuit of the push-pull high-impedance type described in the August 28 biweekly report have been quite encouraging; the circuit switches reliably with the standard MTC input levels of 0 and -40 volts, and is stable -- a variation of 20% in the plate supply of the switch tubes changes the output voltage by only 1/2%. Rise time, because of high (5000 ohm) impedance, is longish -- 3 μsec working into 100-μμf load; this is not expected to be a great hindrance in working with magnetically-deflected CR tubes. John Crane has taken over design and layout of the finished decoder panel.

IBM Typewriter Unit

(R. Hughes) (UNCLASSIFIED)

Since the original completion signal put out by this device was a variable gate from a single-shot multivibrator, a 0.1-μsec thyratron pulse generator was developed on one of IBM's standard plug-in units to

2.14 Memory Test Computer (continued)

make the device compatible with MTC control. Its digit input has been accomplished by sensing the console indicator lights of accumulator digits 10-15. Testing to date has shown the unit to be working quite well at the rate of 7 characters a second.

Procurement

(L. Sutro, W. Ogden) (UNCLASSIFIED)

Quantities and delivery dates have been given to the shop for most units needed in the program of MTC additions.

D-C Power Supplies

(R.G. Farmer, D.M. Fisher) (UNCLASSIFIED)

During this period efforts have been directed towards elimination of oscillations in the regulator section of one of the 150-v power supplies. Oscillations in the eight series tube panels have been stopped. Attention is now focused on the d-c amplifier section where the over-all gain could be improved upon.

It is expected, because of information obtained from this supply, that the debugging time of six more similar supplies will be at a minimum.

A-C Power Control

(R. Jahn) (UNCLASSIFIED)

Control wiring has been installed and is ready for testing.

2.15 Equipment Design and Schedules

Procurement

(A.P. Kromer) (Restricted)

Considerable attention has been given to the problem of preparing the necessary information and specifications to permit the IBM purchasing organization to start actual buying of materials and components for the XD-1 and XD-2 prototype models. It has become evident that the Standards Committee proceedings require too much time. Arrangements are being made to establish a smaller group empowered to prepare recommendations for materials and components to be used in the prototypes. Only in cases of lack of agreement between the MIT and IBM members of the small group will the matter be referred to either the Central Standards Committee or to N. Taylor and Crago jointly for resolution.

Equipment Installation

(W. Ayer) (Confidential)

Preliminary discussions with the cooling-equipment consultants have indicated that a serious space problem exists in fitting this equipment into the basement of Building A in Lexington. Recommendations will be drawn up as soon as the consultants are able to give us some approximate dimensions on the air-handling and the refrigerating equipment.

Work is continuing on the etched-wiring layouts in conjunction with IBM. Final layouts cannot be made, however, until the circuits are frozen and all component specifications are complete.

Layout of the equipment in Building A is continuing as rapidly as information on circuits and block diagrams can be assembled and correlated to show the physical size of the necessary racks and frames. A scale model of the building will be made in the near future to help in the final layout.

Mechanical design of the XD-1 has been delayed slightly due to redesign of the pluggable unit. The model of the second proposal turned out to be less rigid than was anticipated, and a new, larger unit has been laid out. The increased size of this latest unit will affect the size of the etched-circuit cards as well as the bay or modular design. It now appears that there will be little or no room below the pluggable units for decoupling components, fusing or marginal-checking equipment. This equipment will have to be housed in additional cabinet modules located as required in the various equipment rows.

2.15 Equipment Design and Schedules

Materials

(J.D. Bassett) (UNCLASSIFIED)

A proposed specification for use of laminated plastic materials has been prepared and distributed to those concerned for comment.

A proposed specification for pre-paint treatment of metals has been prepared and will be distributed in the near future. Committee work is progressing on selection and specification of flat metal stock, threaded hardware, and processes for welding fabrication and application of organic protective films to metals.

M. Raffensperger has been contacted with regard to the status of the video-mapper sub-contract with Bendix, and a meeting will be arranged in the near future to discuss means for establishing close liaison between IBM, MIT, and Bendix as work progresses.

Drafting Subcommittee

(J. Giordano) (UNCLASSIFIED)

The Drafting Subcommittee met at Cambridge on September 9 and 10. Comments on the proposed electrical-drawing format were reviewed which resulted in a revised proposal by this committee. The proposal will soon be submitted for formal approval.

Electrical drafting standards were completed at this meeting. They will be submitted for formal approval after they are drawn on the standard format.

2.16 Transistors

Saturating Flip-Flops

(C. T. Kirk Jr.) (UNCLASSIFIED)

Marginal curves have been taken of the saturating two-transistor flip-flop. An M-note pertaining to these curves is being written.

Two types of crystal diode gates have been investigated as to their suitability for use with a saturating transistor flip-flop.

Minority Carrier Storage

(N. T. Jones) (UNCLASSIFIED)

The results of the diode storage tests have indicated several things. First, the Sylvania diodes lie slightly above the midpoint of the order. Hughes 1N90 diodes are highly superior to all others with Kemtron K34 in second place. As predicted, the "bonded" diodes fall at the end of the list by exhibiting the worst storage characteristics.

A Teletronix Laboratory PG 200A Pulse Generator has been received. This is an excellent piece of test equipment and eliminates the bottleneck due to the Rutherford B-2 Pulse Generator.

Symposium

(N. T. Jones) (UNCLASSIFIED)

Eckl, Cohler, and Jones attended the Symposium on the Application of Transistors to Military Equipment, sponsored by the Defense Department in New Haven, September 1, 2, and 3rd.

2^5 Counter

(E. U. Cohler) (UNCLASSIFIED)

Test circuits have been designed to check the reliability of the 2^5 Counter over long periods of operation. Since reliability is expected to be rather high, the check is an over-all one, depending only on total count. A transistor pulse generator has been developed to fit into this setup as it was not deemed advisable to tie up a large pulse generator for this purpose alone. The transistor pulse generator delivers 6-v, 0.5-μsec pulses into a 2.2-k load at rates which may be varied from 2 kc to 20 kc.

2.16 Transistors (Continued)

Junction Flip-Flop

(E. U. Cohler) (UNCLASSIFIED)

A trip was made to Lincoln to discuss the results of the study of the d-c conditions of the junction type flip-flop with R. H. Baker. It was found that similar results had been obtained in both spots. Mr. Baker had some interesting suggestions on graphical methods which he had developed for doing this analysis. We are now proceeding with an analysis of the triggering and transient conditions in such a flip-flop.

2.17 Display

(R. von Buelow) (UNCLASSIFIED)

A new Display Section was formed in Group 62. C. Corderman is Section Chief.

At a meeting between IBM and MIT display personnel it was decided to continue development of the Triest (of IBM) type character generator, to have interleaved track data, to reduce the number of history points if necessary, and to have two intensification levels. See M-2403 for further details on this.

Two 19" Charactron tubes were received from Convair. The first phase of the evaluation of these tubes is being carried out in the Storage Tube lab by C. Corderman.

A conference was held with IBM, MIT, and Convair personnel regarding all phases of the Charactron. Convair is looking into the possibility of providing large rectangular tubes. It seems the greatest difficulty of this tube is getting a satisfactory post acceleration. Separate dag bands and a spiral dag are being considered. Convair is also putting tubes on life test immediately.

Charactron Display Scope

(H. E. Zieman) (UNCLASSIFIED)

An intensification amplifier has been designed in a plug-in form and will be tested in the 16-inch scopes in MTC. A single amplifier consists of one of Hal Boyd's flip-flops plus a second plug-in unit. A separate amplifier will be required for each intensity level desired; the present setup will permit up to three levels to be displayed at random. If more than one level is to be used, an extra plug-in unit will be required to mix the various levels.

2.17 Display (Continued)

(H. E. Zieman) (Continued)

A new magnetic deflection amplifier has been designed, and four units are presently being built in the shop. It is hoped that this new amplifier will have better noise rejection than the present amplifier. Extra current capacity has been built into these new amplifiers to permit the use of faster yokes if desired. The current capacity is 500 ma.

A block diagram has been drawn up for a new vector generator, and the component circuits are presently being tested. The first circuit to be built and tested has been a Miller integrator. Tests show that the circuit is quite promising for the purpose in mind.

Design has been started on the electrostatic deflection amplifier for character selection and vector generation. Construction of four of these units will be started early in the week of 14 Sept.

Display Control

(R. H. Gerhardt) (UNCLASSIFIED)

Two days of the past biweekly period were spent at IBM in conference with D. C. Ross, R. Butler, and P. Rocco. These discussions about the control, cross-telling requirements (with regard to the display control), and the word layout are summarized in M-2402.

Some time was spent reworking a control system I have proposed.

Digital Display

(M. Epstein) (CONFIDENTIAL)

A memorandum has been written to give present thoughts on the digital display. Suggestions and comments on the size and number of displays needed are requested.

An evaluation was started on methods of allowing an operator to choose among several displays.

2.2 Group 63 (Magnetic Materials)

(D. R. Brown) (UNCLASSIFIED)

The production of ferrite memory cores continues at General Ceramics. Cores made there since September 4 are being held to apply to the IBM order when it is received. Our order for 100,000 good cores should be filled from the 160,000 cores that General Ceramics shipped to us last month.

IBM has ordered 50,000 untested cores from RCA Victor. RCA is still experimenting to determine a suitable ferrite.

A round robin to coordinate measurement of ferrite memory cores at MIT, IBM (Plant 2 and High Street), General Ceramics, and RCA Victor is expected to begin this week.

Production of Ferrite Cores

(R. A. Maglio) (UNCLASSIFIED)

Stokes press dies machined to very close tolerance with a chrome-plated top-punch face have produced the most satisfactory cores since the beginning of our study of core forming. Dies have been ordered with completely chromed working surfaces and also with carbide-steel working surfaces.

Ferrite material has been worked on in an effort to produce a cleaner particle. A comparison of our reacted powder with that of General Ceramics makes it clear that the General Ceramics particle is harder and cleaner. In order to increase the hardness of our particle, prefiring temperature is undergoing change. An increase in the prefiring temperature has increased the hardness, removed a great deal of dust, and increased the yield of the desired particle size fraction.

Runs have also been made attempting to remove the dust by magnetic attraction. This method is satisfactory; however, a suitable piece of equipment will have to be designed before it can be used.

Firing of F-394 Cores

Cores pressed from General Ceramics composition MF-1326-B, Batch 2, have been fired and tested. The results, up to now, are not as good as General Ceramics firing. Additional firing cycles are being made.

Test results have been received for cores fired in the Harper Furnace July 28, 1953. Electrical properties of the cores taken from different locations in the muffle are in very close agreement.

(J. Sacco) (UNCLASSIFIED)

Two series have been completed and submitted for testing in an endeavor to compile additional information for our investigation of the MgO, MnO, Fe_2O_3 ternary system.

2.2 Group 63 (continued)

Production of Ferrite Cores (continued)

A third series has been started which has been indicated to be of significance by recent data-correlation work.

Processing has also been started on a batch with a composition believed the most suitable for the production of F-394 memory cores.

(F. S. Maddocks) (UNCLASSIFIED)

Setting up analytical procedures for use in the applied chemical study of memory-core production requires analysis of constituent materials for ferrite cores.

Preliminary analyses have not yielded conclusive results, except for showing discrepancies in Fe_2O_3 content in some core materials from the calculated value. Further work is needed in the establishment of sound and applicable analytical methods.

The Structure of Mn_3O_4

(J. B. Goodenough and A. L. Loeb) (UNCLASSIFIED)

Since Mn_3O_4 is a probable constituent in the magnesium-manganese ferrites currently being investigated for memory-core application, an investigation of this compound has been undertaken. This material has a distorted spinel structure. It is tetragonal with $c/a = 1.16$. It has a conductivity $10^8 - 10^9$ smaller than Fe_3O_4. It is paramagnetic down to 90 K. In order to explain these facts, it has been proposed that Mn_3O_4 is $2MnO.MnO_2$ rather than $MnOMn_2O_3$. It is also proposed that Mn_3O_4 crystallizes in an ordered arrangement with alternating planes of Mn^{+2} and Mn^{+4} ions perpendicular to the c-axis. Preliminary calculations verify that such an ordering will give the observed distortion to tetragonality. A calculation of the conductivity to be expected through the double exchange and the superexchange mechanisms is being carried out.

2.2 Group 63 (continued)

Stress Sensitivity of Ferrites

(N. Menyuk) (UNCLASSIFIED)

The General Ceramic ferrite Ferramic H has been found to be stress sensitive. A preliminary investigation of the magnetic properties of this material shows that both the squareness and switching time increase upon application of a compressive stress. Further investigation of this material and of the stress-sensitive ferrite core 204 F-250-103 obtained from the Ferroxcube Corp. is to be undertaken.

SECTION III - CENTRAL SERVICES

3.1 Purchasing and Stock

(H. B. Morley) (UNCLASSIFIED)

Two Ferranti Readers have been received. The remaining one is promised for late September delivery.

Orders requiring priority are now being sent to Lincoln instead of the Institute for certification. Arrangements are being made for Lincoln messenger service to pick up and deliver the purchase orders as required.

An inventory of all office and plant equipment has been requested by Lincoln and the Air Force by October 15. This requirement was anticipated so that large portions of it have been completed well within the deadline date.

The expediting section recorded vendor delivery performance as follows for the month of August:

Orders received complete		325	
" "	on time as promised	146	45%
" "	1-7 days overdue	80	24%
" "	8-14 " "	39	12%
" "	15-21 " "	15	5%
" "	22-28 " "	21	6%
" "	29-60 " "	18	6%
" "	61 or more "	6	2%

3.2 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 23 Construction Requisitions totaling 203 items satisfied since August 28, 1953 and there are 25 Construction Requisitions totaling 398 items under construction by the Group 60 electronic shops.

For further information please call the Production Control office (ext. 3492).

Outside Vendor

(G. A. Murdoch) (UNCLASSIFIED)

There are 6 orders now open with vendors, totaling 153 outstanding items. Deliveries in the past biweekly period have totaled 175 items. Information on specific orders may be obtained from the writer (ext. 3476).

3.3 Component Analysis and Standards

3.33 Standards

(H. W. Hodgdon) (UNCLASSIFIED)

An interim issue of Standard Practice Instructions has been issued as Section 6.501 of the Standards Book, pending the preparation of a complete and detailed Handbook.

A complete revision of the section on electron tubes is being prepared.

3.34 Vacuum Tubes

Tube Operation

(H. B. Frost) (UNCLASSIFIED)

Changes made in the indicator-light registers to allow the 5696 tubes to operate within ratings have apparently been adequate. Since the changes were made, no difficulties have been experienced with these circuits. Life test checks of the 5696 operating under rated conditions show no major changes in about 300 hours.

Tube Testing

(H. B. Frost) (UNCLASSIFIED)

The tubes removed from the five-digit multiplier when it was shut down are now undergoing tests. So far, a number of 7AD7 tubes have been tested. Many of these tubes seem rather good and near the initial specifications. However, plate-to-cathode leakage is very common. The resistance is ordinarily several megohms, so that it would not cause circuit trouble except in unusual circumstances. When all of these tubes have been tested, the data will be analyzed, as the age of many of these tubes is in excess of 30,000 hours.

A life-test run of 5965 tubes has completed 1500 hours. During this run, the plate dissipation of one side was 1.1 watts, with the other side cut off. So far, no major changes have occurred, although the tubes dropped somewhat during the first 500 hours. There is no interface impedance and no grid emission. However, one tube had a plate-to-cathode leakage path of about 10 megohms. The tubes are now being operated with one plate at a dissipation of 2.2 watts, the other section cut off. The bulb temperature is about 120 C, near the maximum value which should be used. Results will be reported as they are obtained.

A life test of 7AK7 tubes (Lot D3P) has run 1500 hours and has been discontinued. These tubes show fairly serious grid emission but no other defects. A new lot, G3P, has now been placed on life in the sockets vacated. Design changes should have eliminated the trouble from grid emission in these tubes.

3.34 Vacuum Tubes (Continued)

ASTM Meeting

(H. B. Frost) (UNCLASSIFIED)

I attended a meeting of ASTM Committee B4 VIIIA task force on interface impedance on September 10. This committee is trying to specify a standard test method for cathode interface impedance. To implement this work, a round-robin test is to be conducted, with about 40 tubes to be circulated to 6 testing activities. I agreed to supply 25 6AG7 tubes for the testing work. In addition, this Laboratory is one of the testing organizations.

Thesis Research

(H. B. Frost) (UNCLASSIFIED)

RT410 was processed satisfactorily on August 29. This tube is very similar to the satisfactory RT409, but a cathode from a different lot sprayed at a different time was used. In addition, a thermocouple is welded inside the cathode for temperature measurement. Tests thus far have shown this tube to have a very good cathode, with good emission over a wide range of cathode temperature. However, efforts to obtain a curve of cathode-voltage drop versus cathode current have always resulted in a nonlinear curve, when such a characteristic should be a straight line if the cathode resistance is constant. The reasons for the curvature are now being investigated both theoretically and experimentally. The cathode thermocouple has so far been quite satisfactory.

Plans are being made for a total of 4 more tubes similar to RT410. These tubes should provide sufficient material for the experimental part of my thesis research.

The diffusion equation has now been normalized and placed in a form suitable for machine computation. It is hoped that this problem can be solved on WWI. A family of solutions containing only one variable parameter is needed. All necessary solutions can be obtained by scaling solutions in this family.

3.4 Test Equipment

Test Equipment Committee

(L. Sutro) (UNCLASSIFIED)

At meetings on August 31 and September 14, the Committee received inventories of standard and commercial test equipment (and planned further efforts to locate 19 missing items in the latter category). Approval was granted for the purchase of three -300-v, 300-ma power supplies and six Weston Model 931 Voltmeters in two ranges, 0-3, 0-7.5, 0-30 volts and 0-3,

3.4 Test Equipment (Continued)

(L. Sutro) (Continued)

0-15, 0-150 volts. Bille reported to the Committee that the jitter exhibited originally by the Tektronix 517 had been eliminated and that this instrument is now performing very well.

Test Equipment Headquarters

(A. Bille, L. Sutro) (UNCLASSIFIED)

During the past week, 66 pieces of Burroughs test equipment have been released by their users. They are available to anyone who needs them.

Work Completed:

	Video Checked	Repaired & Video Checked
Standard test equipment	33	52
Oscilloscopes	4	7
Other commercial test equipment	7	3

Whittemore Building D-C Supplies

(R. Jahn) (UNCLASSIFIED)

Two more d-c supply control circuits have been modified to eliminate the relay "race" condition during starts.

Reports of prolonged periods of over and under voltage on some supplies will be investigated by monitoring several lines with Brush Recorders.

3.5 Drafting

MIT-IBM Drafting Subcommittee

(A. M. Falcione) (UNCLASSIFIED)

The last meeting of the Drafting Subcommittee, held at Cambridge on September 9 and 10, was attended by the following personnel: A. Falcione and J. Giordano from MIT, and W. Cornett, J. Wieland, and H. Hayden from IBM.

3.6 Administration and Personnel

Terminated Staff

(J. C. Proctor) (UNCLASSIFIED)

Edward Craig
Stanley Gill
Howard Smead

New Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Alice Carbonaro is a new member of the Drafting Room.

Richard Heimer is an MIT student working with the Test Equipment group.

Jean Pfaff has transferred from the Instrumentation Lab to become Mr. Proctor's secretary. (Margaret Bateman will replace Eleanore Galant when the latter leaves at the end of this month.)

Edna Raemer is a new secretary in Group 62. She is a transfer from another Lincoln Division.

Terminated Non-Staff

Students:

John Blackmer
David Bourne
David Goldman
Martin Jacobson
Mary Keefe
Irma Kushner
Paul Marino
James Ricketts
Lowell Schwartz
Perry Smoot

Others:

Auberte Boulais
Richard Downey
Theodore Iossa
Gerald Loughman
Joseph Papandrea
Corinne Pascoe
Richard Thompson
Ethel Voedisch