Lincoln Laboratory
Massachusetts Institute of Technology
Cambridge, 39, Massachusetts

SUBJECT: DIVISION 6 BIWEEKLY REPORT, May 22, 1953

To: Jay W. Forrester

From: Laboratory Staff

Section I CAPE COD SYSTEM

1.1 Group 61

1.10 General

(C.R. Wieser) (CONFIDENTIAL)

Modifications on the Raytheon Pathfinder indicators required for conversion radar mapping are essentially complete.

Actual programming for track-while-scan functions in the 1953 Cape Cod System appears to be on schedule. Initial logical flow diagrams for all of the 8 major categories of subprograms are about 90% complete. Written descriptions of the programs are about 50% complete. About 50% of all the coding remains to be done. Some of the coded programs will be tried out on the computer during the first part of the next biweekly period. Work has started on determining the number of storage registers required by each program and the length of time needed by the computer to carry out the program.

Simulation programs for radar data are being worked on and the parameters for use with N. Truro data are under study.

The MEW radar at Bedford has been shut down for removal and will not be used again in the 1953 Cape Cod System.

Just prior to shutdown of the MEW attempts were made to check out a program for four simultaneous interceptions. In the time available, successful flight tests were made with two simultaneous interceptions and later with three.

Progress in checking out the revised interception and tracking programs for use with N. Truro data has been extremely slow and is now almost at a standstill. Poor data from Truro, improper operation of the MITE, and computer operation difficulties have all contributed to the slow progress. It now appears that the start of interception tests with the N. Truro data will be delayed about two weeks beyond May 25.

Considerable progress has been made in the past two weeks on the preparation of written descriptions and flow diagrams for the various

1.10 General (Continued)

(C.R. Wieser) (Continued) (CONFIDENTIAL)

non-track-while-scan programs for the Cape Cod System.

For the experiments this summer we will want cross-telling from an adjacent GCI station and coordination with them when we scramble interceptors into their area of responsibility. Station P-13 was visited, and the commanding officer has agreed to cooperate.

As a result of the coverage tests run by Group 22, the sites for the two gap fillers have been chosen. One will be Chatham, which was chosen to cover Otis AFB and the cluttered area around N. Truro, and the other will be Derry, New Hampshire, which will cover Bedford and the area northeast of the field. There will also be two nodding-beam height finders. One, the MPS-4, will remain at Halibut Point on Cape Ann, and the other, a TPS-10D, will be set up on Nantucket.

1.11 Equipment Engineering

(E.S. Rich) (CONFIDENTIAL)

Radar Mapping Equipment

The modifications on Raytheon Pathfinder indicators required for their conversion to radar mapping use are essentially complete on the two units received. These units appear to operate satisfactorily with a simulated signal generated by test equipment but further study of the circuits in the units is necessary before they can be put into operation. This study is underway and should be completed on the two units by May 29.

Photocell pick-up units and the amplifier panel are being delivered from the shop to meet this testing schedule satisfactorily. It is planned to install one of these modified indicators in Room 216 in final form for use as a mapper for the CPS-6B set. The second unit will be installed as a monitor on the output of the 6B set mapper so personnel can be more easily trained in mapping techniques.

The remaining two Pathfinder indicators are ready at Bldg. B and will be shipped to us in the next few days. Group 24 reports that they are not satisfied with the present azimuth drive units and that improved models are expected to be ready in a few weeks. These will be substituted in our mapping units as they become available.

Several opinions have been stated on whether a PPI monitoring scope for N. Truro data should be set up in the present control center or whether the mapper scope in Room 216 or the Plan 12 indicator in Room 140 will suffice for viewing data at such times as a computer display is not available. In accordance with the latest majority opinion, it is not planned to set up a PPI display of Truro data at places other than Room 216 and Room 140.

1.11 Equipment Engineering (Continued)

(N. Alperin) (CONFIDENTIAL)

The first half of this biweekly period was spent working with Al Shortell on the video mappers. This period is covered in his report.

Five light guns and two amplifier and pulse-generator panels were received from the shop. The light guns were returned for some minor mechanical modifications.

Due to a shortage of tubes, testing of the panels was delayed three days but is now proceeding at a good rate. Barring any unforeseen difficulties, one panel will be installed at the beginning of next week.

(H. J. Kirshner) (CONFIDENTIAL)

The Digital Radar Relay Link and the MEW radar located at Bedford have been shut down and data from this system will no longer be available at the Barta Building. Thanks should be extended to Ralph Van Wood, John Frazier, Nathan Levine, Robert Barrett, and others at AFCRC who have maintained this equipment at a high level of performance for more than two years -- performance which contributed significantly to the progress made by Group 61 over that period of time.

The playback heads of the Ampex twin-track recorder have been re-aligned to eliminate a time delay between channels. This time delay prevented the two channels of recorded Truro data from being played back in correct synchronism. The low frequency response of each of the playback amplifiers was degraded in order to obtain a better playback of recorded SDV. The recorded Truro SDV signal is now a very close approximation of the line signal and, as such, may be used with the Truro Demodulator.

A prototype radio-switching panel is now under construction.

(B. Morriss) (CONFIDENTIAL)

The MITE unit and the associated equipment for the N. Truro data have been operated a number of times during the previous period. On most of these occasions, one of the few engineers who is familiar with the equipment has been present. An attempt has been made to set up a system which will not require the presence of an engineer but the attempt has not met with success. Unfortunately, the equipment is usually desired at night, and a considerable burden is placed on the few engineers familiar with its operation.

Some time was spent discussing the problem of marginal checking the MITE equipment. The marginal-checking lines necessary should be available during the coming period.

1.11 Equipment Engineering (Continued)

(D. Neville) (CONFIDENTIAL)

The Indicator Light Register Panel is now installed in WWI.

The Activate Register Panel has been delivered and will soon be installed.

Two of the scope-console "Positioning and Expansion Control" panels have been installed and the remaining six will be delivered by May 25.

A remote-control system is now being designed for the N. Truro Demo[illegible]ators.

(J.H. Newitt) (CONFIDENTIAL)

Since "the die is cast" on the bulk of the control-room equipment, and the installation procedures are well defined, I have lessened my vigilance on scheduling and have been concentrating mainly on the remaining equipment-design problems.

A few critical procurement items remain but these will be solved shortly without too much overall effect on installation.

Some very late requests for special equipment are just getting into drafting and while every possible effort will be made to speed this work, the actual equipment is not likely to be available before early July. Other as yet undefined items should be brought to my attention in the very near future if they are to be a part of the September experiment.

We can still expect to see the bulk of the control-room equipment installed and hooked up by June 1 with a good part of the special gear being incorporated by the end of June. Two stations are operable now.

Considering the magnitude of the job and the difficulties involved, present progress is reasonably close to our original target of May 15 for completion of the control-room equipment. Inside facilities have been ahead of schedule in many instances while poor control of vendors has caused most of our present delay.

(A.V. Shortell, Jr.) (CONFIDENTIAL)

Radar Mappers

During the past week one phototube mount was received from the shop. This mount has been wired to Pathfinder Unit #1 and is ready for testing. During installation of the mount on Unit #1, waveform measurements and photographs have been made on the sweep and intensification circuits in Unit #2. Testing of Unit #1 including the phototube mount will be completed by the middle of next week, and installation should be made during the latter part of the week.

1.11 Equipment Engineering (Continued)

(A.V. Shortell, Jr.) (Continued) (CONFIDENTIAL)

CRT Filter (Radar Mapper) Amplifier and Pulse Generator Panel Serial #1 have been received. No testing has been done on this panel due to unavailability of 5965's. However, a large shipment of these tubes is overdue so that we will probably have tubes for this panel next week.

(G.A. Young) (CONFIDENTIAL)

Computer programs have been written for testing the expanded display system, intervention registers, and indicator lights during installation. These programs have not yet been checked out with the computer.

The display test program will display at each scope position the matrix pairs selected by the switches at that position.

The intervention-register test program will display the content of the intervention registers on most of the 16-inch scopes.

The indicator-light test program will transfer the content of the flip-flops in test control to the indicator lights.

A rough draft of an M-note describing how the GA unit (Ground-to-Air Link) is to be integrated into WWI has been completed. This note does not completely describe the operation and utilization of the unit from the programmer's point of view. For this information, M-1978, UHF Automatic Ground-to-Air Data Link, by C.A. Zraket, should be read.

1.12 Bedford Experiment

(D. R. Israel) (CONFIDENTIAL)

The MEW radar at the Bedford Airport was removed from operation at the end of the first week of this biweekly period. The loss of the MEW--necessitated by the runway expansion program at Bedford--terminates the associated MEW flight-test activity which has continued at increasing tempo since the first successful guidance and interception tests early in 1951. No flight tests have been run during the past week; but, as previously noted, flight test activity will be resumed shortly with data from the CPS-6B at N. Truro.

An intensified effort was made during the last week of MEW operation to conduct several four-pair intercepts (four interceptors, four targets). Weather, poor radar data, and difficulties with VHF communications and aircraft procurement curtailed the activity. The assistance of aircraft from Squadron VF72 of Air Group 7, temporarily stationed at Quonset Point, helped in the latter respect. The combination of difficulties and circumstances resulted in the conducting of only two tests, each involving only three interceptors and three targets. One test was successful, the other was not.

These two interception tests pointed out a number of desirable changes in flight plans, room arrangements, and test procedures. These are now being made. Construction of the partition to separate the area used for flight-test activity from the remainder of Room 222 is presently underway; this partition will replace the curtain which was formerly in use in Room 222. Several changes are being made in the new flight-test area (Room 228); to a large extent these will make the arrangement and use of available equipment more consistent with that planned for the 1953 Cape Cod System.

Progress in checking out the revised interception and tracking programs for use with N. Truro data has been extremely slow and is now almost at a standstill. Poor radar data, improper operation of the MITE, and computer operation difficulties have all contributed to the slow progress. It now appears that the start of interception tests with the N. Truro data will be delayed about two weeks beyond the May 25 date given in the previous biweekly. The only flight-test activity in the new two weeks will be coverage tests of the N. Truro CPS-6B.

Arrangements are being made to install a PPI scope in Room 228 to provide a display of incoming SDV data from N. Truro. This will be used by the flight-test section during preparation for flight tests, in a fashion similar to the use made of the digital PPI operating with the data link from the MEW.

1.12 Bedford Experiment (Continued)

(P. C. Cioffi) (CONFIDENTIAL)

I resumed work on the interception problem this period, in particular studying the note by W. Lemnios on three-dimensional interceptions. Results of the three-dimensional interception problem may be written up as a supplement to M-1489.

(F. Garth) (CONFIDENTIAL)

The rewrite of the Truro Data Single-Pair Combined Interception Program was completed, and 4 hours of computer time were scheduled for an initial run. Tape conversion had to be done before the program could be tried. Since parity alarms were occurring on the average of one every 7 minutes, and since the tape is quite long, no garble-free converted tape was obtained during the entire 4-hour period. Had there been available a conversion program which made provision for a restart at the last block mark reached before a parity, little time loss would have resulted.

Also during this ill-fated 4-hour period an attempt was made to try a command tracking program which had been inserted into the Single-Pair Combined Interception Program which uses Bedford radar data. No technician was available, however, to take care of the ampex data and the program could not be tested.

(Wm. Lemnios) (CONFIDENTIAL)

The flow diagram for the interception calculations for all possible types of interceptions (except final-term interceptions) has been completed. This diagram was written with C. Gaudette, S. Knappe, and F. Heart.

R. Onanian has duplicated some of the curves which Major Baldwin has loaned to us. When the remaining curves are duplicated, they will be ozalided and distributed.

1.13 Data Screening

(R. L. Walquist) (CONFIDENTIAL)

M-2154, "Allocation of Indicator Light Registers," has been issued. This memo discusses the interconnections and proposed uses of indicator lights for the Track-while-Scan (TWS) functions in the 1953 Cape Cod System.

M-2182, "Track-while-Scan Subprograms," has been typed and is in the print room. This memo briefly outlines the 8 major categories of subprograms for carrying out the TWS function.

The actual programming for TWS appears to be on schedule. Initial logical flow diagrams for all of the 8 categories mentioned above are about 90% complete. Written descriptions of the programs are about 50% complete. Coded programs and detailed flow diagrams have been completed for some of these 8 categories. About 50% of all the coding remains to be done. Some of the coded programs have been discussed in conference and will be tried out on the computer during the first part of the next biweekly period.

Work has started on determining the number of storage registers required by each program and the length of time needed by the computer to carry out the program. A first estimate of these is expected by the middle of the next beweekly period.

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

I have completed the coding and the flow diagram for the Smoothing and Prediction section of the 1953 Cape Cod Program. I have written a memo, M-2175, describing the smoothing and prediction functions.

Certain changes in the non-TWS demands upon the master control program have caused some changes in the master control program. These changes will be described in detail in M-2143-1 to be issued soon.

(D. Goldenberg) (CONFIDENTIAL)

The two-error analysis programs were run unsuccessfully. The programming errors have been corrected and the programs await computer time.

A memorandum is in preparation which will present all the work completed on the problem of the effect of earth curvature on the radar coordinates and distances of targets from the radars.

(H. Frachtman) (CONFIDENTIAL)

Several different kinds of data collection programs have been written and discussed.

1.13 Data Screening (Continued)

(J. Ishihara) (CONFIDENTIAL)

Program and flow diagrams of Correlation-First Stage (Track Sort, Track Density check, and Crossing Track check) for the 1953 Cape Cod-TWS have been completed. A preliminary draft of the program description has been written.

(J. Levenson) (CONFIDENTIAL)

The past biweekly period has been spent on actual programming for the monitoring sections of the TWS for the September System. Thus far, the programs for monitor action by the computer have been completed, except for minor details. The program for switch interpretation of monitor action by the human monitors must still be written.

(H. Peterson) (CONFIDENTIAL)

I have been continuing work on displays and have developed a program for converting a number to a decimal base and displaying it with initial zero suppression that has the advantage that it is independent of the number of digits in the number.

(H. H. Seward) (CONFIDENTIAL)

The track sort and the track density and crossing track check sections of the Cape Cod System have been written and will be checked out next week.

(W. Wolf) (CONFIDENTIAL)

Initial programming for the data collection and display subroutines of the 1953 Track-while-Scan Master Control Program was completed and discussed in conference.

A permanent filter for stationary clutter was constructed to be used with the B-scan filter in Room 224.

1.14 Tracking and Control

(S. Best) (CONFIDENTIAL)

The program for investigating velocity-heading smoothing is being rewritten to make it more automatic and to make use of the scope for a sort of contour-map display.

(M. Frazier, A. Mathiasen) (CONFIDENTIAL)

A program is being written to determine the optimal values of the parameters for NLS-2c when modified for use with a 12-second scan rate and smoothing interval coupled with an extra prediction 6 seconds after smoothing. This form of the tracking equations is contemplated in the September System. Attention is being given to effects that may occur at extreme ranges.

(B. Lone) (CONFIDENTIAL)

A flow diagram has been prepared for a program which simulates radar returns in a manner to indicate the movement of an aircraft. This program will be used to test out some of the functions of the Cape Cod System.

(A. Mathiasen, B. Lone) (CONFIDENTIAL)

A program has been written which takes data from a simulation section and in another section tracks with this data in a conventional manner. It also, however, computes the deviations, Δx_q and Δy_q, between predicted and observed (quantized) positions, the deviations, Δx_a and Δy_a, between predicted and actual (non-quantized) positions, and in addition computes $\Sigma \Delta x_q$, $\Sigma \Delta x_a$, $\Sigma |\Delta x_q|$, $\Sigma |\Delta x_a|$, $\Sigma \Delta x_q^2$, $\Sigma \Delta x_a^2$, and similar quantities in y. This is done with any smoothing method desired, with or without height-corrected data. This is a study of how good tracking is positionally being undertaken for the information of Boeing. A computer test was unsuccessful because of power failure and a faulty storage tube.

(B. Stahl) (CONFIDENTIAL)

The treatment of data from A. Mathiasen's program for comparison of nonlinear smoothing routines is finally completed. We now have a basis for judging the merits and limitations of these methods of smoothing for several velocities at extreme ranges and for both 1-mile and 0.5-mile quantizations. This analysis will in all probability be covered more extensively in the Summary Report.

1.15 Air Defense Center Operation

(D.R. Israel) (CONFIDENTIAL)

Following the initial installation of several push-button and toggle-switch panels in the Operations Room, it became apparent that rearrangements of panel within individual frames would be desirable from the standpoint of ease of operation. Following discussions with Dodd, O'Brien, Newitt, and G.F. Sandy, it was decided to continue the frame and panel installation as specified in M-1979, Frame and Panel Layouts, and in M-1979-1 until all units were installed and operating. At that date, and after operating personnel have had experience with the equipment, changes will be made. The procedures for these future changes are described in M-2169, Equipment Changes in Cape Cod Control Center (S.Dodd). As a means of correcting several typographical errors in M-1979 and to list certain omissions which occurred, M-1979-1 is being prepared and will be issued in the next week.

The specific wiring of each push-button panel to digits of the data insertion registers has been decided and will be issued as M-2185, Wiring of Push-Button Panels to Data Insertion Registers (Israel, Geraghty). This is a rather lengthy memo and is intended for use by programmers as well as equipment engineers. M-2185 also specifies appropriate labels for panels and switches; Rick Onanian will prepare temporary labels during the next biweekly period. Any advice or suggestions as to the most suitable means of permanent labels would be greatly appreciated. The desirable characteristic is that these labels be readable in a very low level of illumination.

M-2180, Light Gun Connections To In-Out Register (D.R. Israel) has been prepared and should be issued in several days.

Discussions have been held during the past two weeks on the best means of testing display lines and intervention switches on a daily basis, prior to flight tests. Gus O'Brien and Ben Morriss will provide their own programs for installation testing. The display-line program for installation testing of display lines will probably be suitable for daily tests, but no decision has yet been made on the best method of rapidly checking intervention switches. One outcome of these discussions has been the decision to provide a common display category (the geography display) to all scopes both for testing and calibration. This will require several changes to the listings of M-1999; a supplement to this memo is being prepared by H. Benington.

The content and format of all digital-information displays (DID's) has been chosen. Benington has prepared ozalid copies of drawings of these displays and has distributed them informally to members of the ADCO section. The drawings will be issued in the near future as part of a memo.

Considerable progress has been made in the past two weeks on the preparation of written descriptions and flow diagrams for the various non-track-while-scan programs for the Cape Cod System. Several days were spent during these weeks in determining the basic timing, sequence, and frequency of these programs.

1.15 Air Defense Center Operation (Continued)

(D.R. Israel) (Continued)

C. Gaudette will now proceed to prepare the overall flow diagram for the non-TWS programs. After further decisions have been made, the subject will be discussed in a memo.

On Wednesday, May 20, C.R. Wieser, Capt. Sullivan, and I, visited the 654th AC&W Squadron at Brunswick, Me. Problems arising out of the tests this summer and fall were discussed with Major Barnes, the Commanding Officer. The 654th has offered its full cooperation and has agreed to the installation of a telephone line from the Weapon Director's position of the Cape Cod Operations Center to the Senior Director's position at Brunswick.

(H. Benington) (CONFIDENTIAL)

During the past biweekly period, work has continued on all phases of the display problem. Conferences have been held with most people concerned with display, and meetings were attended which discussed, among other things, the place of displays in the overall timing problem. Throughout these latter discussions the central problem was whether the final master control program would consider the loading on the system over a period of several scans, and so adjust the number of functions performed; or whether, in the interests of reliability and simplicity, the number of functions would be fixed before loading the computer. On the basis of past experience the latter course was chosen. This decision reduces the display problem to finding immediately make-up and display times. In this way, the displays which can be afforded will be set within several weeks and their frequencies set soon thereafter.

Conferences with C. Grandy have advanced the Track Situation Display program to a point where one can say with certainty that a complete display of positions, vectors, identities, assignment statuses, and track numbers for sixty-four tracks can be done in a quarter of a second. Similar work has started on the Radio Communicator Digital Information Display (DID) and the Weapon's Assignment DID.

An inter-office memo has been issued which specified the information and physical layout of all DID's. This will be supplemented in the next period with a memo giving exact spacing constants with respect to the decoders for all displays.

The following work is presently in progress and should demand most of the time in the next period:

1. Completion of the Track Situation Display and Make-up program which will sense light guns and new information from TWS;

2. Completion of the Weapons Assignment DID;

3. Start the selected Track DID Programs for the FTU and Visitors;

4. Cooperation with M. Brand on IDO displays so that the best time in a scan for their display can be fixed;

1.15 Air Defense Center Operation (Continued)

(H. Benington) (Continued)

5. Start of the Summary Data Display program;

6. Investigation of Geography Display times;

7. Presentation to G. O'Brien of all changes in scope switch assignments as outlined in M-1999: these equipment changes should be completed by July 1.

(M. I. Brand) (CONFIDENTIAL)

The simulated identification program (phase II) has been run fairly successfully on the computer. Previous inoperation of the program has been traced to the incompatibility of the correlation section to the remainder of the programs. Previous testing has been limited to the examination of the effect of variation of operations per scan on the EDS and DID display. Subsequent testing will be concerned with more sophisticated types of simulated data and rearranged timing methods.

The memo describing the entire identification function is complete. It has been shown to various people for comment. When these comments are completed the memo will be modified accordingly and probably issued in some form.

Work is almost completed on the final flow diagrams for identification programs. I have drawn the overall ID flow diagram and am working with J. Hayase on the displays flow diagram. It is expected that the actual conversation from our simulated ID program to the final Cape Cod porgram will not be difficult since many of the sections are preserved virtuallyintact.

I have worked with J. Arnow and B. Lone on the design of the intervention registers and console for the Flight Test Umpire function. We have arrived at a design which provides compatibility between use as a FTU station for complete function testing (carried on by Arnow and Lone) and as a device to provide simulated track control for use in testing Non-Track-While-Scan programs. In line with this latter statement, I have written a memo which proposes a systematic method for testing Non-TWS Cape Cod programs. I have attended several meetings of a group considering this problem.

I have attended several meetings of a group which is considering overall Non-TWS program timing.

(J.J. Cahill, Jr.) (CONFIDENTIAL)

An MPS-4 nodding-beam height-finder will be installed on Nantucket some time in June by Group 22. It was hoped that a longer range TPS-10D, already requisitioned by Lincoln, would be used, but it will not be available in time for September. However, the MPS-4 should be useful for covering the clutter areas of the CPS-6B, and a set at Nantucket will not overlap coverage

1.15 Air Defense Center Operation (Continued)

(J.J. Cahill, Jr.) (Continued)

with the Rockport MPS-4 to the wasteful extent that the Scituate TPS-10 does presently.

A program to test the new MPS-4 will be prepared soon.

During this period, a conference among Bell Lab, Army Signal Corps Project 414, and Lincoln personnel was held at Lexington, during which the ground-to-ground data link developed by Bell Lab for the 414 (AN/TSQ-7) was discussed, together with the question of its usefullness with the Lincoln Air Defense Center System. The conference was attended by E.S. Rich, W.A. Clark, C.C. Grandy, and the writer, as Division 6 representatives. Notes were taken, by Clark, Grandy, and the writer and will be summarized in an inter-office memo to C.R. Wieser.

On May 20, I visited Camp Wellfleet on the Cape to observe practice firing by a unit of the 15th Group AAA (Boston). Little firing was done due to unexpected difficulty in orientation procedures preparatory to firing for record. However, considerable insight was gained into the difficulties encountered in preparing to fire radar-controlled AA weapons, particularly as they concern the M-33 radar system. An inter-office memo to C.R. Wieser, covering the trip, is being prepared.

The kindness and helpfullness of Col. D.G. Pamphlin,USA, Lincoln Liaison Officer during the trip must be noted.

Two attempts have been made during this period to check out T2574 the new multiple aircraft AA & H-F program. On the first occasion after a tape error and program error were found and corrected, it was possible to test the tracking, initiation, and some of the display features of the program and particularly the control feature which reads the TWS and non-TWS sections of the program on and off the drum in the proper sequence. However, failure of the Selective FFS Reset and Restart (PB) remote equipment, in Room 222, prevented checking out the bulk of the program features. Some time was wasted trying to make the equipment work.

(P. Cioffi) (CONFIDENTIAL)

The program simulating the operation of the proposed identification section for the Cape Cod System was checked out and operated successfully this period. This program has been referred to in the past few reports and represents the combined efforts of the members of the ID group.

It is expected that this program will be demonstrated to various people for the purpose of evaluating this feature of the System as it is now proposed. Quite possibly, weak points may become apparent from this operation, and corrective measures and other refinements suggested can be incorporated for the final design.

1.15 Air Defense Center Operation (Continued)

(W.A. Clark) (CONFIDENTIAL)

During the past I have been attending some of the meetings in which timing of the non-track-while-scan programs were discussed. I expect to work with C. Gaudette beginning next week.

(O.T. Conant) (CONFIDENTIAL)

A large part of the last period was spent in writing summaries and descriptions of the equipment and operation of the telephone system. J. Arnow and H. Kirshner are now engaged in minimizing the amount of equipment which must be furnished by Group 61. This work will be completed during the next biweekly period and will be issued as M-2187, Cape Cod Telephone Intercommunication Network.

Various changes in previous specifications for the standard digital information display, including a breakdown into an Assignment DID and a Track DID, have delayed the start of programming. It also appears that the requirements of most sections of the geography display are not yet sufficiently definite for programming. However, programming will be started as soon as firm decisions are made and will occupy most of my time after M-2187 is out of the way.

Discussions with the flow-diagram group during the last period covered phases of interception, use and insertion of height information, and various other details.

(A.W. Curby) (CONFIDENTIAL)

Several days of the past biweekly period were spent in reading the Identification programs in search of the causes of various difficulties we had encountered in our previous run on the computer. Some modifications were made which resulted in a satisfactory run last week, though due to the frequency of parity alarms no continuous run could be made which was long enough to check out the turning and termination of flight plans. New data will be simulated which will utilize these phases of the extrapolation program in a short run.

Meetings at which the timing of non-TWS programs for the September system was discussed were attended; subsequent to decisions on this and other matters, flow diagrams for the final processing and extrapolation programs were made up.

(C.H. Gaudette) (CONFIDENTIAL)

A flow diagram of the interception calculations for the September System is now complete. This diagram was prepared by S. Knapp, F. Heart, W. Lemnios, and myself.

The Combined Interception Program is ready for testing. W. Lemnios, F. Garth, and I tried to check it out last Tuesday night (May 19) but we were unable to convert the standard tape because of persistent parity alarms.

1.15 Air Defense Center Operation (Continued)

(M.A. Geraghty) (CONFIDENTIAL)

A supplement to M-1979, Frame and Panel Layouts, and M-2185 giving the complete wiring of all data-insertion registers have been written and will be distributed in the next period. These memos should provide the necessary information for programming in connection with September, excluding display-line allocations, described in H. Benington's M-1999.

The status of the 8 A/C HF and AA guidance program, described in previous reports as delayed by lack of equipment, may be summarized in this report as delayed by lack of operation equipment during scheduled computer time. See M. Brand's report on usable computer time and his summary of the last period's operation.

(C. Grandy) (CONFIDENTIAL)

During the past period I have reviewed the work that had been done on the displays for the Cape Cod System and have been working with H. Benington on the programming of the track-situation display. A wide variety of programming techniques has been used in an attempt to find the optimum program for this display; however, a completely satisfactory program has not yet been written. Work on this program will continue. It is anticipated that the program, when satisfactory, will be circulated among Group 61 staff members for their comments and suggestions for improvements. Inasmuch as the track-situation display is a major display output timewise, considerable effort to find the optimum program seems justified.

I attended a conference held by Lincoln Lab with representatives of Bell Laboratories concerning the AN/TSQ-7 Ground-to-Ground data transmission link under development by Bell Lab. An interoffice memo concerning this link is being written with J. Cahill and W. Clark. I also attended the May 20 meeting of the IBM-MIT In-Out Group at which M. Astrahan of IBM outlined some of the problems of cross-telling and proposed a feasible method for performing this function in the transition system.

(J. Hyase) (CONFIDENTIAL)

The past biweekly period has mostly been spent studying the identification system of the 1953 Cape Cod System.

A method to generate an arrow using the vector generator has been devised, but it was found later that H. Peterson has a simpler program.

(F. Heart) (CONFIDENTIAL)

A fair amount of time was spent trying to debug the North Truro version of the four-on-four program. Much of this time was at night. So far, equipment difficulties have prevented much progress. The speed with which this debugging will advance is a function of the amount of available time in

1.15 Air Defense Center Operation (Continued)

(F. Heart) (Continued) (CONFIDENTIAL)

which the computer, the MITE equipment, the video mapper, the 222 equipment, and the demodulator all work at once.

Work continued on Group efforts to prepare a logical flow diagram for the interception function of Cape Cod. I also continued to participate in Cape Cod planning discussions.

I prepared the flight test section of the forthcoming Summary Report.

(S. Knapp) (CONFIDENTIAL)

Further trouble with the MITE equipment and, on one occasion, the magnetic drum has slowed the process of checking out the Four Pair Intercept Program for N. Truro data. Lack of tracks using the Truro data has made it impossible to check thoroughly the 8 a/c tracking program; however, preliminary experiments were successful as far as displays, etc. were concerned.

The proposal for the operation of the Senior Director and Weapons Director has been revised and expanded.

The work on the flow diagram for the Interception Program for the Cape Cod System is nearly complete.

(L.T. Murray) (CONFIDENTIAL)

The Four-Pair Intercept Program is now being tested for Truro data. During the past biweekly period, several hours of computer time have been devoted to this. Not too much progress has been made because of difficulties with the MITE equipment and the drum. It is hoped that during the next two weeks this program will be checked out.

A rough draft was written of the memo concerning the equipment and duties of the Radio Communicator for the September System. When this has been checked and revised it will be issued as an M-note.

A flow diagram and coded program for the Radio Communicator's DID display are now being written.

(G. Rawling) (CONFIDENTIAL)

The past period has been devoted to learning the proposed Cape Cod height finding and antiaircraft phase. Talks with Geraghty and Cahill have helped considerably.

Their original rough-draft flow diagram is being studied, and a revised layout suitable for ozalid reproduction will be finished shortly.

1.15 Air Defense Center Operation (Continued)

(G. Rawling) (Continued) **(CONFIDENTIAL)**

A shorter form of this flow sheet is being planned which will contain crucial logic but omits many minor technical details.

(F. Webster) (CONFIDENTIAL)

Work has been continued on the analysis of communication categories in an air-defense system. It is clear that at any time selection is made only between a limited group, or ensemble, of messages. If these groups are clearly defined for the various situations likely to arise, the uncertainty of transmission is decreased. While the probability of overload is reduced by increasing the efficiency and certainty of transmission, there still remains the possibility of breakdown of lines of communication. Normally, equal weighting is given to data of very unequal importance. When breakdown or overload occurs, however, it becomes essential that the important data be favored. How the importance is to be decided and indicated is itself one of the communication problems of the system.

The D-sized diagram of communication lines in the September system is being brought up to date.

(C.A. Zraket) (CONFIDENTIAL)

Work is continuing on the weapons-direction phase of the Cape Cod System. This includes the programs for the Radio Communicators, Squadron Operations Officers, and Weapons Director. The design of the displays and the switch input requirements have been decided upon and frozen. Coding of the interception program should begin as soon as data-storage requirements are frozen and the flow diagram is reviewed and checked.

1.16 Associated Studies

(E.J. Craig) (CONFIDENTIAL)

A thesis progress report is in the writing which will discuss progress and results of experiments with the author's minimized error iteration procedure for linear simulation equations.

(W.I. Wells) (CONFIDENTIAL)

The past two weeks have been spent searching the literature in an attempt to compile a rather complete list of the applications of statistical-filter theory to engineering problems. It is hoped that with the background I have constructed in this field, these various and diversified contributions can be fitted together to present a unified picture. Up to now each contribution appears as a disjointed effort rather than an extension of basic principles. I hope to being to straighten this out, in my own mind at least.

1.17 Computer Operation

(M. Brand) (CONFIDENTIAL)

MEW-Truro Tracking and Control	9 hrs 15 min
Flight Tests	8 hrs 30 min
Data Screening	2 hrs 25 min
Multiple Radar Tracking and Control	10 min
Air Defense Center Operations	11 hrs 20 min
Equipment Characteristics	8 hrs 0 min
Demonstration	1 hr 0 min
Conversion	45 min
Total Time Used	41 hrs 25 min
Computer Breakdown (parities, etc.)	11 hrs 45 min
Time Given to In-Out	8 hrs 0 min
Time Given to Adams	50 min
Total Time Lost	20 hrs 35 min
Total Assigned Time	62 hrs 0 min
Percentage Assigned Time Used	67%
Percentage Available Time Used	100%

1.18 Flight Tests

(F. Heart) (CONFIDENTIAL)

A large part of the week of May 11 was spent planning, discussing, and participating in flight tests with the MEW radar. Note that all the flight-test hours indicated below occurred during only the first week of the biweekly period.

Results of this week of intensive scheduling were only fair. Troubles encountered included 1) weather, 2) ground radio strength and cross-talk, 3) computer trouble, and 4) aircraft procurement.

(F. Heart) (CONFIDENTIAL)

The following statistics apply to the last biweekly period:

1) Computer hours scheduled for flight tests	22
2) Computer hours used for flight tests	7.5
3) Computer hours returned due to flight test cancellations	14.5
4) Total aircraft hours flown	40
5) Aircraft hours flown by 6520th Wing at Bedford	28
6) Aircraft hours flown by Navy (Quonset-based Squadron)	12

(Art Hill, P. Dolan) (CONFIDENTIAL)

May 11, 1953, 1030-1200 Final Turn Intercept, Zraket

Fighters: 2 F-9F's (Naval Air Group #7), Concord, 8.5, IAS 250 K
Targets: 2 F-3D's (Navy) 10 miles N. Provincetown, 9.0, IAS 200 K

Run #1: Fighter rolled out at 3 miles 12 o'clock to targets, continued on course and passed to rear; this was a beam attack.

May 12, 1953 0930-1100 Two Aircraft Intercepts, Zraket

Fighter: F-51 Concord, 8.5, IAS 250 K
Target: B-29 10 miles N. Provincetown, 9.0 IAS 200 K

Run #1: Closest separation at initial contact: 3 miles

1.18 Flight Tests (Continued)

(Art Hill, P. Dolan) (Continued) (CONFIDENTIAL)

May 12, 1953, 1100-1200 Four Pair, Knapp-Heart

Fighters: Two Navy and two Air Force - scrambling from Grenier
Targets: Four Multi's (AF) about 90 miles from Bedford and positioned along the coast with about 15 miles separation vertically.

One run made: Fighter #1 3 miles at 12 o'clock to Target #1
#2 3 miles at 12 o'clock to Target #2
#3 1 mile at 9 o'clock to Target #3

One Navy fighter aborted, leaving only three to participate.

May 12, 1953, 1400-1600 Four Pair, Knapp-Heart

Fighters: Same as AM test
Targets: Same as AM test, slight change in positioning.

Run #1: Fighter #1 passed 3 miles at 2 o'clock to Target #1
#3 tallyho, but no closing course
#2 and #4 no intercept

Run #2: Started, but cancelled due to computer failure.

May 13, 1953, 0900-1200 Two Aircraft Intercepts, Zraket

Fighter: F-51 Concord, 8.5, IAS 250 K
Target: B-25 10 miles N. Provincetown, 9.0, IAS 200 K

Aircraft were airborne one hour and attempted to run mission; forced to cancel due to bad weather.

DATE	TIME	SCHEDULED TEST A/C	SCHEDULED TEST Description	TEST ACTUALLY RUN A/C	TEST ACTUALLY RUN Description	REASONS FOR CHANGES OR COMMENTS
5/8	1300-1430	1	Coverage	-	Cancelled	Weather
	1430-1600	2	2 A/C Intercepts	-	Cancelled	Weather
5/11	0900-1030	1	Coverage	-	Cancelled	Computer Inop.
	1030-1200	2	2 A/C Intercepts	-	Run for 3/4 hour	Computer Inop.
5/12	0930-1100	2	2 A/C Intercepts	2	As Scheduled	
	1100-1200	8	4 Pair Intercepts	6	Ran 3 pair	One Navy fighter aborted, mechanical trouble
	1400-1600	10	4 Pair Intercepts	10	One Run: 3 pair One Run: 4 pair	Ran one 3 pair while waiting for Navy fighters
5/13	0900-1200	4	2 A/C Intercepts	2	Ran from 1100-1200	Cancelled rest of test due to weather
	1400-1600	10	4 Pair Intercepts	-	Cancelled	Weather
5/14	0900-1030	4	2 A/C Intercepts	-	Cancelled	Weather
	1030-1200	10	4 Pair Intercepts	-	Cancelled	Weather
5/15	1300-1600	10	4 Pair Intercepts	-	Cancelled	Weather

* Added to schedule during week of test

1.19 Miscellaneous

(W. Clark) (CONFIDENTIAL)

WWII

With other members of Group 61, I attended a meeting on the AN/TSQ-7 data link at Building B. A report on the meeting is being prepared by J. Cahill.

At the Hartford In-Out meeting of the 19th, it was decided that a review of items to be stored with track data should be undertaken. Accordingly a meeting is scheduled for the 26th in Cambridge, which will be attended by Goldman and Rocco of IBM and interested members of Groups 61 and 62; the results of this review will be outlined at the next Hartford meeting.

MTC

Two programs designed to fit panel storage were written for MTC. The first is a simple memory work out and display program; the second, a form of bootstrap which might be useful when marginal checking.

1.2 Group 64

(S.H. Dodd) (CONFIDENTIAL)

WWI reliability has become progressively worse during this bi-weekly period. This temporarily reduced reliability was predicted several months ago and is a direct result of modifications and the installation of the large amount of equipment associated with the September Cape Cod System. Every effort is being made to keep the computer reliability at a usable level but reduced maintenance time as well as installation and modifications are reflected throughout the system. Higher reliability can be expected in a few weeks.

Adjustments of the equipment associated with the North Truro telephone-line data link must be made frequently. Some of the Group 64 operations technicians are being trained to turn on and adjust this equipment.

Progress on installation and testing of the terminal equipment associated with the Cape Cod Control Center is good and progressing according to the schedule. A number of problems have been encountered during the testing of stations E12 and F11 but these have been satisfactorily corrected.

1.21 WWI System Operation

(N.L. Daggett) (UNCLASSIFIED)

Deflection-shift troubles have continued to cause considerable loss of computer time during the last two weeks. However, it appears that replacing the Decoder Output Amplifier panels with spares has eliminated the difficulty. The original panels will be rebuilt with better resistors and returned to service.

A somewhat large number of interrupting failures has occurred recently. In one case, failure to shift properly was traced to a crystal pigtail protruding through the hollow lug on which it was mounted. The pigtail had grounded on the metal panel. In another instance, failure to

1.21 WWI System Operation (Continued)

read from storage to PR properly was traced to improper line termination during an installation-day cabling change. A failure of the read-in program to work resulted from a blown fuse which did not give an indication.

Operation

(C. L. Corderman, A. J. Roberts, D. M. Fisher) (UNCLASSIFIED)

ES operation during this period was unsatisfactory. The principal source of difficulty appeared to be caused by variations in the deflection voltages. New ESD output panels were installed, and present ES operation indicates that greater reliability is to be expected.

(L. L. Holmes) (UNCLASSIFIED)

Rack EX5 of the computer room is now being converted into a spare Electrostatic Storage digit. The rack will provide replacement tubes that can be cabled in place of troublesome digits of both ES banks. Work should be completed the week of June 8.

Magnetic Drum

(P. W. Stephan) (UNCLASSIFIED)

Reliability and marginal checking of the drum is done by drum checking programs. The last modification of the drum marginal-checking program (2553) did not check some drum circuits, so a new modification was written to correct this error. It has not been tested yet.

Another program is being written to provide a complete test of drum reliability.

A change is being contemplated of locking out Group 11 from record, instead of Group 7, and having the input program on Group 11.

(C. W. Simmonds) (UNCLASSIFIED)

The ERA chassis are being assembled for the extra drum bay in the magnetic-drum assembly. Work is continuing on the test panel for plug-in units.

1.21 WWI System Operation (Continued)

Marginal Checking

(D. A. Morrison) (UNCLASSIFIED)

Parts are on order to complete the installation of the Marginal-Checking Control System, Mod. II, WWI; other work in connection with the installation is proceeding according to plan.

(J. H. Hughes) (UNCLASSIFIED)

A report (M-2184) on the marginal-checking system, Mod. II, is nearing completion. The new Automatic Control Panel is assembled and ready for bench testing.

Test Programs

(T. Leary) (UNCLASSIFIED)

All test programs used daily have been modified for programmed marginal checking. PMC has been operated successfully and should be in regular use shortly.

A new shift-check program has been written which is intended to give the shifting circuits in AC and BR a hard time. When first tried out, the program could not be run until a prf-sensitive cathode follower in BR was located and eliminated.

Block Diagrams

(J. H. Hughes) (UNCLASSIFIED)

All programmers and operators should note that the "Time Pulse 3 FF Storage Reset" is no longer gated out during read in by the Read-In Interlock. If you want to avoid TP3 FF resets, you must throw the appropriate switch on the Flip-Flop Reset Panel.

1.22 Terminal Equipment

(J. A. O'Brien) (UNCLASSIFIED)

The installation of terminal equipment for the Cape Cod System is proceeding according to schedule. The testing is lagging behind, however. The vector and number generators have been installed, and the display system is being tested. The principal difficulty to date has been oscillations in the display system caused by too close coupling between the inputs and outputs of the IOS driver plug-in units. This

1.22 Terminal Equipment (Continued)

is being corrected by separating and rerouting some of the cables and by making wiring changes that reduce the extent of amplifier cascading. Otherwise, the system appears OK so far.

MITE

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

Modified MITE is operating with WWI for programmers and checking purposes. Clear and complement facilities are now being installed for all MITE flip-flops in line with the marginal-checking schedule that is being drawn up. For the convenience of programmers, we have been on hand recently whenever MITE was being used; meanwhile, we have been acquainting the Systems technicians with MITE so that programmers should be able to use modified MITE with a minimum of difficulty after May 22.

Although marginal checking and its allied programs will improve the overall reliability of MITE, this equipment has been operating reliably for the past three weeks.

Standard MITE #1 and MITE #2 will be completely wired ready for testing during the next two weeks. A "MITE Operate-Test" Panel is being designed to connect the demodulator inputs to MITE's for operating or to switch in programmed test information.

Numerical Display

(F. E. Irish) (UNCLASSIFIED)

The numerical-display system is not satisfactorily displaying the basic trace pattern on all of the display scopes. The difficulty is introduced by the wide differences in the frequency response of the deflection yokes used in the various display scopes.

The system can be made to present a suitable basic trace pattern by either using identical deflection yokes in all of the scopes or by adding a compensation network in cascade with the amplifier of each scope which will reduce the effective bandwidth of that scope to the bandwidth of the worst one. The waveforming generator then can be adjusted so as to present a suitable pattern on all of the scopes.

Vector Generator

(F. E. Irish) (UNCLASSIFIED)

A test program (T-2634) has been written for the purpose of aligning the vector-generator decoders. This alignment consists of adjusting the cathode resistors in the vector-generator switch-tube units

1.22 Terminal Equipment (Continued)

so that current drawn from the ladder attenuator of the decoder by each unit is effectively equal.

The program manually can be made to step through a sequence of 14 cycles. Each cycle allows one digit of the decoders to be adjusted.

Display

(R. H. Gould) (UNCLASSIFIED)

A new 16-inch display scope has been installed on the shelf in Test Control. The scope that was on the shelf is now mounted in the rack under the shelf for the exclusive use of the camera.

Of a recent shipment of 3 K1084P7M CRT's from Dumont, 3 showed evidence of emission from the control grid. A phone call to the Dumont plant was unproductive. The tubes will be returned to Dumont with a detailed description of test conditions. Five more K1084P7M's were received on May 22 and will be tested immediately.

In-Out Control

(R. H. Gould) (UNCLASSIFIED)

On May 25, changes in In-Out Control and video cabling will be made to read the Real-Time Timing Register into the In-Out Register on TP1 of si 0005.

(T. J. Sandy) (UNCLASSIFIED)

Modifications in the in-out switch which are necessary for the new display system are almost completed. The system is being checked out now.

The camera order was changed so that both si 0500 and si 0004 will select camera on the in-out switch. si 0500 will be removed in a couple of months.

Installation

(G. F. Sandy) (UNCLASSIFIED)

The general power wiring for Rooms 222, 216, and 228 is about completed. Ten 16-inch scope frames have their d-c and a-c power, except for the a-c for the convenience outlets. Sixteen units have their side frames attached and all panels now available mounted in the frames.

1.22 Terminal Equipment (Continued)

Connections to be made from Room 222 to the remote-station distribution box are complete for the 16 units mentioned above, and the 20-conductor cable for several other stations has been run.

The three 16-inch scope side frames have been completely wired for scopes E12 and F11, except for the audible-alarm panels which have not been received.

Another technician will join the installation group on May 25 to assist in wiring the side frames as quickly as they arrive.

Flexowriter

(L. H. Norcott) (UNCLASSIFIED)

The circuits tested for the past five weeks in the breadboard Tape Verifier have proved satisfactory. Packaging and layout design for the production model will now be handled by Mal Demurjian and the Drafting Room.

During the past few weeks I have been studying Farnsworth's use of the FL Flexowriter for printing from magnetic tape.

Magnetic Tape Print-Out

(E. P. Farnsworth) (UNCLASSIFIED)

Debugging of the long-carriage delayed print-out and automatic delayed punch-out is continuing. Spark suppression has been applied to all relay coils and has resulted in improved performance. An intermittent dynamic timing discrepancy causing skipped characters which occurs after about 30 minutes of printer operation is being investigated as time permits. The results of this work are applicable to the proposed buffer-drum print-out equipment. An anti-repeat circuit for delayed punch has been designed and will be tested when the FL printer functions reliably.

Magnetic-Tape System

(J. W. Forgie, E. P. Farnsworth) (UNCLASSIFIED)

Magnetic-tape reliability has suffered slightly in the past biweekly period as a result of the changes being made to the in-out system. This condition will continue for some time. Every effort will be made to insure that the magnetic-tape system is checked out prior to application periods which follow installation work.

1.22 Terminal Equipment (Continued)

Production has been started on auxiliary control panels for all tape units. These should be available and installed in a few weeks. With these panels in service, the trouble caused by switching the computer to standby with the tape units on should be eliminated.

A complete block schematic of the magnetic-tape units and control circuitry is being prepared. This drawing should enable any interested person to understand the system.

1.23 Records of Operation

(F. J. Eramo) (Unclassified)

The following is an estimate by the computer operators of usable percentage of assigned operation time and the number of computer errors for the period May 8-21, 1953:

Number of assigned hours	111
Usable percentage of assigned time	74
Usable percentage of assigned time since March, 1951	85
Number of transient errors	133
Number of steady-state errors	7
Number of intermittent errors	13

Storage-Tube Complement in WWI

(L. O. Leighton) (Unclassified)

Following is the storage-tube complement as of 2400 May 21, 1953:

Digit	STM No.	Tubes	Hours of Installation	Hours of Operation
0 B	38	ST-619-C-1	10069	4221
1 B	12	ST-711-C	11989	2301
2 B	31	ST-807	13501	789
3 B	4	ST-821	14226	64
4 B	33	RT-380	13516	774
5 B	41	ST-745	12982	1308
6 B	3	ST-751	13170	1120
7 B	13	ST-823	14239	51
8 B	44	ST-742	12640	1540
9 B	42	ST-720-C	12937	1353
10 B	2	RT-382	13629	661
11 B	25	ST-753-1	13129	1161
12 B	28	ST-747	13261	1029
13 B	9	ST-803	13411	879
14 B	24	ST-624-C-1	10507	3783
15 B	16	RT-383	13629	661
16 B	11	ST-716-C-1	11702	2588

Storage-Tube Complement in WWI (continued)

Digit	STM No.	Tubes	Hours of Installation	Hours of Operation
0 A	43	ST-722-C	13130	1160
1 A	20	ST-817	14148	142
2 A	19	ST-816	13910	380
3 A	23	ST-802	13411	879
4 A	32	ST-808	13516	774
5 A	40	ST-525	13389	901
6 A	34	ST-710-C-1	12889	1401
7 A	35	ST-800	13340	950
8 A	29	ST-811	13829	461
9 A	39	ST-814	13910	380
10 A	30	ST-801	13363	927
11 A	36	ST-744-1	12822	1468
12 A	8	ST-746	12982	1308
13 A	14	RT-381	13581	709
14 A	5	ST-614	13235	1055
15 A	22	ST-805	13457	833
16 A	27	ST-613	9046	5244

ES Clock hours as of 2400 May 21, 1953. 14290
Average life of tubes in service in Bank B. . . 1428
Average life of tubes in service in Bank A. . . 1116
Average life of last five rejected tubes. . . . 2839

Storage-Tube Failures in WWI

(L. O. Leighton) (Unclassified)

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

ST-729-1 was removed after 1176 hours of operation because of consistent positive switching.

ST-812 was rejected after 277 hours of operation because of failure to hold a positive array.

ST-601 was removed after 5702 hours of operation in order to make room for an ion-collector tube.

ST-540 was rejected after 6301 hours of operation because of heater-cathode short.

Component Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following failures of electrical components have been reported since May 8, 1953:

Components	No. of Failures	Hours of Operation	Reasons for Failure
Condensers			
.001 mfd mica	1	7349	Open
Crystals			
1N34A	1	16693	Low R_b
1N34A	1	140	Low R_b
Resistors			
1000 ohm, 22 watt, w/w	1	16137	Open
Tubes			
7AD7	1	0 - 1000	Short
	2	3000 - 4000	1-Short; 1-low I_b
	1	4000 - 5000	Leakage
	1	9000 - 10000	Low I_b
	1	17000 - 18000	Short
	1	18000 - 19000	Low I_b
7AK7	2	0 - 1000	1-Short; 1-low I_b
	1	17000 - 18000	Short
12AU7(5963)	1	3000 - 4000	Low I_b
	1	4000 - 5000	Short
6AU6	2	10000 - 11000	1-Short; 1-broken pin
5687	1	4000 - 5000	Short

1.24 General

Air Conditioning

(R. E. Garrett) (UNCLASSIFIED)

The computer air-conditioning system was tied in with the new compressors, and the entire air-conditioning contract is essentially complete except for minor "clean up" items.

Building Power

(R. E. Garrett) (UNCLASSIFIED)

We now have a capacity of 450 KVA available at the Barta Building which is fed in through a new main circuit breaker rated 600 amps. This capacity is accomplished by paralleling a second delta bank of three 50 KVA transformers with the existing delta bank of three 100 KVA transformers. Our present peak load is 300 KVA.

D-C Power Supplies

(S. Coffin) (UNCLASSIFIED)

Several changes and simplifications have been made in the relay system of the 150-volt, 50-amp regulated d-c supply that will be installed in WWI. This will reduce starting time and improve reliability of operation.

(S. E. Desjardins) (UNCLASSIFIED)

The past biweekly period was spent in studying the history of electrostatic storage and testing storage tubes. This activity should continue for a few more weeks to gain experience in preparation for maintaining ESS in WWI.

(J. Dintenfass) (UNCLASSIFIED)

A thesis proposal on "Coordinate Conversion in a Multiplexed System" has been prepared and submitted.

1.3 Group 65

1.31 Storage Tube

(P. Youtz) (UNCLASSIFIED)

The primary interest of the storage-tube group during this period was to construct and test 800-series storage tubes and install them in ES row. The construction and test facilities were operated at full capacity at all times to meet these requirements.

Experiments on the deposition and bakeout of stannic-oxide coated envelopes and work with the Philips "L" cathode continues. The present series of experiments with stannic oxide are concerned with investigating the most satisfactory concentration of $SnCl_4$ required to meet our specifications. Although the coating of nonex with stannic oxide is a simple procedure, the high temperatures used in the processing of storage tubes causes the conductivity of stannic oxide to break down. Our coatings of stannic oxide for other applications have been satisfactory.

Work has been started on revising and bring up to date the tube-construction memoranda.

Storage Tube Construction

(T. F. Clough, J. S. Palermo, T. R. Parkins) (UNCLASSIFIED)

During this period, eight 800-series storage tubes were constructed as replacements for any marginal tubes and old model tubes in Bank A and Bank B. No experimental or research tubes were constructed this period.

During periods of extreme damp and humid weather, some leakage at 1000 volts has been observed between the collector and auxiliary collector in the target assembly. In the past period, no breakdowns have been recorded since mica washers have been placed between the lava insulators and the auxiliary collector screen. Rheotrols, proportioning devices which permit control of the rate of temperature rise during the bakeout of a storage tube, have been installed on the three vacuum systems used for processing storage tubes.

Television Demonstrator

(D. M. Fisher) (UNCLASSIFIED)

Eight storage tubes were pretested. One tube, a Philip "L" cathode research tube, was rejected because of a weak high-velocity gun.

1.3 Group 65 (continued)

Remote controls were installed in the Television Demonstrator unit during this period for the purpose of increasing the unit's flexibility.

Storage Tube Reliability Tester

(R. E. Hegler) (UNCLASSIFIED)

ST819 through ST825 were tested at the STRT. All were satisfactory except ST819 and ST822 which were marginal. ST819 had a small spot interaction and the main collector voltage on ST822 had to be increased to 110 volts to hold a positive array for one hour.

Philips "L" Cathode

(R. J. Biagiotti) (UNCLASSIFIED)

There were no tubes constructed with "L" cathodes during the past period. New heaters have been ordered but are not expected for 3 to 4 weeks. The new heaters will be used in attempting to attain the operating temperatures required for "L" cathodes at a heater voltage of 6 to 7 volts.

After power was restored to the tube made with a platinum-plated grid, it showed about an 80-percent decrease in target current after a 4-day shutdown of the test equipment. Within an hour after the tube was turned on, the cathode current had reversed direction seeming to indicate copious grid emission. In two days this current has changed to the normal direction of flow and increased by about 60 per cent. The beam current during this interval has increased by approximately 150 percent but is still only about 40 percent of what it was prior to the shutdown.

Attempts are being made to measure the currents due to grid emission in available tubes when the grid is kept 10 volts beyond cut-off as determined by zero, or minimum, target current. At present, only a single tube can be tested using fixed voltages but it is hoped that in the near future a number of tubes can be tested simultaneously under pulsed operation.

Pulse Readout

(A. J. Cann) (UNCLASSIFIED)

The previously reported factor of improvement of 20 over the r-f system is in error. It was obtained while using different

1.3 Group 65 (continued)

safety factors on the r-f and pulse-readout amplitudes. When r-f and pulse amplitudes are so chosen that they produce equal amplifier-output amplitudes (at a low gain setting so that no limiting takes place), the difference in spot charging is only about a factor of 3. The improvement is definitely not enough to permit eliminating rewrite, and not enough to warrant converting the computer.

However, the writer feels that the safety factor on read-out amplitude presently used in the computer is excessive. An increase in overall reliability might be obtained by reducing the r-f pulse amplitude and duration, thereby reducing spot charging. This is discussed in the forthcoming thesis.

Velocity-Distribution Measurements

(C. T. Kirk) (UNCLASSIFIED)

During this biweekly period, the following changes were made on the 10-Kc system. The analog differentiating unit was debugged and is operating satisfactorily in the equipment. The sweep-generator panel was modified to provide four voltage ranges for the cage sweep circuit, with a fixed sweep time of 60 seconds. An RC filter was constructed in which the RC time can be varied step-wise from 0 μsec to 200,000 μsec. At this time the 10-Kc system is operating quite well and velocity-distribution curves of the holding beam at various surface voltages are being taken.

The noise problem has been remedied to the extent that good velocity-distribution curves can be taken even under the worst conditions possible from the standpoint of signal-to-noise ratio. However, there is still something to be desired in the reduction of the noise. The noise problem arises largely from the fact that the differentiator discriminates highly in favor of the noise (which is at a higher frequency than the signal). Thus, ordinarily "good" signal-to-noise ratios become intolerable in this equipment.

Storage Tube Report

(C. L. Corderman) (UNCLASSIFIED)

A report is being started which will cover all development work on storage tubes up to the present time. Starting with the 100-series type described in R-183, the various tests and computer-operating experience leading up to the 800-series type will be described. This will include the most important changes in tube construction and processing.

SECTION II - WHIRLWIND II

2.1 Group 62

(N.H. Taylor) (CONFIDENTIAL)

The following paragraphs give short summaries of current activity in Group 62:

1. MTC

The MTC computer passed its initial milestone on schedule, and everyone is very pleased with its operation. At one point it was stated that the computer ran for four hours with various programs without any alarms. Certainly this is very commendable for a computer which has been tied together for less than two weeks. In order to coordinate the gains made in MTC project, we will now spend from six to eight weeks in a thorough marginal-checking study and establish in a very quantitative way the quality of our magnetic memory.

2. Arithmetic Element and Control

Although a formal method of releasing information to IBM is still under discussion, the block diagram for control and arithmetic element of the WWII system has been informally released to the Project High group. Mr. Ross of IBM is in charge of this activity. He is at present building three breadboards to obtain quantitative information on the margins of operation of three sections of the arithmetic element. We have asked Mr. Ross to exercise considerable freedom in the way he uses the basic circuits within the framework of the block diagram which has been jointly agreed on. Should any need arise to change the basic block-diagram arrangement, however, we will review these decisions in a joint meeting with the IBM group.

3. Input-Output

Two meetings were held regarding input-output: one concerning display, the other concerning cross-telling. We are gaining background and getting a feeling for the magnitude of these various jobs of the input-output portion. Detailed decisions on the exact nature of each portion of the in-out equipment will not be forthcoming until the middle of the summer.

4. Mechanical Design

A meeting on mechanical design of the arithmetic and control elements of WWII resulted in a general agreement that the machine will be patterned somewhat after the MTC computer.

2.1 Group 62 (cont'd.)

(N.H. Taylor) (CONFIDENTIAL)

It seems probable that the number of plug-in unit types can be limited to less than 6. It was agreed that 3 sizes of plug-in units would be designed containing 4, 6, and 9 tubes. It may be that 2 of these 3 will be sufficient for most of the final design.

5. Time Schedules

An overall summary time schedule has been prepared which should result in a functioning WWII prototype computer by July, 1955. If IBM concurs with this schedule, we anticipate this will become formal and binding on both groups in so far as it is humanly possible to adhere to it.

6. General Comments

The systems planning portion of the WWII effort seems to be progressing quite satisfactorily. However, we should attempt to put more effort and energy into the basic circuitry and component work necessary to support the systems plans. A method of agreement on components and basic circuits should be arrived at quite soon. An attempt to reduce duplicate effort may allow us to use man power more intelligently.

2.11 Systems

(R.P. Mayer) (CONFIDENTIAL)

The comprehensive logical diagram for WWII (SD-54846-2) and its traffic diagram (SB-37625-2) are being redrawn to incorporate timing changes which will make the electronic design of memory, and control matrices less difficult. The redrawn sketches will also show some preliminary thoughts on test memory and circuits for allowing the program to run directly from the drum.

A note describing a proposed "extract and store" instruction is about to be issued. This instruction will make packing easier.

A conference is being held next Wednesday to discuss the in-out instructions required.

2.12 Arithmetic and Control

(J.F. Jacobs) (CONFIDENTIAL)

A second draft of the preliminary block and traffic diagrams for WWII is about to be completed. The parts of this diagram which deal with the arithmetic element and its control were worked out in cooperation with the Arithmetic

2.12 Arithmetic and Control (cont'd)

(J.F. Jacobs) (CONFIDENTIAL)

Element and Control Group in Poughkeepsie and are close to being in their final form. The next major steps will include the following items:

1. The choice of a time-pulse distributor. Ten possibilities which are variations of three basic types are being considered by the Basic Circuits sections here and at Poughkeepsie.

2. Margins on the accumulator. A model of the accumulator is now being built in Poughkeepsie. With this model, the performance of the accumulator will be studied and its margins checked.

3. The control switch. A model for the control switch is being designed by the Basic Circuits group and methods of marginal checking it are being considered.

Memory Control According to the present thinking, the memory control will be separate and the read, write, and disturb pulses will be initiated and ended with pulses from a delay line.

In-Out Instructions The number and nature of the in-out instructions have not as yet been determined. A series of meetings has been planned which will lead to a final proposal for these instructions.

Indexing System There are plans for two index registers and an index adder on the address part of the instruction register. This adder will be a WWI-type adder with the carry flip-flops replaced by delay lines.

In-Out Interlock Several proposals for the in-out interlocks are being considered. The choice of the most promising system should be made in a week.

Pluggable Unit A study was made to find the optimum size of the pluggable unit. This led to the choice of a 6-tube pluggable unit.

Design and Basic Circuits Manual A joint committee of four was set up to organize the results of the Basic Circuit groups into a convenient design manual and to set up the mechanisms for the choice of basic circuits.

(M.A. Epstein, R.H. Gerhardt, A.W. Heineck, R.C. Jeffrey)
(CONDIFENTIAL)

In-Out Interlocks, WWII The past biweekly period was spent studying in-out interlocks and drum controls for Whirlwind II. An M-note on interlocks is being prepared and will be issued during the week of May 25th. Epstein, Gerhardt, and Jeffrey are doing a study to evaluate the speed gained in the interlocked system of block transfers against the equipment that could be saved

2.12 Arithmetic and Control (cont'd)

(Epstein, Gerhardt, Heineck, Jeffrey) (CONFIDENTIAL)

in a slower system using no interlock, no in-out register, and no in-out control counters. They are also beginning a study of control for external units (card readers, magnetic tape, etc.)

(R.J. Callahen, Irving Aronson) (CONFIDENTIAL)

Physical Design, WWII The past biweekly period was spent working with the physical-design committee.

An investigation of several pluggable-unit possibilities was made, and a proposal was presented at Hartford on May 21.

Assuming that it is desirable to:

1. Minimize the number of pluggable unit types,

2. Minimize the number of excess components and the space necessary to obtain standardization,

3. Use readout gates,

then we are led to the conclusion that a 6-tube unit is the best choice.

It was decided at the Hartford meeting that a 6-tube unit would be built, and that the following combinations should be further investigated:

6 and 9 tube units, 4 and 6 tube units, and 4, 6, and 9 tube units.

(W.A. Klein) (CONFIDENTIAL)

Study of High-Speed Multipliers. Report R-223, "A Study of High-Speed Multipliers" is not as yet completely written. The organization of the Report has been worked out, and several main sections have been written. The remaining sections are outlined and partially written. Many details of presentation remain to be worked out and incorporated into the Report.

(A. Heineck, R. J. Callahen) (CONFIDENTIAL)

Arithmetic Elements A. Heineck, R. Callahen, and J. Giordano met with J. Foley and D. Thompson to discuss and plan a design and basic-circuit manual for WWII.

Design Manual The purpose of the design manual is to enable the block-schematic diagrammer to draw a block schematic from a logical outline. This manual will contain the results of the basic-circuits work and will be arranged so that circuit-design information can be most easily found and applied.

2.12 Arithmetic and Control (cont'd)

(A. Heineck, R. Callahan) (CONFIDENTIAL)

Basic-Circuits Book The basic-circuits book will contain those circuits which are found to have adequate margins, and satisfactory performance characteristics. Part of the work of the group will be to define the words "adequate" and "satisfactory" as used above.

(D.J. Eckl) (UNCLASSIFIED)

Transistor Accumulator The total operating time is now 5000 hours. During the past biweekly period, all gate-tube panels were replaced with the new units wired for the +150-volt supply. The margins on these units were such that they all gave at least a 22-volt pulse with the screen voltage reduced to 5 volts. Some of the cabling between Burroughs units was changed to improve operation. Two Burroughs Pulse Mixer boxes were found to have their output leads shorted at the coax connector.

α versus I_E Plotter Sergio Valdez has completed the initial breadboard model of the plotter. Another method of producing the same pattern (which requires a differentiating circuit) was considered, but did not appear too promising.

Flip-Flop Study The results of Ed Cohler's study of the two-transistor flip-flop will soon appear in an Engineering note. Dan Esakov is now making a study of saturating and non-saturating two-transistor flip-flops.

(N.T. Jones) (UNCLASSIFIED)

Minority Carrier Storage A number of Transitron T2 bonded diodes, GE large-area diffused-junction diodes, Transistor Products bonded diodes, and the Western Electric grown-junction diodes have been checked for forward and reverse recovery characteristics. Only the grown junctions show a forward conduction delay. The diffused-junction diodes have less carrier storage than the grown junctions. The bonded diodes show no forward conduction problem and little reverse recovery or storage current.

Measurements The characteristics and our opinions of Transistor Products, Hytron, Texas Instruments, National Union, and GE transistors are being summarized in memos.

Life Tests Construction of panels for the d-c tests continue. Data for the old, terminated life tests is being processed with the goal a memorandum or engineering report on the results.

(S. Oken) (UNCLASSIFIED)

Transistor Core Driver A proposal for a Masters' Thesis entitled "Transistor Magnetic-Core Drivers" has been written and distributed as M-2166.

2.12 Arithmetic and Control (cont'd)

(S. Oken) (UNCLASSIFIED)

The static and dynamic "N" curves of the core driver have been displayed on an oscilloscope through use of a differential amplifier probe designed by Henry Zieman. There was a fairly good correlation between what was expected from the theory and what actually happened. The study of these curves has led to a possible explanation of the change in transistor characteristics after about 400 hours of continuous operation. It was probably due to a peak emitter current of 25ma which occurred when the core driver was pulsed.

2.13 Memory

(W.N. Papian) (UNCLASSIFIED)

MTC Memory The MTC Magnetic-Core Memory has been operating, after a fashion, for a couple of weeks now. Gross adjustments have been made, and only gross or qualitative information is available about it as yet. In the simple modes of operation which have been tried (where instructions are all in toggle-switch storage and reference to magnetic-memory registers is sequential) margins on all parameters (drive currents, sensing-amplifier gains, sense-gate screen voltages, etc.) have been hopefully wide. Sense-gate screen voltages, for example, may be varied by more than ± 70 volts before parity alarms occur. Two somewhat more difficult programs have been tried. One is a simple conversion program (Flexowriter to 4-6-6 tape), the other is a bootstrap program (instructions in one half of the memory check the other half and then shift halves). Both have worked for short periods, but sensing-amplifier waveforms have looked very bad, and margins have been low. The sensing amplifier is being modified in hopes of improving operation. The work of the next few months will be aimed at using this machine to obtain special data and information for those working on magnetic cores and core memories and to demonstrate the operational characteristics and reliability of the memory under near-standard computer conditions.

WWII Memory The WWII work is going on in three general areas. First, in conjunction with Group 63 and IBM, thought is being given to the specifications of the cores to be used, to plane sizes and configurations, and to methods of assembly and correction. Second, under "Address-Selection Systems," work and evaluation is proceeding on vacuum-tube and pulse-transformer drivers, and magnetic-core switches and drivers (see Memorandum M-2162 by J.L. Mitchell). The third category, "Digits and Read-Write Systems," covers investigations of sensing techniques and digit-plane driving problems. An M-note on this subject is almost ready for printing.

(E.A. Guditz) (UNCLASSIFIED)

MTC Memory A few preliminary tests have been run on the memory in MTC to check its performance against data taken on Memory Test Setup V. More detailed tests will be made when the latest changes are incorporated in the sensing amplifiers. In the meanwhile, the memory is checked daily to detect any changes in driving currents or sensing-amplifier gain. Except for slight readjustment of the latter, no readjustment has been necessary for the last 5 days.

2.13 Memory (cont'd)

(J.L. Mitchell) (UNCLASSIFIED)

Magnetic-Matrix Switches An M-note describing some of the different systems in which a magnetic-matrix switch can operate is being written and should be completed in the near future. In addition, some thought has been given to the problem of setting up a system to test large switches under something close to actual operating conditions.

Memorandum M-2162, "WWII Memory-Address Selection Systems," was issued last week.

(W.J. Canty) (UNCLASSIFIED)

Digit-Plane Driver, WWII The past biweekly period has been spent investigating various schemes for supplying digit-plane current pulses in the WWII memory. A report is nearly complete which describes four possible schemes and gives the advantages and disadvantages of each.

(S. Fine) (UNCLASSIFIED)

Memory Test Setup I A readout scheme whereby noise produced during the rise and fall of the read pulse is made to cancel, as explained in Memorandum M-2170, has been tried with success on Memory Test Setups I and IV. With the memory holding a pairs-checkerboard pattern, delta and air-flux noise was reduced to a very small magnitude. This scheme will soon be tried on a 32 x 32 plane.

Memorandum M-2186, "Two Methods of Improving Magnetic-Core Memory Operation," has been completed and will soon be published.

A note on existing and proposed readout schemes for possible WWII use has been completed.

(A. Katz) (UNCLASSIFIED)

Magnetic-Matrix Switch The first 64-position matrix switch (64-1) is now under construction and should be completed early next week. Facilities have been incorporated for the forced-air cooling of the switch and for direct measurement of the delay-line effect. An attempt is being made, for the first time, to improve switch performance by preselecting cores. The major problem remains that of removing the considerable heat energy generated by the cores when pulsed at moderately high repetition frequencies (about 100 KC).

An Engineering note, E-555, is being written which treats the analysis and design of a magnetic-matrix switch.

2.13 Memory (cont'd)

(W. Ogden) (UNCLASSIFIED)

Digit-Plane Driver, MTC This unit was modified to reduce a tendency toward ringing and to otherwise shape the current-pulse output to have a rise and fall time of approximately 0.4 μseconds and an amplitude variable from 200 to 600 ma.

Sensing Amplifier, MTC A single unit was modified by C. Laspina and A. Hughes to eliminate microphonics and to balance the response to positive and negative input pulses. It is undergoing final tests, and modified units will be installed in MTC in about one week.

(A.D. Hughes) (UNCLASSIFIED)

Memory-Plane Tester The tester was used to check individual cores in all 17 memory planes. An M-note describing the tester and the results and conclusions of the tests is in the process of publication.

Switch Cores A test using a thermocouple has been set up for running temperature versus frequency curves for a single switch core. The effects of forced air-cooling will also be tested.

(J. Raffel) (UNCLASSIFIED)

Switch Cores Calculations of power dissipation in the latest magnetic-matrix-switch designs have been made, and methods of cooling are being investigated.

A report is being prepared on the general problem of power dissipation in switch cores.

2.14 Vacuum-Tube Circuits

(R.L. Best) (UNCLASSIFIED)

We had been planning on having the WWII flip-flops give outputs of +10 to -30 volts. +10 is a good level for the gate-tube suppressor, since it makes the tube look like a good pentode. With the suppressor at ground, the tube is oversuppressed, with accompanying loss of plate current and increase in screen current. It now appears that the amount of current drawn by a gate-tube suppressor from a +10-volt level is very much of an unknown. A joint IBM-MIT meeting here May 22 initiated several courses of action that should get us the 7AK7 data needed, some of it within a week, and the rest on a longer-term basis.

Five IBM engineers have been here at various times in the past 2 weeks discussing flip-flops, gate tubes, buffer amplifiers, and transformers. One of our engineers went to Poughkeepsie to discuss one of their schemes for X-Y plane drivers. I have been to Poughkeepsie for the discussions involved in turning over responsibility for control and the arithmetic element to Ross at IBM and have also been to Hartford to discuss layout problems of WWII.

(J.S. Gillette) (UNCLASSIFIED)

Level-Setting Circuits

The various methods of d-c level inversion and amplification are being studied. At present, the possibilities of driving the load directly from a level-setting cathode follower are being studied. The problem of keeping reasonable design margins, low crystal currents, and reasonable output currents presents a difficult problem as all these requirements are in opposition to each other. I suspect that a separate output cathode follower will be needed to provide desired load currents.

(B. Remis) (UNCLASSIFIED)

Cathode-Follower-Driven Diode Circuits

A preliminary scheme for marginal checking the crystal-diode circuitry of the class matrix and the command-pulse-generator matrix in the control section has been devised. The crystals to be marginally checked are all used as level-setting diodes driven by cathode followers. The checking is accomplished by raising the -150-volt bias return of these cathode followers which accept current (positive "and" current) from the external circuitry into the cathode; and by lowering the +150-volt plate supply of those cathode followers that supply current (positive "or" current) from the cathode to the external circuit.

High-Speed Flip-Flop Triggering Circuitry

An E-note is being written covering a proposed triggering circuit to increase the impedance seen by the trigger pulse.

2.14 Vacuum-Tube Circuits (Continued)

(H. Boyd) (UNCLASSIFIED)

Low-Speed (5965) Flip-Flop

Two types of low-speed flip-flops have been designed, and preliminary tests have been run. A variation of one of the types is being tested by R. Wienburg at IBM.

The maximum prf of these flip-flops is to be about 200 kc, and they will employ only one 5965. Reliability and simplicity are the first concerns.

(H. Platt, C. Morrison) (UNCLASSIFIED)

Gate Tube Circuit

An investigation of the type load presented by an MTC 32-tube gate panel showed that it is essentially a transmission line and not a lumped capacitance as was first believed. With a spacing between grids of 2" and 6" (alternately), the optimum termination was 20Ω (32 gate-tube grids); with an open wire 12" between grids and 12" between grids and control line, the optimum termination was 20Ω (16 gate-tube grids).

More experimentation is being carried on with different output transformers and different loads to study the effect on the output waveform. The 1:1, 3:1, and 5:1 hypersil transformers are the ones that are being used so far.

(S. Bradspies) (UNCLASSIFIED)

Buffer Amplifier

The experiment of trying to simulate a gate tube by the use of diodes, resistors, and capacitors has been abandoned because of the discovery by one of the group members that the MTC Dual Gate Panel actually appears to be a transmission line, whose characteristic impedance is about 21 ohms.

Tests are being run, attaching various resistors across 3:1 and 5:1 transformers, in order to see which would be better in the neighborhood of 20 ohms and other loads.

(J. Woolf) (UNCLASSIFIED)

Pulse Delays

Investigations of driving delay lines with gate tubes indicate that a load on a delay line of one flip-flop will attenuate the 0.1-μsec pulse so that the transfer ratio is less than unity gain. It is indicated that a buffer amplifier will be necessary to drive the flip-flop.

Character Generator

Initial investigations have begun on the requirements for a character generator required for a high-speed computer. A trip to Bell Labs is planned with R. von Buelow to investigate a working model of their character generator.

2.14 Vacuum-Tube Circuits (Continued)

(J. Woolf) (UNCLASSIFIED)

Pulse Standardizer

The circuit of a modified blocking oscillator indicates a need for further modification because the output waveform is dependent on the slope of the input waveform.

(C.A. Laspina) (UNCLASSIFIED)

Contacts (Single-Pulse Synchronizer)

The hand-operated contact has been temporarily replaced by a SPDT relay which will operate at about 20 cps so that the waveforms at various points can be seen by a high-velocity scope.

A maximum pulse amplitude of 34 volts is available from the unit.

Some small pulses(3 volts, 0.1-μsec long) are also occurring when a large pulse is generated. I am not sure what is causing them, but I think they are due to grid conduction. Methods of preventing this are now being tried.

(D. Shansky) (UNCLASSIFIED)

X-Y Plane Driver

A driver capable of driving a magnetic-core-matrix switch has been assembled and is presently being debugged. A trip was made to IBM at Poughkeepsie where we observed the feasibility of using a linear transformer matrix for X-Y plane selection. A feedback amplifier to furnish regulation for this system of plane driving was designed.

Z-Plane Driver

Memorandum M-2144 covering the specifications of the "Z" plane driver and offering a tentative schematic diagram has been written.

(H.E. Zieman) (UNCLASSIFIED)

Decoder Output Amplifier

The original circuit of the decoder output amplifier had a frequency response which peaked considerably at 5 mc, and went into oscillation at 5 mc. for certain settings of the gain control. The circuit components have been changed to form a higher-impedance circuit as shown at 5 mc and stopped the tendency to oscillate. The trimmers can be adjusted to give a fairly good square-wave response to a 1-μsec pulse at any given setting of the gain control, but so far the trimmers must be readjusted for other settings of this gain control.

Considerable trouble is being experienced with a 360-cycle ripple on the output which seems to originate from a similar ripple on the -300-volt d-c supply.

2.15 Magnetic Circuits

(H.K. Rising, G.R. Briggs) (CONFIDENTIAL)

Input System

A "drum demand" sampling system for getting radar returns onto the input drum appears to have the best probability of storage of any of the schemes thought about to date. It requires no sampling switch, but does require synchronizers at each counter. A temporary storage register at the drum frame is no longer necessary. M-2174 has been issued describing the system.

Work is starting on trying to use WWII basic circuits wherever possible in the SDU demodulators, and on combining the counters and demodulators into one unit to save cathodes. Rosen of Division 2 will work closely with us on this.

(C.J. Schultz) (UNCLASSIFIED)

Magnetic-Core Shift Register

The condenser storage transfer circuit between stages of the shift register has been tested with different combinations of circuit components in order to optimize operation. Stability and frequency limitations are dependent also upon driving-current amplitude, duration, and rise time. Data will be compiled concerning allowable component and pule-input variations for satisfactory operation.

Junction Rectifier Life Test

After 1100 hours of operation under simulated shift-register conditions, 90% of the GE-4JA1A1 rectifiers being tested have not appreciably changed in their forward or reverse characteristics. However, one sample decreased in back resistance to 20% of its normal value at intervals of approximately 300 hours, always recovering shortly afterwards.

2.16 Memory Test Computer

(K.H. Olsen) (UNCLASSIFIED)

The magnetic memory is installed and operating, and several programs have been run successfully. Most of these have been test programs that put regular patterns in the memory, but a conversion program and a bootstrap program which are completely in memory have been run successfully several times.

The computer is operating without air conditioning and on Lab power supplies but work is progressing on these units. The arithmetic element and the most significant points of the memory are marginal checked every day and the marginal checking for control is being installed.

The Flexowriter system is not reliable as yet but it is being worked on. Toggle switches in toggle-switch storage continue to fail with no hope for improvement.

2.16 Memory Test Computer (Continued)

(W. Hosier) (UNCLASSIFIED)

MTC Operation and Memory Test Procedure

Aside from installations and line-up work on the memory, operation of the computer as a memory-testing device has been quite informal over the past fortnight. Toward putting into effect a more controlled and directed series of tests, a meeting was held Wednesday, May 20, 1953 at which most of the present MTC group, as well as D.R. Brown, W. Papian, A. Guditz, and W. Ogden were present. There it was decided that the first step is necessarily to put MTC on as regular a schedule as possible, with an MTC engineer responsible at all times, in cooperation with one of the memory groups and one or more technicians. For the present, this means that Hosier, Papian, Guditz, and R. Hughes will be operating MTC in the daytime (8-5) and that Bagley, Ogden, and Delmege will be operating it at night (3-11).

A bootstrap program written by H.E. Anderson has proved to be the most taxing so far for the magnetic memory, presumably because it is entirely contained in the magnetic memory and therefore causes access to occur at a higher repetition rate than when instructions are in toggle switches.

(R. Hughes) (UNCLASSIFIED)

Marginal Checking

Margins on all flip-flops and gates except those in control are taken each morning from 8 to 9 A.M. and are fairly good. With all flip-flops varied together the margins are +51 to -29 volts. All gates together can be varied from +28 to -44 volts.

Component Failures

For the past 2 biweekly periods:

Tubes	Number of Failures	Hours of Operation	Reason for Failure
6145	7	0-500	Mechanical
6145	1	0-500	Change in characteristics
7AD7	2	0-500	Mechanical
7AD7	1	0-500	Change in characteristics
SR1407	1	0-500	Mechanical
7AK7	2	0-500	Mechanical
6080	2	0-500	Mechanical

(H. Henegar) (UNCLASSIFIED)

Marginal Checking of Control

Installation of the necessary cabling is continuing. It is expected that this will be completed within the next biweekly period.

2.16 Memory Test Computer (Continued)

(H. Henegar) (UNCLASSIFIED)

Testing of MTC Plug-in Units

It is planned to construct test rigs for the three types of plug-in units now being used in the MTC. These include flip-flops, digit-plate drivers, and sensing amplifiers. This is to insure that we will always have backlogs of tested units available for quick replacement in the computer.

(J. Crane) (UNCLASSIFIED)

Marginal Checking

A pushbutton selector panel for selecting marginal-checking voltages has been designed.

Toggle-Switch Storage

An M-note on toggle-switch storage, MTC, is being written. Five switches failed in the last biweekly period.

(H. Anderson, P.R. Bagley) (UNCLASSIFIED)

Parity Checking

The logic of the parity-checking system has been made more straightforward; false indications of parity checks have thus been eliminated. The system continues to check all information coming from the memory regardless of whether it is to be rewritten.

Control Diagrams

The following drawings of MTC Control now exist:

Block Diagram, Control, MTC SD-37376 (graded)
Block Diagram, Pulse Control, MTC SC-37460
Block Schematic, Control, MTC SD-53580 (graded)

(R. Pfaff) (UNCLASSIFIED)

MTC In-Out

A tape-feed button has been added to the test console to enable an operator to feed tape from the Flexo punch while the Flexo is tied into the computer. Certain circuit modifications were necessary to accomplish this.

The Flexowriter is introducing random errors during read in. This will be cleared up as soon as possible.

2.16 Memory Test Computer (Continued)

(R. von Buelow) (UNCLASSIFIED)

Memoranda have been written describing the Fuse Alarm System (M-2131), the Marginal Checking System (M-2136), and the Start-Stop Panel (M-2148).

(R.G. Farmer) (UNCLASSIFIED)

MTC Power Supplies

The wiring which will distribute 3-phase power to the rectifiers has been started. As soon as this wiring is completed, the testing of the rectifiers will begin.

Due to load expansion, the MTC Motor-Generator will be operating near its capacity of 50 KVA to supply both filament power and 3-phase power for the rectifiers. The d-c power supplies will be of such quality that they will need no pre-regulation and may be supplied from commercial service if it is necessary.

(R.E. Garrett) (UNCLASSIFIED)

MTC Air Conditioning

The equipment to be installed in the penthouse is now in position, and the contractor is proceeding at a rapid rate. It is anticipated that one half of the system will be in operation within the next biweekly period.

(R. Jahn) (UNCLASSIFIED)

MTC Alternator

Balanced and unbalanced load runs were made on the alternator. The unbalanced-load voltages differ enough to justify sensing the voltages of all three phases and regulating the average. Frequency and phase measurements are now being made.

(P.R. Bagley) (UNCLASSIFIED)

Conversion Program

The basic Conversion Program has been run successfully.

Multiply Subroutines

Several subroutines for multiplying two 15-digit numbers and retaining the full 30-digit product have been written but not yet tested.

Memory-Test Programs

Several new memory-test programs have been written and tried recently. Several ways of testing for the worst pattern now exist.

2.16 Memory Test Computer (Continued)

(H.E. Anderson) (UNCLASSIFIED)

MTC Bootstrap Program

A two-part testing-type bootstrap program has been written for MTC. It operates entirely within the magnetic memory. It first ran successfully on May 21 and will be described more fully in an M-note to be written soon.

2.17 Equipment Design and Scheduling

(C.W. Watt) (UNCLASSIFIED)

Standards, Components

A meeting held May 12 and 13 at MIT resulted in Components Application Memo #6, "Electrolytic Capacitors," and in the discussion of several other components. Next meeting will be at Poughkeepsie May 26 and 27.

Joe Giordano has distributed copies of all the application memos issued to date to a large group of circuit designers. He will see that new sheets get issued as they are finished and that the books are kept up to date. Comments on the sheets issued are earnestly requested.

Standards, General

The overall organization of the MIT-IBM Standards Committees is now in the process of being established. IBM has designated R.N. Sweetland as the responsible standards man at High. He and three aides visited here May 14, at which time the MIT proposals for organization were presented. A meeting will be held Monday May 25 at Poughkeepsie after which we hope to issue a joint memo on responsibilities and organization agreeable to all.

Standards, Drafting

Agreement has almost been reached on block-diagram and block-schematic symbols. The final standard on this should be issued during the next two weeks.

Standards, Basic Circuits

Heineck and Callahan of MIT and Foley and Thompson of IBM have prepared a proposal for the Basic Circuits Manual, which will be presented for consideration during the week of May 25.

(P.J. Gray) (UNCLASSIFIED)

The past period has been spent working with A. Kromer and H. Smead on a study of the time relationships of the engineering, procurement, construction, installation, and testing phases of the Transition System program. The overall program outlined in TM-20 is being used as a guide for this study(which is expected to be expanded with more detail during the next biweekly period).

2.17 Equipment Design and Scheduling (Continued)

(J.D. Bassett) (UNCLASSIFIED)

The past biweekly period was spent partly in compiling information to help expedite Air Force contract negotiations, and partly in studying ways and means of intelligently approaching the problem of standards and specifications for WWII.

A detailed survey of currently effective MIL, JAN, and Federal specifications is being made to insure that the new specifications to be written for WWII will lie as much as possible within the framework of accepted Air Force design practice.

(W.H. Ayer) (UNCLASSIFIED)

The IBM-MIT committee on the packaging of WWII submitted its recommendations to a joint meeting of all interested persons at Hartford on May 21. A decision was made at that time to accept the suggested layout for the AE and Control sections of the machine. In this proposal, individual registers are vertical, with their power-distribution panels directly below in a manner similar to the MTC arrangement. The pluggable units are horizontal, and one-tube high to coincide with the height of an individual digit. Four,six, and nine-tube units will be developed simultaneously until such time as a definite decision can be made on the optimum size desired.

Another meeting will be held June 14 to decide on the remaining proposals.

(J. Giordano) (UNCLASSIFIED)

The MIT-IBM Sub-Standards Committee has been continuing its work on drafting a final proposal of standard block symbols and their functions for WWII. Also the initial meeting this week of the IBM-MIT Circuit Design Manual group succeeded in drafting its initial proposal.

2.2 Group 63 (Magnetic Materials)

(D.R. Brown) (UNCLASSIFIED)

The first samples of the proposed memory core for WWII were received from General Ceramics on May 20. The material is the same as that used for MTC, body MF-1326B, but the core is smaller, part number F-394 having an outside diameter of 0.080 in., an inside diameter of 0.050 in., and a thickness not yet specified, but probably 0.025 in. Highest priority has been assigned to the evaluation of samples from three different firings.

Pulse Tests of Magnetic Cores

(J. Schallerer) (UNCLASSIFIED)

Preliminary tests have started on MF-1326-B, F-394. Present indications show good operating range from 0.9 amp to 1.2 amp for the cores fired in Globar Kiln #5. These cores are 25-30 mils thick with an O.D. & I.D. of 80 & 30 mils, respectively. Further tests will be run to determine delta and disturb zero. Physical dimensions will be measured and compared to other core characteristics.

(J.R. Freeman) (UNCLASSIFIED)

A program for studying the necessary specifications for and characteristics of magnetic switch cores has begun.

Seven hundred and fifty General Ceramics MF-1312-B, F-262, ferrite cores were tested and sorted for desirable outputs. Four hundred and sixty five cores were selected as being good switch cores, and four hundred were delivered to Group 62 Memory Section for assembly into a 64-position switch.

The outputs of twenty 140-wrap, 1/4-mil, 1/4-inch molybdenum permalloy metallic cores were also observed. Sixteen of these cores will be built into a 16-position switch and the remaining cores pulse tested individually.

(D.A. Buck) (UNCLASSIFIED)

Raytheon reports disturb sensitivity on Magnetics, Inc. cores (of the type in which we are interested) is worse than anticipated. Instead of levelling off exponentially, as disturbed one's are thought to do, the one disturbed output drops continuously, even to 788 disturbances for certain current adjustments. When the current is lowered to remove disturb sensitivity, switching time is about 12 microseconds.

Automatic Pulse Tester for Magnetic Cores

(R.A. Pacl) (UNCLASSIFIED)

The pilot model of the production core tester is nearing completion. Two different tracks have been tried; apparently both will perform satisfactorily. It is expected that next week will see the unit in operation.

2.2 Group 63 (Continued)

Automatic Pulse Tester for Magnetic Cores

(R.F. Jenney) (UNCLASSIFIED)

The solid probe for the production tester was tested and found satisfactory. There was some trouble with grounds, but no additional difficulty is expected.

A scheme for measuring disturb sensitivity automatically is being investigated. This test was to have been done semiautomatically because of electronic difficulties but recent developments may make automatic testing feasible.

Mod. V and VI core drivers will be tested for long-term stability of pulse height. Some changes in circuitry are expected.

(B. Gurley) (UNCLASSIFIED)

The experimental sense amplifier for the automatic core tester has been completed and appears satisfactory. The amplifier is designed to drive one or more gate tubes. The input is differential, and the output is push-pull. A 4-mv signal on one input produces a 15-volt output on either output terminal. The rise time is about 0.07 microsecond with a 180-μμf load. The equivalent noise input is about 0.15 mv.

The long-time stability will be investigated.

(J. Schallerer) (UNCLASSIFIED)

The driving logic for the automatic core tester was designed this week. The pulse sequence is such that the disturb one and disturb zero can be measured with 6 & 64 half-select pulses during one mode of operation.

Hysteresis Loop Tracer

(B. Smulowicz, F. Vinal, J. McCusker) (UNCLASSIFIED)

The hysteresigraph was modified mechanically and electrically in order to increase the testing rate. The testing rate now is approximately 4 times faster. The unit now uses a 60-ampere source and has a one-turn primary. Squareness is now measured directly.

(R.A. Pacl) (UNCLASSIFIED)

A second 60-cycle hysteresigraph has just been completed. The checkout showed satisfactory operation.

2.2 Group 63 (Continued)

Ferrite Synthesis

(J. Sacco, F. Vinal, R. Maglio) (UNCLASSIFIED)

On the basis of test data of the stoichiometric $MgO.MnO.Fe_2O_3$ series, a new series hasbeen prepared to examine more closely the compositional ranges of greatest interest. Cores from such a series have been fired at several time-temperature schedules and submitted for testing.

Work has been started on another $MgO.MnO.Fe_2O_3$ series containing a slight excess of MgO. This is of particular interest since it is in a region not previously investigated by this Laboratory but approaches the compositional range of General Ceramics bodies.

A detailed investigation of General Ceramics process for producing ferrites is under way. This Laboratory will set up production facilities, on a small scale, which will duplicate insofar as possible the General Ceramics process.

While setting up this process, thought will be applied to the design and assembly of a system which will produce a uniform, continuous flow of ferrite material.

The Harper furnace installation is complete, and the furnace is now being brought up to temperature so as to purge the refractory of absorbed water. A study of the temperature gradients and control limits within this furnace will be made before it is used for firing ferrite bodies.

Microstructure of Ferrites

(J.B. Goodenough, F. Vinal) (UNCLASSIFIED)

The necessary procedures for surface preparation of ferrite materials for microstructure studies have been developed. Microstructure studies of a series of samples has begun.

Stress Sensitivity of Magnetic Properties

(J.B. Goodenough) (UNCLASSIFIED)

E-545 has been completed and will be out soon. It discusses the stress sensitivity of coercivity and B-H loops from the hypothesis of nucleation of domains of reverse magnetization at grain boundaries.

Neutron Irradiation of Ferrites

(P.K. Baltzer) (UNCLASSIFIED)

Ferrite samples which had been sent to Oak Ridge for irradiation were received. There were 2 cores of MF-1312 and MF-1118 which had been irradiated for a period of about one week at a temperature of 50° C. These samples were hot when first removed from pile but could be handled after a period of three weeks.

2.2 Group 63 (Continued)

Neutron Irradiation of Ferrites (Continued)

Pulse-test data was taken on the samples and compared to the original data; there was no detectable change.

The amount of irradiation that might be necessary to incur a detectable change in the electrical properties of these materials is not known; therefore, the results obtained above are only preliminary. Further work will be done concerning longer periods of irradiation.

Theory of Ferrites

(A.L. Loeb) (UNCLASSIFIED)

The meeting of the Physical Society in Washington and a visit to Eckert-Mauchly in Philadelphia were reported on at the regular seminar. Note M-1733 is being rewritten (1744-1) to cover all the material presented in a paper at the Physical Society Meeting.

The Néel paper has been partially debugged, and an explanation of various inconsistencies and ambiguities will be given in a review lecture on Tuesday, May 26. Contact is being maintained with Drs. Maxwell and Short of the Naval Ordnance Laboratory regarding the Néel paper and its inherent difficulties.

A talk was presented on the free energy model for the Group 35 colloquium on Wednesday, May 20.

Ferroelectrics

(D.A. Buck) (UNCLASSIFIED)

A sample of .002-inch-thick barium titanate ceramic has been received from Glenco. The sheet has transparent areas which may be single crystals throughout the thickness. Pulse tests are being made to evaluate this material for memory work. Additional samples of General Ceramics body 8189 which displays nonlinear conduction phenomena have been received.

SECTION III - CENTRAL SERVICES

3.1 Publications

(Diana Belanger) (CONFIDENTIAL)

The following material has been received in the Library, W2-325.

LABORATORY FILES

No.	Title	No. of Pages	Date	Author
UNCLASSIFIED				
A-42-5	Biweekly Reports	3	5-19-53	J. B. Bennett
M-2119	Auxiliary Drum Testing, Summary #3	3	4-28-53	K. E. McVicar
M-2123	Iteration Procedures for Simultaneous Equations, Sc.D. Thesis Proposal	21	5-12-53	E. J. Craig
M-2124	DC Flip-Flop Tester, MTC	2	4-30-53	H. Henegar
M-2131	Memory Test Computer Fuse Alarm System	2	5-5-53	R. von Buelow
M-2133	MTC Tests on Magnetic Memory-Automatic Memory Display	3	5-5-53	H. E. Anderson
M-2134	MTC Tests on Magnetic Memory-Load and Check Program for all Ones or Zeros	1	5-5-53	R. Pfaff
M-2136	MTC Marginal Checking System	2	5-8-53	R. von Buelow
M-2139	1953 Electronics Components Symposium	9	5-1-53	C. W. Watt
M-2146	Reliable Components Meeting #11-Hughes Aircraft Co., Culver City, Calif.	5	5-8-53	C. W. Watt
M-2148	MTC Start-Stop Panel	2	5-11-53	R. von Buelow
M-2151	Scheduling of Work for Group 60 Shops	1	5-11-53	Production Control
M-2155	Biweekly	39	5-8-53	
M-2156	WWII Basic Circuits-Low Speed Level Amplifier	1	5-11-53	J. Gillette
M-2157	WWII Basic Circuits-Low Speed Level Inverter	1	5-11-53	J. Gillette
M-2162	WWII Memory Address Selection Systems PB#62	4	5-6-53	J. Mitchell
M-2165	Camera-Scope Calibration	1	5-14-53	(W. A. Clark (W. M. Wolf
M-2166	Transistor Magnetic Core Drivers, M. S. Thesis Proposal	5	5-18-53	S. Oken
M-2169	Equipment Changes in the Cape Cod Control Center	2	5-15-53	S. H. Dodd
M-2170	A Proposed Readout Scheme	1	5-18-53	S. Fine
M-2171	Proposal for Design of Plug-in Units	2	5-15-53	A. P. Kromer
M-2172	Minutes of the MIT-IBM Components Sub-Committee, May 11 and 12, 1953	2	5-18-53	C. W. Watt
CONFIDENTIAL				
M-1978	UHF Automatic Ground-to-Air Data Link (CONF.)	10	5-8-53	C. Zraket

3.1 Publications (Continued)

LABORATORY FILES (Continued)

No.	Title	No. of Pages	Date	Author
CONFIDENTIAL				
M-2143	Master Control Program Functions, (CONF.)	4	5-7-53	W. Attridge
M-2150	Air Defense Biweekly Report, (CONF.)	29	5-8-53	
M-2154	Allocation of Indicator Light Registers, (CONF.)	14	5-11-53	R. Walquist

LIBRARY FILES

No.	Identifying Information	Source
UNCLASSIFIED		
B-254	PRINCIPLES OF RADAR, 3/E, 1952, J. F. Reintjes and G. T. Coate	McGraw-Hill Book Co.
B-255	CONSTRUCTION AND APPLICATIONS OF CONFORMAL MAPS, Symposium, June 22-25, 1949	National Bureau of Standards
B-256	PULSE TECHNIQUES, 1951, S. Moskowitz and J. Racher	Prentice-Hall, Inc.
B-257	NUMERICAL METHODS IN ENGINEERING, 1952 M. Baron and M. Salvadori	Prentice-Hall, Inc.
2359	High Vacuum in Industry, Graduate School of B. A.	Harvard University
2360	The Present State of Research on Mechanical Translation	Repr. AMERICAN DOCUMENTATION, 10/51
2361	Factors Affecting the Life of Impregnated-Paper Capacitors	H. F. Church
2362	The General Theory of Relaxation Methods Applied to Linear Systems	G. Temple
2363	Lagrangian Interpolation	Wright ADC
2364	The Elliott-NRDC Computer 401 Mark I	ONR
2365	Tests on the Position Coder of a Numerically Controlled Milling Machine	
2366	Chain Reliability: A Simple Failure Model for Complex Mechanisms	Rand Corp.
2367	An Experimental Rapid Access Memory Using Diodes and Capcitors	National Bureau of Standards
2369	An Outline of a Theory of Semantic Information,	RLE
2370	Report of the Committee on Scientific Personnel	US AEC, 10/47
RESTRICTED		
2368	Summary of Papers Presented at the Seminar on Data Handling and Automatic Computing, (U.S.T.)	ONR, 2/51

3.2 Purchasing and Stock

(H.B. Morley) (UNCLASSIFIED)

The greater part of components needed for construction requisitions have been supplied from stock. This was possible because of the Project Director's advance notification that the "Crash" program was in prospect, allowing purchasing to plan for advance orders.

Attempts now to restock are in some cases hampered by lack of knowledge of future construction requirements and by poor deliveries, as discussed below.

The Ward-Leonard Electric Co., a major source for noninductive and inductive power resistors, has repeatedly failed to make deliveries as promised. This Company now need 10 weeks minimum time to process our orders.

Slower deliveries of JAN-manufactured material have become a definite trend and are especially noticeable in the high-quality components needed for the project. A minimum of 8 to 10 weeks is needed by such manufacturers to fabricate and deliver.

The delivery slow-down can be expected to become worse when vacation schedules interrupt production; and even more difficult with components of a highly complex technical nature, for which six months or more must be allowed for delivery. Such equipment would include specialized items made by Leeds and Northrup or equipment built to our specifications, excepting construction work performed by local assembly shops.

Three more Dumont K1084P7M CRT's were received on May 19th. They will be returned to Dumont for retesting because of secondary emission from grid. Five more tubes were received on May 22nd, bringing the total to 25. Fifteen are still due.

Critical items continue as listed below. Sufficient lead time must be allowed for orders to arrive on time.

Many slow deliveries of items which are called "critical" often represent normal and ordinary manufacturing periods needed for fabrication. They become "critical" only because our demands for the items are sudden and thus do not allow for the necessary "lead time" so often mentioned in past biweekly reports.

Resistors: Ward-Leonard; Electra; Sprague "Koolohms"; Allen-Bradley fixed and variable; Ohmite.

Meters: Weston (16 weeks is common); specialized meters of any manufacturer (16 to 30 weeks).

Capacitors: Sangamo and Sprague, most types.

Connectors: All Jones and Cinch-Jones items.

Sockets: Cinch, Eby.

Transformers: All manufacturers, excepting manufacturers' standard units sometimes available at local jobbers.

Relays: Clare; Allied; Kurnam; Sigma; Allen-Bradley.

3.3 Construction

(F. Sandy) (UNCLASSIFIED)

The assembly of the 16" scope units in Room 222 is about complete. However, all the equipment that is to be installed in these units has not arrived. This equipment will be installed as it is obtained from the shops or outside vendors.

(F.F. Manning) (UNCLASSIFIED)

Production Control

There have been 37 Construction Requisitions totaling 630 items satisfied by Group 60 electronic shops since May 8, 1953.

There are 26 Construction Requisitions totaling 704 items under construction by Group 60 electronic shops.

For further information, please call the Production Control Office (Ext. 3492).

(R.F. Bradley) (UNCLASSIFIED)

Production Control CR-Orders Open with Vendors

There are now outstanding 22 orders with outside vendors totaling 6446 items. Deliveries during the past biweekly period total 5643 items.

Further information may be secured from the writer, extension 3476.

3.4 Component Analysis and Standards

3.41 Component Analysis

(B.B. Paine) (UNCLASSIFIED)

Visits have been made to Cook Electric Co. and Ohmite in Chicago, Crosley in Cincinnati; Vitramon in Bridgeport, and Cornell-Dubilier in New Bedford to gather reliable-components information. These visits will be reported in M-notes to be issued eventually.

Components failing in any sort of equipment should be tagged and sent to W2-326 for analysis. Special tags are available from me.

3.42 New Components

(B.B. Paine) (UNCLASSIFIED)

Sprague is now packaging pulse transformers that meet our electrical specifications 193-6 and 193-7 in a metal tube with glass end seals. This construction should have excellent reliability. It may be possible to increase the resistance to moisture penetration of our resin-cast pulse transformers by vacuum-impregnating them with a silicone preparation. This will be investigated.

3.43 Standards

(H.W. Hodgdon) (UNCLASSIFIED)

Work for this period has been concentrated on bringing up to date some of the standards needing revision and on preparing some new material on transformers. A proposal was prepared on blank chassis bases and circulated for comment.

A survey of various insulating laminates is being made to see if we can select a better material than the Grade LE linen-base phenolic now used.

Sample paint chips in various grades of finish are being obtained so that an improved-finish specification can be prepared.

3.44 Vacuum Tubes

(H.B. Frost, S. Twicken) (UNCLASSIFIED)

Life test of 6145, lot D3P, has completed 100 hours, the initial stabilization burn-in period. During this period, average plate current dropped from 35 to 31 ma with a decrease in standard deviation.

Life test of 6145, lot L2P, has completed 600 hours. There has been a slight increase in current of the low-duty-factor tubes and a slight decrease in current of the high-duty-factor tubes.

Life test of 5963's at high heater voltage has completed 1500 hours. The conducting sides continue to show a higher interface impedance than the cut-off sides. The average difference in plate current between on and off sides is lower, however, than that on the first test run at rated heater voltage.

Pulse characteristics of the 7AK7 in the positive control and suppressor-grid region are available as drawings SA 40547, 40548, and 40549.

Considerable progress has been made on the construction of the new tube tester. The tester should be delivered by the outside vendor about August 10th.

500 5965's have finally arrived and are being tested. Urgent requirements of MITE and MTC will be met early the week of May 25. Those who have taken 12AV7's as substitutes can get 5965's at the tube shop.

3.5 Test Equipment

(L. Sutro) (UNCLASSIFIED)

Test Equipment Headquarters

Now that the testing of new equipment bought during the past year is nearly completed, the technicians are starting to test equipment that has been in service more than a year. There are now 1500 panels of standard test equipment, 98 Tektronix scopes, 20 synchroscopes, and other smaller oscilloscopes. They will marginal check all the units. Standard test equipment will be checked with 5.5 volts on the filaments and with the screen voltage of tubes wired for marginal checking varied through a range yet to be determined. Oscilloscopes will be checked

3.5 Test Equipment (Continued)

with a supply voltage at the lower limit at which it is intended to operate.

Half of the missing test equipment listed in M-2128 has been found. We are still hopding to hear about the other half.

(R.E. Garrett) (UNCLASSIFIED)

D-C Bench Distribution

The d-c bench-outlet boxes will be modified to provide a single cutoff switch for all d-c voltages thereby providing additional safety. Another series switch for -450 volts is provided so that -450 volts may be turned on only when needed.

3.6 Drafting

(A.M. Falcione) (UNCLASSIFIED)

Drafting facilities have been tied up for the past three to four weeks with thesis drawings (102); therefore, other work has been delayed. This delay has caused a considerable backlog of work which should keep the Drafting Room busy for the next six weeks at least.

3.7 Administration and Personnel

(J. C. Proctor) (UNCLASSIFIED)

Staff Termination

Margaret Mann

(R.A. Osborne) (UNCLASSIFIED)

New Non-Staff Personnel

Patricia Brogan is a new clerk in Group 6345.

Martin Jacobson has joined us for the summer as a messenger boy.

Robert McClellan is a new member of the Whittemore Building janitor crew.

Cornelius McLaughlin is a new technician in Group 64.

Harlan, Noyes, Beverly Petrelis, and Francis White are all new members of the Drafting Department.

Leo Sartori is a summer student in Group 6345.

3.7 Administration and Personnel (Continued)

Terminated Non-Staff

Melvin Aronson
Jerome Davis
Robert Ham
Nina McMasters
Elizabeth Sanderson
Carol Small