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Memorandum M-2457

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

SUBJECT: BIWEEKLY REPORT, October 9, 1953

To: Jay W. Forrester

From: Division 6 Staff

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SECTION I - CAPE COD SYSTEM

1.1 Group 61

1.10 General

(C.R. Wieser) (CONFIDENTIAL)

During the past biweekly period we have made our first attempts to operate together the Track-While-Scan and Weapons-Direction sections of the 1953 Cape Cod System with live radar data. One of the objectives of these early tests has been to check for unforeseen difficulties which might arise in a System this size. No difficulties of this nature have been evident so far; however, we have had a good deal of trouble of the kind we expected. With a program of about 16,000 orders and an electronic system of about 13,000 cathodes, frequent interruptions of the tests have occurred; with brand new programs it is not always easy to determine whether the fault lies with the equipment or the program. Several program errors and several equipment troubles have been located and corrected. (Trouble-shooting should be easier in the near future when a parity check on auxiliary-drum transfers is added.)

The frequent interruptions caused by program or equipment trouble have allowed very little operational experience. The small amount of experience gained has been valuable in training an Air Force operating team and in pointing the way to improvement. An experimental 16-inch console which can be quickly off-centered to any quadrant by means of

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1.10 General (Continued)

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

a single knob (the expansion is fixed) has been tried and found very helpful in track monitoring. The criteria for presenting tracks to monitors are still being studied. At present we seem to be overconservative; i.e., tracks are assigned for monitoring more often than necessary.

The System will be available for demonstration to interested groups outside the Laboratory on and after October 29. Visitors have been urged to come only on Thursdays so that further development work will not be seriously hampered.

During the present phase of our training program most of the stations in Room 222 are manned by both Air Force and Group 61 personnel. The limited space in Room 222 is crowded at best, and the steady stream of visitors from within the Lab makes the situation even worse. It has become necessary to admit to Room 222 only those people who have business there. This restriction is not intended to reject anybody whose work will benefit from seeing the system operate - on the contrary, the idea is to make room for such people. If you feel that you should see the System in operation, please contact R.J. Horn, who can arrange a visit and a guide so that visitors may receive the maximum benefit and ask questions without interrupting the operating personnel.

(R.J. Horn) (CONFIDENTIAL)

Summary

As noted above the Track-While-Scan and Weapons-Direction (formerly Non-Track-While-Scan) sections of the 1953 Cape Cod System programs have been combined and operated with live radar data for the first time during this biweekly period. Further details may be found in Sections 1.12, 1.14, and 1.15.

The General Electric Company is building an experimental coder for connecting their data link to the WWI computer. Installation of this GE data link here is for experimental purposes and is not intended to replace our present Air Force Cambridge Research Center link.

The Ampex 14-track recorder No. 2 has been modified for selective recording on a single track and is being installed. The old Digital Radar Relay equipment (DRR) has been restored to operating condition and will be connected with Building B when a phone line is obtained. A teletype machine for picket-ship communication has been received but is not yet installed.

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1.10 General (Continued)

(R.J. Horn) (CONFIDENTIAL) (Continued)

A limited study of the merits of using the number of consecutive misses as part of the velocity-smoothing correction showed no significant advantage from this addition.

The dials of the M-33 tracking radar at Belmont will be photographed, and the frame numbers recorded via telephone at Barta. This M-33 data will be combined with data from radars overlapping the M-33 coverage in order to obtain an estimate of the accuracy with which positions can be predicted by the computer.

Additional reporting of Group 61 activities for this biweekly period is given in M-2458 (SECRET).

1.11 Equipment Engineering

(E.S. Rich) (CONFIDENTIAL)

Mr. Hurley of the General Electric Company visited me on Oct. 1 to go over technical details of the experimental coder which GE will build for connecting their data link to the WWI computer. This is not expected to be ready for integration with the computer before the end of the year. Installation of this GE data link here is for experimental purposes and is not intended to replace our present Air Force Cambridge Research Center link.

(N. Alperin) (CONFIDENTIAL)

Light guns have been installed at all stations except Q and U. A gun is available for station U and can be plugged in when needed. Since there is no hanger available for it, it seems advisable not to leave it around in Room 250. The gun for station Q will be installed the next installation day.

A new logic has been proposed to make the light-gun operation more reliable. In order to make use of the new idea a more consistent phototube output is needed. This problem is now being investigated. As it stands now, the phototube output varies in size and shape from tube to tube and is not clean enough for the proposed system.

The spare 14-channel Ampex tape unit has been modified and will be ready for installation soon. When it is placed in operation the one currently being used will be modified also so that channel-by-channel recording will be possible.

1.11 Equipment Engineering (Continued)

(R.E. Garrett) (CONFIDENTIAL)

The low-level lighting problem is being investigated from two approaches. Room 225 is provided with a high-voltage (6000V) series-connected cold-cathode fluorescent fixture; Room 223, with incandescent fixtures. The room preparation, which has been slowed by material procurement and scheduling problems, will be ready for evaluation next week.

(H.J. Kirshner) (CONFIDENTIAL)

Fourteen-track Recorder No. 2 is being installed after having been modified for selective recording. This feature will permit recording on a track of a particular tape without alteration of data on other tracks of the tape.

Some difficulty has arisen with the time source for the "Time Register." A new source is being designed and will be constructed shortly.

The old Digital Radar Relay equipment (DRR) has been taken from mothballs and rejuvenated. It is now operable. A phone line is on order for the purpose of connecting this equipment to its transmitter at Building B.

A teletype machine for picket-ship communication has been delivered but not yet installed by the telephone company.

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

The consolidated program for the manual checking of the Cape Cod equipment has been recorded on magnetic tape. The tape is filed in the test-program cabinet in Test Control. At the moment it is necessary to place the tape on Magnetic Tape unit 1 and transfer it to the drum with Magnetic Tape Read-In Program 3058M9. Early next period it will be recorded on tape unit 0 with a read-in program so that it may be read in by throwing a few switches. Difficulties with the magnetic-tape units prevented this recording during this period. The program includes a calibration pattern for all scopes; test programs for the scope-selection systems; programs for checking light guns, insertion switches, and indicator lights; displays of all radar data; and a number of programs useful for diagnosing troubles.

Manuals have been attached to all stations which describe the steps necessary for checking the equipment at that station with the above mentioned program. It is believed that the programs and manuals are now up to date with all changes.

On the sixth and eighth of October tests were run on the operation of the equipment with Air Force personnel manning the stations. Approximately 80 minutes was required for a complete check, of which at least one-third

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1.11 Equipment Engineering (Continued)

(G. Young, B. Morriss) (Continued) (CONFIDENTIAL)

was spent getting all scopes operating and calibrated. The tests were successful in discovering several malfunctions and indicated that with practice and improvement in calibrating scopes, the time might be reduced by a factor of two.

Some time was spent studying the proposal by Roberts and Ziegler for a parity check on the magnetic drums. Such a check would be very useful and seems possible with a small amount of change. Also investigated were some of the possibilities for using the Buffer Drum with input and output devices other than those used for radar data.

(D. Neville) (CONFIDENTIAL)

The input to the Data-Link Coder is being adapted to both IOR (In-Out Register) input and to a mechanical test signal input. A mechanical unit is being built by Lincoln to be installed by Nov. 1. This installation will put a pattern of test messages on the air whenever Whirlwind is not using the Data Link. Toggle-switch input for trouble shooting will also be installed.

(J.H. Newitt) (CONFIDENTIAL)

During the past biweekly period arrangements have been completed for further lighting experiments for the control center. M-2423, "Lighting Conditions and Design Considerations in the SCC Control Center," has been issued to discuss the problems involved and to offer solutions. Some design considerations for future control centers are also discussed.

A new design for illuminating labels in the control center has been devised. This design does not require removal or drilling of the presently installed switch panels. We have ordered the fabrication of blank labels for all toggle and push-button panels of the center. These can be engraved and installed before the end of the month if there is no delay in the freezing of engraved panel nomenclature.

Illuminated map and writing shelves of the type described in the above M-note for each console in the Center are well along in fabrication and will be installed within a week or so.

An additional 16" scope is scheduled to be installed in Room 250 within a few days.

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1.11 Equipment Engineering (Continued)

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

Circuit schematics involving the Pathfinder scopes are being brought up to date to include our modifications. These drawings are about ready for drafting. It is planned to establish a file of schematics in Room 224 to aid in the maintenance of the Mappers.

Additional modifications to the scan-synchronizer units have been made to increase their reliability. The jitter inherent in the azimuth pulses from the gap-filler sets is the primary source of trouble now that the marginal operation of these units has been corrected.

1.12 Data Screening

(R.L. Walquist) (CONFIDENTIAL)

The Track-While-Scan (TWS) and Weapons Direction (formerly Non-Track-While-Scan) programs have finally been combined into a single program. From all outward appearances, these programs are operating satisfactorily. Operation with live data has uncovered very few program errors. However, equipment difficulties (reported in a separate section by E. Wolf) and poor radar data (mainly a low blip-scan ratio) have kept us from running successful interceptions.

The present combined program is now recorded on a computer-operated magnetic tape unit; the program can now be brought into the machine by setting a few switches and pushing the read-in button. A great deal of difficulty was experienced with our attempts to place the combined program on the magnetic tape unit. Faulty recording circuits and replacement of the read-record heads on the tape unit required many wasted hours of computer time before a successful recording was obtained.

Training of Air Force personnel in the TWS positions is continuing. The men appear interested in operating the system and are doing quite well considering the small amount of training they have received. The biggest obstacles to satisfactory initiation and monitoring are still the scope displays and the radar data. The jitter in the displays on the monitor scope is equivalent to about a 4-mile change in track position. Good monitoring becomes impossible under these conditions. (The surprising thing is that the monitors seem able to maintain interest under such trying conditions.) The poor blip-scan ratio on aircraft for the S. Truro radar, coupled with a fairly large number of apparently random returns from the land-coverage areas, also makes monitoring difficult. Automatic tracking also has been very poor because of this.

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1.12 Data Screening (Continued)

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

System-equipment reliability has improved over the previous biweekly period but still is not satisfactory. Integrated operation of TWS and Weapons Direction programs has commenced and the longest error-free period has been about 45 minutes. With the help of staff personnel, Air Force personnel have been manning all TWS positions except Tracking Officer and Combat Data Director (CDD).

A new start-over and restart program is now being checked out. It will enable the CDD to control operation of utility programs (calibration, switch check) and to start up the system or to restart in several modes of operation.

(H. Frachtman) (CONFIDENTIAL)

The statistical program is being finished. This is somewhat more complex than was anticipated.

Some time was spent watching the Radar Mappers.

(D. Goldenberg) (CONFIDENTIAL)

I have started a study of the effect of trouble tracks on the work of the Track Monitors. In the first stages I have been observing the work of the Monitors and gaining a familiarity with their procedures.

The memo on the earth's curvature problem is in preparation.

(J. Ishihara) (CONFIDENTIAL)

Work continues on the 1953 Cape Cod Program. I am assisting in the training of Air Force personnel as monitors during operational test.

(J. Levenson) (CONFIDENTIAL)

A great deal of time has been spent attending tests of the Cape Cod System and training Air Force personnel for Track Initiator Position. A log has been started with the training time and rating for all Track-While-Scan (TWS) personnel.

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1.12 Data Screening (Continued)

(J. Levenson) (Continued) (CONFIDENTIAL)

I am writing a program which reads a list of parameters from Flexocode on a paper tape and stores them in the correct places on the drum. This should make it easier to introduce the parameters which are inserted daily before the program runs.

Rough drafts are completed for the two memos mentioned in the last biweekly.

Charts have been drawn up with the lettering to be put on illuminated panels for the TWS consoles.

(H. Peterson) (CONFIDENTIAL)

During this biweekly period I finished the rough draft of my memorandum on Cape Cod System Displays and the accompanying flow diagrams and have spent nearly half of my time acting as a monitor or instructing others to.

I have also started to give consideration to a display of 8 scans of track history.

(E.W. Wolf) (CONFIDENTIAL)

A series of three programs is being written which will allow information to be transferred between the auxiliary drum and the magnetic tape and between different magnetic-tape units. It is intended that these programs will allow such transfers to be made with greater reliability, flexibility, and convenience than has been possible heretofore. A memorandum describing the transfers in detail will be distributed as soon as all three programs are operational. Two of them are now ready for testing on the computer.



1.13 Tracking and Control

(S. Best, H. D. Neuman)

See M-2458 (SECRET).

(W. Lone) (CONFIDENTIAL)

The simulated program for use by the Flight Test Umpire is being modified so that simulated interceptors, originating from Bedford or Otis, will automatically maneuver to collision point, the necessary speed and heading being received from the interception program.

(A. Mathiasen) (CONFIDENTIAL)

A new tracking program has been partially checked out; because of equipment trouble it has not been completely through the mill.

The simulated-data tracking-accuracy program will be rerun in order to supply more data than is now available on the distribution of errors.

In a limited study by members of this Section on the merits of using the number of consecutive misses as part of the velocity-smoothing correction following such a succession (see September 11 biweekly for details) no significant advantage was discovered.

(B. Stahl) (CONFIDENTIAL)

Programming and associated work on DID's (Digital Information Displays) for H. Benington's group having been completed, the study of multiple-radar tracking and smoothing methods has been resumed. More simulated flight plans have been and are continuing to be run as computer time is available.

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

We visited the Anti-Aircraft Artillery site at Belmont on October 1 to acquaint ourselves with the operations of the M-33 tracking radar and a method of taking pictures at stated intervals of the dials giving the range, azimuth, and elevation of the aircraft being tracked. The frame numbers will be recorded via telephone at Barta on one channel of the tape while data from radars overlapping the M-33 coverage is being recorded on other channels. This combined data will later be used to obtain an estimate of the accuracy with which positions can be predicted by the computer. The exact details of how this will be done have not been worked out, but it is likely that during the tracking, the predicted positions at the times the camera takes pictures will be printed out together with other pertinent information.

1.14 Weapons Direction

(D. R. Israel) (CONFIDENTIAL)

The rewritten and revised versions of the Weapons Direction (formerly Non-Track-While-Scan -- NTWS) programs (see previous biweekly) have been consolidated into two major programs: NTWS-2 and NTWS-2A. The two versions differ only in that NTWS-2 will use the old Master Control Program and will include the necessary auxiliary programs to permit operation independent of the Track-While-Scan (TWS) programs. This version will be used to check and test program changes and modifications. NTWS-2A is written to operate with the new Master Control Program and is to be used only in conjunction with the TWS programs. NTWS-2 uses drum groups 1-9; NTWS-2A uses drum groups 1-6.

NTWS-2 was first prepared and successfully operated on September 25. NTWS-2A was prepared from NTWS-2 and was satisfactorily merged with the TWS Programs on September 30. NTWS-2A has been successfully operated during several simulated and actual flight tests during the past 10 days and, to the best of present knowledge, is error free and does not in any way conflict with the operation of the TWS programs. Several minor changes and modifications in both NTWS-2 and NTWS-2A have been made during the past week. As of October 13 the present version of NTWS-2A will be "frozen" and further improvements and modifications will not be made until after one or two months of operating experience have been gained.

The combined TWS and NTWS programs were operated during three flight-test periods this past week. These periods of operation were frequently interrupted by computer difficulties; as yet there has been no opportunity to conduct actual interceptions. The Identification and Weapons Assignment features of the programs have functioned quite successfully under actual operating conditions. Progress in checking the calibration and accuracy of the height-finder radars has been delayed because of the short periods of computer operation and the scarcity of sufficient tracks against which height finder reports could be correlated. With the elimination of computer difficulties and with modifications in the flight plans of the test aircraft, it is expected that both the interception and height-finding aspects of the programs will be successfully operated during the coming week.

During the three flight tests of the past week, the most noticeable difficulties affecting the operation of the NTWS programs have been:

- a. The system of assigning track numbers;
- b. The lack of sufficiently long tracks with which to make height finding and interception tests;
- c. The lack of sufficient radar data on interceptor-type aircraft.

1.14 Weapons Direction (Continued)

(D. R. Israel) (Continued) (CONFIDENTIAL)

The present track-numbering scheme does not sequence through all possible track numbers; rather it immediately reassigns the lower track numbers as they become available from dropped tracks. The Track-While-Scan Section now plans to make a change so that higher track numbers will be assigned before the lower numbers are reassigned; this change may not be made for several weeks. It is hoped that satisfactory radar data and suitable flight plans will improve the track situation. The difficulty in tracking the interceptors is one which probably can be ameliorated only through the use of beacon or IFF (Identification, Friend or Foe) returns.

During the flight tests of the past week, operation has been hindered because of delays in the installation of various telephone lines. Teleregister equipment has yet to be installed and the 5-inch Digital Information Display does not yet have sufficient brightness and clarity. The radio equipment has been installed and has operated without difficulty.

The system of Log and Summary Sheets described in the previous biweekly has been used with considerable success during the flight tests of the past week. Check lists for pre-test arrangements and preparations have been drawn up, and in all respects the preparations for and actual operation of Weapons Direction positions during the tests has been carried out smoothly and without confusion. Group 61 personnel have continued to monitor the operation of Air Force personnel who now man all but one of the Weapons Direction positions. Following another week or two of actual flight-test operation, it is felt that the Air Force personnel will be able to man and operate the Weapons Direction positions without the assistance of Group 61. Under present plans, only the Weapons Direction position of the Sub-sector Commander will continue to be manned by Group 61 personnel during tests and demonstrations.

With the completion of the programming for NTWS-2 and NTWS-2A, steps are now being taken to consolidate the results and experience of the recent work. Memos describing the facilities, operation, and use of the various Weapons Direction Programs are being prepared for distribution as M-notes. Work is presently under way towards the determining of the frequency of occurrence of various orders or groups of orders within the programs. It is felt that a considerable amount of useful data can be taken which may affect the computer orders and programming for XD-1 and the Transition System.

Procedures are presently being set up for the frequent review of the operation of the Weapons Direction program and equipment; suggestions, changes, revisions, or additions, are being accumulated for future incorporation into the programs. An inter-office memo describing these procedures has been prepared and issued to members of the Air Defense Center Operations Section.

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1.14 Weapons Direction (Continued)

(D. R. Israel) (Continued) (CONFIDENTIAL)

The use of the light guns at the Weapons Direction positions has been reviewed during the past two weeks and a decision has been reached whereby the mode of operation of the light guns at these operation positions will be simplified. The new mode of operation of the light guns is described in M-2451, "Use of Light Guns for Non-Track-While-Scan Positions," (D. R. Israel).

It has become evident during the simulation and flight-test activities of the past week that the facilities of the Flight Test Umpire (FTU) Room should be revised and improved. Certain changes in the room layout and external communication will be made. It now appears that this room should not be used for visitors and demonstrations, but should be devoted solely to FTU facilities.

Rough sketches of diagrams indicating the interaction between the personnel and equipment at various Weapons Direction positions and major elements of the computer programs are being prepared. It is expected that this material will be issued for the briefing of visitors during the forthcoming demonstrations.

(H. D. Benington) (CONFIDENTIAL)

The Light Gun Program in the Display Master Makeup program has been written so that only displays are called for by the light gun. In the case of the Intercept Directors, Anti-Aircraft Liaison Officer, Height Supervisor, Weapons Director, Combat Operations Officer, and Flight Test Umpire, use of the light gun on a track calls for a Digital Information Display on that track without any other setting of the switches. The Identification Officer receives an Expanded Display in the same manner.

Several other minor changes were made in the Display Master Makeup.

Cards were attached to all the Weapons Direction 5" scopes showing the information available on the DID's.

(M. I. Brand, A. W. Curby)

During this period the Identification programs were checked both with Weapons Direction and combined Weapons Direction-TWS programs. At this point the programs are for all intents and purposes checked out. Only a few minor corrections remain to be made.

An inter-office memo is being prepared which will recommend changes both logical and programming for inclusion in the ID Section during and after the ensuing three-month period.

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1.14 Weapons Direction (Continued)

(M. I. Brand, A. W. Curby) (Continued) (CONFIDENTIAL)

Work is progressing on a rewrite of the rough draft of the ID memo in conjunction with J. Degan.

Work is under way in conjunction with E. Farnsworth, M. Geraghty, S. Hauser, and J. Degan on the plans for use of IBM punched-card input of flight plans, Ground Observer Corps early warning, and cross-tell reports. This project is for work with respect to the Cape Cod System.

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

On Sept. 28 I visited General Electric at Syracuse with B. Widrow of Group 62 and P. Sebring of Group 24 to inspect the FPS-6 nodding-beam height finder. This trip will be reported on by Widrow, in a memo addressed to C. R. Wieser and N. H. Taylor.

Data on programming and computer-equipment needs for height finding is being collected and will be presented to Sebring for use in a proposal for automatic height finding in the Transition System. This is going slowly due to the load imposed by tests of the Cape Cod System.

Two height-finding (H-F) and one Anti-Aircraft (AAA) guidance exercises have been run on live data. Results have been totally inconclusive, due to failure to track the aircraft which are under Cape Cod control consistently.

In addition to the time spent at the Cape Cod Defense Center during the tests mentioned, some other time was spent there assisting at equipment check-out and simulated-data test periods. It is felt that considerable time will be spent in this manner until the H-F and AAA functions are operating smoothly and the Armed Forces personnel operating the stations are thoroughly familiar with their work.

(P. O. Cioffi) (CONFIDENTIAL)

The writing of the final-phase-intercept memo has been held up pending the clarification of certain objections raised with respect to the various features intended to be incorporated. In particular, the validity of a full lead-collision final-phase intercept was questioned on the basis of Airborne Intercept (AI) equipment characteristics.

A meeting with Capt. Bergeson and Cmmdr. Hilgedick of the Navy Liaison Office was instrumental in resolving the various questions and objections. The writing of the description of this type intercept is resumed.

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1.14 Weapons Direction (Continued)

(F. M. Garth) (CONFIDENTIAL)

In a computer try to run the final-turn program W. Lemnios and I have been working on, fairly successful results were noted except for a computation error. After a modification an additional attempt was made, but computer troubles prohibited any results.

Besides being on hand for the Cape Cod System tests, I have been working on climb curves to establish F-89C characteristics.

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

The rewrite of all the ID (Identification) programs is now complete. However, two minor improvements are being made. A count of each type of ID data, i.e., GOC (Ground Observer Corps) reports, cross tells, early warnings, and flight plans, will be made for the Summary Display Makeup Program. Also, when any of this ID data is outside the 160-mile range, and therefore can only be seen on the ID Contracted Display, an audible-alarm indication will be given.

The combined TWS-Weapons Direction programs have been recorded on magnetic tape. Similarly, the independent Weapons Direction programs had been recorded on magnetic tape, but a modification of the head of this particular unit has made this recording void. These Weapons Direction programs will be rerecorded as soon as possible.

(M. A. Geraghty) (CONFIDENTIAL)

Several simulated-data and two flight-test checks of the Height-Finding section of the Cape Cod programs have as yet revealed no serious deficiencies in the program.

(S. Hauser) (CONFIDENTIAL)

A study is being made of the manual inputs for the Transition System. The problem is to find the optimum system which combines use of IBM input equipment, efficient operation by non-skilled personnel, and reasonably simple programming.

(F. E. Heart) (CONFIDENTIAL)

I continued to assist in various revisions and tests of the Cape Cod Identification programs.

Additional time was spent preparing, testing, and revising record forms for the Weapons Direction section of the Cape Cod System. Some consideration was given to weather input and distribution.

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1.14 Weapons Direction (Continued)

(W. Z. Lemnios) (CONFIDENTIAL)

The final-turn program has been incorporated into the Interception Program, and tests are now being conducted with it.

Analyses are being carried out to obtain the climb characteristics of F-89C, F-86D, F-3D-1 and F-94C. These will be inserted in the Interception Program.

(L. Murray) (CONFIDENTIAL)

The major part of the past biweekly period has been spent helping the Air Force personnel with combined system operations.

A final form of flow diagrams for the Radio Operator and Intercept Director Digital Information Displays is now almost complete.

(J. F. Nolan) (CONFIDENTIAL)

Approximately 40% of the past biweekly period was spent in assisting in the testing of the present Cape Cod System.

The remainder of the time was spent in drawing a flow diagram of the operation of the Interception Program and in rewriting the combined Weapons Assigner Display Request programs for incorporation into the rewritten form of the Intercept Direction programs.

The Assignment Calculations and Display programs are performing correctly for both hostiles and flight-plan aircraft.

(G. Rawling) (CONFIDENTIAL)

Activity in the past biweekly period has been channeled into two phases:

Assistance in training Air Force personnel and testing height-finding techniques;

Coordination of preparation of edge-lit panels for control stations M, P, and Q in Room 222. Apparent agreement previously reached was premature. New panels are being drawn.

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1.14 Weapons Direction (Continued)

(F. A. Webster) (CONFIDENTIAL)

Most time has been spent at the Flight Test Umpire Assistant (FTUA) position, during tests; and in preparing maps for these tests.

The FTUA position permits monitoring many of the channels within the Combat Center. Though it is as yet too early to make an analysis of the messages and message-loadings on the various lines, an important source of message delays is evident. To make certain decisions, a serial set of messages is required — some of the events in the series involving appreciable delay. This situation uses a number of different lines in sequence and may cause communication bottlenecks unless the messages can be made routine and some of the events arranged in parallel.

(C. A. Zraket) (CONFIDENTIAL)

The final-turn interception subprogram has been written and tried once on the computer. Due to a programming error which resulted in an overflow, the program could not be checked out. The error has been corrected and the program will be run again as soon as possible.

A great deal of time has been spent during the past biweekly period preparing for and attending System flight tests of the Cape Cod System.

An inter-office memo describing the weapons-direction programs has been issued with D. Israel.

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1.15 Direction Center Operations

(R.N. Davis, P. Cioffi) (CONFIDENTIAL)

Live testing of the 1953 Cape Cod System was begun the last week of this period. Details of the flights are reported elsewhere. In spite of the many interruptions and delays to the test operations due to computer and other equipment malfunctioning, results are regarded as having been significantly good. Though little or no data on which to base an analysis of the System were recorded - or could have been reasonably expected to be recorded at this early time - the operational experience was effective in pointing out some of the major and minor defects and omissions of equipment installation and facilities at the Flight Test Umpire (FTU) position. These positional deficiencies along with other non-equipment criticisms - data forms, furniture arrangement, intra-Center liaison, etc. - are being discussed in the Flight Test Section of Group 61. It is expected that to remedy these deficiencies will greatly increase the usefulness of the FTU position to the Cape Cod Direction Center and will enable us to be of more assistance to P 10's operation, a good gesture for splendid cooperation and understanding.

(E.W. Wolf) (CONFIDENTIAL)

Beginning with this biweekly report an account of equipment failures encountered in the operation of the Cape Cod System will be given. This information will apply only to daytime operations and not to program-checking time. For the purpose of these reports, the total assigned time will be broken down into four categories, as follows:

- a) Periods during which all operations can be carried out as planned and on schedule will be designated as Unrestricted Operating Time.
- b) Periods during which all operations cannot be carried out as planned or on schedule, without, however, necessitating a shut-down of the entire system, will be designated as Limited Operating Time.
- c) Periods during which all operations are suspended as the result of equipment failure will be designated as Down Time.
- d) The periods (following any Down Time) required to restore operations to conditions existing before operations were interrupted will be designated as Recovery Time.

The time lost due to various types of equipment failures will be classified as follows:

- a) Computer, including auxiliary drum and magnetic tape,
- b) Room 222 (scopes, light guns, push buttons, etc.),

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1.15 Direction Center Operations (Continued)

(E.W. Wolf) (Continued) (CONFIDENTIAL)

- c) Radar Data and Input (mappers, radars, MITE), and
- d) Miscellaneous (aircraft, radio link, etc.).

It should be noted that the total of the time lost due to the various equipment failures may exceed the total assigned time since more than one piece of equipment may be defective at any one time.

For the period from Sept. 29 through Oct. 8 equipment failures affected System operations as follows:

Assigned Time for System Opn.	23.0 hours	100.0 per cent
Unrestricted Operating Time	1.0	4.3
Limited Operating Time	9.7	42.4
Down Time	11.1	48.2
Recovery Time	1.2	5.1

Time Lost	Limited Operation	Down Time
Computer	0 hours	9.6 hours
Room 222	14.0	1.0
Radar and Input	13.8	0
Misc.	3.0	0

(A. Hill, P. Dolan, P. Cioffi, R. Davis) (CONFIDENTIAL)

The following table is a summary of the extent of the flight-test schedule for this period. The number of aircraft shown include the reserving of jets as interceptors. Because of the many interruptions to the tests (due to computer, etc.) and the sporadic tracking experienced, only a few intercepts were undertaken, and the jets were used for a small portion of the scheduled time.

Details of the tests are available from the Flight Test Section of Group 61.

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SECURITY INFORMATION



APPROVED FOR PUBLIC RELEASE. CASE 06-1104.

DATE	TIME	SCHEDULED TEST		TEST ACTUALLY RUN		REASONS FOR CHANGES OR COMMENTS
		A/C	Description	A/C	Description	
10/2	1000-1200	4	Tracking and Coverage	3	held with 3 aircraft	one F3D aborted - mechanical
10/6	1300-1600	9	Tracking, Coverage, and Calibration	0	Cancelled	Weather
10/7	0900-1200	8	Tracking, Coverage, and Calibration	0	Cancelled	Weather
	1300-1600	12	Tracking, Coverage, and Calibration	10	held with 10 aircraft	two aircraft aborted - mechanical
10/8	0900-1200	10	Tracking, Coverage, and Calibration	0	Cancelled	preparing for p.m. test
	1300-1600	10	Tracking, Coverage, and Calibration	10	Operations Plan 2	
10/9	1200-1600	12	Tracking, Coverage, and Calibration	12	Operations Plan 2	

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

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\* Added to schedule during week of test

1.15 Direction Center Operations (Continued)

(M. Brand) (CONFIDENTIAL)

The following is a summary of Group 61 computer activities for the last biweekly period.

Weapons Direction	6 hr. 10 min.
TWS	17 hr. 10 min.
TWS-Weapons Direction	16 hr. 35 min.
Tracking Control	5 hr. 35 min.
B. Morriss	5 hr. 0 min.
Math Group	1 hr. 30 min.
Computer Out	17 hr. 0 min.
Not Used	6 hr. 0 min.
	<hr/>
Total Assigned Time	75 hr. 0 min.

1.16 AN/FSQ-7 XD-1 Support

(D.R. Israel) (CONFIDENTIAL)

Work on the preparation of floor plans and layout for the basement of Building A has been suspended pending a decision on the size of the system to be associated with the installation and a decision regarding the amount of space to be made available for operating areas.

(E.S. Rich) (CONFIDENTIAL)

A series of bench tests for the new Radar Mappers designed by IBM have been worked out at the request of J. Jacobs of Group 62. These tests are designed to simulate many of the dynamic conditions under which these Mappers must work and to provide data on which to judge their performance.

(H.D. Benington) (CONFIDENTIAL)

Conferences were held with several people in Group 62 concerning the displays. Familiarization with their work is well under way. I attended Project Grind meeting on radar switching and cross telling.

(B.G. Farley) (CONFIDENTIAL)

In cooperation with W.A. Clark an improved design of flip-flop register light indicators has been designed, and an experimental model is being built for trial on MTC.

Some time has been spent on cross-talk problems on MTC caused by capacity between wires of cables added during recent changes.

~~CONFIDENTIAL~~

SECURITY INFORMATION

1.16 AN/FSQ-7 XD-1 Support (Continued)

(M.A. Geraghty) (CONFIDENTIAL)

Some time has been devoted to attempting an estimate of input requirements for XD-1. In this connection, meetings have been held with Hauser, Brand, and Farnsworth on proposed methods of flight-plan input via the Buffer Drum to the Cape Cod System.

(C. Grandy) (CONFIDENTIAL)

Preliminary results of the study of space requirements and floor plans of the basement of Building A indicate the desirability of obtaining additional space for the XD-1 installation. A decision on the availability of more room is pending; work on the floor plans has been awaiting this decision.

Several conferences have been held with B.F. Green of Group 38 concerning the mechanical design of the XD-1 Display Console. A wooden model is being constructed so that an actual study of such things as scope height and slant, location of auxiliary scopes, location of switch panels, location of indicator lights, etc., can be made. This model will be available early in the next biweekly period.

1.17 Associated Studies

(W. Wells, B. Smulowicz)

The entry for this section appears in M-2458 (SECRET).

~~CONFIDENTIAL~~

SECURITY INFORMATION

1.2 Group 64

(S. H. Dodd) (CONFIDENTIAL)

Core Memory operation has greatly improved during the past two weeks as a result of circuit changes. Moving the Core Memory to its new position and tying it in with the permanent control should permit a further improvement of operation, particularly with a more comprehensive marginal-checking system.

Operation of the Room 222 defense center has continued to improve. At the moment, there are three main equipment difficulties which cause difficulty in operation:

1. The display-system deflection has been noisy probably due to bounce in the +90-v supply. This bounce probably has been aggravated recently by the consolidation of Walquist's and Israel's programs which may operate at such a repetitious rate as to increase the +90-v bounce.
2. Difficulties with the magnetic-tape system have interrupted operation a number of times. Group 61 is now using the magnetic-tape system much more frequently than before and depending upon good magnetic-tape reliability.
3. The auxiliary drum has been causing intermittent trouble. The in-out delay count has been doubled to insure adequate time for the field-switching relays to operate. There still seems to be some intermittent trouble in Digit 12 which has not yet been eliminated.

1.21 WWI System OperationCore Memory

(N. L. Daggett) (UNCLASSIFIED)

On October 6, the Core Memory ended a six-day stretch without any parity alarms. Since that time there have been several failures in Bank B. Bank A, the new core bank, has still given no failures since the 6th. It appears that the higher delta noise encountered with the old (Bank B) cores makes this bank more susceptible to power transients.

(L. L. Holmes, A. J. Roberts) (UNCLASSIFIED)

We have continued to remove or reroute the power wiring and video cabling in the EX1 - EX8 area. The work was completed on October 10. The racks and wireways in this region will be dismantled and removed during the forthcoming biweekly period. This will allow us to locate Core Memory in that section of the room.

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SECURITY INFORMATION

1.21 WWI System Operation (Continued)Core Memory

(L. L. Holmes, A. J. Roberts) (Continued) (UNCLASSIFIED)

Air-conditioning plans for the Core Memory equipment have been completed and should be placed into effect within two weeks.

Rack EO has been stripped of ES equipment, cabling, etc. Core Memory Control will be installed in this rack by the end of the installation day of October 19.

Considerable effort has been applied to produce a good marginal-checking system for Core Memory Control. The system will be placed in service when the equipment is mounted in Rack EO.

Auxiliary Magnetic-Drum System

(H. L. Ziegler) (UNCLASSIFIED)

A test setup has been devised to display on a scope the operate and release times of group-selector relays under test. Preliminary results are not overly encouraging; operate and/or release times ranged up to 24 milliseconds on the first chassis (Type 9) tested. Careful adjustment improved some of these times but not to the extent hoped for. Also, there appeared to be some thermal effects involved; operation of relays was considerably poorer immediately after the chassis was turned on as compared to operation after a warm-up period.

It seems both desirable and practical to use the present Parity Register and its auxiliary to perform a parity check on the magnetic drums. A proposal to this effect has been drawn up and submitted to interested parties. As yet no action has been taken on this proposal.

(K. E. McVicar) (UNCLASSIFIED)

The problem of sluggish relay operation in the group-selection system has been attacked via two routes. The first (and so far not very successful) alternative was to attempt to increase the relay operate speed. The second approach has been to increase the relay setup time counted by the In-Out Delay Counter.

There is reason to suspect that the auxiliary drum is occasionally making an error in a single digit and a single register. The error is permanent rather than transient, i.e. the drum surface has been altered. The digit and register in error seem to vary and are not confined to any particular group.



1.21 WWI System Operation (Continued)

Auxiliary Magnetic-Drum System

(K. E. McVicar) (Continued) (UNCLASSIFIED)

The replacement for the auxiliary drum has arrived. It will be installed and tested as soon as it can be determined that the new heads are satisfactory on the buffer drum, the heads being similar to those used on the replacement auxiliary drum.

Tests on the auxiliary drum with an interlace of 4 have been run, and marginal checking of the drum circuits indicates that satisfactory operation can be expected. Permanent change of the interlace will await elimination of the errors mentioned above to avoid confusion which might result from piling the troubles one upon the other.

Work on the logic for a drum parity check is in progress. In the meantime we are starting construction of the elements in the drum required for a parity system.

Typewriter and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

The past two weeks have been spent on routine overhaul of our Flexo-writers. During the next few weeks we plan to concentrate on overhauling several more.

1.22 Terminal Equipment

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

Means of marginal checking the equipment in the control room without requiring the action of operators to throw switches and observe displays are being investigated. It is hoped that the addition of a few relays operating upon the bias voltages of the switches will permit the computer to simulate the operation of the switches. Further, we hope to be able to use the light gun in its next position to indicate the presence of displays on its scope, thus closing the loop back to the computer and allowing the use of programmed marginal checking.

The problem of panel illumination in the control room has been reviewed with an eye to devising a system that would not require the modification or removal of any equipment now installed. We have arrived at a solution that appears to fit the bill, and a prototype will be assembled and tried out in a few days.

A panel has been designed and installed on one of the 16" display scopes to permit expansion and off centering. A five-position switch permits the operator to select normal operation or to look at any one of the four quadrants.

1.22 Terminal Equipment (Continued)

(R. H. Gould) (UNCLASSIFIED)

The new display system operates correctly but satisfactory operation of the light cannon and light guns has not yet been achieved. The phototube circuits are the weak, unreliable link. Experimental work toward improved circuitry is being done.

Large "jumps" noticed recently on the display scopes seem to be caused by noise on the +90-v supply to the decoder output amplifiers. A display program that utilized the real-time clock might synchronize itself with the power-supply ripple and cause a display point to appear in either of two places rather than at random within a given area. A "stiff," "smooth" source of +90 volts is needed.

Another digit has been added in a temporary fashion between digits 1 and 2 of the IODC in order to get a greater than 16- $\mu$ sec delay for the drum-change-group relay switching. A more permanent installation will be made when time permits.

Another high-voltage power supply for a 16-inch display scope caught fire, probably because the voltage was accidentally turned to maximum and left there. All high-voltage power-supply voltages will be checked frequently to prevent further trouble.

Marginal Checking

(T. Sandy) (UNCLASSIFIED)

A new prototype holder for the light guns on the WWI 16" display scopes, Mod.II, is being made in the shop. When placed in this holder, the light gun always looks at the same point on the scope face. This can be used to check deflection of the 16" display scopes.

(S. B. Ginsburg) (UNCLASSIFIED)

A holding and driving circuit for display-switch bias control was designed and breadboard tested. This circuit will be used for programmed marginal checking of the display circuits and insertion registers. The circuit is now in drafting.

Panel Lighting

(S. B. Ginsburg) (UNCLASSIFIED)

A prototype of the circuit and panel to be used for controlling the lighting of switch designations on the consoles in Room 222 is being constructed in the shop.

1.22 Terminal Equipment (Continued)MITE

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

The "MITE for Buffer Drum" in L-8 has been dynamically checked with the buffer drum, successfully using Forgie's T-3182 to record all zero's, all one's as well as all counts up to 256 in alternate registers around the drum.

Marginal-checking lines for the new MITE have been installed and permanent cables have been ordered. "Sense Record" synchronizers have been installed and are in use; "Group Record" synchronizers, not yet in use, have been installed. MITE Control Auxiliary has been installed and is in use. Some mixer panels have been installed for mixing information from the new MITE's before sending the information to the drum; more mixers will be installed with the installation of additional new MITE's.

A modification has been ordered for all existing GT-BA's; this provides for limiting as well as improved waveform of the output while still retaining the ungated input. Further tests are being run on BA-BA's in an attempt to retain limiting, as in the GT-BA's, and still improve the gain.

Buffer-Drum System

(K. E. McVicar) (UNCLASSIFIED)

The buffer-storage section of the buffer drum has been run successfully with the one MITE which has been installed in Room 156. Marginal checking of the auxiliary-storage section of the buffer drum revealed that the margins were about the same as those on the auxiliary system except for the reading amplifiers. The low margins on the reading amplifiers are attributed to the setting of the heads.

A representative is on his way from ERA to help reset the heads on the buffer drum and to help with the installation and checking of the replacement auxiliary drum.

(P. W. Stephan) (UNCLASSIFIED)

I have revised several drum test programs to provide flexibility and to allow them to be used for buffer drum.

I am now working on parity check for the magnetic drums.

1.22 Terminal Equipment (Continued)

Ferranti PETR

(F. E. Irish) (UNCLASSIFIED)

A clutch-brake driver for the Ferranti PETR has been constructed. Using this circuit along with a test-equipment setup, the new PETR has been operated in what is essentially a line-by-line mode.

The maximum speed of the paper tape when used in this reader is 25 inches of tape or 250 Flexowriter characters per second. If the brake is applied while the unit is operating at this speed, the tape will stop its motion in from 0.5 to 1.0 milliseconds. Starting takes from 0.75 to 1.25 milliseconds.

A design for the information-channel amplifiers to be used in this reader is being developed. Roughly speaking, each channel amplifier will consist of a phototube, followed by a single triode amplifier stage and a cathode-follower output.

Magnetic Tape

(E. P. Farnsworth) (UNCLASSIFIED)

Minnesota Mining Co. has supplied us with several reels of high-output green tape on the Scotch acetate base for trial. We have installed one of these reels on unit 3B to check for the twisting action which developed in the first production batch. This tape was broken, apparently through mishandling, less than 12 hours after installation, reemphasizing the importance of the mylar base. 3M is still trying to get 1.5-mil mylar in 1200-foot lengths from Dupont.

During this period, three Raytheon read/record heads become marginal due to mechanical wear, and one failed due to insulation breakdown. Replacement of these heads necessitated rerecording of the "permanently" recorded data on units 0 and 1, much to the consternation of individuals who had assumed greater permanence in magnetic tape than is attributed to punched paper tape, in spite of the possibilities of tape damage due to mishandling, accidental erasure (except on unit 0 which is locked in "read"), head failures, etc.

1.23 Records of Operation

(F. J. Eramo) (UNCLASSIFIED)

The following is an estimate by the computer operators of the usable percentage of assigned operation time and the number of computer errors for the period September 25 - October 8, 1953:

Number of assigned hours	128
Usable percentage of assigned time	89
Usable percentage of assigned time since March, 1951	85
Number of transient errors	5
Number of steady-state errors	5
Number of intermittent errors	8

1.23 Records of Operation (Continued)

Component Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following failures of electrical components have been reported since September 25, 1953:

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Capacitors</u>			
220 $\mu$ f, +10% mica capacitor	1	0 - 1000	Shorted
220-ohm, 1-watt carbon resistor, 10%	1	6000 - 7000	Burned out
<u>Crystals</u>			
1N34A	6	6000 - 7000	Low R <sub>b</sub>
<u>Tubes</u>			
6BL7	2	0 - 1000	1-Mechanical failure 1-Short
	1	1000 - 2000	Short
6CD6	1	0 - 1000	Accidental damage
SR-1407	1	6000 - 7000	Broken envelope
3E29	1	7000 - 8000	Low I <sub>b</sub>
6Y6G	1	20000 - 21000	Short
8008	1	0 - 1000	Open filament
7AK7	1	0 - 1000	Short
	2	2000 - 3000	1-Short, 1-low I <sub>b</sub>
	1	12000 - 13000	Short
	1	19000 - 20000	Short
7AD7	1	1000 - 2000	Short
	1	10000 - 11000	Short
	2	12000 - 13000	Short
	1	19000 - 20000	Short
	1	15000 - 16000	Leakage
715B	12	0 - 1000	2-Short, 5-leakage, 1-grid emission, 1-low I <sub>b</sub> , 1-open filament, 2-grid emission and leakage



1.23 Records of Operation (Continued)

Component Failures in WWI

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

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Tubes</u> (Continued)			
6145	15	0 - 1000	11-Short, 1-open cathode, 2-grid emission, 1-plate-shield short
	5	1000 - 2000	2-Low I <sub>b</sub> , 3-short
	1	2000 - 3000	Short
	1	3000 - 4000	Grid emission
	2	10000 - 11000	1-Grid emission, 1-Low I <sub>b</sub>
6080	50	1000 - 2000	49-Short, 1-broken key
	6	0 - 1000	3-Short, 2-cracked header, 1-broken base
5965	1	1000 - 2000	Low I <sub>b</sub>

1.24 General

D-C Power Supplies

(S. T. Coffin) (UNCLASSIFIED)

Work is completed on the 250-v, 50-amp regulated d-c supply, which will be installed in WWI on October 19. The old 250-v WWI supply will be redesigned for the Whittemore lab supply.

Equipment Conditioning WWI

(R. E. Garrett) (UNCLASSIFIED)

The air-handling unit has been installed in Room 026. The duct work, freon piping, and compressor-overhaul phases are nearly complete. It is expected that this system will be tested and "debugged" within the next biweekly period.

The maintenance program mentioned in the last biweekly has been proceeding with the inventory of spare parts being brought up to standard.

1.3 Group 65

1.31 Storage Tubes

(P. Youtz) (UNCLASSIFIED)

Further storage-tube production was stopped at the end of this biweekly period. Components have been stowed properly, so that production could be started again in the event of an emergency.

The filtered-air room adjoining the chemistry room has been turned over to J. C. Proctor for reassignment. We are removing most of our materials from the storage area in the Whittemore Building and shipping them to Fort Heath. This area will be available for reassignment on October 30.

All storage tubes and research tubes that could not be used in WWI will be destroyed during the next biweekly period.

The next biweekly period is the scheduled vacation period for most of the Group. Those few persons who have taken a vacation will do maintenance work during this period. Lou Martin has been transferred to Group 62; Marlene Wise will be transferred to the Food Technology Lab; Roy Hegler has been terminated.

During this past period considerable laboratory work was done for Group 25. Trips were made with Group 62 to the West Coast to study the work on the Charactron tube and Hughes Storage Tube. A trip was made to Chicago with Group 25 to study "Internal Electrostatic Deflection Yokes" at Motorola's Research Department.

The conventional electrostatic system has two centers of deflection, because it uses two crossed pairs of plates. The new system proposed by Motorola performs the biaxial deflections simultaneously and has only one center of deflection for all rays. This system may improve the Charactron and Hughes Storage Tube.

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

During the past biweekly period four storage tubes were constructed. Storage-tube production ended on October 5, 1953, with ST893.

At the request of Group 25 we constructed a hydrogen-muffle furnace incorporating the safety features recommended by Mark Dondero, MIT safety engineer. The furnace successfully produced the specified temperature gradient and is available for experiment.

Other experiments for Group 25 included high-vacuum sublimation of zinc sulphide and construction of a Charactron prototype.

This week our area and equipment were prepared for vacation shutdown. The filtered-air room has been cleared and is ready for reassignment to another group by J. C. Proctor.

1.31 Storage Tubes (Continued)

(T. F. Clough) (UNCLASSIFIED)

During the past biweekly period we processed five 800-series storage tubes. We completed our storage-tube program with ST893.

We constructed three research tubes for H. B. Frost's cathode studies, one Charactron tube, and one experimental evaporation tube, ELX 14, for Group 25.

1.32 Test

Television Demonstrator

(A. Zacharias) (UNCLASSIFIED)

During this past biweekly period three tubes, ST885, ST887, and ST888, were tested at the TVD. All were satisfactory.

Destruction of all storage tubes that cannot be used in WWI has been started.

Storage Tube Reliability Tester

(L. E. Martin, R. E. Hegler) (UNCLASSIFIED)

One storage tube was tested at the STRT during this period and found satisfactory.

1.34 General

(R. E. Hegler) (UNCLASSIFIED)

This period terminates my employment at MIT. Starting October 12, I will be in the Field Service Division of the Sperry Gyroscope Company.

## SECTION II AN/FSQ-7

2.1 Group 62Summary and Activities of Group 62

(N. H. Taylor) (CONFIDENTIAL)

Group 62 activity has intensified in the area of display and magnetic drums. A 19" Charactron tube is being set up in the MTC area; it is expected that demonstration of its operation under the control of the MTC computer will be possible within the next two or three weeks. An IBM magnetic drum will be shipped to Cambridge within the next two weeks, and plans are well along for its installation and test with the MTC system.

A trip to Convair and Hughes during the last biweekly period has given us a very realistic picture of problems and potentialities associated with the use of the Charactron for display. A rather complete description of this trip is covered in M-2466, "Summary of West Coast Visit," by C. L. Corderman.

IBM activity is at a high level in all phases of the project. Purchase specifications of five or six items have been written, and plans to complete these specifications by October 20 are putting considerable pressure on several members of the Standards Group.

IBM has subcontracted the design and construction of the d-c power supply to the General Electric Company in Lynn.

Magnetic-core shifting registers are also about ready for subcontracting and at present it looks as if Raytheon will be chosen to do the final engineering and packaging of this item.

A survey of the tube count in the XD-1 machine indicates that magnetic drums are calling for a large percentage of the tubes in the system. A review of the logic of this portion of the job has been initiated and a serious effort to reduce the tube count here will be made.

IBM has been requested to look into the feasibility of providing plated drums of twice the present diameter.

Ken Olsen has transferred his center of activities to the Poughkeepsie area and will be our second resident engineer on the IBM premises.

Three engineers have been added to the study of outputs under the direction of J. Jacobs. It is hoped that these men (in conjunction with J. Arnow of Group 61) will form specifications for the output system by February 1.

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SECURITY INFORMATION

## 2.12 Magnetic-Core Memory

### AN/FSQ-7 Digit-Plane Driver

(W. J. Canty) (RESTRICTED)

This circuit should be ready shortly for approval and inclusion in the Military Reference Data Book. I am now compiling all the data necessary for this step.

### Core Memory, Mod. II, Address Decoder

(W. J. Canty, R. S. DiNolfo) (UNCLASSIFIED)

The breadboard of this circuit has been tried and found to work successfully.

### Switch Cores

(A. D. Hughes) (UNCLASSIFIED)

Using the samples available, i.e., metallic cores which were originally made for memory-core application, an attempt is being made to determine the relation between core geometry and the devised equivalent circuit for a switch core. The equivalent circuit is essentially a current source, resistance, and inductance in parallel. An attempt is being made to find a relationship for metallic cores between these equivalent elements and tape thickness, inside diameter and number of wraps.

### 64 x 64 x 19 Memory

(E. A. Guditz) (UNCLASSIFIED)

Two sample 64 x 64 memory planes have been completed. Six of the 19 planes for the Core Memory, Mod. II, are partially completed.

Material for two sample 64 x 64 planes has been delivered to IBM for construction by personnel at Plant No. 2. These planes will be returned when completed and will be inspected by our inspection department.

## 2.13 Vacuum-Tube Circuits

### Delay-Line Circuits

(J. S. Gillette) (UNCLASSIFIED)

Circuits for driving various lengths of delay lines have been tried and seem to work quite well. The problem of noise and line reflections is



2.13 Vacuum-Tube Circuits (Continued)

(J. S. Gillette) (Continued) (UNCLASSIFIED)

practically nonexistent. I am going to IBM Oct. 13 to discuss these circuits.

Sense Amplifier

(C. A. Laspina) (UNCLASSIFIED)

A new stabilizing circuit for the feedback portion of the sense amplifier was designed and incorporated in the unit. The new circuit will provide higher loop gain at the high end of the pass band, thereby increasing gain stability in that region.

Gate-Tube Investigation

(C. A. Laspina) (UNCLASSIFIED)

Characteristics of the 7AK7 gate tube were taken for various control-grid voltages and currents with the screen and suppressor voltages as parameters. It was found that the 7AK7 makes an excellent pentode with the suppressor at +10 and the screen at 90 to 150 volts. With 150 on the screen, an increase of 90% in plate current is available over the +90-v screen connection, but the plate resistance is not as high.

Drum Circuitry

(H. E. Anderson) (UNCLASSIFIED)

A breadboard model of the IBM circuits associated with the timing tracks has been built and tested. Performance is about as expected. This is the circuit which makes the 0.1- $\mu$ sec timing pulses for the drum.

Testing of the plated surface of the drum for MTC continues at Poughkeepsie. It is hoped that the drum will be brought here in the near future.

Several schemes for write switching have been proposed and are now under consideration.

2.13 Vacuum-Tube Circuits (Continued)Pulse Transformers

(E. Gates) (UNCLASSIFIED)

The design of a transformer for driving MTC Memory is finished except for deciding on one of two cores. It will be more desirable to use a die size F-415 but this may be difficult to wind because of the small inside diameter and thick cross section. Several manufacturers have been contacted, and a final decision will be made next week.

Register Driver

(S. Bradspies) (UNCLASSIFIED)

It has been found that if 100 feet of 93-ohm cable is connected between the gate tube and the Register Driver (RD), neither the Register Driver output-pulse heights or shapes are affected. The output saturates at 31 volts - the crossover points are 13 and 31. If two RD's are driven, the crossovers are at 15 and 27. Between crossover points, the gain is greater than unity. This data is with the line of driven gate tubes whose suppressors are at ground.

When the GT suppressors are at -30 volts, the crossover points when driving 1 RD are 10.5 and 28.5; when driving 2 RD's, 12 and 27.5. Voltages at the last grid of the GT line are about 3 or 4 volts below these values.

When driving only 8 gate tubes, the crossover points are 10 and above 40 volts, for suppressors at 0 or -30, at the first or last grid.

One serious difficulty has been encountered: this is diode current, which is excessive. This diode is used for damping at the RD grid. If 100 ohms is placed in series with it, the current is 170 ma. If this resistance is further increased, the pulse shape is ruined by ringing.

Various input transformers have been tested for the RD. The best found so far are the tight coupled, which are better than loose coupled. The 11:33 stepup has proven superior to the 9:27. It is intended that tightly coupled 10:20 and 10:25 shall be tried to see if they are better.

2.14 Memory Test Computer

General

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

Five of the 8 MTC power supplies were put into operation replacing the Whittemore units. The MTC Alternator was connected, and the load was measured as 23.5 kw. It will be noted that this does not include the drum, magnetic-core memory, and assorted input and output equipment which will be added to the MTC system.

Louis Sutro is now working part time with MTC.

Construction and testing of circuitry for the drum and Charactron investigations were continued.

Drum Circuits

(H. Boyd) (UNCLASSIFIED)

The Angular Position Counter (APC) unit, consisting of the Mod. II HSFF and Mod. II GT, was extended to 17 digits and tested. The results are:

Maximum PRF (20-40 volt input)	4 mc
GT delay per stage	0.022 $\mu$ sec
FF margins (input:30-v at 2mc-all FF's)	+44, -49
GT margins ( " " " -all GT's)	>+50, -24
Indicators good to 4 mc for marginal checking	
FF margins (tubes 70% down)	+44, -1.5
(Failure located by indicator lights)	

The APC-DAR Coincidence Detector (CD), designed and built during the last biweekly period, was tested and found to perform very satisfactorily. Built-in delays are sufficient to eliminate the need for delay units. The HSFF margins are not changed by the addition of the CD to its outputs. A special panel layout to house the CD and the inverter and gate that are required was sent to the shop for construction.

Harlan Anderson and I will spend the next week at IBM to become more familiar with the drum and associated equipment.

General Circuitry

(J. Crane) (UNCLASSIFIED)

A study was made of plugboard storage and toggle-switch storage. Certain lines connecting these units proved to be critical because of inter-capacitance, so a better physical arrangement will be made.

The Charactron Decoder for MTC was installed, and preliminary checks were made.

2.14 Memory Test Computer (Continued)MTC Power Supplies

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

During this period the following power supplies were completed and are now operating favorably with the computer:

-150 v, 13 amp  
-300 v, 4 amp  
+150 v, 12 amp  
+250 v, 2.5 amp  
+90 v, 1.5 amp

Work is continuing in an effort to complete the remaining supplies shortly.

MTC Alternator

(R. Jahn) (UNCLASSIFIED)

The MTC Alternator has been successfully operated with the computer. A temporary control circuit which bypasses the third-floor controls is now in use. It will provide over and under voltage protection until the permanent system can be completely checked.

Computer Operation

(R. Hughes) (UNCLASSIFIED)

Preliminary tests were made on the Angular Position Counter during the past biweekly period; the margins on this register look good. A more extensive test will be made on it when it is wired in final form.

The following MTC supplies are now feeding power to the computer: -300, -150, +150, +250, and +90. Since they were connected the number of transient errors has been considerably less.

2.15 Equipment Design and Schedules

(W. Ayer) (UNCLASSIFIED)

Operation Shoe Horn, involving the layout of the basement of Bldg. A in Lexington, continued throughout the last two weeks. Unfortunately the tendency of the frames of the computer to increase in length has continued to exert itself. Both the Right Arithmetic Element and the Left Arithmetic Element increased by 9 feet over Columbus Day, while the control section attained a total length of 67.5 feet. Tentative floor plans will be kept up to date so that decisions may be made as soon as the dust settles.

2.15 Equipment Design and Schedules (Continued)

(W. Ayer) (Continued) (UNCLASSIFIED)

Some of the remaining difficulties at Bldg. A have been resolved by moving the power supplies and air-handling equipment out of the basement, either into other basements or to a special building adjacent to Bldg. A. Several methods of getting the air ducts into the proper areas are under study by Francis Associates. The magnitude of the problem may be judged from the fact that a duct at least 5 x 8 feet will be needed to supply air to the computer and drum room and another duct of equal size will be necessary to exhaust this air from the room.

Most of last week was spent at IBM clearing up some difficulties in the pluggable-unit design. A layout that will satisfy the requirements of the cooling people and still retain the necessary rigidity has not been easy to achieve. In addition, the possible use of a T-12 envelope has still not been resolved.

(J. D. Bassett) (UNCLASSIFIED)

A visit was made to High Street during the week of October 26 for a joint IBM-Div. 2-Div. 6 meeting to discuss the video-demodulator circuits. Areas of agreement were wide, and progress on this subject should be rapid in the future.

H. Hagopian of the IBM standards group has sent us copies of proposed mechanical-components standards sheets; applications data on these components will be forthcoming soon for entry in the Military Reference Data Book.

More attention from this office will be focused upon the output-display activity (console) in the near future in an attempt to keep pace with the transfer of this effort to the IBM Vestal Lab in Endicott and to render assistance where possible.

Military Reference Data Book

(J. Giordano) (UNCLASSIFIED)

MRD books for AN/FSQ-7 will arrive from IBM next week and will be distributed upon arrival. For further information please contact the writer (ext. 3463).



## 2.16 Transistors

### Transistor Accumulator

(D. J. Eckl) (UNCLASSIFIED)

The recent modifications made to the transistor circuits seem to have improved margins. In particular the high collector voltage for the flip-flop now has an allowable variation of  $+30$  volts compared to the approximately  $+10$  volts previously permitted.

Problems with control have prevented a careful evaluation of the margins. An attempt is being made to substitute Whirlwind plug-in units for some of the less reliable sections of the control.

### Transistor Gates

(C. T. Kirk) (UNCLASSIFIED)

The transistor gate described in the previous biweekly was found to operate marginally at best. The inherent stray capacity associated with the pulse transformer and the large (relatively) amount of power required to switch the emitter load are the reasons for this.

Investigation of the gate problem is being continued.

### Transistor Core Drivers

(S. Oken) (UNCLASSIFIED)

The problem of stabilizing the output from the driver with different transistors is being investigated. Bell, GE, and RCA transistors with wide variations in parameters have been tested in the circuit. The output-pulse width varies appreciably with different transistors. After these transistors have been tested in the delay-line type driver, the compensation needed to stabilize the output will be studied.

Another type of driver which employs a switch core as the energy-storage element has been investigated. This does not work well yet. Theoretically it should provide a stabilized output because the valley point of the transistor "N" curve is not used to determine the width of the pulse.

### Junction Flip-Flop

(E. U. Cohler) (UNCLASSIFIED)

Work is progressing on the analysis of the junction flip-flop. The present state of the analysis agrees in the main with the work of

2.16 Transistors (Continued)

(E. U. Cohler) (Continued) (UNCLASSIFIED)

at Lincoln. However, there seems to be some disagreement when it comes to applying the equations to design of a flip-flop. This is due, evidently, to some erroneous assumptions as to the importance of certain parameters on Baker's part. A short note on this design procedure will appear presently.

Transistor Counter

(E. U. Cohler) (UNCLASSIFIED)

The note on the  $2^5$  counter is ready, and the reliability tests are proceeding. The standard counter to be used is to be made up of flip-flops and gates. It was thought that some other simpler system could be devised, but an investigation of the matter revealed that the present setup is the only one which would be reliable, thorough, and flexible.

Hole Storage

(E. U. Cohler) (UNCLASSIFIED)

Some thought has been given to the past work done on "hole storage" in transistors. A mathematical model has been worked out, but at present needs some modification to fit all the experimental results. In addition, new data will be taken to see if some of the aspects of the model can be verified.

A transient analysis of the point-contact flip-flop is being made in some detail.

Minority Carrier Storage

(N. T. Jones) (UNCLASSIFIED)

A sample of Transitron  $S_4$  silicon bonded diodes was tested for Hunter of Transitron. These diodes exhibited very little storage but had high forward resistance. Back resistance in silicon diodes is phenomenal — measured in tens of megohms — but the back voltage ratings are quite low.

The present plan is to set up a standard reverse-recovery-measurement and recording scheme. This will soon be outlined in a report.

2.17 Display

(C. L. Corderman) (CONFIDENTIAL)

All units needed for testing Charactron tubes with MTC have been completed. Exhaustive tests covering intensification times, light output, and registration will be in progress for the next few weeks. An attempt will be made to get a display similar to the planned track-situation display with the 64 registers of MTC. Units for a second console are being constructed so that the two may be operated in parallel as in the proposed system. Various aspects of both digital and analogue expansion will also be checked.

A summary of the recent visit to Convair and Hughes Aircraft Co. is available in M-2446, "Summary of West Coast Visit," C. L. Corderman.

(M. Epstein) (CONFIDENTIAL)

This past period was spent in an examination of the drum space and console requirements of the proposed system to see if our present allowances are adequate for digital display. This was done with assistance from Group 61. I hope to get a tentative approval of drum-space allocation in the next biweekly period.

(R. von Buelow) (CONFIDENTIAL)

Numerous rearrangements of the Charactron matrix for both digital information display and track situation display have been made. Latest versions are available as drawings A-56522-1 and A-56559.

Discussions with Group 61 personnel have continued. Some of their opinions are reflected in M-2453 which will be available shortly.

Discussions with D. C. Ross and R. Butler of IBM led to a number of decisions with regard to display. They are:

1. A block of track numbers can be preassigned to interceptors.
2. There will be a category of proposed interceptors.
3. Flight plans will have identity F and status P.
4. Raid number will be displayed at intercept points.
5. Forced displays are always bright.
6. Requested displays may be bright or dim.
7. Categories may be bright or dim.
8. There will be 4 sets of feature switches per console.
9. A square will be used to encircle attention points or forced displays.

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SECURITY INFORMATION

2.17 Display (Continued)

(R. von Buelow) (Continued) (CONFIDENTIAL)

To augment the track-situation display, use will be made of fictitious tracks. These tracks will permit displaying one of two (or even three) characters in one location. This is discussed in detail in M-2453.

Emphasis has been placed on the use of digital expansion for the display in order to avoid the noise problem inherent in analogue expansion. A system for doing this has been suggested by K. Olsen.

(R. H. Gerhardt) (CONFIDENTIAL)

On September 29 and 30, D. C. Ross and R. E. Butler of IBM were here to discuss display problems. We concluded that feature selection would use toggle switches. Features which can be switched on and off are Intercept Point, Track No., Identification, Pair No. or Operational Status, Altitude, and History.

Two memos, M-2447, "Proposed Word Layout on Track Display Drums," and M-2448, "Proposed Word Layout on the Uncorrelated and Correlated Data Fields," were written and will be issued shortly.

Charactron Display Scope

(H. E. Zieman, J. I. Woolf) (CONFIDENTIAL)

The magnetic-deflection amplifiers have been completed and tested. These amplifiers have a rise time better than 2 microseconds and a variable gain from 75- to 160-ma output for 1-v input. The common-mode gain was small enough not to be measurable with a Tektronix scope except from a transient disturbance of about 1- $\mu$ sec duration.

The electrostatic-deflection amplifiers have a variable gain from 0.5 to 1.5 and have a rise time as good as the present decoder. Exact measurements of rise time have not been made because an accurate push-pull square wave was not available.

The defocus amplifier puts out a variable negative gate from 30 to 215 volts with a 10% droop in the flat top in 300 microseconds. The rise time is 2 microseconds. The amplifier is driven by a Boyd flip-flop.

The intensity control puts out four levels of gate variable from 0 to 120 volts with a maximum variation between the four levels of 40 volts. The rise time is 1 microsecond.

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SECURITY INFORMATION

2.2 Group 63 (Magnetic Materials)

(D. R. Brown) (CONFIDENTIAL)

Selection of good cores for the new MTC memory continues. Approximately 300,000 good cores have been obtained to date. During the last week the rate of selection has increased remarkably because of the successful operation of the fully automatic core tester.

Plans are being made for testing the 150,000 good cores required for XD-1 by January 1, 1954. MIT and IBM may share the testing load.

Recent samples from RCA Victor indicate that RCA is ready to begin supplying cores for XD-1 in quantity. This will increase the testing load.

Group 63 is working with Group 37 to plan a program of fundamental magnetic measurements of ferrites.

Ferrite-Core Pulse Tests

(J. Schallerer) (UNCLASSIFIED)

To date roughly 30,000 good cores have been turned over to Group 62 for construction of planes for Core Memory, Mod. II. These cores have been split into two bands, one from 90 - 105 millivolts and the other from 105 - 120 millivolts. The automatic tester has done all of the splitting, and the results have been good.

Roughly 250,000 tests have been made on the semiautomatic tester. The down time has been excessive the last week. A few changes have been made, and performance is expected to improve.

Approximately 140,000 cores have been received from General Ceramics since 1 August. Of these about 115,000 have been tested.

Pilot-Plant Production of Ferrite Cores (R. Maglio) (UNCLASSIFIED)

The firing and testing of the F-294 cores of DCL-2-225 composition have been completed. Test results have been indicated by J. Sacco. A new composition has been prepared which varies slightly from the DCL-2-255. However, difficulty has been encountered in pressing the F-394 cores. This trouble developed mainly because of poor machine work on the dies which were available.

A set of carbide-tipped punches with a solid carbide die section has been received from B.M.S. Carbide Specialties Inc., Boonton, N.J. This unit is of a General Ceramics design and does not comply with our design. However, it may be possible to use them, since the differences are slight. Four sets of carbide-tipped compacting dies have been ordered for our press.

~~CONFIDENTIAL~~



2.2 Group 63 (continued)Pilot-Plant Production of Ferrite Cores (continued)

Chrome-plated dies will be completed next week, and with these new dies it appears that a short production run is possible in about 3-4 weeks.

(J. Sacco) (UNCLASSIFIED)

A series of samples consisting of  $MgO \cdot Fe_2O_3$  with MnO added in 5-mol percent steps has been completed. D-262 cores will be fired and tested during the following week.

A number of variations in firing conditions have been made on the previously reported F-394 cores. On the basis of data obtained thus far, the cores seem to be fairly comparable to the General Ceramics material in squareness, coercive force, and switching time, but the peak one output is considerably lower. Several new batches of slightly different compositions have been started in an endeavor to improve upon this material.

Study of the  $MgO \cdot MnO \cdot Fe_2O_3$  System (R. Maglio) (UNCLASSIFIED)

Modifications have been completed on the thermal-analysis furnace and the Leeds and Northrup Controller. The system has been tested, and data has been taken to determine the characteristics of the thermal-analysis furnace. Our Minneapolis Honeywell Recorder was converted for use as a differential-type recorder primarily for testing the couple circuit. The conversion proved satisfactory for test but is not good for thermal study due to poor sensitivity.

A Speedomax Type G Recorder has arrived and will be used for differential thermal recording. During this period, thermal analysis will begin.

Chemical Analysis of Ferrites (F. Maddocks) (UNCLASSIFIED)

Chemical analysis of General Ceramics MF-1326-B, February 1953 batch, has been completed and material of this composition is now in preparation.

Several problems remain before analytical techniques can be applied to the determination of valence states of manganese in manganese-magnesium ferrite-core materials. All constituents are known and can be quantitatively determined; therefore, the first approach will be to estimate two- and four-valent manganese by difference arriving at a result which will account for 100 percent of the sample weight.

2.2 Group 63 (continued)Stress Analysis of Ferrites

(N. Menyuk, J. B. Goodenough) (UNCLASSIFIED)

As reported previously,  $S$  measurements have been made on a Ferroxcube ferrite core as a function of  $T$  applied stress. In addition, measurements of the hysteresis-loop squareness have been made for this core, and the squareness has been found to increase with increasing stress.

An attempt has been made to correlate the observed variation of the switching coefficient with the theoretical equation

$$S_w \propto \sqrt{K + \lambda T}$$

where  $K$  is the anisotropy constant,  $\lambda$  the magnetostriction constant, and  $T$  the applied stress. However, the data available does not suffice either to prove or disprove the correlation.

SECTION III - CENTRAL SERVICES

3.1 Purchasing and Stock

(H. B. Morley) (UNCLASSIFIED)

An inventory at both Whittemore and Barta Buildings of capital equipment and capital office equipment of account 6889, requested by the Contracting Officer, is nearing completion and is expected to be ready in time to meet the October 15 deadline. Concurrently, a similar inventory, plus test equipment, of account 6345, and broken down into Whittemore and Barta Building lists, is in process. This is a separate requirement, with no deadline date established.

The Purchasing Agent and buyers have been accepted into membership in the New England area branch of the National Association of Purchasing Agents. The published economic and business-trend data of the Association should be valuable in the functioning of this office.

A comparative stock-data analysis of Division VI and Division I is being prepared. A preliminary Division I estimate suggests that they could supply only 15% of our component requirements. Our report will show a closer estimate of stock duplication and the stock area required by Division VI for the specialized high-quality materials stocked for computer use.

The ~~expediting~~ section recorded vendor delivery performance as follows for the period 9/1 through 9/30:

Orders received complete	--308		
"	"	on time, as promised	--115 or 37%
"	"	1-7 days overdue	89 or 29%
"	"	8-14 " "	34 or 11%
"	"	15-21 " "	22 or 7%
"	"	22-30 " "	13 or 4%
"	"	1 mo.-2 mos. "	22 or 7%
"	"	2 mos.-3 mos. "	8 or 3%
"	"	3 mos. or more	5 or 2%

3.2 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 26 Construction Requisitions totaling 129 items satisfied since September 25, 1953; there are 27 Construction Requisitions totaling 312 items under construction by the Group 60 electronic shops.

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

### 3.2 Construction (Continued)

#### Outside Vendor

(G. A. Murdoch) (UNCLASSIFIED)

There are 8 orders now open with vendors, totaling 1314 items. Deliveries in the past biweekly period have totaled 279 items. Information on specific orders may be obtained from the writer (ext. 3476).

### 3.3 Component Analysis and Standards

#### 3.33 Standards

(H. W. Hodgdon) (UNCLASSIFIED)

Both painted and unpainted samples of the aluminum finishes described in M-2378 are now available for examination.

Revision of the Standards Book section on Electron Tubes has been completed and is now being typed.

A draft proposal of a standard on composition resistors for the Lincoln Lab. was prepared and submitted to the Lincoln Laboratory Standards Committee.

#### 3.34 Vacuum Tubes

(H. B. Frost) (UNCLASSIFIED)

During the past two weeks my time has been devoted almost entirely to thesis work, except for rather incidental duties. In this period three research tubes have been made. These tubes are RT411, RT412, and RT413. RT411 and RT413 have rather heavy cathodes, with coatings of about 7 mg/cm<sup>2</sup> in contrast to the other tubes made thus far, which have coatings of about 4 mg/cm<sup>2</sup>. These two tubes also have tungsten-nickel cathodes. RT412 has a light-weight coating (4 mg/cm<sup>2</sup>) with a passive-alloy cathode. So far RT412 has been tested rather completely for preliminary characteristics, RT411 has been tested only to a limited extent because of the need for additional aging, and RT413 is due to be sealed off the vacuum system on 9 Oct.

RT413 is a comparatively unknown quantity at present. Because of an accident while outgassing a new ionization gauge, it was accidentally exposed to air after the cathode had been converted. Currents obtained while aging it on the vacuum system appear to be rather low.

3.34 Vacuum Tubes (Continued)

(H. B. Frost) (UNCLASSIFIED) (Continued)

Additional progress has been made on the solution to the diffusion equation. I have discussed the solution to this equation with J. Porter. He will probably do the detailed coding following my mathematical setup of the problem. Because the routine for the extraction of square roots is rather long, a coarser net than desirable may have to be used.

(S. Twicken) (UNCLASSIFIED)

The 5965 life test has now completed 2000 hours. Following a recent increase in the plate-dissipation rating, the life-test conditions were revised at 1500 hours to increase the plate dissipation on the conducting sides from 1.1 to about 2.2 watts. This increase in dissipation has been accompanied by a marked increase in plate current on both on and off sides. A comparison of contact-potential measurements on these and new tubes shows about the same average with a smaller range in the new tubes. No interface impedance is evident at 2000 hours. The life test is continuing.

Thirteen 5963's which had operated as flip-flops without failure for about 12,000 hours in Group 24 equipment were tested and appraised. All tubes showed considerable cathode interface impedance which agrees with the results of our previous life tests on the tube type. On the zero-bias plate-current test most of the tubes pass the retest specification which is 20% lower than the new-tube specification. The tubes look quite good on cutoff but only fair on grid current with several tubes showing excessive grid-to-cathode leakage. Of considerable interest is the fact that plate-to-cathode leakage as low as 2.5 megohms steady state was observed in most of the tubes with sharp reductions in the resistance of the others on tapping. This sort of leakage was also observed in some tubes with much longer life from the 5-digit multiplier.

The life test of type 6145 Lots G2P, H2P, and J2P has completed 4200 hours. Plate currents are down about 10% from 100-hour values with a standard deviation of about 3.5 ma. Only 11 tubes remain of the original 20, the other 9 having been retired for shorts. The 6145 Lot L2P life test has completed 2600 hours with plate currents down about 8%. Seventeen tubes remain of the original 20. The 6145 Lot D3P life test has completed 2100 hours with plate currents down about 12% in the conducting tubes and at about initial level for the cutoff tubes. Only 11 tubes remain of the original 20, 9 having been retired for shorts. However, this lot has only one-half the life of the first group of 3 reported.



### 3.4 Test Equipment

#### Test Equipment Committee

(L. Sutro) (UNCLASSIFIED)

Cathode interface impedance has raised its ugly head amid the 70 Tektronix 514D scopes. When a square wave is applied to the vertical amplifier of this scope, the square wave appearing on the scope face has an overshoot initially less than 10% of the flat portion. After one to three months of continuous operation the overshoot may be nearly 20%, due to interface impedance in the 6AH6 driver tubes. The Committee is considering a modification of the 514D scope which would replace the 6AH6 by 6AU6. The cathode-ray tube then has to be replaced by the 5ABP type to make up for the lower gain provided by the 6AU6's.

#### Test Equipment Headquarters

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

Simpson meters that were tested more than six months ago are now being checked in Test Equipment Headquarters. If the d-c scales are more than 3% incorrect, the a-c scales more than 5% incorrect, the meter is sent out for repair.

J. Childress has recommended a modification to the Model V and VI Core Drivers which has improved the waveform and stabilized the amplifier so that it is free of parasitic oscillations. This modification is being made to core drivers requiring it.

A delay-line amplifier similar to that in use in MTC and WWI is being developed as test equipment. Three such amplifiers can be mounted in one panel and can take the place of three Burroughs Delay Line Panels when fixed delays are satisfactory.

### 3.5 Drafting

#### Drafting Procedures for AN/FSQ-7

(A. M. Falcione) (RESTRICTED)

I am now preparing a memorandum for internal distribution regarding the above subject. This memorandum will explain in detail the various procedures which have been agreed to by IBM and MIT. It is expected that this memorandum will be issued prior to the next Biweekly Report.

3.5 Drafting (Continued)

Interchange of Brown-Line Prints

(A. M. Falcione) (UNCLASSIFIED)

Through some misunderstanding, some brown-line prints of IBM drawings have been received by engineers in Division 6. This practice will lead to confusion if allowed to continue. IBM is being notified that all brown-line prints and drawing specifications or any similar material should be sent to the writer so that one central file will exist. From this central file, distribution of prints will be made to those who require them. Within the next week or so it is planned to issue a weekly accessions list of the brown-line prints received from IBM. This accessionslist will be distributed to all staff in Groups 60 and 62. It would be appreciated if sepias of IBM drawings now in the hands of various engineers were turned over to the writer as soon as possible so that one central file can be maintained.

3.6 Administration and Personnel

Terminated Staff

(J. C. Proctor) (UNCLASSIFIED)

Roy E. Hegler

New Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Elinor Albanese is a new messenger at the Barta Building.

Pauline Cochary is Mr. Morley's new secretary.

Philip Chandler is an MIT student working part time for Group 63.

Robert Johnston has joined the Whittemore Building janitor crew.

Eugenia Patterson is a new senior clerk in the Publications Office.

Carol Small has returned to join the Drafting Department.

Terminated Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Lillian Durso  
Eleanore Galant  
Sheila Heffernan

Nancy Heselton  
Charlebert Ingram  
Edmund Landers

3.6 Administration and Personnel (Continued)

Open Non-Staff Requisitions

(R. A. Osborne) (UNCLASSIFIED)

- 1 Computer Operator
- 2 Electronic Technicians
- 2 Inspectors
- 1 Secretary
- 1 Senior Detailer