

Memorandum M-2311

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Lincoln Laboratory  
 Massachusetts Institute of Technology  
 Cambridge 39, Massachusetts

SUBJECT: DIVISION 6 BIWEEKLY REPORT, July 17, 1953  
 To: Jay W. Forrester  
 From: Division 6 Staff

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Auth: <u>DDJ/SY</u>
By: <u>J.R. Enright</u>
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Section I CAPE COD SYSTEM

1.1 Group 61

1.10 General

(C.R. Wieser) (CONFIDENTIAL)

The Division II SDV converters were removed July 17 to make room for the ground-to-air link coder. Temporary installation of six channels of the 14-channel tape recorder has been made.

Storage space on the auxiliary drum will be extremely limited and will restrict the ability to make desirable improvements in the 1953 Cape Cod Programs without sacrificing other features.

Operations to be performed by Cape Cod personnel are being discussed with Bob Davis (Group 21) and Aymers, Deegan, Green, and Harris of Division III.

A fairly successful single-pair test of the four-pair intercept program was run using Truro data.

A schedule for testing non-Track-While-Scan programs is given in Section 1.14.

A memo describing a proposed Operator's Console for AN/FSQ7 XD-1 has been written.

~~CONFIDENTIAL~~

SECURITY INFORMATION

1.11 Equipment Engineering

(E.S. Rich) (CONFIDENTIAL)

Good progress has been made toward a new layout of equipment in Rm. 224. Installation of the remaining radar mapping units and of the 14-channel recorder and the associated SDV signal amplifiers has been pressed so the two SDV converters in Rm. 224 can be removed to make room for the ground-to-air link coder. Considerable work remains to be done to get a satisfactory installation of the recording equipment. For this reason a temporary installation of six channels has been made for immediate use in testing the 1953 Cape Cod System.

A target date of August 15 has been set for completing the ground-to-air link installation. Since both the engineer we have assigned to that project and the AFCRC engineer who built the coder will have vacations in the meantime, the work is being pushed. Accordingly, the Division II SDV converters are being dismantled July 17 even though the gap-filler data inputs through the MITE units and the new radar mappers have not been thoroughly tested. No major trouble is expected in getting these new input channels into operation, however, following next Monday's installation period. The ground-to-air link coder, then, will be brought in the first of next week.

(N. Alperin) (CONFIDENTIAL)

The 14-channel Ampex recorder has been tuned up and the levels set. It has been found that when recording less than 14-channels at one time and the remaining channels at another time, the first recordings will be erased while making the second recording. There is also a large amount of noise out of the playback amplifiers when the machine is idle with the power on. A relay control panel has been designed to correct these two defects.

Three Light Guns are ready to be installed; one was sent to IBM one has to be received, and the rest are under construction and will be installed as they are received. A special 2" panel was made to distribute power to the Gun at station U11 since there are no power terminals available at the front of the scope.

(H.J. Kirshner) (CONFIDENTIAL)

Tracks #1 through #6 inclusive of the fourteen-track Ampex recorder are now available for use. Assignment of the tracks is as follows: Tracks #1 and #2 - two gap fillers; Tracks #3 and #4 - Truro; Tracks #5 and #6 - Radio Consoles 1 and 2 respectively. These track assignments will remain in effect until the switching facilities for the recorder are completely installed. Ten tapes, each of one-hour duration, are available for use.

Cable and junction boxes are being installed for use with the Radio Control Panels recently installed in Rm. 224.

1.11 Equipment Engineering (Continued)

(H.J. Kirshner) (Continued) (CONFIDENTIAL)

The two SDV receivers installed in Rm. 224 have been removed and returned to Group 24. These units have been replaced by MITEs #1 and #2.

The two seven-inch PPIs in Rm. 228 are no longer operative. Two 16-inch mapping scopes in Rm. 216 replace these units.

The Plan Twelve Indicator used for displaying Truro data has been returned to Group 24 at their request.

A ten-channel amplifier and relay unit is under construction for use as radio remoting equipment.

Two fourteen-channel cathode follower panels are under construction for use with telephone line amplifier panels already completed.

(B. Morriss) (CONFIDENTIAL)

The new equipment being installed for the Cape Cod System contains approximately 1,500 switches and indicator lights. The detailed checking of all of this equipment at frequent intervals seems to be out of the question unless a highly organized procedure is adopted which makes use of the personnel normally operating the equipment. Some checking prior to operation is necessary to insure that all equipment has been turned on. It has been suggested and discussed with members of the Systems Group that this check be expanded to include a detailed check of all switches and lights. Methods of integrating into one smooth operation the checking of scope calibration, display selector switches, light guns, indicator lights, real time clock, insertion switches, activate buttons, ground-to-air coder, and radar data are being worked on by E. Wolfe, G. Young, and myself. Suggestions are invited, and information about similar efforts by other people would be appreciated.

Most of my time has been spent with the buffer magnetic drum. I have been measuring pulses and signals, and in general familiarizing myself with the equipment.

(D. Neville) (CONFIDENTIAL)

An antenna mast is being installed on the roof of the Barta Building for the radio link between Barta and Prospect Hill.

The data link coder and associated equipment will be received from AFCRC for installation during the week of July 20.

~~CONFIDENTIAL~~  
UNCLASSIFIED

1.11 Equipment Engineering (Continued)

(J.H. Newitt) (CONFIDENTIAL)

Modification work in the SCC control room is continuing. While no serious difficulty has been encountered in the inclusion of mods, they do take time and cause delay. Planned modifications should be subject to careful analysis first to determine that they are vitally needed and second, to see if no better way of making the mod will be subsequently found (without operating experience). If the mod is questionable or optional, it may be well to wait until some operating experience is gained before making a decision to include it.

One serious problem has come up in the form of a continuing failure of the DuMont power supplies on the 16" scopes. The source of our difficulty lies in the use of an inexpensive and unreliable television-set component (h-v coil) which arcs between turns. I have asked DuMont to recommend a replacement component and either they or I will produce a rapid solution to this difficulty. In the meantime, if casualties continue to mount, it might be advisable to paint these coils with a low-dielectric-constant plastic. This should be done with caution, however, (one unit at a time) since the h-v coil is part of an oscillator circuit. The design of this supply in general is not too good in that there are large exposed metal surfaces where corona and brush discharge can occur. This is a potential source of present and future trouble.

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

Maximum effort is being expended to have all mapper scopes completely wired on the next installation day, Monday, July 20. This includes scope Ell, the inverse mapper.

Since one of the photoelectric pickups is being used with the inverse mapper, Y33 will be without a photocell for two more weeks until the shop can construct one more unit. It is planned to use scope Y33 as the monitor scope for Y31 (North Truro) so that the present monitor, Y32, may be used with the gap fillers.

We have received two new azimuth drive units from Division II. Although they have only been tested with test equipment data, they seem to be much less sensitive to missing azimuth pulses than were the other units.

Scope E31 is being connected with the phototube high voltage interlocked with room lights in Rm. 222. All four room-lighting circuits must be off before the phototube high voltage is applied at the scope.

(G. Young) (CONFIDENTIAL)

A ready-reference list of the si addresses has been compiled (D-55565).

All Block Diagrams of the In-Out System are being brought up to date and all sketches drawn up as graded drawings.

An Engineering Note describing the paper tape units will be issued soon.



1.12 Data Screening

(R.L. Walquist) (CONFIDENTIAL)

Testing of track-while-scan (TWS) programs continues. Almost every time a program is reviewed, new problems appear which had been overlooked previously. Some of the programs have been tested out satisfactorily only to discover that oversights in the logical structure necessitate complete revision. Testing of some of the programs has been delayed by marginal operation of the equipment in the Control Center; however, the equipment situation is improving daily.

It now appears that we must not only worry about information processing time but that storage space on the auxiliary drum will be limited. The TWS programs are now squeezed into drum groups 6-9. Drum groups 0-5 are assigned to the non-TWS programs. Drum group 11 has the read-in program and is permanently locked out. This leaves only drum group 10 (which up to now has been assigned to utility programs) and both TWS and non-TWS programs could use this space. The most important result of this limited drum space will be the inability to make desirable improvements in the 1953 Cape Cod programs without sacrificing other features.

Discussions have been held with Bob Davis (Group 21) and some of the psychologists of Division III on the operations to be performed by the TWS personnel. Their feeling is that the toughest position to man in the Cape Cod System is that occupied by the Tracking Officer (TO) and the Combat Data Director (CDD). Some thought is being given to the problem of simplifying and better distributing the jobs of these two men.

A joint meeting between SCEL (Signal Corps Engineering Lab) and Lincoln was attended at Bldg. B on July 15. On the day prior to this meeting, discussions were held with some of the people from SCEL on the problem of earth's curvature corrections and how these corrections should be mechanized.

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

The master control program was run successfully and has since been rewritten to conserve storage. To facilitate testing the non-TWS programs a special stop section has been included with the new version.

Integrated testing of the TWS function has been delayed by programming errors and subsequent delays in tape preparation of modifications.

I have started to work more on the alarm recycling problem and hope to arrive at some system of taking care of this problem. Closely related to this is the problem of initially starting up the system.

A system of records for the TWS section has been started. Two notebooks are being used, one a loose-leaf notebook for coded programs and flow diagrams, and the second a bound computation book for brief program description, computer operation summary, and program record.

1.12 Data Screening (Continued)

(H. Frachtman) (CONFIDENTIAL)

The trouble track make-up and display programs are ready to be checked on the computer.

Some time has been spent learning about the magnetic tape system.

(D. Goldenberg) (CONFIDENTIAL)

The comparative analysis between the accuracies using stereographic and gnomonic projection systems has been completed for a spherical earth. Results indicate that for the Cape Cod System the stereographic projection system is but a bit more preferable. In addition, at a meeting with representatives of SCEL (Signal Corps Engineering Lab) and W.D. White of Airborne Instruments Company, it was learned that SCEL will use a stereographic projection, as necessitated by the large extent of the systems they are considering. For these reasons, it is recommended that a stereographic projection system be used for the Cape Cod System, pending some further analysis of the cross-telling problem for a spheroidal earth.

The changeover from gnomonic to stereographic projection will involve only modification of some of the coordinates of the radars in the system. The new coordinates are not more than 0.018 nautical mile from those being used now and until we can finally establish that for the cross-telling problem the stereographic is preferable to the gnomonic for a spheroidal earth, the old coordinates can be used without serious error.

A report of the meeting with the aforementioned people was submitted to R.L. Walquist and C.R. Wieser.

A quarterly report summary of the work on the earth's curvature problem is in preparation.

The earth's curvature problem is complete but for one aspect. The cross-telling problem is being analyzed for a spheroidal earth. The results of this analysis will enable the E-note on the problem to be completed and a final choice of systems to be made.

(J. Ishihara) (CONFIDENTIAL)

The Track Sort, Track Density Check, and Crossing Track-Check Program for the 1953 Cape Cod-TWS has been completely checked out using test parameters. The Correlation Program was modified to include automatic initiation of tracking on data immediately after it has been found not to correlate with any track. Further checking of this latter program remains to be done.

1.12 Data Screening (Continued)

(J. Levenson) (CONFIDENTIAL)

At present the Track Trouble Detection and Interpretation Program is completely checked out. The monitoring in the Track Cross-Check Program has been checked out independently, as well as with the Track Cross-Check Program.

The Switch Input Program was checked out using the actual switch settings. It was found to operate satisfactorily, but changes have been made to cover situations not heretofore handled, and a reallocation of registers within the program has been made. All this has been combined in a new tape which remains to be checked out.

(H. Peterson) (CONFIDENTIAL)

During the past two weeks I put the Uncorrelated Data Display and Associated Light Gun Action Program and the Trouble Track Display in coded form.

(H. Seward) (CONFIDENTIAL)

Mating of the Correlation Program with other TWS programs has progressed. A track display program is being written for use in later tests.

(W.M. Wolf) (CONFIDENTIAL)

The Data Collection, Data Analysis, and Data Conversion and Display subprograms for the 1953 September System TWS operate satisfactorily. It remains to match these subprograms with the Correlation, Master Control, etc.

Complete logical flow diagrams, outlines, and a more descriptive memo draft have been written for these TWS subprograms.

Some time was spent with Capt. Sullivan and CWO Crow discussing the feasibility of having an azimuth-range grid superimposed on the PPI display for the officer having radio contact with pilots in flight tests (SOO). It was decided that this would have to be programmed rather than inserted as data and would thus fall under the non-TWS category.

The Correlation Program described in M-1921 was tried on the computer; a reset error was detected and corrected. The program then operated successfully. The program collects and stores on the auxiliary drum two scans of data, then correlates the data by computing the radius between each return on one scan (comparing scan) with each return within a sector on the other (compared scan). The sector is a fan-shaped segment about the return on the comparing scan 64 azimuth units wide and 128 miles long (arbitrary settings).

The program then prints out the results of correlation in twelve columns. Each column contains the number of returns on the comparing scan having as a radius to the closest return on the compared scan the value at the column heading. A display is also given of these results scale factored so that the largest number in a column has the maximum scope deflection.

1.12 Data Screening (Continued)  
(W.M. Wolf) (Continued) (CONFIDENTIAL)

The results for the one time operated are:

Rmin. =	0	1	2	3	4	5	6	7	8	9	10	g10	(nautical miles)
No. of													
Returns =	3	2	2	3	2	3	4	5	7	7	5	141	

This would tend to indicate poor correlation. It might be mentioned that only 184 returns were collected per scan due to heavy filtering. The returns were outer range returns which would tend to be more unreliable.

More time will be spent with this program on the computer in the next two weeks in an attempt to substantiate the degree of correlation expected.



1.13 Tracking and Control

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

Since computation time is quite lengthy in the NLS-2c parameter optimization program and since a large number of parities occurred in two runs on the computer, it has been decided to modify the program to transfer data periodically to the drum so that computation may resume after a parity alarm without loss of previous results. Because of computer troubles, not very much data has been obtained yet.

(Wm. Lone) (CONFIDENTIAL)

A parameter has been written for the FTU (Flight Test Umpire) program and testing of the program is underway.

(A. Mathiasen, W. Long) (CONFIDENTIAL)

Parameters have been written for the tracking study program to make use of the delayed printer or the direct printer. One run in this period produced no results because of an excessive number of parities.

(A. Mathiasen) (CONFIDENTIAL)

Poor data using Clinton and Londonderry made the first half of a flight test on July 9 useless. A switch to Chestnut Hill and Fall River during the second hour provided what seemed to be good data. Trouble was had in tracking, however. This may have been due to small search circles used in an effort to combat the effects of noise.

A flight test for July 15 was cancelled ahead of time because of anticipated trouble with electrostatic storage. This move was agreed upon in a conference with R. Mechlin and further in a conference between him and N. Daggett. Computer operation at the time the test was to run was poor.

Present tracking programs will be modified for MITE because of the removal of the present equipment from Room 224.

(H. D. Neumann) (CONFIDENTIAL)

The problem of tracking aircrafts in case ~~Re~~ information is transmitted by voice and inserted manually into the computer was considered. Preliminary tests will be made to get a better insight.

1.14 Weapons Direction

(D.R. Israel) (CONFIDENTIAL)

Satisfactory progress is being made in the preparation and testing of the non-Track-While-Scan programs for Cape Cod. This testing will proceed in three phases:

- 1) Static tests of initial programs. There are 56 programs in this category, each to be tested individually with parameter tapes or stored data. Scope displays and printed outputs will be used to check the correctness of operations.
- 2) Dynamic tests of groups of related initial programs from Phase 1. The dynamic tests will be conducted using data simulated by the FTU (Flight Test Umpire) program and will make use of the Master Control Program and the Track Situation Display Program. At the end of this phase of testing, four or five major programs will have been checked out.
- 3) Grouping and testing of the programs from Phase 2 into the single-program to operate in subframes 2 and 4 of the Cape Cod computer program.

Phase 1 (above) is expected to be completed by August 15; however, the bulk of the testing should be over by August 8. This is a fairly tight schedule and will require two to four hours of computer time daily. It will also be necessary that the tape preparation process keep pace with the increased programming activity. Discussions with Jack Porter, Ed Kopley and Peg Mackey indicate that this can be done. Phase 2 has not yet been fully planned, but tentative scheduling points toward completion by the last week in August. If Phase 1 and 2 proceed as planned and without unexpected delay and complications, Phase 3 should be completed one or two weeks after Phase 2.

In addition to the log described in the previous biweekly, definite procedures have been established to assist in the keeping of records and in the planning and implementation of Cape Cod NTWS program testing. Gaudette and Knapp are supervising this activity and their desks are now located in Room 3-439.

Jack Nolan has rejoined Group 61 and will work with C. Zraket on the interception programs.

Progress is being made on the problems of training of personnel and manning of the Cape Cod System. Bert Green of Division 3 has prepared a definite proposal for the training of personnel. Bob Davis, Group 21 is preparing a proposal for the manning of Direction Combat Center with Air Force and Group 61 personnel. It is expected that a meeting will be held next week at which definite decisions will be made on both of these problems.

Weapons Direction (Continued)

(D.R. Israel) (Continued)

Personnel from Division 3 have been assisting Group 61 in problems relating to the operation of the Cape Cod System. Deegan, Aymers, Green, and Harris are assisting in the following fields: identification, further personnel training, room illumination, and switch design and illumination.

Flight test activity in the past two weeks has been devoted chiefly to coverage tests with the 6-B at Truro. The activity for the next four weeks will continue to emphasize coverage tests inasmuch as the computer time made available by the lack of interceptor flight tests will be necessary for Cape Cod program testing and checking.

The results of coverage tests seems somewhat erratic; on the majority of occasions very satisfactory coverage on B-29 aircraft was experienced; on several occasions rather poor data was received. On three occasions during the past biweekly period, single-pair tests were attempted. These tests were plagued by a number of difficulties, among them, unsatisfactory radar data, lack of Mark X data, scheduling difficulty, and a misunderstanding regarding a change in the computer decoders.

The N. Truro PPI scope used to watch SDV data during coverage tests is being removed by Group 24. Communication equipment will be installed in Room 216 and the coverage tests will be held with the 16-inch radar mapping scopes installed in that room.

(H. Benington, C. Grandy) (CONFIDENTIAL)

During the past biweekly period the display section (Benington, Conant, Grandy and Stahl) has centered its attention on writing the Display Master Make-up (DMM) and Selected Track DID Make-up and Display (STMD) programs. These two programs will be combined with the modified Master Control Program (Attridge, Gaudette and Knapp), the FTU program (Brand) and the Switch-read-in Program (Levenson). This first combination of non-track-while-scan Cape Cod programs will be started during the next biweekly period.

Three versions of the Track Situation Display (TSD) were run; these tested the visual effect of different symbols. The character generator was working sufficiently well so that the character size could be set for the September tests. The format of the TSD has been set and checked out.

The study of the flow diagram for DMM was further altered to cover slight changes in its duties; the programming is one-third complete. Special attention is being given the many possibilities of identity or assignment status change from frame-to-frame which may result from the

1.14 Weapons Direction (Continued)

(H. Benington, C. Grandy) (Continued)

action of any one program and may affect the other programs. Charts covering all foreseeable possibilities are being prepared and these will be circulated in an attempt to minimize misunderstanding or hidden logical defects.

The programming for the STMD is nearly finished. The remaining problem is to choose the flow diagram that will minimize time and storage assuming average DID requests. Good progress has been made here and the program should be checked out during the next period.

Two M-notes have been completed. Digital Information Display (Benington, M-2251) describes all types of DID's to be used in September. Sample displays are given together with a glossary of all terms and symbols used. Display Categories and Assigned Scope Displays (Benington, Grandy; M-1999-1) gives a complete revision of scope switches, a list of the 110 si addresses for the display categories, and a summary of the revised loading.

(John J. Cahill) (CONFIDENTIAL)

A flight test of the Multiple Aircraft Height-Finder and AAA program was made on July 8. Radar data was very poor and very little was accomplished other than the training of Air Force personnel who will work on these tests. The program worked well.

The AAA Calculation Display Make-Up and Display sections of the September program have been coded in relative address form.

(P.O. Gioffi) (CONFIDENTIAL)

Details of the Weapons Director (and Senior Director) function for A/C assignment actions have been outlined and shown in flow diagrams completed this period. The design is in conformity with previously established abilities and requirements of other programs of the 1953 Cape Cod System and in accordance with other agreements made concerning certain changes and innovation to such programs brought to light by a study of the originally proposed Weapons Director function.

About 25% of the programming has been done. The remainder of the programming along with the necessary parameter tapes and directions for testing the various actions of this program are expected to be completed during the next period.



1.14 Weapons Direction (Continued)

O.T. Conant (CONFIDENTIAL)

The FTU's selected track DID Make-up and Display Program, mentioned in the last biweekly, has been expended to include the DID's for the two visitors' stations.

This program will make up the display tables once per scan and will display twice per scan. It should be completed early in the next period and checked out shortly thereafter.

(A.W. Curby) (CONFIDENTIAL)

A Switch Interpretation program, T-2851, has been written and run on the computer, but due to an error in the data parameter tapes it did not function correctly. This program examines the ID activate digits and insertion register contents stored each half scan and determines whether the Data Processing or Flight Plan DID Make-up program should be read in, or neither. It then sets the Master Control program counter accordingly.

A Data-Processing program, T-2852, has also been written, but not tested. It is hoped that this program will be checked out next week.

(F.M. Garth) (CONFIDENTIAL)

The display program for the Radio Operator and Interceptor Director has been completed and run satisfactorily in a time which proved acceptable.

The table make-up program for this display is being worked on and should be completed shortly.

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

A program has been written to be used in checking out Non-TWS subprograms. It will be used with the Master Control program and will fit into the registers normally used by the Data-Collection program, both in ES and on the Drum (Group 9). The program will:

- a) print out on Flexowriter selected registers or small groups of registers determined by a parameter tape;
- b) print out on the delayed printer one block of registers determined by FF settings;
- c) examine any register in ES or on Drum;
- d) insert a quantity from a ff register into any register of ES or the Drum.

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1.14 Weapons Direction (Continued)

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

An inter-office memo describing the program in detail will be distributed soon.

A system of record keeping for the Non-TWS subprograms has been inaugurated.

Work on the all-over flow diagram for the Non-TWS function will continue as time permits.

(Michael A. Geraghty) (CONFIDENTIAL)

A flight test and a demonstration were attempted in the last period with J. Cahill and the writer's Truro AA and HF guidance program. The failure of the flight test is described in J. Cahill's report. The demonstration on July 16, for Truro RHI and Pigeon Hill and Nantucket Nodding beam height-finder operators, was slightly hampered in the first place by the unavoidable absence of half of the invited personnel, and in the second place by the absence of data through the mapper for 35 minutes.

All mods to Control Center equipment requested up to date have been installed.

The last week has been largely spent in polishing the AA program for September. It is now in a form J. Cahill and the writer hope will be final.

(J. Hayase) (CONFIDENTIAL)

The Auxiliary Identification Data Situation Make-up and Display program, tape #2857 mo, was put on the machine, but due to program and tape preparation errors only 8 Early Warning displays were obtained. The corrected program is scheduled to be tried again on July 17.

Preparations are being made to request a tape for the Auxiliary Identification Data Situation Display program, tape #2858.

The Flight Plan Situation Make-Up and Display Program, tape #2855, has been written. Tape preparation requests will be made after another check.

(F. Heart) (CONFIDENTIAL)

A large amount of time was spent working on logic and actual programming for various parts of the weapon direction problem.

Continued efforts have been made to utilize the four-pair intercept program. Although a fairly successful single-pair test was run with this program, its operation did not yet appear sufficiently well defined to try an 8-aircraft mission. Another single-pair test will be run.

1.14 Weapons Direction (Continued)

(L. J. Murray) (CONFIDENTIAL)

During the past biweekly period the display program for the RO (Radio Operator) and IND (Identification Director) DID has been checked out. It is felt that the display time was reasonable.

The table make up program for these displays should be completed and checked this week.

(J. Nolan) (CONFIDENTIAL)

The time from July 8th to the present has been spent becoming acquainted with the work of the Weapons Direction Section and, in conjunction with F. Heart and C. Zraket, coding the interception program.

(G. Rawling) (CONFIDENTIAL)

Works on the coding of the input sections of the Cape Cod Height-Finder and AAA subprograms is in progress. The 4 flow diagrams of programs by Cahill have been completed, and the AA intake and AA Track Rotation flow diagrams are finished.

A short checkout program for the AA intake program is being written.

(B. Stahl) (CONFIDENTIAL)

I have continued to work on display and display make-up programs. In addition to the AA Talker display, a program has been written and checked out for the Selected Track display, and in connection with O. T. Conant a display make-up program has also been written. Work will now continue with the Weapons Assigner DID and the make-up and display program for the Summary Data display.

(F. Webster) (CONFIDENTIAL)

A number of discussions on the problems of simulated tracks have been held during this period. Members of group 38 demonstrated the equipment they have been using for presenting simulated tracks to crews (as in a GCI center) who must analyze the data, make decisions, and pass on appropriate information to various users. Up to 100 simultaneous tracks were used in the study. A report is under preparation by this group.

Discussions have been held with R. N. Davis and Air Force personnel (as well as the above group) as to what problems should be included in an adequate sampling of possible tracks. Major H. U. Smith and J. Davis from the Flight Test Squadron of the 6520th participated in some of these discussions. It was their belief that: (1) hostile aircraft might operate for

1.14 Weapons Direction (Continued)

(F. Webster) (Continued)

extended periods as low as 100 feet above the ocean and for short periods as low as 20 feet; (2) that they might also join a commercial route and use airborne radar to pick up commercial flights which they would then follow so closely as not to be separately detected by anything except CW radar. Another problem they mentioned was the matter of Naval practice flights that are apt to cause low tracks, appearing close-in, that deviate from any specific flight plan. Davis pointed out that the multiple corridor Identification system has so much leeway and so few required choices that it cannot provide a high-probability identification. Moreover, less than a fifth of incoming flights make use of the system. From the point of view of commercial flights it has the disadvantage of introducing some delay (up to 6 minutes or more where "authentication maneuvers" are required). Additional complications are introduced by the lack of direct two-way communications in the identification procedure.

A set of 18 preliminary tracks has been plotted and tabulated. The data is to be used by various members of group 61. In this connection a table has been drawn up which converts nautical miles per hour to a seven digit binary representation.

A small amount of time has been spent with members of Group 38 on the matter of reducing delays and errors in the operation of switches and buttons in Room 222.

(E. W. Wolf) (CONFIDENTIAL)

The Intervention and Activate Button Test Program has been substantially completed, tested in the computer, and found to be working. Certain additional display features are now being incorporated into this program.

There remains the task of checking each of the 1115 individual intervention buttons and toggle switches.

(C. A. Zraket) (CONFIDENTIAL)

Work on the Weapons-direction programs for the Cape Cod System has been progressing according to schedule. The Intercept Director and Radio Operator display Make-Up and Display and the Data Link Program have been completed and are ready to undergo initial testing on July 21. The Intercept-Point Symbol Display Program has been completed and has undergone initial testing. Two of the Weapons-assignment programs have been completed and the remaining five are being programmed. The overall switch-interpretation program has been finished and will be initially tested on July 23. The major part of the work that remains is concerned with the main interception program which is about one-third completed. The major portion of time will now be spent on this program. The group concerned with the foregoing programs consists of Cioffi, Garth, Heart, Lemios, Murray, Nolan, and Zraket. Considerable delay has resulted and will result this month due to vacations.



1.15 Direction Center Operations

(M. Brand) (CONFIDENTIAL)

The following is a summary of scheduled computer time used by Group 61 during the last biweekly period:

MEW-Truro Tracking and Control	
Flight Tests	5 hrs 45 min ✓
Data Screening	6 hrs 5 min
Multiple Radar Tracking and Control	
Magnetic Tape	4 hrs 55 min ✓
Air Defense Center Operations	12 hrs 50 min
Indoctrination Programs	10 min
Equipment Characteristics	12 hrs 5 min
Conversion	1 hrs 5 min
Calibration	5 min
	<hr/>
Total Time Used	43 hrs 0 min
Computer Breakdown (parities, etc.)	8 hrs 25 min
Time Given To Adams	9 hrs 5 min
Time Given To In-Out	2 hrs 30 min
	<hr/>
Total Time Lost	21 hrs 0 min
Total Assigned Time	64 hrs 0 min
Percentage Assigned Time Used	66.5%
Percentage Available Time Used	100.0%

(F. Heart) (CONFIDENTIAL)

During the last biweekly period several tests were made of UHF operation, and, in general results were good.

The unavailability of official, up-to-date SECRET scheduling information for the Truro radar has continued to hamper present flight test operation.

During the past biweekly period a change was made, by the Air Force, in the operational frequencies for Mark X IFF. The 6520th Wing was not able to convert immediately and therefore, we have been unable to use Mark X IFF for this period.

The Truro PPI scope in Rm. 228, Barta, is being removed. Coverage tests will be run from Rm. 216. A radio panel and other necessary communication equipment will be installed in Rm. 216 for this purpose.

As had been planned by the Systems Group, the computer scope decoders were recently changed to operate only in the "new" system. It was discovered that this change rather seriously inconvenienced Group 61 operation. At our request, the decoders are now again available in either the "new" or "old" system. It is expected that this choice will remain until Cape Cod programs are advanced enough to obsolete present operational programs.

~~CONFIDENTIAL~~

1.15 Direction Center Operations (Continued)

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

The following statistics apply to the last biweekly period.

1) Computer hours scheduled for flight tests	10
2) Computer hours used for flight tests	4
3) Computer hours returned due to flight test cancellations	6
4) Total aircraft hours flown	11
5) Aircraft hours flown by 6520th Wing at Bedford	11

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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	
7/6	1000-1200	1	F-89 UHF check	1	As Scheduled	
7/7	1000-1200	2	Single Pair Intercepts	2	Held from 1030-1200	Test delayed 1/2 hr. due to a/c mechanical trouble
7/8	1000-1100	2	Single Pair Intercepts	-	Cancelled	Test cancelled due to a/c mechanical trouble
	1100-1200	2	Height Finder Calibration	2	As Scheduled	
7/9	1000-1200	1	Cape Cod Coverage	1	As Scheduled	
7/10	0900-1200	1	CPS-6B Tracking	1	As Scheduled	
7/14	1000-1200	3	Single Pair Intercepts	-	Cancelled	a) Computer trouble b) Otis A.F.B. not ready to scramble fighter a/c due to fueling delay
	1200-1500	1	CPS-6B Tracking	-	Cancelled	Weather
7/15	1000-1300	1	CPS-6B Tracking	-	Cancelled	Weather
	2300-0100	1	Cape Cod Coverage	-	Cancelled	Computer trouble
7/17	1000-1200	2	3 Radar Tracking	-	Cancelled	a) PPI scope inoperative b) Program trouble
	1200-1400	1	CPS-6B Tracking	-	Cancelled	PPI scope inoperative

Memorandum M-2311

1.15 Direction Center Operations

(A.P. Hill)

(CONFIDENTIAL)

(continued)

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\* Added to schedule during week of test

1.15 Direction Center Operations (Continued)

(A.P. Hill) (Continued) (CONFIDENTIAL)

Results of flight tests held:

July 6, 1000-1100, F-89 UHF Check

An F-89 was used to check the operation of the UHF radio. Generally, the results were favorable on all channels. The aircraft was readable out to a maximum range of 135 miles at altitudes ranging between 12-15000 ft. When at a range less than 90 miles, altitudes between 8-12000 ft. gave the best results.

July 7, 1000-1200, Single Pair Intercepts

Using an F-89 as the interceptor starting over Kennebunk, Me., at 14500 ft., IAS 250 knots. The target (B-29) started over Lurcher at 15000 ft., IAS 200 knots, vectoring for Boston. One run was completed fairly successfully with the F-89 passing directly under the target.

July 8, 1100-1200, Height Finder Calibration (CPS-6B)

Two aircraft were used. An F51 started over Portland, Me., at 15000 ft. and vectored for Provincetown. The other aircraft (F-89) started over a point 25 miles southeast of Chatham at 15000 ft. and was vectored for Portland via Provincetown. General results: Program operated satisfactorily, but the radar data was poor; this made tracking difficult and few altitude readings were made.

July 9, 1000-1200, Cape Cod Coverage

This was a tracking test using a B-29 flying at 6000 ft. between Milford, Mass., and Quonset Pt., R.I. Tracking was attempted on the Fall River and Chestnut Hill sites. General results: The program did not track satisfactorily.

July 10, 0900-1200, CPS-6B Tracking and Coverage

A B-29 was used on the following course: Provincetown - North Nantucket - Lurcher - South Portland - Boston - Provincetown. Two runs were made. In general the results were favorable; for specific results blip scan tallys were made and may be obtained from F. Heart.



1.16 FSQ-7 XD-1 Support

(D.R. Israel) (CONFIDENTIAL)

An inter-office memo describing a proposed Operators Console for XD-1 has been written and distributed for comment. It is hoped that a final proposal can be made within the next biweekly period. This console would be the one from which programs would be operated and tested in preparation for the Transition System. The console might not be included in production machines.

(W. Clark) (CONFIDENTIAL)

At the request of R.C. Hopkins, a program was written and run on MTC which analyzed the performance of a proposed XD-1 output drum system coupled to AN/FSQ-7 data links over several phone lines. The principal output of the program was the efficiency of utilization of the phone lines as a function of the number of phone lines and the number of buffers between the phone lines and the drum. These results are summarized by Hopkins in M-2296.

More data are being obtained from the MTC program G-34 in connection with a joint report with I.S. Reed and G. Dinneen of Group 24 covering the message rate performance of the GE ground-to-air data link. This computation should be completed in the next biweekly period.

(B.G. Farley) (CONFIDENTIAL)

A program for checking cores of the MTC memory in such a way as to produce the smallest theoretical signal-to-noise ratio is awaiting additional test storage installation. This cannot be done in memory because of the disturbing effect of the test program itself.

A test has been made on writing a program to convert WWI tapes on MTC in order to take some load from WWI. Debugging a portion of a new MTC conversion program is also underway.

~~CONFIDENTIAL~~

1.2 Group 64

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

The equipment installation for the Cape Cod System is now essentially complete, and parts of it are being used by Group 61 programmers for program tests. All modifications to the wiring that have been received have been made, although it is expected that experience will dictate many more modifications.

The principal difficulty with the computer proper has been with the E.S. deflection, as noted below.

The buffer drum has been removed from its system and returned to ERA where inspection showed bearing damage. The rotor and bearing have been replaced, and the unit will be returned after the heads have been reset.

The principal difficulty in the display of characters on the display system was found to be interference caused by a bad tube in the vector generator. The display of characters is now very good. The scope noise has not yet been eliminated.

The new MITE units are now being tied permanently to the computer. The work of improving the margins on the MITE system has led to a study of the gate tube and amplifier plug-in unit with an eye to improving the margins of a chain of such units. Some success has been had with modifications of the GT-BA unit, but very little with the BA-BA unit.

1.21 WWI System Operation

(N. L. Daggett) (UNCLASSIFIED)

Electrostatic Storage continues to cause a very serious loss of computer time. Although we still have cases of surface switching and tube failures, the most serious problem is the inability of the ES deflection system to return to the same spot each time with a sufficiently close tolerance. This is not a new problem, of course, but the situation has been aggravated recently by at least three factors.

1. The arrays have been expanded to make room for the mica crossbars on the newer tubes. This has effectively demanded higher precision from the deflection system.
2. We have had a great deal of difficulty getting good drift-free, 715C's for the decoder output amplifiers.
3. The spot size has been reduced generally to improve erasure margins. This has made the storage tubes more susceptible to deflection shift troubles.

1.21 WWI System Operation (Continued)

(L. L. Holmes) (UNCLASSIFIED)

During the past biweekly period the new spare ES digits were placed in operation. The new digits have already proven very useful.

In addition to the new ES digits, two new Delay Line Amplifiers were placed in service in ES Control. The panels replace test equipment whose presence was always considered undesirable because of the lack of blown fuse indication and marginal checking facilities.

Electrostatic Storage

(A. J. Roberts, S. E. Desjardins) (UNCLASSIFIED)

Poor storage reliability was experienced during this period because of deflection shift and a phenolic breakdown at the gate generator for the RF Pulser. In an effort to reduce the effects of the deflection shift the plate current in the 715's in the ESD output panels has been decreased and the writing gates have been adjusted to give bigger spot size. The change in the deflection level has caused some defocusing of the beam which together with the increased spot size make the tubes more sensitive to spot interaction. A change in the high velocity gun second-anode voltage will be made on the next installation day to improve the focus of the writing beam.

Several stannic oxide tubes have been installed during this period. They appear to be less susceptible to positive switching and have not indicated the failure to hold a plus array which is evident in the dag tubes. The two spare tubes have been installed and have been used to improve operations.

Auxiliary Magnetic Drum

(H. L. Ziegler) (UNCLASSIFIED)

The Magnetic Drum Test Rack is now in use and seems adequate for our purposes. From data collected by tests of several reading amplifiers (Type 2), test specifications have been set up for these chassis. These tests include marginal checking to insure that a chassis passing these test specifications will not only operate correctly in the system, but will also provide normal operating margins on the WWI Marginal Checking lines.

Similar test specifications will be determined for each type chassis used in the drum systems.

(P. W. Stephan) (UNCLASSIFIED)

A sketch of the d-c power distribution for the auxiliary and buffer drum was made.

1.21 WWI System Operation (Continued)

(P. W. Stephan) (Continued) (UNCLASSIFIED)

The block diagram of the multiple terminal equipment selector was converted to a block schematic, and the plug-in units obtained.

Some more measurements were made on buffer drum pulses.

Block Diagrams

(J. H. Hughes) (UNCLASSIFIED)

I am getting the block diagrams up to date preparatory to turning them over the Tim Leary.

Marginal Checking

(J. H. Hughes) (UNCLASSIFIED)

Special spares for the Marginal Checking system have been ordered. A complete replacement clutch assembly is being made as a spare for the Marginal Checking Auto Drive Mod III. The drawings for this unit are being redrawn by the drafting room.

WWI Service File

(D. A. Morrison) (UNCLASSIFIED)

The Room 156 WWI Service File has been set up. It contains drawings of equipment installed in Room 156 arranged in the same general manner as the as the WWI Service File. Requests for adding drawings to the File should be made to Julie Gunn.

Typewriter and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

Chad disposal chutes have been made for Flexowriter tables in the tape preparation room. One table has been modified to take these chutes; the remaining tables will be modified shortly.

In preparation for the month of August when we will be short one man out on vacation throughout the month, we plan to concentrate on routine overhaul of the Flexowriter equipment for the remainder of this month.

1.22 Terminal Equipment

Buffer Drum System

(K. E. McVicar) (UNCLASSIFIED)

The buffer drum has been noisy ever since we received it from ERA.

1.22 Terminal Equipment (Continued)

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

As mentioned in a previous biweekly report, this was assumed to be the result of damage to the bearings which was caused by an impact during shipment. ERA's mechanical engineers decided that the damage might be such as would shorten the bearing life significantly and so we have shipped the drum back to St. Paul.

ERA has received the drum, and inspection and disassembly was begun immediately. It now appears that the noisy operation was the result of damaged bearings.

The rotor and bearings have been replaced, and preliminary tests after replacement show quiet operation. ERA is now in the process of installing heads. An incidental advantage to us of having the rotor replaced is the elimination of the nick in one of the dual head tracks which was previously reported.

While the drum is gone, efforts are being directed towards connecting the buffer drum system with the computer and MITE.

MITE

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

Pulse testing for improving MITE margins has continued with some degree of success; margins on all MITEs have been improved but more work remains on MITE-2 to make all MITEs uniformly reliable. The filter switch in the bottom of rack K-3 has been removed since only the new permanent filter is now connected to MITE-0. All MITEs have been modified to provide the new pattern for calibrating the permanent filters. Memo M-2287 describing the use of the Demodulator-Filter Switch Panel is now available.

Next week the Video Cable Switch Panel at the top of K-6 will be removed so that all MITEs will be connected permanently to WWI. Plans are under way and the construction will start next week on new MITE units for the Buffer Drum.

Plug-In Units

(J. W. Forgie) (UNCLASSIFIED)

Observation of the pulse amplitudes and margins of the MITE equipment indicate that the characteristics of the GT-BA and BA-BA plug-in units are inadequate for systems which require cascading many of these units. Accordingly, an investigation of these units has been undertaken. So far, some success has been achieved with the GT-BA combination. Both high gain between 10 and 20 volts input and limiting action above 20 volts have been obtained. As yet there has been no success with the BA alone.



1.22 Terminal Equipment (Continued)

New Control Room Installation

(G. F. Sandy) (UNCLASSIFIED)

This installation is practically complete except for modifications that have to be made.

The major pieces of equipment that have to be completed are the last two CRT filters, the scopes for station "M", station "E11," and miscellaneous low-level lights. The CRT filters should be installed by July 20, 1953. The scopes for stations "M" and "E11" will be installed as soon as it is released from test control. The miscellaneous lights will be installed as the work load and available time allows.

The major modifications to be effected are the re-running of the +5, -30, and +150 supplied for the side panels of the display consoles. This will be taken from rack J1 and fused at each console rather than from the RSDB.

The blown fuse indication system for the consoles - involves a modification of the auxiliary panels, a new fuse panel in each console, an indicator light in each console, and a new blown fuse indication panel in test control.

(T. Sandy) (UNCLASSIFIED)

This biweekly period was spent checking out the new terminal equipment. I.E., Intervention registers, Indicator light registers, and display gates. All of the display gates are working correctly at the present time. We are still checking the intervention registers and indicator light registers.

Project Grind

(G. F. Sandy) (UNCLASSIFIED)

I have been actively participating in the power supply, power supply control, and power distribution discussions. Two trips were made to Poughkeepsie with Dick Farmer and Joe Gano, besides several meetings here.

Magnetic Tape System

(E. P. Farnsworth) (UNCLASSIFIED)

The shipment of mylar base green oxide coated magnetic tape has been received from 3M and will be installed on all units this coming Sunday. This tape has several times the tensile strength of the standard plastic base tape, but it should be handled with great care to avoid dirt, scratches, creases, tearing, etc. as the cost is three times as great. The greater strength should eliminate tape breakage in normal operation and the increased output amplitude will improve the signal to noise ratio.

1.22 Terminal Equipment (Continued)Magnetic Tape Mechanisms

(E. P. Farnsworth) (UNCLASSIFIED)

Drawings of the Test Panel have been completed and graded and construction is scheduled. Parts have just been received which will permit replacing the 120 Raytheon CK708 crystal diodes in the reel-tension magnetic amplifiers with 20 selenium rectifiers for improved reliability.

Magnetic Tape Print-Out

(E. P. Farnsworth) (UNCLASSIFIED)

Installation of WWI design panels to replace the breadboard equipment is progressing. Two final panels are in, a third will be placed in service next week, and the assembly for the fourth is now being laid-out in drafting.

The installation of a special indicator light panel in TC17 this week, facilitates marginal checking and trouble shooting of the delayed punch and print system. Two defective flip-flops in the Index Pulse Counter were found and replaced.

A sound-proof enclosure is being designed for the delayed output flexowriter table to reduce the noise which annoys and distracts other groups when the storage and delay feature of the equipment causes its use to overlap into other scheduled periods. The effectiveness of the celotax lined plywood enclosure in the tape preparation room indicates that this will be a better solution to the noise problem.

Display

(R. H. Gould) (UNCLASSIFIED)

All of the new 16-inch display scopes except the one in Room 250 have been adjusted for proper gain and position using a calibration program. Slight distortion due to limiting in a deflection amplifier can be noticed in several scopes. The one case investigated was caused by a weak tube. The other cases will probably be as easily cured.

In the past month, three Dumont 263B high-voltage power supplies used with the 16-inch display scopes have started burning while in use. In one case the fault was the position of the high-voltage output lead installed in our shop. Stringent inspection will prevent recurrence. The other two fires were apparently caused by breakdown of the high-voltage transformer in the supply. The local representative of Dumont has been notified. He will report to the factory next week after their vacation ends. Replacement of the high voltage transformer will probably cure the trouble.

1.22 Terminal Equipment (Continued)

Vector Generator and Character Generator

(F. E. Irish) (UNCLASSIFIED)

The source of the distortion of the characters produced by the character generator was traced to the vector generator. During the character displays, the vector generator produced a spurious signal originating indirectly from the IOR. These signals were mixed onto the reflection lines along with the character generator waveforms resulting in the observed distortions. This has now been corrected.

Room 222

(F. E. Irish) (UNCLASSIFIED)

All the modifications "to date" to signal wiring in Room 222 have been completed.

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 July 3-16, 1953:

Number of assigned hours	104
Usable percentage of assigned time	78
Usable percentage of assigned time since March, 1951	85
Number of transient errors	179
Number of steady-state errors	1
Number of intermittent errors	11

Storage-Tube Complement in WWI

(L. O. Leighton) (UNCLASSIFIED)

Following is the storage-tube complement as of 2400 July 16, 1953:

<u>Digit</u>	<u>STM No.</u>	<u>Tubes</u>	<u>Hours of Installation</u>	<u>Hours of Operation</u>
0 B	38	ST-619-C-1	10069	5227
1 B	15	ST-820-R-1	14404	892
2 B	31	ST-807	13501	1795
3 B	4	ST-821	14226	1070
4 B	33	RT-380	13516	1780
5 B	11	ST-836	14617	679
6 B	3	ST-751	13170	2126
7 B	17	ST-822	14846	450
8 B	44	ST-742	12640	2546
9 B	42	ST-720-C	12937	2359
10 B	2	RT-382	13629	1667
11 B	25	ST-753-1	13129	2167
12 B	41	ST-856	15290	6
13 B	27	ST-841-1	14845	452
14 B	24	ST-624-C-1	10507	4789
15 B	16	RT-383	13629	1667
16 B	19	ST-845	14886	410
17 B	18	ST-852	15062	234

Storage-Tube Complement in WWI (Continued)

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

<u>Digit</u>	<u>STM No.</u>	<u>Tubes</u>	<u>Hours of Installation</u>	<u>Hours of Operation</u>
0 A	43	ST-722-C	13130	2166
1 A	20	ST-817	14148	1148
2 A	10	RT-384	15049	247
3 A	23	ST-802	13411	1885
4 A	32	ST-808	13516	1780
5 A	40	ST-525	13389	1907
6 A	8	RT-389	15290	6
7 A	35	ST-800	13340	1956
8 A	45	ST-825	14307	989
9 A	39	ST-814	13910	1386
10 A	30	ST-801	13363	1933
11 A	12	RT-387	15175	120
12 A	13	RT-390	15290	6
13 A	14	RT-381	13581	1715
14 A	37	ST-819	14404	892
15 A	22	ST-805	13457	1839
16 A	9	ST-855	15194	101
17 A	26	ST-847	15062	234

ES Clock hours as of 2400 July 16, 1953 15295.7  
 Average life of tubes in service in Bank B 1684  
 Average life of tubes in service in Bank A 1128  
 Average life of last five rejected tubes 492

Storage-Tube Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

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

- ST-831 was rejected after 529 hours of operation because of failure to hold a plus array.
- ST-849 was rejected after 16 hours of operation because of failure to hold a positive array.
- ST-850 was rejected after 57 hours of operation because of failure to hold a positive array.
- ST-851 was rejected after 82 hours of operation because of failure to hold a positive array.



Storage-Tube Failures in WWI (Continued)

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

- ST-853 was rejected after 67 hours of operation because of failure to hold a positive array.
- ST-746 was rejected after 2238 hours of operation because of loose target assembly.
- ST-710-C-1 was removed after 2401 hours of operation to provide space for stannic oxide tube. Tube and mount sent to STRT.
- ST-744-1 was removed after 2444 hours of operation to provide space for stannic oxide tube. Tube and mount sent to STRT.

Component Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following failures of electrical components have been reported since June 19, 1953:

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Crystals</u>			
1N38A	2	0 - 1000	1-Open; 1-high forward and low back resistance
D357	1	10000 - 11000	Low $R_b$ and drift
<u>Capacitors</u>			
.1MFD, 600-volt oil-filled bathtub	1	1000 - 2000	Faulty end seal
<u>Tubes</u>			
6SH7	1	4000 - 5000	Low $I_b$
6SN7	1	11000 - 12000	Broken alignment pin
	1	16000 - 17000	Open cathode
	2	18000 - 19000	Short
6J5	1	6000 - 7000	Short
6080	1	1000 - 2000	Short
7AK7	1	10000 - 11000	Low $I_b$
SR-1407	2	2000 - 3000	Unbalance
	1	3000 - 4000	Unbalance

Component Failures in WWI (Continued)

(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>			
5687	1	5000 - 6000	Short
6AS7	1	0 - 1000	Low I <sub>b</sub>
3E29	1	4000 - 5000	Low I <sub>b</sub>
	1	13000 - 14000	Low I <sub>b</sub>
	1	18000 - 19000	Low I <sub>b</sub>
5670	1	1000 - 2000	Low I <sub>b</sub>
	1	6000 - 7000	Short
	1	7000 - 8000	Short
6AL5	2	10000 - 11000	Low I <sub>b</sub>
7X6	6	10000 - 11000	4-Low I <sub>b</sub> ; 1-short; 1-leakage
6L6	7	18000 - 19000	Low I <sub>b</sub>
2021	1	0 - 1000	Broken envelope
6145	2	0 - 1000	1-Gassy; 1-short
	1	1000 - 2000	Leakage
	1	10000 - 11000	Short
7AD7	3	0 - 1000	Low I <sub>b</sub>
	1	9000 - 10000	Low I <sub>b</sub>
	2	10000 - 11000	1-Short; 1-low I <sub>b</sub>
	2	11000 - 12000	1-Short; 1-low I <sub>b</sub>
	3	13000 - 14000	2-Short; 1-low I <sub>b</sub>
	1	15000 - 16000	Low I <sub>b</sub>
	1	16000 - 17000	Short
	2	17000 - 18000	Short
	8	18000 - 19000	4-Short; 3-low I <sub>b</sub> ; 1-leakage
	1	19000 - 20000	Low I <sub>b</sub>
5969	1	0 - 1000	Broken
5881	1	1000 - 2000	Low I <sub>b</sub>
2C51	1	0 - 1000	Open heater
5696	31	0 - 1000	30-Short; 1-open heater
715C	17	0 - 1000	5-Low I <sub>b</sub> ; 1-leakage; 2-plate current drift; 3-broken envelope; 4-short; 1-bad plate weld; 1-gassy

1.24 General

D-C Power Supplies

(S. T. Coffin) (UNCLASSIFIED)

A +250 volt, 50 amp regulated d-c supply is being completely rebuilt and will go into WWI next month. It will operate on unregulated a-c, thus relieving the present load on the plate alternator.

1.3 Group 65

1.31 Storage Tubes

(P. Youtz) (UNCLASSIFIED)

Further research and development on the storage tubes has been curtailed. Most of the effort of the group has been directed toward the construction and testing of 800-series storage tubes and their installation in ES row.

The operational history in the computer of the 800-series storage tubes with stannic-oxide coatings has been satisfactory. During this period it was decided that all future tubes should have a stannic-oxide coating instead of dag. This was done with the full realization that oxide-coated cathodes do not activate so well in the presence of stannic-oxide coatings. However, there have been no recent problems of tubes failing because of weak cathodes.

Work was done this period on tubes for the cathode investigation of H. B. Frost.

There was some consultation with Group 25 on their work.

Storage-Tube Construction

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

During this period, three 800-series storage tubes with dag-coatings and seven with stannic-oxide coatings were constructed as replacements for any marginal tubes and old-model tubes in Bank A and Bank B of ES row.

Two experimental tubes for H. B. Frost were processed.

1.32 Test

Television Demonstrator

(D. M. Fisher) (UNCLASSIFIED)

Ten storage tubes were pretested during this period. Seven were accepted and transferred to the STRT for final testing. One of the rejected tubes had poor focussing action in the high-velocity gun. This tube will be reprocessed with new guns installed.

The remaining rejected tubes had high-lower switching potential. We have found from similar acting tubes that this action is caused by a buckled square-mica spacer which forces the main collector to recede from

1.32 Test (continued)

the mosaic in the buckled area. Corrective measures are being taken to minimize this difficulty.

An effort is being made to reactivate the storage surfaces of tubes which have been rejected from WWI because of failure to hold a positive array. Progress at this stage of the investigation is encouraging, but no conclusive results have been obtained at this time.

Storage Tube Reliability Tester

(R. E. Hegler) (UNCLASSIFIED)

ST853 through ST856 were tested at the STRT and sent to WWI.

RT387, RT389 and RT390, which have stannic-oxide for a conductive coating, had very good margins and were sent to WWI.

(L. B. Martin) (UNCLASSIFIED)

The week of July 6 through 10 was spent repairing test equipment with A. Zacharias.

The following week was spent assisting R. Hegler on the STRT.

(C. A. Zacharias) (UNCLASSIFIED)

The week of July 6 was spent repairing test equipment. During this time, an a-c register panel, decimal scaler, and pulse standardizer panel were repaired and their functioning checked against standard specifications.

The week of July 13 was devoted to learning the procedure and method of operation of the storage tube pretest TVD equipment.

1.33 Research and Development

(C. L. Corderman) (UNCLASSIFIED)

Because of the consistent failure of storage tubes in WWI, no more dag tubes are being made. A stannic-oxide coating is now used on all storage tubes. There have been no failures of stannic-oxide tubes due to internal breakdown. It is felt that if a breakdown is initiated in these tubes, the stannic-oxide will probably not release enough gas to sustain the discharge. In addition, if the discharge is maintained, the surface may not be damaged. In dag tubes the failure to hold an array after breakdown is a good indication that a deposit of carbon particles is covering the surface.



### 1.33 Research and Development (continued)

Insufficient experience has been obtained concerning the positive switching in stannic-oxide tubes with only one questionable case in one of five tubes in the computer. Monitoring of positive switching in dag tubes continues. During four days of operation without the -2400 volts on the high-velocity gun, ST858 has not switched positive. After another week under these conditions the high voltage will be applied, but the high-velocity gun-heater voltage will be removed.

#### Philip "L" Cathodes

(R. J. Biagiotti) (UNCLASSIFIED)

All work on "L" cathodes has been terminated temporarily except for the tubes which are in the life test rack at the present time. Both of these tubes developed grid emission which could not be remedied by means formerly used.

Tubes tested for grid emission to date have attained a steady value after a period of about three days. The tubes maintained this grid current for the remainder of the test which usually lasts about a week. This seems to indicate that if the emission is due to deposition of barium on the grid aperture, there is a limit beyond which additional barium coating has no effect at a given set of electrode potentials.

#### Velocity-Distribution Measurements

(C. T. Kirk) (UNCLASSIFIED)

The investigation of the RT218 surface continues. A bread-board unit has been designed to allow observation of the restoring current curves at higher sweep speeds. A step generator has also been incorporated into this unit to facilitate measurement of the time constant associated with the surface. This unit is now under construction.

Some thought has been given to a method of observing the presence of this time constant on an ordinary storage tube surface.

(E. J. Stevens) (UNCLASSIFIED)

The work was continued on Philip "L" cathodes with regard to grid emission and life test. A study of the problem of gas discharge within the storage tubes during operation has been started. Work was also started with J. S. Palermo on the stannic-oxide spraying of storage tube envelopes. A new method of masking the envelopes is being worked on at present.

~~CONFIDENTIAL~~  
UNCLASSIFIED

## SECTION II - WHIRLWIND II

2.1 Group 62

(N.H. Taylor) (UNCLASSIFIED)

Project Grind

Six memorandums, M-2266, 2267, 2268, 2283, 2284, and 2285 have been written which give the minutes of the first six meetings of Project Grind. A seventh meeting was held during the last period which covered:

Crosstelling  
Manual Inputs  
Power Supplies  
Subcontract of Video Mappers

These subjects are being pursued by IBM and progress is satisfactory.

IBM

A visit to IBM indicated that the general activity has reached a much higher tempo. Tests on arithmetic type of circuitry and logic are beginning and within a month data should be available in this portion of the system. Video mapping, shifting registers for input and output, magnetic drum logic are all proceeding at a good rate.

Magnetic Memory

A plan is underway to build a sizeable memory at MIT using 64 x 64 planes driven by transformers to spur along the AN/FSQ-7 (XD-1) memory program.

2.11 SystemsIn-Out Block Diagrams

(J.F. Jacobs, K.H. Olsen) (CONFIDENTIAL)

The block and timing diagrams for the radar input system are nearing completion. The design of the input buffer and the specifications for the other drums are expected to be completed about July 24. The block outline of the crosstelling system has been chosen. Relays have been chosen for interlocking and switching in the manual input system. The complete display block and timing diagrams cannot be determined until the cathode ray tubes, character generator, etc., are chosen. Both the track and digital display are in the block outline stage. A proposal, M-2296, for the weapon output system has been prepared.

Computer Block Schematics

(J.F. Jacobs, K.H. Olsen) (CONFIDENTIAL)

The block schematics of the arithmetic element and its control are almost completed by Ross's group. These diagrams will be available for inspection in Jacob's or Kromer's office. These diagrams will be subjected to a critical check by members of the Systems and Basic Circuits group.

~~CONFIDENTIAL~~

2.11 Systems (Continued)Input Counters

(J.F. Jacobs, K.H. Olsen) (CONFIDENTIAL)

The block diagram and timing diagram for the radar inputs are being worked into a final form by M. Epstein at MIT and W. McMillan at IBM. R.L. Best is being kept up to date on possible circuit pitfalls in the block diagrams. J. Gillette of Best's group will be working with the magnetic core circuits group to help with the development of core drivers.

Circuits Application Manual

(J.F. Jacobs, K.H. Olsen) (CONFIDENTIAL)

The first entry in Circuits Application Manual, the high-speed flip-flop, has been distributed and comments are being collected.

Input Counters

(H.K. Rising) (CONFIDENTIAL)

Work with junction diode magnetic core counters will come to an end as soon as the counter checking equipment has been debugged. The counter checker is versatile enough to test any future counters which will be built. As soon as this equipment is working satisfactorily, work will be started on the IBM type of stepping register using point contact diodes.

Circuit Application Manual

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

The first entry in the Circuit Application Manual has been distributed. This entry is a summary of the characteristics of the high-speed flip-flop. Several more entries, not as complete as the flip-flop entry, will be issued in the near future. They are summaries of the characteristics of the cathode follower, 0.5- $\mu$ sec delay unit, gate tube circuit, and buffer amplifier.

M-notes are now being written which describe the purpose and contents of the Circuit Application Manual and give the responsibilities of the Basic Circuit's Sub-Committee.

Input Counters

(C.J. Schultz) (CONFIDENTIAL)

The  $2^9$  core counter has been placed in a life test setup which records errors in the system. The core counter is operating at a counting rate of 2KC and a shifting rate of 65KC, and is compared with the count produced by the standard test equipment  $2^6$  low-speed counters. The errors registered after several hours operation have been few and were due mainly to power line transients.

2.11 Systems (Continued)Input Counters

(M. Epstein) (CONFIDENTIAL)

Diagrams of the radar counters have been drawn in conjunction with McMillan of IBM. A drum speed of 10  $\mu$ sec per register was assumed in the timing.

(R. vonBuelow) (CONFIDENTIAL)

The "dark trace" tube of Freed Electronics is yet applicable to our system. It takes 2 or 3 seconds for erasure (which is not complete even then) using a defocused beam and a bright incident light. Selective erasure is practically impossible. I do not believe this tube could be produced in the necessary quantities for some time.

Memorandum M-2262 on Category Selection is available.

The number of vectors necessary for display was discussed with D.R. Israel. It is felt that 22 1/2 degree angular increments are adequate and that six different lengths are sufficient. This means a total of 48 vectors. This number of vectors plus the alphabet plus ten numerals can easily be put on the matrix of a charactron.

The Charactron is being investigated next week at Convair.

Display System

(R.H. Gerhardt) (CONFIDENTIAL)

A block diagram of the display system is being made. In order to make the drum read-out times consistent with the tentative display times, an interleave on the drum is being considered. Thus a minimum of storage within the display system will be accomplished.

I am also studying a system designed at IBM which will store all information for one track in a core register and then read from the cores to the decoders as is needed.

(R.C. Jeffrey) (CONFIDENTIAL)

The last biweekly period was spent working with the In-Out group at High Street on specifications and design of the drum system for XD-1, especially of the input buffer drum. The design of the input buffer and the specifications for the other drums are expected to be completed on July 24. A detailed proposal based on that work will be presented to Project Grind during the week of August 17, after vacations of the people concerned.

2.11 Systems (Continued)

Outputs to Weapons

(R.C. Hopkins) (CONFIDENTIAL)

M-2296, "Weapons Output Proposal for Transition System," is now being reproduced. This will serve to stimulate thought, discussion, and suggestions among those interested in this phase of the Transition System and will act as a starting point for further work on weapons outputs. The next step will be to obtain more detailed specifications of data links and other equipment with which the system must operate in order to propose concrete solutions to outstanding questions, notably, equipment comparison between possible phone line distribution systems and interlock problems.

(R.P. Mayer) (UNCLASSIFIED)

The minutes of the Project Grind meetings for June 30 to July 2 are slow in being issued because an attempt is being made to have them checked by some of the people at the meetings. Some of these people have been away on vacation. The object of the minutes is to put on record some of the decisions made and some of the reasons for these decisions. Any problems will be brought into the open so that decisions can be made as soon as possible. If there are any errors or omissions in the minutes, they should be called to the attention of A.P. Kromer or R.P. Mayer.

A series of informal discussions has been initiated with IBM for the purpose of bringing together the logical diagrams from the various in-out groups and organizing them into a unified diagram of the details of the whole in-out system.

Marginal Checking

(I. Aronson, R. Fallows, R. Pfaff) (UNCLASSIFIED)

Work on marginal checking continues in conjunction with Walters and Beeby of IBM. The following work has been accomplished in the past two weeks:

1. Study of breakdown of computer into large groups for trouble detection and smaller groups for trouble location. Program and arithmetic registers have been covered; control is being started. Work continues on this. It appears that complete agreement will not be reached as to how this breakdown should be accomplished.
2. Some rough programming has been done to try breakdowns and gain a feeling for the subject.
3. Investigated a proposal by Mr. Everett to marginal check between tracking programs during regular computer operation.
4. Meeting with Papian and Best to study marginal checking for memory.



2.12 Memory

Miscellany

(W.N. Papian) (UNCLASSIFIED)

We hope to have the 4,096 tested XD-1 type cores for our 64 x 64 experimental plane delivered soon. The plane is seriously needed; test results on it are expected to have a serious effect on the course of the design work of the next few weeks.

The Project High IBM people have a completed 64 x 64. Unfortunately it is not made of tested cores; it is useful, however, for "impedance" measurements, etc., which they are now working on. Most of their effort is at present channelled toward the construction of two types of test setups, one for individual cores (like those in Group 63), and one for planes and memory arrays (like Test Setup V, but 64 x 64 in size).

XD-1 Sensing & Digit-Plane Driving

(W.J. Canty) (UNCLASSIFIED)

Most of the past biweekly period has been spent on specifications for the sensing amplifier and digit-plane driver in the XD-1 memory system.

The geometry of the sense and digit-plane windings has also been investigated. If it becomes necessary (due to delta noise) to use two sense windings per plane, a new geometry has been evolved which should give the same delta noise output per winding as that in the present MTC 32 x 32 array.

Switch Cores

(J. Raffel) (UNCLASSIFIED)

Some new ferrite materials were tested for possible switch-core use. None seemed especially promising. A note on switch-core design and power loss is being revised.

Switch Cores

(A.D. Hughes) (UNCLASSIFIED)

An MF 1312, F262 ferrite switch core was lowered in temperature with constant prf and the variation in output was found to be the same as when the core was raised in temperature the same amount.

Other tests of switch cores using different types of driving sources and different loads are being conducted.

2.12 Memory (Continued)

Selection-Plane Drivers

(J.L. Mitchell) (UNCLASSIFIED)

Pulse transformers to drive the next memory are being tested and evaluated. We are trying to reduce the change in secondary current due to the "back" voltage produced by the memory core's switching. We hope to find a suitable transformer within the next few weeks.

Memory Test Setup I

(S. Fine) (UNCLASSIFIED)

A study of memory-plane geometry is being undertaken as part of a thesis on readout noise reduction. Planes have been built using fiber washers instead of magnetic cores. From these planes an investigation into inductive and capacitive pickup for various sensing winding geometries will be made.

Memory Test Setup V

(E.A. Guditz) (UNCLASSIFIED)

Data has been gathered on the following:

1. "Back" voltage across a coordinate driving line versus driving-current risetime for a real and a dummy memory plane.
2. Sensing winding output voltage versus risetime of digit-plane current.

The test setup is being modified to get data on a reading method which uses staggered read pulses.

### 2.13 Vacuum-Tube Circuits Section

(R.L. Best) (UNCLASSIFIED)

Harlan Anderson has come to this section from MTC to work on drum circuits, and Hal Boyd is going to transfer to the MTC section, to, among other things, evaluate the XD-1 flip-flop in MTC use.

Two groups of engineers from IBM are scheduled to visit here the week of July 20, one to discuss the various proposed flip-flops, and the other to discuss gate tubes, pulse amplifiers, and pulse transformers.

Experiments with driving control lines (large numbers of gate tubes) show that the load presented when these gate tube grids go positive is severe enough so that it can halve the impedance of the control lines for large pulses. This makes the pulse amplifier design a little harder than was anticipated. If the effect is too serious, heavily loaded control lines may be broken into sections and driven separately.

Experiments are under way to evaluate gate-tube-flip-flop combinations when wider pulses are used such as will be needed with the drum and magnetic stepping registers.

#### Intensification Amplifier

(H. E. Zieman) (UNCLASSIFIED)

A new "sticky" flip-flop has been built to drive the intensification amplifier. The new flip-flop uses a single duo-triode thus simplifying the original two-tube flip-flop. It purposely orders one state so that the scope will not be left intensified.

The new amplifier will permit a constant first anode voltage which will help to limit grid emission. Maximum intensity will be controlled in the intensification amplifier.

#### Decoder Output Amplifier

(H. E. Zieman) UNCLASSIFIED)

A new output stage is being designed for the decoder output amplifier to put out a 50-volt push-pull signal across a 300-ohm twin-conductor cable. It is hoped to limit pickup noise by increasing the transmitted signal level from the present 20 volts to this new 50-volt level.

### 2.13 Vacuum-Tube Circuits (Continued)

#### Flip-Flops

(H. Boyd) (UNCLASSIFIED)

Investigations are being made on the compatibility of gate-tubes, and high-speed and low-speed flip-flops, to determine whether or not load driving cathode-followers are required. Of particular importance are the flip-flop's margins, noise pulses in both gate tube and flip-flop outputs, and the gate-tube's input-output characteristics. The above effects will be noted for the cases where there is and isn't a delay between triggering and sensing of a flip-flop.

A high-speed flip-flop breadboard, with all components, including tubes, "off" in their worst acceptable directions and locations, was shown to have margins comparable to those of logic high-speed flip-flops.

The shop has begun production of 30 high-speed flip-flops for use in MTC.

The "slave" flip-flop performed as suspected, but is comparatively hard on diodes. It will be put through tolerance and marginal-checking tests at a later date. It is expected that maximum static tolerances and margins will be realized at input trigger amplitudes of 20 volts and more.

A trinary flip-flop (flip-stick-flop), designed about two months ago, was built and given some preliminary tests. It worked well, but will be abandoned as R.P. Mayer is no longer interested in such a gadget.

IBM's low-speed flip-flop will be built and given comparison tests to our low-speed flip-flop. Each have merits of different natures making them suitable for different applications.

#### Pulse Transformers

(E. Gates) (UNCLASSIFIED)

A large number of transformers with turns ratios ranging from 3:1 to 7:1 have been wound for use in the gate-tube circuit. Several arrangements of the windings on the core are also being investigated. From the results of these various transformers in the gate tube circuit a final design will be determined.

These transformers are also being tested before and after potting since the potting procedure affects the amplitude and width of the pulse.

2.13 Vacuum-Tube Circuits (Continued)Gate-Tube Circuit

(H.J. Platt) (UNCLASSIFIED)

Not much progress was made on this circuit during the last two weeks because of the press of business of the Electronic Components Committee.

However, the requirements of a new gate tube circuit were made known. It is required to drive one-half of an IBM recording head from a gate tube. A  $1\frac{1}{2}$ - $\mu$ sec pulse of 250 ma at a prr of 8  $\mu$ sec is needed. A quick experiment showed that a 193-10 transformer (5:1, 0.5- $\mu$ sec pulse) will put 400 ma through the half winding. The tentative pulse shape is to be a sine wave or a clipped sine wave. Thus, it seems that the requirements can be easily met.

Delay Lines

(J. Woolf) (UNCLASSIFIED)

A basic circuit for a 1.0- $\mu$ sec delay has been developed, using a tetrode connected 7AK7 and 400-ohms distributed delay line.

Character Generator

(J. Woolf) (UNCLASSIFIED)

A basic circuit to generate the character B has been built and is being debugged. This character generator utilizes the Bell Laboratory idea of superimposing portions of sinusoids.

Pulse Amplifier

(S. Bradspies) (UNCLASSIFIED)

Data has been collected on the comparison of driving a pure resistance, a gate tube panel with tubes on, and a gate tube panel with tubes off.

When the gate tubes are off (cathodes are cold, but tubes are in sockets), we find that the "transmission line" looks like 27 ohms, if a 3:1 step down output transformer is used. If a 5:1 transformer is used, the line looks more like 20 ohms.

When the gate tubes are on, in either case, (3:1 or 5:1 transformer), the transfer (output versus input) characteristic of the buffer amplifier shows that the curve for a transmission line follows that for a pure resistance until the gate tube grids are driven above



2.13 Vacuum-Tube Circuits (Continued)

Pulse Amplifier (continued)

(S. Bradspies) (UNCLASSIFIED)

zero. When the pulse height reaches 15 volts, the transfer curve sags, and the output rises slowly for increased inputs.

The total delay for the transmission line is about 0.025-0.030  $\mu$ sec. This indicates that if more delay may be tolerated, the inductance of the line may be increased so as to increase the  $Z_0$  of the line and increase the output of the buffer.

Memory Selection Plane Drivers

(D. Shansky) (UNCLASSIFIED)

The selection plane driver circuitry for the next memory has been designed and is presently being breadboarded. It is hoped that coupling into the memory via a transformer will prove feasible.

Magnetic Drums

(H. E. Anderson) (UNCLASSIFIED)

July 13-15 was spent at IBM in Poughkeepsie becoming acquainted with their magnetic drum work. The possibility of connecting a drum to MTC is being studied. A "read head simulator" is being built now, to aid in amplifier studies.

2.14 Memory Test Computer

General

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

For the past two weeks MTC has been operating on a regular two-shift schedule, nominally 0800 to midnight. The hours from 1700 to midnight can usually be made available to any persons who would like to try programs; those interested should contact Bill Hosier.

Bob West and Frank Durgin of IBM have just returned to Poughkeepsie after a four months' period of working with the Laboratory on various aspects of the magnetic-core memory. One of their major efforts was taking some 30 or 40 hours data on the MTC memory, collaborating with Papian and Widrowitz. They are now digesting this data in Poughkeepsie and expect to issue a summary of their findings in a week or two, which will be available in the library.

2.14 Memory Test Computer (Continued)General (continued)

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

Bernie Widrowitz still has a series of measurements in progress on the MTC memory (see below); these, too, will be summarized and circulated shortly.

More specific proposals have recently been made for making MTC an integral part of the program to test AN FSQ-7 (XD-1) units. The most important of these is to add an IBM drum, divided into three fields to simulate auxiliary, input buffers, and output buffer drums respectively. H.E. Anderson has been transferred from MTC to Dick Best's group to work on circuitry for this drum. Attention is now being given to the question of what sort of re-casting of MTC control will promote early and fruitful use of the drum and associated devices.

Memory

(B. Widrowitz) (UNCLASSIFIED)

A procedure for finding optimum operating conditions has been tried on three programs. It was found that increasing X and Y read driver rise times beyond 0.6  $\mu$ sec does not improve the one-to-zero ratio appreciably. A note is being written to describe this procedure and how it was arrived at.

Except for the failure of a sensing amplifier, memory operation has been good during the past two weeks.

Programs And LogicInstruction Code

(P.R. Bagley) (UNCLASSIFIED)

The equipment for instruction mh, multiply, has been recabled and appears to be operating without error. The operation of mh is described in the latest revision (-2) of M-1881, "MTC: Guide to Coding and MTC Operation Code".

A variation of the print/punch instruction, pr, has been planned to permit punching paper tape without the 7th hole position being punched. This feature is necessary if MTC is to punch paper tape which can be read in to the Whirlwind I computer. This feature also makes it possible to program the feeding out of blank tape, and to insert blank lines periodically in punched tape to assist in visual checking of tape.

2.14 Memory Test Computer (Continued)

Programs And Logic

Read-In Process

(P.R. Bagley) (UNCLASSIFIED)

The MTC read-in and conversion programs are being modified to provide for a sum-check feature on 4-6-6 tapes. The revised conversion program will also provide for the following features:

1. Automatic clearing of magnetic memory during read-in, if desired.
2. Conditional or unconditional transfer of control, after read-in, to first register of program.
3. Provision for ignoring extraneous information punched on standard tapes, such as tape number, title, and programmer's name.

Marginal Checking

(P.R. Bagley) (UNCLASSIFIED)

A series of marginal checking programs more comprehensive than the present programs are being prepared for MTC. These programs are designed each to fit in 32 registers of Panel Storage. When the 32-register Plugboard Storage becomes available, each program may be semi-permanently installed in a plugboard, thereby facilitating the speed and accuracy with which the program may be installed in the computer.

It is planned that the daily marginal checking procedure will be somewhat simplified by varying the voltage on groups of lines which have similar voltages and similar margins (as proposed for the AN/FSQ-7 (XD-1) ). Margins on individual lines will be taken perhaps once every two weeks, or whenever a group of lines has shown margins significantly poorer than normal.

Conversion of Tapes for WWI

(P.R. Bagley) (UNCLASSIFIED)

Plans have been made for MTC to assume the task of converting Whirlwind programs to 5-56 tapes where only the Basic Conversion program is required. To this end, three tasks are in progress:

2.14 Memory Test Computer (Continued)

1. Install provision to punch without 7th hole.  
(P. Bagley)
2. Modify flexowriter control equipment to omit the 7th hole. (W. Ogden)
3. Rewrite the Whirlwind I Basic 5-56 Conversion Program for MTC. (B. Farley)

Electronic Design and Installation

Digit Plane Driver Plug-in

(J. D. Crane) (UNCLASSIFIED)

Plans for a panel to facilitate checking of Digit Plane Driver Plug-in units are complete.

Cathode Follower, Mod V, MTC

(J. D. Crane) (UNCLASSIFIED)

A Mod V cathode follower is being made to drive the additional live register lines necessary when live registers are added.

Marginal Checking

(J. D. Crane) (UNCLASSIFIED)

Marginal checking lines for the Digit Plane Driver and Memory Address Flip-Flops are now installed.

Plug Board Storage

(H. Henegar) (UNCLASSIFIED)

All shop work has been completed on the plug board and it is now being assembled. A good deal of wiring remains to be done, however, and the completion date is still several weeks away.

2.14 Memory Test Computer (Continued)

Electronic Design and Installation (continued)

Plug Board Storage (continued)

(H. Henegar) (UNCLASSIFIED)

The question of additional flip-flop storage registers or LR's (live registers) in the MTC has come up. At present, only one LR is available in the computer, but it may be inserted in as many panel storage registers as desired. Due to mechanical difficulties, additional LR's will be available only in the plug board registers (panel storage registers 32 through 63). Each LR, including the present one, may be inserted in as many as five of the plug board registers.

Maintenance

Marginal Checking

(R. Hughes) (UNCLASSIFIED)

Computer margins have remained constant for the last month and deterioration of components is not noticeable.

The new marginal checking blown fuse indication panel has been installed in the system and appears to work properly.

Component Failures

(R. Hughes) (UNCLASSIFIED)

The following components have failed in MTC during the last biweekly period.

<u>Component</u>	<u>Number of Failures</u>	<u>Hours of Operation</u>	<u>Reason for Failure</u>
Tube 6145	4	0 to 1000	Short
Tube 6145	5	0 to 1000	Changes in Characteristics
Tube 5687	1	0 to 1000	Short
Toggle Switch	1	0 to 1000	Mechanical
Burroughs Pulse Control Unit	1	0 to 1000	Intermittent



2.14 Memory Test Computer (Continued)

Power Supplies

(R.G. Farmer) (UNCLASSIFIED)

All sections of the MTC supplies which were originally planned for have been received. Two additional 150-volt, 10-amp supplies are being constructed. These have been delayed by procurement of transformers but are expected to be received by August 1.

An effort is being made to get the +250 supply in operation as soon as possible because this is the voltage which is causing the computer the most trouble. It is believed that most of the supplies will be in operation within three weeks.

Power Supply Control

(R. C. Hopkins) (UNCLASSIFIED)

Memorandum M-2310, operating instructions for the MTC Power Supply Control System, will be reproduced shortly. A panel to add control of two additional power supplies to the system is now being designed. It is expected that the Power Supply Control Panels, exclusive of the new panel mentioned, will be checked out and ready for connection into the computer if desired and for operation with either building power or the MTC alternator and either building d-c power supplies or MTC power supplies within the next week.

Air Conditioning

(R.E. Garrett) (UNCLASSIFIED)

An increase in capacity of the air-handling unit has been effected by the purchase of a larger circulating pump and by adding anti-freeze to the chilled water thereby permitting a lower operating temperature. The debugging of the control is now underway according to recommendations of Francis Associates, our consultant on air conditioning.

2.15 Equipment Design and Schedules

(J. Giordano) (UNCLASSIFIED)

The IBM-MIT Drafting Subcommittee met for the third time at MIT on July 7. As a result of this meeting, a formal proposal for the adoption of certain sections of the IBM Military Reference Data book have been submitted to the Central Standards Committee for approval. The Subcommittee also agreed on modifications of other sections of this book. These sections are now being revised by W. Cornett of IBM. When completed, these sections will consist of the Subcommittee's fourth proposal to the Central Standards Committee on drafting standards.

The initial distribution of the Circuit Application Manual was completed this week. At present the manual consists of the High Speed Flip-Flop designed by H. Boyd. Other circuits, presented in a similar format as the High Speed FF, will eventually be added to this manual.

(J. D. Bassett) (UNCLASSIFIED)

Meetings of the joint MIT-IBM subcommittees on materials and processes and mechanical components standards were held during the week of July 6.

It was agreed by committee members to draw up proposals on metal finishing processes, metal joining processes, metals and plastic laminates to be used in equipment construction, and various types of hardware for both joining and decorative purposes. These proposals will be circulated for comment in the near future.

Memos have been published on trips to the Gavitt and Surprenant wire factories and on the first Basic Materials Conference in New York City. These are M-2278 and M-2293 respectively.

(R. Fallows) (UNCLASSIFIED)

The Tube Standard Subcommittee approved GE technical proposal for Z2177 tube development (improved 5965) and presented SR1782 (improved 7AK7) proposed spec to Sylvania engineers.

2.16 Transistors

Minority Carrier Storage

(N. T. Jones) (UNCLASSIFIED)

The diode samples of all available types were tested for reverse recovery characteristics. The data will be evaluated and these diodes rated for reference of all engineers in a forthcoming memorandum.

2.16 Transistors (Continued)

D. Smith plotted the storage coefficients by manufacturer for a number of the transistors on hand. A low coefficient indicates low storage. Rated in ascending order of coefficient these units fall in the order, Transistor Products 2C, GE G11A, RCA TA 165K, Western Electric 1698, and WE 1734.

Correlation of experimental data with the theoretical predictions of R. Kingston, Lincoln Group 35, for the storage in junction diodes has been done. This correlation indicates that the storage time obtained using his equations are very close to those observed experimentally.

Measurements

(N. T. Jones) (UNCLASSIFIED)

Fifteen GE G11A transistors were received, measured, and placed in use by D. Smith. The efficiency of the present measuring system is such that the complete process, including handling, equipment set-up, measurement, calculations, and recording, takes less than 45 minutes per transistor in small lots such as this.

Life Tests

(N. T. Jones) (UNCLASSIFIED)

D. Thompson has completed design of the special power supplies for the expanded life tests. When these are constructed and debugged, then construction of a few of the dynamic tests, setting up the life test rack, and initial processing of the transistors remain to start the expanded life tests.

Life Tests, June 1952 to April 1953

(D. J. Eckl) (UNCLASSIFIED)

These tests involved a total of 91 transistors, not counting those in the water-immersion test, and there were 13 failures. In the a-c tests, 3 of 29 transistors failed during 5000 hours of operation. In the d-c tests there were 4 failures in 32 transistors. The shelf-life test produced 1 failure in 15, and the elevated temperature test 5 failures in 15 at 60°C (140°F). All 15 transistors in the water-immersion test eventually failed. These results are good when it is remembered that: 1) many of the tests were intended to be destructive tests, not tests under normal conditions; and 2) many of the transistors used were by necessity of somewhat poor quality. The complete data on these tests will be forthcoming shortly in an Engineering Note.

2.16 Transistors (Continued)Transistor Core Driver

(S. Oken) (UNCLASSIFIED)

The single-transistor core driver has been run for 1000 hours without any change in the transistor's characteristics.

After several schemes for paralleling transistors had failed due to load-impedance troubles, a system using a transformer shows very good promise. By adding the output from two single transistor drivers, through use of two windings on a transformer, the output from a third winding was 60 ma across 10 ohms. The possibility of having 4 or 5 such windings on one transformer is being investigated by Earl Gates.

Two-Transistor Flip-Flop

(E. U. Cohler) (UNCLASSIFIED)

The non-saturating two-transistor flip-flop invented by Carlson at CRC was studied and some modifications were made to fit our requirements. It was found that the damping diodes could be replaced by resistors without adversely affecting performance. Triggering at the emitter with a 12-v, 0.1- $\mu$ s half sinewave pulse, the flip-flop would operate reliably up to 2 mc. Some transistors would give operation up to 4.5 mc. The waveform was excellent up to about one megacycle. The output was from 12 to 15 v depending on the transistors used. The triggering was done at the emitter to accomplish complementing easily. This seems to be a good and reliable high-speed transistor flip-flop.

In addition to this flip-flop, some work is being done on building up a low-speed counter (100 kc) and this should be done the early part of next week. In conjunction with this work on flip-flops in general, some attempt is being made to make a transient analysis of the flip-flops on the basis of phase plane plots.

2.2 Group 63 (Magnetic Materials)

(D. R. Brown) (UNCLASSIFIED)

Specifications for the high-speed memory core have been mailed by IBM to General Ceramics and RCA Victor. The delivery schedule is: 75,000 cores by September 15, 75,000 by October 15, and 100,000 by November 15, 1953.

General Ceramics has a batch of material blended in February, 1953, which is adequate for 8 million cores. The first samples from this batch were received July 16 and are now being evaluated.

The 1000 cores from RCA Victor, ordered December 30, 1952, are expected early in August.

An order for 100,000 cores, which meet the specifications for the high-speed memory core, is being placed with General Ceramics for delivery ahead of the IBM order.

Ferrite-Core Pulse Tests

(J. W. Schallerer) (UNCLASSIFIED)

Lots A-4 and A-5 have been tested. Thirty-six hundred good cores resulted out of approximately 10,000 cores. This represents a better final yield than that obtained with cores for MTC. The limits will have to be relaxed however, in order to get enough cores for a 64 x 64 memory plane.

Half of the cores (approx. 2500) from Lot A-5 were sorted according to thickness. The cores were sorted into seven thicknesses and then pulse tested. The yield varied from 16% to 72%. The sections that had the highest yield were in the 0.024-inch to 0.026-inch range. On the basis of these results, it seems the cores should be sorted before being pulse tested. At present, no really fast method of sorting is available to us.

(W. K. Klemperer and J. R. Freeman) (UNCLASSIFIED)

The core-evaluation pulse tester has been torn down completely and redesigned to include a third low-speed counter. This change, along with its new switching arrangement, greatly increases the flexibility and ease of operation of the equipment.

Efforts were made to find the sources of disagreement between our equipment and the production core-tester, which sometimes amounted to as much as 20% and could no longer be attributed to temperature variations. A calibration check of the meters used to set driver current apparently account for about 10% of the deviation. The difference in oscilloscope frequency response to the calibrating signal at a lower frequency and core output at a higher frequency introduces a significant error. We are trying out a pulse voltage calibrator to overcome this.



2.2 Group 63 (continued)

Ferrite-Core Pulse Tests (continued)

(A. C. Switendick) (UNCLASSIFIED)

A study of the pulse-test technique used for primary pulse testing of DCL cores was made with a view to increasing the number of cores tested per day. The logic of the pulse-test equipment was revised and serviced. The use of a different core driver, Mod. III core tester, and the rearrangement of equipment has minimized the "ringing" in the pulse test picture.

With present equipment and techniques, 20 cores per day can be pulse tested. This number is sufficient to keep up with the yield of good cores from the B-H loop test. This improvement of equipment and technique will allow time for more refined tests to be made on promising cores.

Automatic-Core Tester

(B. Gurley) (UNCLASSIFIED)

Two sensing amplifiers for the automatic-core tester have been completed and checked out. An elementary sense logic has been built up but is not yet tested with core inputs. The problem of ringing, etc., on the sensing chassis outputs has been solved.

The prototype calibrating chassis have been completed and are being tested.

Core Sorter

(R. A. Maglio) (UNCLASSIFIED)

In order to achieve uniformity of core height, a core-measuring device will be introduced into the processing system directly after pressing and before firing. A similar device will be used to sort the fired cores.

A breadboard model core sorter has been made and used successfully for separating cores according to height.

A batch of General Ceramics cores has been run through the machine and a fairly uniform section has been tested. These cores show an increase in uniformity of voltage output of about 20%.

Ferrite Analysis

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

Experiments to determine the effect of temperature on the switching coefficient,  $S_v$ , of nickel ferrite and the effect of compression on the switching coefficient of nickel-zinc ferrite Ferroxcube 4B are continuing.

2.2 Group 63 (continued)Ferrite Analysis (continued)

Refiring a nickel ferrite core reduced the coercive from 9.65 oersteds to about 4.5 oersteds. This is still too high to permit measurement with standard equipment. Henry Zieman has therefore designed a unit to give output of 10 amperes with pulse length of 2 microseconds and a rise time of 0.05 microsecond. The prf is 5000/sec. One unit has been built, but does not operate properly. H. Zieman is now debugging the unit. Upon successful operation of this unit, a second will be built and temperature measurements taken.

A preliminary run has been made of the effect of compression on Ferroxcube 4B. The results are not in agreement with those predicted and a further, more extensive experiment will be made as soon as equipment is available.

Ferrite Synthesis

(R. A. Maglio) (UNCLASSIFIED)

The evaluation of temperature variations within the Harper Furnace Muffle for a proposed shelf arrangement indicates that the largest radial temperature gradient exists at the bottom shelf level. This temperature variation is 5° C at 700° C and increases to 6° C at 1300° C. Thermocouple measurements indicate an average of 3° C temperature variation for radial measurements for the entire muffle.

Data obtained will also permit evaluation of the temperature lag, at various points in the muffle, behind the control-point temperature.

A sample batch of cores will be fired and tested. These cores will be tagged according to shelf location within the muffle. A correlation will be attempted between electrical properties and temperature gradients in order to determine if the entire muffle will be satisfactory for core firing.

The modified Stokes press has been returned from the machine shop. A number of chemical mixes having different quantities of binder and types of binders have been pressed.

In every test the ferrite powder was not compressed sufficiently; as a result, the top die was redesigned and is now in the machine shop.

(J. Sacco) (UNCLASSIFIED)

Another series has been completed in the study of the ternary system of MgO, MnO and Fe<sub>2</sub>O<sub>3</sub>. Two more series are being processed. A large batch of material is in process duplicating our most promising composition DCL-2-126.

2.2 Group 63 (continued)

Microstructure of Ferrites

(F. S. Maddocks) (UNCLASSIFIED)

Several specimens of refired cores have been mounted and examined. Comparison with identical cores which have not been refired has given the following results:

1. Grain size not altered by refiring.
2. Porosity not altered by refiring.
3. Second phase precipitations, where visible in the unrefired cores, are reduced or decreased upon refiring. Any precipitate remaining is usually located along the borders of internal flaws.

Until more data are accumulated, no attempt will be made to draw definite conclusions concerning the effects of this process.

# APPROVED FOR PUBLIC RELEASE. CASE 06-1104.

Memorandum M-2311

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## SECTION III - CENTRAL SERVICES

### 3.1 Publications

(Diana M. Helwig)

The following material has been received in the Library, W2-325. However, beginning on Monday, July 27, and continuing thereafter, a Library-issued Accessions List will be distributed to all staff. This accessions list will include all material, of both internal and external nature, received by the Library in the preceding week.

Since some of the documents listed will be classified, limited titles will be given so that the Accessions List may be classified RESTRICTED. All Group Leader Secretaries should keep cumulative binders of the Lists as they are published, as reference for their Group. However, all other copies may be destroyed (deposited in a BURN BASKET) without being returned to the Library.

### LABORATORY FILES (UNCLASSIFIED)

<u>No.</u>	<u>Title</u>	<u>No. of Pages</u>	<u>Date</u>	<u>Author</u>
E-549	Basic Conversion Program	4	7-2-53	H. Briscoe
E-550	Open-Circuit Impedance Representation of Transistors	7	7-9-53	N. T. Jones
M-2274	Basic Circuits -- Sensing Amplifier, Preliminary Specifications, PB #20	2	7-3-53	C. Laspina
M-2276	Test Equipment Committee, Meeting of July 3, 1953	4	7-6-53	L. Sutro
M-2277	S & EC Group Computer Forms	6	6-30-53	K. J. Campbell
M-2278	Trip to Suprenant Manufacturing Company and Gavitt Manufacturing Company	2	6-29-53	J. D. Bassett
M-2279	June 1953 Storage and Research Tube Summary	5	7-1-53	D. M. Fisher
M-2282	MTC Bootstrap Type Programs	2	7-6-53	N. E. Anderson
M-1881-2	Memory Test Computer: Guide to Coding and MTC Operation Code	10	7-3-53	P. Bagley
M-2232	Procedure for Using Group 61 Equipment for Introducing Data into WWI	2	6-29-53	B. Morriss G. Young
M-2287	The Demodulator-Filter Switch Panel	3	7-7-53	R. Paddock
M-2290	Laboratory Personnel	16	7-1-53	
M-2291	Proposal for Reducing the Number of Tubes Used in Driving a Magnetic Matrix Switch	2	7-9-53	J. Raffel
M-2293	Report of First Basic Materials Conference, New York City, 6-16 to 18-53	3	7-9-53	J. Bassett
M-2299	Reorganization of the Standards Committee	2	7-15-53	H. Hodgdon H. Wainwright
M-2301	PSA-AN/FSQ: Scheduling Office Suppl. to M-2300	2	7-15-53	J. Forrester
M-2302	PSA-AN/FSQ: Approval of Schedule Changes (Suppl. to M-2300)	1	7-15-53	J. Forrester
M-2303	PSA-AN/FSQ: Progress Reports to the Scheduling Office (Suppl. to M-2300)	1	7-15-53	J. Forrester

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No.	Title	No. of Pages	Date	Author
M-2304	PSA-AN/FSQ: Transfer of Responsibility from MIT to IBM (Suppl. to M-2300)	1	7-15-53	J. Forrester
M-2305	PSA-AN/FSQ: Approval of Basic Circuits for AN/FSQ (Suppl. to M-2300)	2	7-15-53	J. Forrester
M-2306	PSA-AN/FSQ: Approval of Block Outlines and Block Schematics for AN/FSQ (Suppl. to M-2300)	1	7-15-53	J. Forrester
M-2307	PSA-AN/FSQ: MIT-IBM Communication (Suppl. to M-2300)	2	7-15-53	J. Forrester

LABORATORY FILES (CONFIDENTIAL)

E-562	Organization and Planning of the AN/FSQ-7 (XD-1) - Combat Information Central Program	2	6-30-53	N. H. Taylor
M-2266	Project Grind Meeting of June 24, 1953 (First day)	4	6-29-53	A. P. Kromer R. P. Mayer
M-2272	Summary of MIT - IBM Collaboration, June 1 through June 30, 1953	2	7-3-53	A. P. Kromer
M-2280	Division 6 Biweekly -- July 3, 1953	70	7-3-53	
M-2292	Flight Test Activity Report for June, 1953	2	7-9-53	(F. Heart P. Dolan A. Hill
M-2296	Weapons Output Proposal for Transition System	26	7-14-53	R. Hopkins
M-2300	Planning, Scheduling, and Administering the AN/FSQ-7 Program (with Broad Principles of MIT - IBM Relationships and Some Detail on Division 6 Procedures)	4	7-15-53	J. Forrester

LIBRARY FILES (UNCLASSIFIED)

No.	Identifying Information	Source
2428	Investigations of Methods of Data Preparation for a Numerically Controlled Planer	Servo Lab.
2429	Proceedings of the Association of Computing Machinery, Toronto Meeting	ACM
2432	Magnefile - The New Electronic Business Machine	Macdonald Co.
2433	A Second Progress Report on German Computer Work	ONRL
2434	Symposium on Automatic Digital Computation at the National Physical Laboratory	ONRL
B-258	Introduction to Number Theory, T. Nagell, 1951	John Wiley & Sons
B-259	Experimental Designs, W. Cochran & Gertrude Cox	John Wiley & Sons
B-260	Tables of Chebyshev Polynomials Sn(x) 2nd Cn(x)	National Bureau of Standards

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3.2 Purchasing and Stock

(H. B. Morley) (UNCLASSIFIED)

This office is cooperating closely with the DDL Fiscal Office during the transition period while they are setting up a system to process invoices from their office.

The Lincoln Laboratory Standard Receiving System has been put into operation at both Whittemore and Barta Buildings. Some changes are being made in the operation of the Stockroom and Stock Control System. These changes are internal only and will not affect personnel using these facilities.

We are experiencing some delivery delays, and can continue to expect them during the month of August due to so many of our vendors closing down completely for a vacation period.

Personnel requisitioning material for future Construction Requisitions are reminded that they should first consult Production Control to have a CR number assigned. This will avoid confusion and possible duplication when the parts list is processed through Stock and Procurement Departments.

3.3 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 30 construction requisitions totaling 1052 items satisfied since July 3, 1953 and there are 21 construction requisitions totaling 1030 items under construction by the Group 60 electronic shops.

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

Outside Vendor

(G. A. Murdoch) (UNCLASSIFIED)

There are 13 orders now open with vendors, totaling 2118 outstanding items. Deliveries in the past biweekly period have totaled 155 items. Information on specific orders may be obtained from the writer (ext. 3476).

3.4 Component Analysis and Standards

3.42 New Components

(B. B. Paine) (UNCLASSIFIED)

Four samples of Sprague metal-cased pulse transformers have

### 3.42 New Components (Continued)

successfully passed a 500-hour high-humidity life test. Although more samples will have to be tested before a definite decision can be reached, it appears now that this construction will be entirely adequate for our needs.

Two ovens have now been equipped to perform both wet and dry high temperature life tests on components. It is planned to do some testing of composition resistors and paper capacitors to determine their behavior under conditions of temperature and humidity.

Equipment has been built which may help to evaluate the performance of crystal diodes under various conditions of pulse application. The life tests of diodes at various d-c reverse voltages is continuing, and moderately complete data should be published during the next month.

Visits were made on July 13, 14, and 15 to five firms in Chicago to discuss capacitors, wire-wound resistors and connectors. A trip report on each of these visits should be issued during the week of July 27. It is also planned to catch up on many accumulated trip reports which have not yet been written.

### 3.43 Standards

(H. W. Hodgdon) (UNCLASSIFIED)

Samples of the Clare type GAC relay mentioned in the last biweekly are being procured for evaluation.

A proposed modification of the Standards Committee operation is outlined in M-2299, which has been circulated for comment.

Preliminary tests indicate that the blow-time curves for fuses contained in the Standards Book and in manufacturers' catalogs may not be accurate. Pending further investigation, it is suggested that caution be exercised in applying these curves.

### 3.44 Vacuum Tubes

#### The 715C Story (Continued from the Last Issue)

(H. B. Frost) (UNCLASSIFIED)

As noted in the last biweekly report, 715C tubes are now being preburned. The first lot were burned 200 hours, with no appreciable change in the last 100 hours. A number of these tubes, together with some others which had been previously removed but which passed all tests, were installed in the electrostatic storage deflection amplifiers of WWI on Saturday, July 11. Initial operation was quite good, but the quality of operation deteriorated rapidly, until Monday night July 13, which was quite disastrous (44

### 3.44 Vacuum Tubes (Continued)

parities). The tubes from the vertical amplifier were removed and tested. One tube, which had been operated previously in the computer but which had not been preburned, was found to have an intermittent short between grid 1 and the cathode, probably as a result of cathode peeling. This tube was replaced, and the set of 8 tubes was returned to the computer. Operations since that time have been fairly satisfactory. Adequate numbers of tubes for immediate needs have been preburned, but additional tubes will be preburned as long as time for testing them is available. These tubes are tested for static characteristics and stability before and after preburning.

On July 9 a meeting was held at Sylvania Headquarters in New York with Roger Slinkman and Dick Klein of Sylvania, Goetz and Geisler of IBM, Youtz and Frost from this laboratory. Characteristics and tests for the gate tubes for FSQ-7 were discussed. IBM is to notify Sylvania of the exact numbers required and corresponding dates, so that Sylvania can submit a bid for the production of these tubes. Much of my time last week was spent in the preparation of specifications for use at this meeting.

#### Thesis Research

(H. B. Frost (UNCLASSIFIED))

On Wednesday, July 8, I discussed with Dr. Nottingham my work so far and my future plans in this research. He will be in Europe for the remainder of the summer. I expect to continue work on experimental and commercial tubes and to investigate some theoretical possibilities of cathode stability.

An experimental tube was processed on Saturday, July 11, in the storage tube laboratory. This tube developed a grid-to-collector short, probably as a result of intensive r-f bombing. The intense bombing was intended to clean up the grid so as to avoid poisoning, but this result was not obtained. A second similar tube is due to be processed on July 18, but without such severe bombing. Slight structural modifications have been made to prevent the buckling which damaged the first of these tubes.

A pulse voltmeter of novel design has been designed and built for use on this research. This device has a rather high accuracy and will accommodate a wide variety of pulse lengths and duty factors with only minor changes in calibration. The allowable voltage input is governed by the 1N38A input crystal. Results thus far have been very promising, and this device is likely to be a very useful laboratory instrument of wide application.

#### Life Tests

(S. Twicken) (UNCLASSIFIED)

In an effort to find a replacement for the 715C, now obsolete, the 4X150A, a forced-air cooled power tetrode, is under consideration.

Accordingly, a life test rack for the 4X150A has been designed and is in construction. This rack will permit life evaluation under pulsed, d-c, or cut-off conditions. The 4X150A is not suitable for storage tube deflection circuits because of its high secondary emission but may be suitable for display scopes.

The 5965 life test has completed 500 hours, one side on and the other off. Although there was a general decrease of a few mils in plate current on stabilizing, no interface resistance has as yet developed.

A special life test of 7AK7's for grid emission has completed 500 hours. While all ten tubes initially passed the lab specification of 0.5  $\mu$ a max grid current, none did after 500 hours and only 3 passed the JAN test which allows 4  $\mu$ a max. As reported previously, this grid emission is due to the absence of gold plating on the control grid. Sylvania is aware of the problem and is attempting to rectify it. In the meantime, our reserve of 7AK7's is made up mostly of the lots tested.

Two 12AV7 Pulse Gater failures have been found to have interface impedance.

### 3.5 Test Equipment

#### Test Equipment Headquarters

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

Two types of Burroughs test equipment are needed at the headquarters for distribution. If you can spare a Type 1301AW Gate and Delayed Pulse Gen. or Type 1302AW Delay Line Panel please return it. If you can use a Type 1501AW Pulse Gater, which generates a variable length gate, instead of the Gate and Delayed Pulse Gen., we would like to exchange.

It has been decided to check Burroughs test equipment by varying the screen voltage of those tubes that can be reached through the marginal checking plug. An MTC panel designed for this purpose is being tried.

We have equipment now to accurately calibrate the Delay Line Panel and similar devices.

Work accomplished: Standard test equipment repaired and checked, 33; checked only, 77; scopes repaired and checked, 17; checked only, 3; commercial equipment checked, 3.

3.6 Drafting

New Drawings

(A. M. Falcione) (UNCLASSIFIED)

<u>Title</u>	<u>Cir. Sch.</u>	<u>Assy &amp; PL</u>
Alarm Recycle Control Mod I WWI	C-55154	D-54876
Alarm Recycle Control Mod II WWI	C-54843	D-55240
Magnetic Tape Mechanism Test Panel WWI	D-55048	E-55361
M.T. Relay Transfer Panel WWI	D-55357	R-55418
Photocell Pickup for C.R.T. Filter WWI	B-54684	D-55491
Continuous Lock-Up Alarm Indicator WWI	C-54842	D-54866
Surge Current Suppressor M.T.C.	B-54905	E-54904

3.7 Administration and Personnel

New Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Constance De Caprio is a new messenger girl.

Frances Dobrovalsky is a clerk in the Tape Preparation Room.

Barbara Godfrey is a Laboratory Assistant in Group 64.

Terminated Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Cornelius McLaughlin