

Memorandum M-2362

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

SUBJECT: DIVISION 6 BIWEEKLY REPORT, August 14, 1953

To: Jay W. Forrester

From: Division 6 Staff

CLASSIFICATION CHANGED TO:
Auth: DD254
By: R.K. Crutt
Date: 2/1/60

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SECTION I - CAPE COD SYSTEM

1.1 Group 61

1.10 General

(R.J. Horn) (CONFIDENTIAL)

All parts of the Track-While-Scan Program for the 1953 Cape Cod System except the automatic initiation section have been checked out. Operation of the Program has suggested a few minor modifications in the display-line switches, indicator lights, and in the Program itself. Actual systems testing with the operating personnel is being delayed by data and equipment difficulties.

All but two short Non-Track-While-Scan Programs have been written, and all but a few Programs have successfully completed their initial testing phases. The present work is directed toward "marrying" the programs and testing their combined operation.

Training and operating facilities for the Cape Cod System have been under active discussion among Group 61, Jim Degan of Group 38, and Captain Sullivan of Section C of the 6520th AC&W Squadron.

Under the supervision of Jim Degan an intensive effort will be made during the next biweekly period to obtain the type of flight-plan and cross-telling data to be used in the Cape Cod System.

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1.10 General (Continued)

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

An analysis of SDV data by the Associated Studies Section will be issued as M-2343 in the near future.

1.11 Equipment Engineering

(H.J. Kirshner) (CONFIDENTIAL)

All equipment and associated cabling located in Room 228, Barta, has been removed.

The Blue Coder (VHF Data Link parallel to serial converter) has been removed from Room 224 and returned to AFCRC.

Installation of the SDV monitor station in Room 224 is in progress and will probably be completed in two weeks.

A meeting with personnel of Escort Squadron 16 and others concerned with communication to and from picket ships was attended with R.G. Enticknap of Group 21. Efforts are to be made to obtain communication with the ships via a teletype link to the Navy shore station near Newport, R.I.

(G.Young and B. Morriss)

A number of programs for testing the equipment in Room 222 have been written and assembled. They have been 75% checked out. Manuals are being prepared for each station which give the information necessary for checking the equipment using these programs. It is expected that the manuals and programs will be completed during the next period and may be used to implement present checking methods.

(J.H. Newitt)

Improvements and modifications of the control room are continuing. The following things have been accomplished in the past biweekly period.

1. The skins for the scope consoles and the dust covers for the side frames have been frozen in design after prototypes were made and comments of all interested parties were solicited. These items will now be made in the required quantities.
2. A fan was installed in the wall of the video-filter room and seems to have satisfactorily relieved the overheat problem that was present.

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1.11 Equipment Engineering (Continued)

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

3. A variac-controlled map-illuminating cabinet has been designed for M. Brand. Construction is well under way on this item.
4. Sandy has removed Position J-13, and other miscellaneous modification of nearby equipment has been planned.
5. H. Kirshner has come up with what we feel is the perfect solution to the panel-lighting problem. This involves edge lighting of engraved panel-labels made of lucite. These can be applied to our present panels with very minor modifications. Special light bulbs and sockets are now available for this specific action. I have ordered enough of these special fixtures to equip one complete station. This will be the subject of a future experiment. While this is felt to be the eventual solution, we plan to use more gooseneck lamps plus a liberal distribution of penlights in the interim period. These have been ordered.
6. We have planned to widen an aisle section by mounting the panels in Frame S-22 on the wall. I have designed, built, and delivered a wall mounting box to the control room for this purpose.
7. Additional panels and present spares are being delivered to Israel for his use with the "training stations." It is planned that we will use one of these positions for our panel lighting experiment described in 5, above.
8. Sandy and I have planned the details of the room lighting. This installation work will be completed as soon as Sandy's schedule permits.
9. I have ordered a quantity of switch handles of various shapes suggested by B. Green. These are for experiments of identification by "feel."
10. I have designed a prototype shelf for Israel which can be used to replace any present 16" scope-console shelf. This shelf will project 9" from the edge of the console and will have a lucite sandwich construction which can hold a map or chart. Edge lighting of the bottom part of the sandwich will be provided so that the map (or writing surface) will be illuminated but will not radiate appreciable light as would be the case in normal types of rear lighting. This will be built and tried out soon.

1.11 Equipment Engineering (Continued)

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

11. Some work has been done on the HF power-supply-failure problem. S. Dodd has successfully reduced the operating voltage without detriment to the system. This should help considerably. We have tried coil embedments to varying degrees of success. I am sure that this can be satisfactorily solved as soon as I have a little more time to devote to it. In the meantime if any more failures occur we will coat all coils with silicone grease. This will not adversely affect the HV production and will completely eliminate the corona and brush discharge. Obviously this is not a desirable long-run solution but will solve our problem until I can get back to it again.
12. A prototype table for holding station frames at the same angle as the scope console has been built and is acceptable with slight modification. Outside concerns have been contacted to build the required quantity (18).
13. A special console for the MIV (Manual Intervention) panels (Walquist) has been designed and will be constructed soon.

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

The radar mappers have operated with fair reliability during the past biweekly period. Primary sources of trouble have been the rapid deterioration and failure of crystals in the CRT Filter Amplifier and Pulse Generator, poor filtering qualities of the stripping lacquer being used for masking, marginal operations of the scan-synchronizer units, and parallax.

Crystal failure appears to be due to a design error and will be studied further and corrected.

Bob Maglio of Group 63 has been experimenting with organic dyes in gelatin which may be activated or deactivated with a weak acid or a weak base. The problem here is to find a dye which will turn yellow or colorless depending on the PH factor.

Marginal operation of the scan synchronizers will be improved by increasing the +300-volt supply which had been reduced to +280 to reduce excessive loading on this supply.

1.11 Equipment Engineering (Continued)

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

The primary cause of parallax is the half-inch separation between the glass cover and the center of the CRT. I am planning to eliminate the glass cover by modifying the tube mounting and the high-voltage connection. This appears to be a fairly simple modification using a teflon ring and a concentric aluminum support ring.

(D. Neville) (CONFIDENTIAL)

The Data Link is now installed and will be ready to test with the computer after Monday, Aug. 17, when video cabling to and from WWI is completed.

1.12 Data Screening

(R. L. Walquist) (CONFIDENTIAL)

Changes are being made in the frame at Position E31 in order to make it more presentable. Newitt has drawn up a sketch of a wooden table and backing for the present equipment. The slope of this panel will be changed to match that of the 16" scope face.

On Tuesday, August 11, two members from Division 2, Wieser, and I visited an FPS-3 site. The MTI for this set was not adjusted properly, so it was impossible to determine how the radar picture would look when using MTI. However, without MTI the picture looked somewhat better than for the CPS-6B. The maximum detection range appeared greater than for the 6B, and the amount of noise appeared less. The operation of the FPS-3 in the Cape Cod System should be better than that obtained from the 6B; how much better is still unknown.

Program operation of the TWS program for the 1953 Cape Cod System has been satisfactory. So far, all parts except the automatic initiation section have been checked out. This is being delayed due to difficulties with the light cannon (Scope E11). Operation of the program has suggested a few minor modifications in the display-line switches, indicator lights, and the program itself. One big difficulty with the program is that the size of the displays is too small. At present, 60-cycle noise gives a spot movement about equivalent to a two-mile displacement of a track position. In order to improve this situation, a change in the size of the display will be made. The maximum range of the scope displays will be limited to 160 nautical miles, with full decoder deflection corresponding to 170 or 175 nautical miles.

Actual systems testing of the TWS program with the operating personnel is being delayed due to poor radar data, faulty recording equipment, and faulty functioning of the equipment in Room 222. Of the three tapes which have been recorded with radar data from the 6B and two gap fillers, not one is a really good recording. Subsequent attempts to record data have met with failure due to shut-down of the 6B or faulty operation of the SDV. Trouble has occurred with the tape on the 14-channel Ampex tape unit lifting away from the reading heads. This appears to be due to tape stretching more on one side than the other. Also, it has been noted that the reels of tape have splices and that the recording qualities appear different for the different sections of the tape. For one tape, this necessitated a change in the adjustment of the SDV demodulators for the CPS-6B depending upon the section of the tape. Equipment difficulties in Room 222 are primarily centered around the operation of the 5" scopes and indicator lights. Neither of these is working properly. It has also been noted that the intervention switches sometimes fail to read out correctly. Since some of these intervention switches are being used to control logical operation of the program, faulty read-out can produce unpredictable program operation.

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1.12 Data Screening (Continued)

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

The TWS section of the 1953 Cape Cod System is now being operated regularly four mornings each week. Operation of the program has revealed several unforeseen difficulties which will be corrected partially by programming and partially by minor equipment changes. Intermittent operation of some equipment has given us a few hard moments, but this situation is gradually being corrected.

All possible actions, both legal and illegal, for people in the TWS Section have been listed, and we are now proceeding to check off the results of each one of these actions against the expected results. We should be able to follow almost all the possible paths through the program in this way.

(H. Frachtman) (CONFIDENTIAL)

The TWS DID display is now working satisfactorily.

A test of the alternate trouble-track display was unsuccessful due to improper drum transfers.

Some experience was gained in the operation of the September system.

(D. Goldenberg) (CONFIDENTIAL)

The analysis of the cross-telling problem for a spheroidal earth has been completed. The form of the equations is the same as for the sphere:

$$u = u_0 + kx$$

$$v = v_0 + ky$$

where u_0, v_0 = coordinates of the origin of the x, y plane relative to the origin of the u, v plane,

x, y = coordinates of a point in the x, y plane,

$$k = 1 + \frac{u_0^2 + v_0^2}{(2E_q)^2},$$

E_q = radius of the earth at the equator.

1.12 Data Screening (Continued)

(D. Goldenberg) (Continued)

This form of the equations is an approximation to a more complex form, but the maximum error in making the approximation is the same as for the sphere:

$$\text{Error} = \frac{(u_0^2 + v_0^2)^{1/2} (x^2 + y^2)}{(2E_q)^2}$$

The geographic coordinates of the new long-range radar at South Truro have been obtained from personnel at Lincoln, and a new set of rectangular coordinates of the radars in the System relative to this radar will be issued shortly.

(J. Ishihara) (CONFIDENTIAL)

Checking of the 1953 Cape Cod TWS under operational conditions continues. Copies of programs and records for the present TWS program have been brought up to date.

(J. Levenson) (CONFIDENTIAL)

A good portion of this biweekly period has been spent observing the Monitor Programs in action and analyzing the results. No great changes will be made until the system has been observed a little longer. Certain observations have been made:

1. The most common trouble seems to be that of returns in both search areas. Since this may occur intermittently, the Monitor does not see it continuously, and it may change assignment from one Monitor to another before he has taken action. More effective means of handling this are being devised.

2. The time elapsing after a Monitor has taken an action with his activate button is too long to be effective. A proposed change in the order of blocks will decrease this time.

3. The TIM3 and the TI stations will be interchanged so that TIM3 can see the trouble tracks on Scope F12 and use the light gun and activate buttons associated with that scope.

4. No provision had been made for Monitors accidentally choosing a track number of an empty position.

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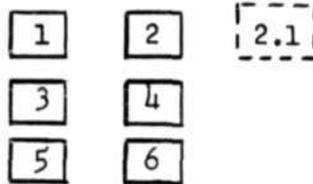
1.12 Data Screening (Continued)

(J. Levenson) (Continued)

5. The tracks have tended to concentrate in one small area on the scope; this makes monitoring very difficult. Some type of expansion may be needed.

(H. Peterson) (CONFIDENTIAL)

I spent this biweekly period checking out programs and writing descriptions and modifications. One main modification rearranges the Trouble Track Display thus:



Position 1 - trouble symbol.

Positions 2 & 2.1 - counts associated with trouble.

Position 3 - ID.

Position 4 - Monitor assignment.

Positions 5 & 6 - Track number.

(E. W. Wolf) (CONFIDENTIAL)

The magnetic-tape program described in the last biweekly report has been tested on the computer and found to be working. A number of additional features are now being incorporated into the program.

(W. Wolf) (CONFIDENTIAL)

The correlation program mentioned in M-2311 (Biweekly Report, July 17, 1953) was operated successfully and showed as a result of a short operation the following results:

R min. =	0	1	2	3	4	5	6	7	8	9	10	g10
	75	4	1	4	0	0	0	0	0	0	0	0

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1.12 Data Screening (Continued)

(W. Wolf) (Continued)

I.e., 75 out of 84 returns had a one-to-one correspondence on two scans, and none of the 84 returns was greater than three miles from perfect correlation allowing for planes or, perhaps, noise. Lack of computer time prevented further operation, but the program will be operated in the next two weeks.

Time was spent with other members of the TWS Group in a systematic operation of the TWS Program. Air Force personnel will be trained to assist this operation as radar mappers.

1.13 Tracking and Control

(S. Best) (CONFIDENTIAL)

On three separate occasions, the single-aircraft tracking program which prints out r and θ was tried. The first and third times, tape errors were found. The second time, there was no recorded data available.

The program to determine suitable velocity-heading smoothing parameters was tried twice, and a number of programming errors were found.

It is planned to make the routine which simulates crossing tracks answer the question: If correlation and smoothing are done as in the Cape Cod System and an untracked airplane crosses the path of a tracked airplane, then what is the probability that the track will be lost for various values of (1) the distance of closest approach, (2) the magnitude of the differences in velocity, (3) the range, and (4) the blip-scan ratio?

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

The tracking-study program is now in working order. Several smoothing-routine parameters have been written as well as a height-correction parameter. These have been partly checked out. It is planned to run studies on a given set of flights for all smoothing routines with and without height correction.

(A. Mathiasen) (CONFIDENTIAL)

Trouble with equipment has made impossible a complete checkout of a modified two-radar tracking program. What has been tested has operated successfully.

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1.13 Tracking and Control (Continued)

(A. Mathiasen) (Continued)

Work has been started on a complete revision of the tracking program in order to get more information from it than is now obtained and to make it more useful in the Boeing study.

Because of lack of time, the NLS-2c parameter-optimization program written with M. Frazier has not been run in this period.

(W. Lone) (CONFIDENTIAL)

The Flight Test Umpire program is working properly in all respects. However, it must now undergo extensive modification so that data generated by the program will be received at the proper time by the data-collection program.

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1.14 Weapons Direction

(D.R. Israel) (CONFIDENTIAL)

Excellent progress has been made in testing and checking out the Non-Track-While-Scan programs. The progress of the past two weeks has been due to increased computer time, vastly improved computer operation, cooperation of the tape-preparation room, and in particular, the efforts of the NTWS programmers who are working many over-time and week-end hours in an effort to expedite matters. All but two short programs have been written, and all but a few programs have successfully completed their initial testing phases. The present work is directed towards "marrying" the programs and testing their combined operation.

The Master Make-up (MMU) and Track Situation Display (TSD) Programs have been written and have been joined to the Master Control Program and Flight Test Umpire (FTU) Program. This combined Program has been tested many times during the past two weeks, and it appears there are only a few additional corrections to be made. The Identification Programs have been checked out individually and will now be joined together with the MMU, TSD, and FTU Programs. The checking of this large "marriage" will occupy a majority of the computer time during the next several days. The majority of the AA and Height Finder Programs have been checked out individually, and these will be joined together for future testing with the MMU, TSD, and TRU Program during the week of 17 August. The writing of the main interception program was completed during this past week. Initial tests of this program were highly successful and point to the satisfactory completion of tests within several days. All the Weapons Assignment and Weapons Direction Programs will be "married" with the MMU, TSD, and FTU Program on the weekend of the 22nd.

On Monday, August 10, Major Sbarra (6520th) and I visited the headquarters of the 32nd Air Division in Syracuse. The coordination of the Cape Cod flight tests with the neighboring Air Defense Direction Centers was discussed. Very satisfactory cooperation was received from Colonel Israel, Commanding Officer of the 32nd Division, and Captain Hansen. A local meeting with representatives of the Boston Air Route Traffic Control Center is scheduled for early next week. A memorandum describing the proposed coordination and tie-in between the Cape Cod System flight tests and local CAA and Air Defense facilities is in preparation.

During the past several days the matter of training and operating facilities with Cape Cod System has been under active discussion among Group 61, Jim Degan of Group 38, and Captain Sullivan of Section C, 6520 AC&W Squadron. A memorandum describing responsibilities for the initial manning and operation of the system and subsequent training of Air Force personnel has been prepared and is being typed for distribution.

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1.14 Weapons Direction (Continued)

(D.R. Israel) (Continued)

Under the supervision of Jim Degan an intensive effort will be made during the next biweekly period to obtain the type of flight plan and cross-telling data to be used in the Cape Cod System. Personnel have been assigned to the Air Route Traffic Control Center and to the Montauk and Brunswick sites to transmit the data over recently installed phone lines to the Cape Cod Direction Center. It is felt that this two-week dry-run exercise will provide a much clearer picture of situations likely to arise during Cape Cod testing.

(H. Benington) (CONFIDENTIAL)

During the past biweekly period, the Display Section (Benington, Conant, Grandy, Hauser, and Stahl) continued checking out the Display Master Make-up (DMM) Program. This work is almost completed; within the first week of the next period the Program should be ready for use by other sections.

Further changes in the scopes assignments have delayed the completion of M-1999-1, "Display Categories and Scope Assignments." This note should be completed during the next period.

The Summary DID Program has been checked out and will be added to the DMM. When this has been done the DMM will use slightly more than one group on the drum.

A study is being made of all the Display Section DID's with respect to using subprograms in common. It is hoped that no more than one drum group will be necessary for these displays after a judicious arrangement has been found.

Work is proceeding on the Geography displays. The Airbase display has been written. The AA, HF, and ID displays are being prepared. In addition, a new Georef display has been added which displays a grid with identifying characters. This program is well under way.

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

The Anti-Aircraft Rotation and DIDMU (DID Make-Up) Program (T 2891-m3) is checked out. The combined Altitude Estimation, Height Supervisor's and Height-Finder Talker's Intake Program (T2892-m1) is also checked out. The latter was written by Geraghty, using draft programs by the writer.

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1.14 Weapons Direction (Continued)

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

The A-A Intake Program (T2890 m2) has run for all except one of a new set of parameters. The trouble with that parameter was traced to a tape error. The error has been corrected, and the program should be finally checked out today.

The Automatic HF Priority, HFT DIDMU and DID, and Trouble Symbol Display Program (T 2893 m1) written by Geraghty will be tested over the week-end of 15 August. The Program is so written that when the above-named features are checked with parameters, the tape can be used, without change, as the combined Height-Finding and AA Talker's DID Program, complete with block transfers, control features, etc., for the September System. The number of the tape will be changed to T 2895 m0 at that time.

Similarly, T 2896 m0 will be the combined AA Intake, Rotation, and Talker's DIDMU Program for September.

(P.O. Gioffi) (CONFIDENTIAL)

During this period, I have been engaged with the checking out of the Interception Program and with the over-all familiarization of the Weapons and Senior Director's positions from operation and program points of view.

With F. Webster, I have formulated a preliminary array of tracks in the Cape Cod area from which can be selected up to sixteen tracks complete with data description to form problem situations for NTWS System testing. The problems are set up so that they are under the supervision and complete control of the FTU position.

(O.T. Conant) (CONFIDENTIAL)

An ID, altitude and flight-size intake program was written in addition to Tape 2799 P-2, mentioned in the last Report, both of which were used successfully in checking out the Display Master Make-up Program.

The check-out procedure consumed a considerable amount of time during the last period, but the Weapons Assignment DID Make-Up and Display has been started and will be combined with the Selected Track DID Program, in order to conserve drum-storage space. Initial checking of these DID's is expected to start August 15 or 16.

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1.14 Weapons Direction (Continued)

(O.T. Conant) (Continued)

The DID program for the Anti-Aircraft Officer and Height Supervisor will be started during the next period and combined with the WAS and ST DID Program if possible.

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

Except for a final check out, both the Interceptor Director and the Radio Operator Digital Information Display Table Make-Up and Display Programs are ready to be married with the Interception Calculations Section. This fusion should be accomplished by next week. The Table Make-Up Program now includes the preparation and sending of all data-link messages.

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

The first NTWS "marriage" of programs was successful. This was a combination of the track-situation display programs and a simulated TWS (FTU) Program.

The second program combination tried was that of the Master Make-up and Display Programs with the simulated TWS (FTU) Program. This is the basis of all future NTWS marriages and is, for the most part, working successfully.

The Identification Programs are now in the process of being added to the above combination.

Some progress has been made on the flow diagram for the NTWS function. Drum space has been tentatively allotted, and, with the help of the leaders of the main sections, much of the logical flow has been determined.

(M.A. Geraghty) (CONFIDENTIAL)

The September AA and HF Programs are written and two-thirds checked out on an individual basis. G. Rawling supplied good parameter tapes, and the MIV (Manual Intervention) and other subprograms of C. Gaudette and S. Knapp were very helpful. See J. Cahill's report for an elaboration of the state of progress.

The revisions to M-1979, "Frame and Panel Layouts" and M-2185 "Wiring of Push Buttons to Data Insertion Registers" have been unaccountably delayed in the typing stage, but should be distributed in the next period.

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1.14 Weapons Direction

(J. Hayase) (CONFIDENTIAL)

The past biweekly period has been spent on checking out tapes 2855, 2857, 2856, and 2858. Changes were also made in these tapes to fit the over-all identification system.

(W. Lemnios) (CONFIDENTIAL)

The Cape Cod Calculations Program has been coded. Tests have been conducted using a parameter which simulates five paired interceptors. These tests have been successful. A more complicated parameter using 16 interceptors in all possible types of interception situations is being prepared. Tests will be conducted using this parameter in two or three days. If these tests are successful, the program will be "married" to the other Weapons Direction Programs.

(J. F. Nolan) (CONFIDENTIAL)

The past biweekly period was spent checking out the display program and writing and checking out the Calculations and Display Make-Up program. The Display program is now operational. The Calculations program is written but not as yet operational.

(G. Rawling) (CONFIDENTIAL)

In this biweekly period, flow diagrams for the HF (Height Finding) part of Cape Cod program have been completed for Altitude Estimation, Height Supervisor Intake, Height Finder Talker Intake, Automatic Priority Assignment, Height Finder Talker DID (Digital Information Display) and DIDMU (Make-Up), and Trouble Symbol Display. These have now been consolidated on a single master flow diagram. A similar consolidation is contemplated for the AA (Anti-Aircraft) program.

Various parameter tapes to help check out the individual parts of the above programs have been prepared. Results may be found in reports by Cahill and Geraghty in this section.

(B. Stahl) (CONFIDENTIAL)

I have continued to work on Digital Information Display Programs, concentrating most of my effort during this period on the Summary Data Make-Up and Display. This is now working very satisfactorily and is ready to be tied in and used with the other programs in the System. The Program will serve not only as a means of displaying total numbers of the pieces of data, but also as a means of checking on other programs which contribute or have access to these totals.

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1.14 Weapons Direction (Continued)

(B. Stahl) (Continued)

My attention will now be directed to other DID's remaining and to Georef calculations in cooperation with S. Hauser.

(F. Webster) (CONFIDENTIAL)

All time has been spent on the generation and tabulation of tracks for testing operation of ATDS (Auxiliary Track Data Storage), TDS (Track Data Storage), etc., with sample data. The material is being used in conjunction with parameters 2 and 3 (T-2799). Data is also being made available for testing ID and HF functions.

(E. Wolf) (CONFIDENTIAL)

The intervention buttons on all but six of the frames in Room 222 have now been checked out with the Intervention Register Test Program.

(C. A. Zraket) (CONFIDENTIAL)

All of the Cape Cod programs associated with Weapons Direction, including the main interception program, have been coded and either checked out or initially tested on the computer. The following programs have been individually checked out but will have to be slightly modified when the time comes to join them for the final system. These modifications are trivial and consist of specifying constants for the Master Control Program for recording and reading from the drum.

1. Weapons Director Assignment Request - Subframe #2 (T-2832);
2. Weapons Director Assignment Request - Subframe #4 (T-2833);
3. Weapons Director Assignment Display (T-2835)
(Display constants may have to be modified later);
4. Intercept Directors and Radio Operators Switch Interpretation Program (T-2842);
5. Interception Points Symbol Display (T-2836);
6. Intercept Directors and Radio Operators DID (T-2840).

The following programs are currently being tested on the computer:

1. Intercept Directors and Radio Operators Display Make-Up and Data Link Program, (almost checked out). (T-2839);
2. Weapon Director Assignment Calculations and Display Make-Up. (T-2834);
3. Interception Calculations (T-2837).

It is expected that these programs will be checked out and joined within the next biweekly period. Francis Garth and Lee Murray are working on T-2839, J. Nolan on T-2834, and W. Lemnios and myself on T-2837. P. Cioffi has been making up test parameters for the interception calculations.

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1.15 Direction Center Operations

(M. Brand) (CONFIDENTIAL)

The following is a summary of Group 61 computer time for the past biweekly period:

Non-Track-While-Scan	44 hrs 20 min
Track-While-Scan	25 hrs 20 min
Equipment Check	3 hrs 25 min
Alperin	1 hr 30 min
Calibration	50 min
Conversion	<u>3 hrs 0 min</u>
 Time Used	 78 hrs 25 min
 Time lost to WWI	 <u>14 hrs 35 min</u>
 Total Assigned Time	 93 hrs 0 min
 % Usable Time	 84%

(P.F. Dolan) (CONFIDENTIAL)

The following statistics apply to the last biweekly period:

1. Computer hours scheduled for flight tests 16
2. Computer hours used for flight tests 0
3. Computer hours returned due to flight test
 cancellations 16
4. Total Aircraft Hours Flown 10
5. Aircraft hours flown by 6520th Wing at Bedford 8
6. Aircraft hours flown by Navy (Quonset-based
 Squadron) 2

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1.15 Direction Center Operations (Continued)

(P.F. Dolan) (Continued) (CONFIDENTIAL)

Aug. 12, 1900-2100, Coverage and Tracking (Walquist)

Two multi-engines and one fighter holding over Brunswick, Me., at 15,000 ft. and one multi-engine and one fighter (Navy jet) holding over Providence, R.I., at 15,000 ft. These aircraft to fly as directed so as to obtain both coverage data and crossing tracks. Due to poor operation of the CPS-6B, sites at Clinton and Hampton were used for coverage, with very good results.

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1.15 Direction Center Operations (Continued)

(P.F. Dolan) (Continued) (CONFIDENTIAL)

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DATE	TIME	SCHEDULED TEST		TEST ACTUALLY RUN		REASONS FOR CHANGES OR COMMENTS
		A/C	Description	A/C	Description	
8/4	1000-1200	3	3 Radar Tracking		Cancelled	CPS-6B inoperative
	1400-1700	2	Height Finder		Cancelled	CPS-6B inoperative
8/5	1000-1200	2	Height Finder		Cancelled	CPS-6B inoperative
8/6	1000-1200	3	3 Radar Tracking		Cancelled	CPS-6B inoperative
	1400-1700	2	Height Finder		Cancelled	CPS-6B inoperative
8/11	1000-1200	6	Coverage & Tracking		Cancelled	CPS-6B inoperative
8/12	1000-1200	6	Coverage & Tracking		Cancelled	CPS-6B inoperative
	1900-2100	6	Coverage & Tracking	5	Cape Cod Coverage	1 a/c aborted; CPS-6B data very poor; used Cape Cod Sites
8/13	1000-1200	6	Coverage & Tracking		Cancelled	CPS-6B unavailable

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* Added to schedule during week of test

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1.16 FSQ-7 XD-1 Support

(B.G. Farley) (CONFIDENTIAL)

During the last period, after the memory was removed from MTC, time has been spent investigating and proposing methods for incorporating the 64 x 64 memory into MTC, and for reorganizing the order code.

Several questions concerning "translation," conversion, and interpretive subroutine programs which might be useful with MTC have also been considered.

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1.2 Group 64

(S. H. Dodd) (CONFIDENTIAL)

The magnetic-memory bank from MTC was put into operation in the WWI on Saturday, August 8, and has been operating very reliably since that time. No major difficulties have been encountered in the installation of this equipment or maintenance.

The progress in debugging and modification of equipment in the Cape Cod Center has been satisfactory. Work is progressing on arranging and implementing marginal-checking procedures for this equipment in an effort to increase reliability of operation. Changes and requirements of the amount and type of equipment in the Cape Cod Center have been frequent enough to require a large percentage of In-Out Group time, but we have been reasonably successful in making the changes while maintaining adequate reliability of operation.

As indicated in the last Biweekly Report by O'Brien, the noise on the display deflection lines continues to be a substantial problem, and work toward eliminating this noise has not been entirely successful. Mr. Zieman of Group 62 is helping us on this problem, and the results of the effort in reducing the display-line noise should be quite helpful in the AN/FSQ-7 design. The deflection-line noise is particularly troublesome on the track initiators and track-monitoring scopes, and particular effort is being made toward improving these particular scopes. A new amplifier design looks quite promising.

1.21 WWI System OperationMagnetic-Core Memory

(N.L. Daggett) (UNCLASSIFIED)

On Saturday, August 8, the MTC magnetic memory was put into operation as one of the two storage banks in WWI. Its operation since that time has been excellent. Unfortunately, none of the three parity alarms which have occurred in the core memory bank have been properly recorded, making it impossible to determine whether any trouble has actually been encountered with the memory itself.

No maintenance has been performed on the core memory since its installation except for measurement of output gate-tube margins. These have remained consistently high, higher in fact than were measured in MTC. This is probably due to the improved power supplies and to layout improvements which were made in the changeover.

1.21 WWI System Operation (Continued)

Magnetic-Core Memory

(L. Holmes) (UNCLASSIFIED)

The installation of one bank of magnetic storage was accomplished during the past biweekly period. The power video cabling changes and the panel modifications of WWI System were made during 12 hours of installation time (8 hours on Saturday, August 1 and 4 hours on Monday, August 3). No serious difficulties were encountered.

In addition to some minor changes to the present Magnetic-Core-Storage System, plans are being made to replace the present Sense GT-BA Panel with a Plug-In Unit Mounting containing WWI type GT-BA units. Drawings are now being prepared.

Electrostatic Storage

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

Storage-tube reliability has become excellent. Both banks are being maintained in top operating condition. Nineteen stannic-oxide tubes are now in service and positive switchings has been greatly decreased. Because of the increased reliability several hours of ES maintenance time will be released to other uses next week.

(D. A. Morrison) (UNCLASSIFIED)

A spare TV video amplifier has been constructed and turned over to Arthur Curtiss.

I have been working on the afternoon shift with A. Roberts to become more familiar with the computer.

Marginal Checking

(D. A. Morrison) (UNCLASSIFIED)

Some time has been spent taking care of some final details of J. Hughes' report on Marginal Checking as well as checking on the progress of MC drawings.

(T. Leary) (UNCLASSIFIED)

We are preparing to make use of the auxiliary drum for our routine marginal checking. The general plan is as follows:

At the beginning of each marginal-checking period a long tape will be read in via PETR which will store all the MC programs on Group 0 of the drum, as well as a Programmed Marginal-Checking program and a set of coded tables of the MC lines to

1.21 WWI Systems Operation (Continued)

Marginal Checking (Continued)

(T. Leary) (UNCLASSIFIED)

be checked with each MC program. This tape will also store a control program on Group 9. The binary-coded decimal addresses of the 400 MC lines (for use with the PMC decoders) will be permanently stored (locked out) in consecutive registers on Group 11.

Once this tape is read in, starting over at 35 (octal) will cause the contents of drum Group 9 to be read into ES. The control program will read in an MC program, its table of PMC lines, and the PMC program from drum Group 0 according to the setting of FF2.

The details of this new system are being worked out.

Auxiliary Magnetic-Drum System

(H. L. Ziegler) (UNCLASSIFIED)

Testing of chassis for the magnetic drums is being hampered by the lack of suitable marginal-checking facilities. To rectify this situation a special power supply is being built and should be completed by the end of the coming week.

Data taken on the Auxiliary-Drum writing circuits indicate the possibility of a fairly simple erasing procedure. Further work will be done on this in the near future.

A modification to obtain better light intensity from the ERA indicator circuits is being held up pending determination of effects on flip-flop operating margins.

The Auxiliary-Drum Monitor in Test Control will soon provide pushbutton selection of the drum groups. An interlock will be provided to prevent operation during programs.

(P. W. Stephan) (UNCLASSIFIED)

A panel was made for the permanent auxiliary-drum power installation and is being wired.

(K. E. McVicar) (UNCLASSIFIED)

We have had word from ERA that delivery of the new auxiliary drum, originally scheduled for August 15, will be delayed indefinitely. ERA is experiencing trouble in material procurement for the new copper-slug heads. In addition their yield has been lower than expected in those that have been produced.

1.21 WWI Systems Operation (Continued)

Typewriter and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

On two occasions recently, FL punches were reported to be leaving out whole lines of code holes when used with the Magnetic-Tape Output system. In each case the punches subsequently checked out perfectly on other Flexo applications.

On other occasions while perforating paper tape from magnetic tape, random characters were printed out on the delayed output printer. When this occurred, the corresponding characters appeared to be missing from the paper tape.

Farnsworth and I are collaborating to locate the cause of these failures.

1.22 Terminal Equipment

Display

(R. H. Gould) (UNCLASSIFIED)

A silicone grease sold by Amphenol has proved to be very effective in preventing corona and arcing on the high-voltage transformer in the 12KW power supply in the 16-inch display scopes. The transformers will be anointed as time permits. The focus-coil circuits of the 16-inch scopes will be modified to permit operation at 10KW if necessary.

Modifications will be made to the 5-inch display scopes to improve their rejection of noise on the intensification-gate lines. Tests will be made with higher than normal accelerating voltage on the CRT to see if the persistence of displayed characters can be improved.

The extremely high failure rate of the 5696 thyratrons in the Indicator Light Registers has been attributed to the very low filament voltage on the tubes for the first few hundred hours in service. Filament voltage is now normal and all tubes that were operated with the low voltage will be replaced.

Results of experiments on the reduction of deflection-line noise have not been very promising as yet. Work continues on this problem.

Buffer-Drum System

(K. E. McVicar) (UNCLASSIFIED)

The surface of the new buffer drum had three nicks in the oxide coating which go through to the aluminum surface. The nicks are located beneath the dual heads. Their appearance suggests that they resulted from a scratch when the shroud was being installed.

1.22 Terminal Equipment (Continued)Buffer-Drum System (Continued)

(K. E. McVicar) (UNCLASSIFIED)

Only one of the nicks causes a spurious read-out on the dual-head tracks with the amplifiers set at normal gain. This nick is one slot wide and has the effect of preventing the computer from recording in that slot and of always permitting a read in that slot. One other dual-head track reads out a spurious signal from the nicks when the amplifiers are set at full gain.

We have notified ERA of the nick in the track, and they are currently investigating the possibility of repair in the field. As soon as they have reached a decision arrangements for repair or replacement will be made.

(P. W. Stephan) (UNCLASSIFIED)

Multiple Terminal Equipment Selector (MTES) was wired, and the cables ordered for it.

Testing of the buffer drum continued.

MITE

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

A sample of Gate-Buffer Amplifier plug-in units are being modified for improved limiting action when used in a cascaded chain. They will be inserted into MITE 2 to check possible improvement in the margins and in reliability in a system.

It has been proposed that the plug-in-unit mounting panels be modified in future use. This modification will consist of inverting the panel so that the Jones strip will be closest to the rack-power wiring and mounting a long terminal board perpendicular to the phenolic strip. This will permit easier accessibility of the components and will keep them clear of the vertical point-to-point wiring. Also, more convenient ground points will be provided on the terminal board.

Several checks have been made on the possible source of pickup when using long open wires for video wiring in plug-in-unit mounting panels, especially for such functions as clearing, complementing a chain of flip-flops, or reading out a chain of gates.

It has been found that by using twisted-pair wiring fed from the center and terminated at both ends, the pick up is negligible while good pulse shape is maintained at any point along the line. This method of wiring will be used in future layouts where pulses have to be routed any appreciable distance within a rack of mounting panels.

1.22 Terminal Equipment (Continued)MITE (Continued)

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

We have had difficulty in negative complementing a string of plug-in FF's due to the existence of the small delay line in the cathode circuit which caused effective pulse broadening and distortion because of the reflections of this delay line. It has been found that terminating the positive complement inputs of the FF's, with 270 ohms, when not being used, permits easy and reliable negative complementing. These resistances will be inserted in the present MITEs and Buffer Storage and in the future system.

Work is still being done in optimizing the layout and wiring for the MITEs to be used with the Buffer Drum. The digits of the counters will be positioned vertically and the FF's and gates of the control section will be staggered to permit a more efficient marginal-checking scheme.

Plug-In Units

(J. W. Forgie) (UNCLASSIFIED)

Modifications to the GT-BA and BA-BA plug-in units are proceeding. The modified GT-BA units give an output of 3.0 volts into 100 ohms with inputs to the gate tube between 15 and 40 volts. The direct buffer input to the same unit requires 25 volts for a full output. Beyond 25-v input, the output shows the same limiting action as the GT-BA combination. The circuit for the BA-BA units will be essentially the same as that for the BA in the GT-BA units except that the dual buffer will give a 35-v output.

Limiting action in these modified units is accomplished by a combination of a series-grid resistor and a resistor between the plate of the buffer and the output transformer. The value of the output voltage at which limiting occurs depends directly on the value of the plate resistor.

A trial lot of modified GT-BA units is being put into service in MITE 2 as the units are completed. A considerable improvement in some margins has already been noted with 20 of the new units in service.

Magnetic-Tape Print-Out

(E. P. Farnsworth) (UNCLASSIFIED)

The proposed sound-proof enclosure for the delayed-output Flexowriter was completed and placed in service during this period, and it seems to have solved the noise problem in Test Control with the least possible operating inconvenience.

1.22 Terminal Equipment (Continued)

Magnetic-Tape Print-Out (Continued)

(E. P. Farnsworth) (UNCLASSIFIED)

Construction is under way on all but two of the remaining panels needed to complete the delayed-output system.

Magnetic-Tape Mechanisms

(E. P. Farnsworth) (UNCLASSIFIED)

Up to the present time, mechanical adjustment and maintenance of the Raytheon magnetic-tape mechanisms has been performed almost exclusively by Al Perry. The desirability of having more than one such expert becomes most evident during vacation period; the problem was discussed with Lew Norcott because of the appreciable similarity in mechanical precision, mechanical components, and logical application of the tape mechanisms and the Flexowriter equipment. The Flexowriter group recently located and corrected a mechanical difficulty which had temporarily disabled unit 2, and they have indicated an interest in taking over some of this work. They plan to familiarize themselves with the tape mechanisms as troubles arise, and we will impart the information which we have collected to date.

Maintenance

(T. Sandy) (UNCLASSIFIED)

Marginal Checking for In-Out Control of WWI is being worked on. Almost all of the necessary marginal-checking lines have been provided for or will be provided for by 17 August.

The labelling of the jacks of the In-Out Switch, WWI, is being brought up to date on the In-Out Switch matrices drawings.

The equipment in Room 222, Barta, is being particularly checked every morning. That is, if a particular type of equipment seems to be giving some trouble, we try to check all of that type of equipment and fix any troubles found. Most of the troubles can usually be traced to bad lugs on the jumper wires feeding the equipment.

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 31 - August 13, 1953:

Number of assigned hours	134
Usable percentage of assigned time	90
Usable percentage of assigned time since March, 1951	85
Number of transient errors	57
Number of steady-state errors	2
Number of intermittent errors	3

Storage-Tube Complement in WWI

(L. O. Leighton) (UNCLASSIFIED)

Following is the storage-tube complement as of 2400, August 13, 1953:

<u>Digit</u>	<u>ST Mount</u>	<u>Tubes</u>	<u>Hours of Installation</u>	<u>Hours of Operation</u>
0 B	27	ST-868	15821	5
1 B	18	ST-865-1	15709	117
2 B	5	RT-393	15370	456
3 B	4	ST-821	14226	1590
4 B	33	RT-380	13516	2310
5 B	11	ST-836	14617	1209
6 B	44	ST-863-1	15662	164
7 B	17	ST-822	14846	981
8 B	6	RT-391-1	15370	456
9 B	42	ST-720-C	12937	2889
10 B	2	RT-382	13629	2201
11 B	25	ST-753-1	13129	2697
12 B	41	ST-856	15290	536
13 B	37	ST-860-1	15641	186
14 B	24	ST-624-C-1	10507	5318
15 B	16	RT-383	13629	2196
16 B	19	ST-845-1	14886	940
17 B	28	ST-747	13261	2565

1.23 Records of Operation (Continued)

(L. O. Leighton) (UNCLASSIFIED)

<u>Digit</u>		<u>ST Mount</u>	<u>Tubes</u>	<u>Hours of Installation</u>	<u>Hours of Operation</u>
0	A	30	ST-862	15641	186
1	A	20	ST-817	14148	1618
2	A	34	RT-388-R-1	15393	433
3	A	23	ST-802	13411	2415
4	A	39	ST-867	15794	32
5	A	40	ST-525	13389	2437
6	A	8	RT-389	15290	536
7	A	35	ST-800	13340	2485
8	A	45	ST-825	14307	1518
9	A	10	ST-861-1	15641	186
10	A	36	RT-401	15534	292
11	A	12	RT-387	15175	656
12	A	13	RT-390	15290	536
13	A	14	RT-381	13581	2245
14	A	29	ST-835	15460	366
15	A	22	ST-805	13457	2269
16	A	9	ST-855	15194	632
17	A	43	ST-864-1	15688	138

ES Clock hours as of 2400, August 13, 1953.....15825.7
 Average life of tubes in service in Bank B..... 1054
 Average life of tubes in service in Bank A..... 1490
 Average life of last five rejected tubes..... 2422

Storage-Tube Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

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

- ST-814 was removed after 1731 hours of operation to make room for stannic oxide.
- ST-841-1 was rejected after 796 hours of operation because of positive switching.
- ST-751 was rejected after 2492 hours of operation because of positive switching.
- ST-847 was removed after 5821 hours of operation to make room for stannic oxide.

1.23 Records of Operation (Continued)

(L. O. Leighton) (UNCLASSIFIED)

- ST-722-C was removed after 2521 hours of operation to make room for stannic oxide.
- ST-808 was removed after 2193 hours of operation to make room for stannic oxide.
- ST-619-C-1 was removed after 5752 hours of operation to make room for stannic oxide.
- ST-820-R-1 was rejected after 1389 hours of operation because of positive switching.

Component Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following failures of electrical components have been reported since July 31, 1953:

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Crystals</u>			
1N34A	5	1- 0 - 100	Low R _b
		2- 2000 - 3000	Low R _b
		2- 7000 - 8000	Low R _b
1N38A	2	1- 0 - 1000	Open
		1- 7000 - 8000	Low R _b
D-358	3	8000 - 9000	2-low R _b ; 1-drift & oscillation
<u>Resistors</u>			
220-ohm, 1/2-w, 10%-carbon	4	0 - 1000	3-above tolerance; 1-under tolerance
<u>Transformers</u>			
5:1 pulse transformer	1	18000 - 19000	Primary open

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1.23 Records of Operation (Continued)

(L. O. Leighton) (UNCLASSIFIED)

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Tubes</u>			
VR-150	1	10000 - 11000	Poor regulation
3E29	2	2000 - 3000	Low I _b
5696	5	1000 - 2000	Short
5881	2	0 - 1000	1-short; 1-low I _b
	1	2000 - 3000	Low I _b
5963	1	3000 - 4000	Low I _b
5965	1	3000 - 4000	Short
5U4G	1	2000 - 3000	Internal breakage
6AS7G	1	3000 - 4000	Low I _b
6AU6	1	1000 - 2000	Short
	1	2000 - 3000	Short
6L6G	2	1000 - 2000	Low I _b
	1	4000 - 5000	Low I _b
6SH7	1	5000 - 6000	Low I _b
	1	9000 - 10000	Low I _b
6SL7	1	10000 - 11000	Low I _b
6SN7	1	19000 - 20000	Low I _b
6145	4	0 - 1000	1-broken envelope; 3-short
	1	2000 - 3000	Short
7AK7	1	0 - 1000	Open cathode
7AD7	2	0 - 1000	Low I _b
	2	3000 - 4000	Short
	1	5000 - 6000	Unbalance
	2	6000 - 7000	1-low I _b ; 1-short
	1	8000 - 9000	Gassy
	1	13000 - 14000	Short
	1	17000 - 18000	Short
	3	18000 - 19000	2-low I _b ; 1-short
SR-1407	1	2000 - 3000	Low I _b

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1.24 General

D-C Power Supplies

(R. G. Farmer) (UNCLASSIFIED)

Two power supplies have been added in WWI to provide -450 and -300 voltages for the magnetic memory. The capacity of each supply at the present is 5 amps. Construction has been planned which will increase the capacity of the -300-volt supply to 10 amps.

The new supplies are now mounted in temporary racks. The permanent racks are being constructed, and soon the supplies will be mounted permanently.

1.3 Group 65

1.31 Storage Tubes

(P. Youtz) (UNCLASSIFIED)

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

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

Some work was done for Group 25. There are some commitments to that Group which will continue.

Work has been started on the Charactron tube. This is reported in C. L. Corderman's biweekly report.

1.32 Test

Television Demonstrator

(A. Zacharias) (UNCLASSIFIED)

During this period I took D. M. Fisher's place at the TVD.

Ten storage tubes were tested during this period. These tubes, ST860-1 through ST865-1 and ST866 through ST869, had stannic-oxide coatings instead of aquadag and were of the 800-series design. ST866 was rejected because of a buckled mica spacer. This tube failed to hold a positive array for 10 minutes. ST867 was marginal because of buckled mica spacer; the array held for 10 minutes. This tube was satisfactory at the STRT but had low margins.

All other tubes were satisfactory. ST868 and ST869 had weak holding guns, but there was no apparent effect from this.

Storage Tube Reliability Tester

(L. B. Martin) (UNCLASSIFIED)

Seven storage tubes, ST860-1, ST861-1, ST863-1, ST864-1, ST865-1, ST867, and ST868, were tested in the STRT and found satisfactory.

1.33 Research and Development

(C. L. Corderman) (UNCLASSIFIED)

Some work has been done on the Charactron tube made by Convair. Two tubes received by Group 25 have been tested. Everyone who saw the tubes in operation was favorably impressed with the quality of the characters formed. One of the tubes has been dissected prior to putting its character matrix in a 16" display tube. The magnetic deflection available for the 16" tubes will allow a more complete evaluation of deflection distortion. Also, the characteristics of P7 phosphor under low current-density excitation can be studied.

Philip "L" Cathodes

(R. J. Biagiotti) (UNCLASSIFIED)

During this period one of the Philip "L" cathodes on the life-test rack failed after about 3500 hours; the other tube is still operating.

Time has been spent vacuum firing parts for storage tubes and silvering mica surfaces.

(E. J. Stevens) (UNCLASSIFIED)

The past two weeks were spent on masking and spraying stannic-oxide envelopes.

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SECTION II - WHIRLWIND II

2.1 Group 62

(N.H. Taylor) (CONFIDENTIAL)

Summary and Activities of Group 62

A study of the schedules for the AN/FSQ-7 (XD-1) has revealed that it will be necessary to release full information on arithmetic and control portions of the machine to drafting by September 1. In order to attempt this scheduling, considerable effort has been expended in reviewing the detail block schematics which have been submitted by IBM. It will also be necessary to release final information on eight of the basic circuits used in this portion of the system by September 1.

Considerable pressure will fall on the issuing of purchase orders in order to meet the construction schedules which have been outlined. The writing of purchase requisitions has been initiated at IBM under the control of the Electrical Engineering Library run by J. Goetz. Two of our people will help in this effort.

A rather extensive review of the block diagrams associated with the magnetic-drum system is being made. Detailed discussions will be held with IBM in the next period.

A Charactron tube has been borrowed from Group 25 and is being evaluated with the help of C. Corderman in Group 65. Preliminary studies indicate that this method of the display would be adequate for the Digital Display Scope and may be usable for the whole display problem.

2.11 Systems

Central Machine Block Diagrams

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

The block schematics of the central machine which were made by H. Ross's section at IBM were reviewed for logic, timing, and circuit errors. These diagrams are not ready for formal approval because some of the drawings are missing, and there are minor errors and omissions in those which are present. Detailed comments on the block schematics are available in the system section office. There is no major criticism of those diagrams. See R. P. Mayer.

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2.11 Systems (Continued)

Track Display

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

A Charactertron evaluation program has been initiated in cooperation with the Storage Tube Group and Group 25 of Lincoln. Several variations of the Charactertron are to be tested.

Three character generators are being evaluated. Those are the BTL character generator and two core character generators. One of these will be **chosen** at the end of the month, and design on this will continue.

The dual deflection tube will be compared with the K1084.

The display system which uses an interleave pattern on the drum is being compared with the noninterleave system proposed by IBM.

Digital Display

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

A block diagram of the digital-display system was drawn up and is now being evaluated in relationship to the track display.

Cross Telling

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

The cross-telling system proposed by H. D. Ross of IBM seems to be superior to all of the alternatives which are known to the systems group.

Magnetic Input Counters

(J. F. Jacobs, K. Olsen) (UNCLASSIFIED)

Work is continuing on optimizing the magnetic shift registers. A Bachelor's thesis is being written on a shift register using ferrite cores.

Marginal Checking

(K. Olsen, J. F. Jacobs) (UNCLASSIFIED)

A complete proposal is being prepared for the marginal-checking system.

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2.11 Systems (Continued)

Marginal Checking (Continued)

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

Work is continuing on marginal checking, with emphasis on the Right and Left AE frames and the Program Register frame. It is expected a proposal will be ready within the next biweekly period.

Display Circuits

(K. Olsen, J. F. Jacobs) (UNCLASSIFIED)

Work has started on the deflection circuits for a 12-inch electrostatic tube.

Input Counters

(H. K. Rising) (CONFIDENTIAL)

A theoretical analysis of the capacitor-coupled stepping register is being attempted. It is hoped that the analysis will allow the design of optimum coupling circuits for given cores and stepping speeds.

(C. J. Schultz) (CONFIDENTIAL)

The capacitor-storage shift register of the IBM type has been optimized for several combinations of R, L, and C in the coupling circuit. There has been difficulty in operating with reasonably wide limits of input pulse length and rise time at about 4-amp turns and 100 kc. Data does not yet conclusively reveal the best circuit.

Ferrite Core Stepping Register

(J. Ricketts) (UNCLASSIFIED)

A Bachelor's thesis is being written on a single-core-per-bit stepping register using ferrite cores.

Design methods applicable to stepping registers using two cores per bit have not proved too helpful in designing and analysing registers using one core per bit, except to give a qualitative picture of the operation. Various delay networks have been tried to improve the characteristics; π networks seem the most profitable so far. Core heating at 125 kc is quite a problem, but the inherently wide limits that the π network affords promise to give a working circuit.

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2.11 Systems (Continued)

Deflection Amplifier

(I. Aronson) (UNCLASSIFIED)

Work has started on the design of a deflection amplifier for the 12-inch electrostatic tube.

Experiments are being run to see if variations in spot intensity can be used to differentiate between types of targets.

Circuit Application Manual

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

The design procedure for diode-driving cathode followers and capacitive-driving cathode followers has been completed and is ready for distribution.

Schematics of the sensing amplifier and x or y plane driver have been obtained and will be distributed in the Manual.

Delay-Line Adder

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

The problem of building a small 3-digit delay-line adder and checking it with MTC has been studied with Phil Bagley. It has tentatively been decided that the 3 digits of the delay-line adder will be substituted for 3 digits of MTC's accumulator. Work on this project has started.

Etched-Circuit Pluggable Unit

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

An etched-circuit layout of the High Speed Flip-Flop has been obtained from Bill Ayer. This circuit was checked against a flip-flop in the conventional island type of pluggable unit. It was found that electronically both types of construction were equal.

Display

(R. von Buelow) (UNCLASSIFIED)

A review of the entire display system is in progress. It is hoped that a number of firm proposals can be made as a result of these discussions.

2.11 Systems (Continued)

Display (Continued)

(R. von Buelow) (UNCLASSIFIED)

Tests were run to determine the time necessary to intensify a point and a character (simulated) on a P-7 screen and have that point or character persist for 2 seconds. Intensification for 5 μ seconds on the point and 20 μ seconds on the character was adequate.

The first experiments to connect points with straight lines on a CRT screen by unblanking were unsuccessful. It is felt this can be accomplished without too much difficulty.

Experiments to determine the feasibility of having two distinct intensification levels throughout the entire 2 seconds which elapse between pulses of any one point are being conducted.

Various size Charactron tubes have been ordered. A 5" P-19 Charactron was set up, and investigations were conducted on intensification times and current requirements.

(R. H. Gerhardt) (UNCLASSIFIED)

The evaluation of a display system using an interleaved pattern on the display drum is continuing. Some block diagrams of separate units have been made. There are many details that have not been worked out. However, from an over-all viewpoint the system looks good.

A short note describing this system has been written.

(M. Epstein) (CONFIDENTIAL)

A block diagram for the digital-display control was drawn up based on an interleave of 64 (successively displayed registers are located on the drum 64 addresses apart). In this system, we store only one register from the drum at a time. This saves equipment in display control but is disadvantageous to the programmer.

A preliminary examination of the displays needed in AN/FSQ-7 was made to see if the size of the slot allowed is sufficient. The tentative conclusion is that it is not large enough for personnel who need to know about more than two planes at one time.

2.11 Systems (Continued)

Comprehensive Logical Diagram

(R. P. Mayer) (CONFIDENTIAL)

Drawing SD-47010 (2 pages), "Summary of Block Schematics: Internal Machine", is drawn in the form of the Comprehensive Logical Diagram of the internal machine. The summary drawing summarizes a number of preliminary block schematics drawn by IBM (listed on Page 1 of the summary). These drawing, being preliminary, are understandably incomplete and somewhat inaccurate. It has been generally agreed that nearly all of the general philosophy shown is acceptable. The summary drawing (SD-47010) can be compared with the comprehensive diagram (SD-54846) to discover the major areas of incomplete design, change in design, etc. The comprehensive diagram is to be redrawn according to the new philosophy.

Study of High-Speed Multipliers

(W. A. Klein) (UNCLASSIFIED)

Typing of the final rough draft of R-223 has begun, and some of the figures should be ready for the Drafting Room within a week. However, the writing is not yet finished.

2.12 Magnetic-Core Memory

Miscellany

(W. N. Papian) (UNCLASSIFIED)

We hope to be able to relinquish the "shower stall" of Test Setup V to Ted Ogden during the weekend of the 22nd. He needs it to test WWI bank B memory planes and stack; after successful tests it (stall, stack, planes, and all) goes into WWI. MTC Memory, Mod. II, and XD-1 Memory design need data on pulse-transformer drive and 64 x 64 signals from Setup V before that date, and every effort is being made to clean this up on time.

Liaison with IBM on XD-1 Memory design problems is now good. Many decisions will be made and frozen before the end of September.

Sensing and Switching

(J. I. Raffel) (UNCLASSIFIED)

A memorandum (M-2351) on sensing-winding geometry was completed. It shows that the difference between the minimum system ONE and maximum system ZERO is the same for a sensing winding which cancels half-selected outputs and one which adds them.

A memorandum (M-2348) on switch-core analysis was completed.

A thesis proposal is being written, and preliminary designs for a master switch plane have been made.

Sensing

(S. Fine) (UNCLASSIFIED)

Experimental data for use in a master's thesis is being compiled. The metallic-ribbon memory plane is being replaced with a ferrite-core plane. This and other ferrite planes will be used during the thesis.

Memory Plane Testing for WWI Bank B

(A. Dadmun Hughes) (UNCLASSIFIED)

A complete test setup has been devised to test the individual cores in the 32 by 32 memory planes for WWI, after x and y wires are inserted but before z and sensing windings are added. The tests are the same as were given the MTC memory planes during their construction.

Two planes have been tested and several "bad" cores found.

2.12 Magnetic-Core Memory (Continued)

Test Setup V

(E. A. Guditz) (UNCLASSIFIED)

Test data shows that the reduction in sensing-winding noise obtained by staggering read-driving pulses is negligible.

One panel of vacuum-tube drive for the 32 x 32-array tester has been changed to pulse-transformer drive. Tests are being made by Jack Mitchell.

The memory rack, stack mount, memory frames, and filament panels for the MTCII memory are all in construction.

A 64 x 64 experimental memory plane has been completed and will soon be installed in the memory tester for sensing-winding-noise tests.

Selection-Plane Drivers

(J. L. Mitchell) (UNCLASSIFIED)

A panel containing 8 pulse-transformer drivers has been placed in Memory Test Setup V. First results indicate that the transformers will drive the load presented by the 3 memory planes now in the test setup with no difficulty. The margins taken at the sense-amplifier output are about the same as the margins for vacuum-tube drive.

2.13 Vacuum-Tube Circuits

Magnetic-Drum Write Circuits

(H. J. Platt) (UNCLASSIFIED)

Preliminary study shows that it is possible to stabilize the plate current of a 7AK7 by using single-input crystal gating circuits on both the control and suppressor grids.

The next step is to design a transformer which will supply the writing head with the necessary current when used with the 7AK7.

It was also found that the suppressor grid in this circuit could be driven with a high-speed flip-flop with no visible effect on the flip-flop.

2.13 Vacuum-Tube Circuits (Continued)

High-Speed Gate-Tube Circuit

(H. J. Platt) (UNCLASSIFIED)

Analysis of a large amount of data concerning pulse transformers has indicated that a 4:1 transformer consisting of 32 and 8 turns on primary and secondary, respectively, would perform well in the gate-tube circuit. On the basis of pulse amplitude and width, this transformer seems to be the optimum.

Investigation is now proceeding to discover whether this transformer will perform favorably when varying the tubes, voltages, and load.

Drivers for Magnetic Shift Register

(J. S. Gillette) (UNCLASSIFIED)

An investigation of the various circuits which may be used to drive magnetic registers has been started. Some construction has been started. As yet, the output requirements are not known exactly.

Character Generator

(J. Woolf) (UNCLASSIFIED)

The letter "V" has been generated and the letter "P" has been cleaned up since the last period.

At present a system is being built up which will be capable of displaying four letters in a sequence within a rectangular area on a scope. This should give us a good indication of the complexities we can anticipate in making such a system.

Delay Lines

(J. Woolf) (UNCLASSIFIED)

A basic circuit using a 400-ohm delay line for a 0.25- μ sec delay has been designed. The next delay interval to be supplied for the memory cycle will be the 1.25- μ sec delay.

MTC Memory Mod. II Digit Plane Driver

(D. Shansky) (UNCLASSIFIED)

Operating margins of the circuit have been investigated and have been found to be adequate. The circuit has been packaged and a prototype constructed. The prototype will be tested in the next period.

2.13 Vacuum-Tube Circuits (Continued)Pulse Transformers

(E. K. Gates) (UNCLASSIFIED)

0.1- μ sec Pulse Transformers for Gate-Tube Applications. Transformers were supplied to Herb Platt in order to determine uniformity of the cores. Pulse amplitude, pulse width, and primary inductance were measured and results fell within reasonable limits.

Transformers for Driving Magnetic Memory. Eight transformers have been installed in the shower stall and tests are being made by Al Guditz and Jack Mitchell.

Transformers have been supplied to Woolf for use in a character-generating scheme.

Pulse Amplifier

(S. Bradspies) (UNCLASSIFIED)

A circuit has been designed for the life testing of 20 gate tubes which drives the grids from -15 volts to +10 volts (25 volt-pulses) when the suppressor is either at 0 volts or -15 volts. The gate tubes are 7AK7's. The same circuit takes care of both cases. The pulse repetition rate is 2 megacycles.

A different circuit has been completed for the life testing of 10 gate tubes whose grids are to be driven from -15 to +30 volts (45 volt-pulses). The repetition rate here is 1 megacycle. The 7AK7 gate tubes are tetrode connected.

Work has begun again on driving large numbers of gate tubes at the 200-kc rate, and once again there is difficulty. As one travels down the line, the pulse is considerably attenuated. It is difficult to determine a termination for this line. It is apparent that the small value of terminating resistor will not do; we must use a large one. $50\ \Omega$ is too small, even though the line has been found to look like less than $50\ \Omega$.

Memory-Sensing Amplifier

(C. A. Laspina) (UNCLASSIFIED)

A sensing amplifier for use in MTC has been built and is now being tested. A breadboard of the unit operated satisfactorily on a test setup. A unit will be made in an MTC, Model I, package and tried with useful programs.

2.14 Memory Test Computer

General

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

Besides the planning previously mentioned to change MTC control and in-out system to accommodate a future magnetic drum, etc., there has been much thought and discussion of how most conveniently to make use of the anticipated 4096 (64 x 64)-register memory (since MTC now has only 11 address bits, capable of indexing 2048 registers).

The four principal proposals so far advanced to solve this problem are:

1. To divide the memory into four 32 x 32 quadrants, access to which is had by a bank-switching instruction;
2. To have half the memory accessible to all instructions, with the other half accessible only to 3 or 4 special instructions having 12-bit addresses: ca, st, tr, id. This reduces the possible number of instructions by 3 or 4;
3. To use a 12-bit address throughout by cutting the instruction code to 4 bits;
4. To add a 17th digit to all necessary registers.

The details of these proposals, with their respective merits and shortcomings, are discussed in M-2361.

In a brief display test made for von Buelow's people, it was established that one can write on a P-7 phosphor at a speed of 25,000 inches per second without too bright a flash and still have satisfactory persistence over 2 seconds. Further display tests are in preparation, including trials of the Convair Charactron.

Electronic Design and Installation

Toggle-Switch Storage (J. Crane) (UNCLASSIFIED). Toggle-Switch Storage, MTC, was modified to accommodate installation of Plug-Board Storage.

Plug-Board Storage (J. Crane) (UNCLASSIFIED). Present plans indicate that 12 IBM plug-boards will be available for use with MTC.

(H. Henegar) (UNCLASSIFIED). Plug-board storage has been installed in the Memory Test Computer and is in operation. Work is now being directed toward decreasing the access time of panel storage. This increased much more than was expected after the installation.

2.14 Memory Test Computer (Continued)

Equipment (H. Smead) (UNCLASSIFIED). Drafting and construction of equipment for the 64 x 64 memory for MTC are proceeding according to schedule. The only procurement difficulty thus far encountered is the 100-ohm, 10-watt, noninductive Ward Leonard resistor for the Digit Plane Driver unit. A nonstandard substitute for possible temporary use (Sprague) has been obtained from the Lincoln Lab stock.

Power Supplies

(R. G. Farmer) (UNCLASSIFIED)

The first of the MTC power supplies is completely tested and has been found to have very good characteristics. When the supply was initially turned on it produced oscillations at the output. This was overcome by a compensating circuit in the feedback loop. Much experience was gained in testing the first supply; the time to test the remainder should be much shorter.

Air Conditioning

(R. E. Garrett) (UNCLASSIFIED)

The insulation labor trouble has been settled, and it is expected that this work will be completed within the next biweekly period. The consultant has made a final inspection of the installation and will submit a report on the entire project shortly.

2.15 Equipment Design and Schedules

(A. P. Kromer) (UNCLASSIFIED)

Most of the period was devoted to the preparation of information regarding the time phasing of contractual coverage and delivery of equipment and estimates of the cost of the equipment which will be required for the initial production lot to be installed by ADC in the first sector set up with the Transition System.

A visit was made to IBM to introduce representatives of Western Electric - Bell Labs (CADS II) to the IBM High Street and production manufacturing operation at Poughkeepsie.

(J. D. Bassett) (UNCLASSIFIED)

Meetings of the joint MIT-IBM Mechanical Components Subcommittee and the Materials and Processes Subcommittee were conducted during the week of August 10th. A standard format has been adopted for the presentation of approved proposals submitted by all of the joint standards subcommittees. Arrangements have been made for cooperation with the Lincoln standards group to make available to them any information desired from the joint MIT-IBM standards work, as well as to provide the Lincoln committee with some extra manpower on a part-time basis.

2.15 Equipment Design and Schedules (Continued)

(W. H. Ayer) (UNCLASSIFIED)

The pluggable unit containing the etched-circuit flip-flop and the IBM style flip-flop has been tested. A comparison of the waveforms showed very little difference between them except that the etched-circuit pulse seemed to be cleaner.

Layouts of the cathode-follower and gate-tube circuits are being prepared and will be tested in the next two weeks. An investigation is also being made of the procurement problems involved in this technique.

An investigation into the air-conditioning installation that will be necessary for the XD-1 equipment has been started and will continue throughout the next month. Joint meetings with IBM and the consultants will start within two weeks.

2.16 Transistors

Transistor Pulse Generators

(D. J. Eckl) (UNCLASSIFIED)

Two different types of transistor pulse generators have been constructed and tested. These have operated the 2^5 counter model satisfactorily. Several other types of single- and two-transistor flip-flop models have been built as test and demonstration circuits. The transistor pulse generators will operate these satisfactorily.

Tetrode Transistors

(D. J. Eckl) (UNCLASSIFIED)

Sylvania is producing a tetrode point-contact transistor with two emitters for commercial use. We expect to be able to test some samples in the near future. Such a transistor may prove to be the answer to our gate problems.

Transistor Flip-Flops

(E. U. Cohler) (UNCLASSIFIED)

The past biweekly period has been spent largely in the study of the d-c conditions of various junction-transistor flip-flops. Several conditions of operation have been found for the typical circuit. A thorough presentation will be produced shortly. In addition some time has been spent on checking the operation of the transistor counter, and a new clearing system has been added which results in much improved clear operation. At present, studies of the margins of the counter are being undertaken.

2.16 Transistors (Continued)

Minority Carrier Storage

(N. T. Jones) (UNCLASSIFIED)

The point-diode samples are now undergoing their third series of tests. All these diodes are rated according to their reverse-recovery characteristics. The first such test indicated that several types of Hughes diodes rate highest. The present test is essentially a duplication of Heath's circuit (from IBM).

One full day during this biweekly period was spent with Heath and Lawrence of IBM on the subject of the measurement of diode reverse-recovery characteristics. Fundamental differences in approach to the problem exist between their group and ours but the results are in general agreement.

Procurement

(N. T. Jones) (UNCLASSIFIED)

Another inquiry has been made of Sylvania about their transistors. Sylvania is the first to market hermetically sealed units and such types as the 3N21 tetrode transistor. A Sylvania representative will visit this Group about August 21 to discuss their products.

Transistor Core Drivers

(S. Oken) (UNCLASSIFIED)

Several other schemes for paralleling transistor core drivers have been tried without much success. A note on transistor core drivers has been started.

A replacement for the carry flip-flop in the transistor accumulator which uses a switch core driven by transistors is also being investigated. The main problem here will be that of back voltage induced in the core.

2.2 Group 63 (Magnetic Materials)

(D. R. Brown) (UNCLASSIFIED)

The average yield from General Ceramics cores is now 60 percent. One lot of 896 cores, A-85, had a yield of 96 percent. To date, 7889 cores have been accepted. These cores are being used to construct the first seven planes for the second bank of magnetic memory in WWI. Capacity of the semi-automatic core tester is over 10,000 cores per day, but minor technical difficulties have prevented maintaining this rate for more than several days at a time.

Ferrite-Core Pulse Tests

(J. W. Schallerer) (UNCLASSIFIED)

The semi-automatic core tester has been operating for the last biweekly period. Approximately half of this time was spent in making necessary modifications on the machine and logic.

Thirty-thousand cores have been tested at the optimum current (0.835 amp). The voltage limits were 100 mv to 130 mv. 24,218 cores were accepted during this test for an initial yield of 81 percent. In one week of testing, roughly 50,000 tests have been made.

Enough acceptable cores for eight arrays have been turned over to Ted Ogden. The over-all yield has been running approximately 60 percent.

(W. Klemperer) (UNCLASSIFIED)

For our constant-temperature measurements we have set up a half-liter Dewar flask with supports for the direct comparison of 2 sets of 100 cores under identical operating conditions. With this setup, several core lots have been evaluated at different driving currents and temperatures.

After agreement with the production tester was achieved on August 6, differences occurred again this week. Therefore, a daily checking procedure has been instituted which is being followed to the letter. All necessary apparatus has been placed on a handcart to be wheeled to each tester at the start of the day.

The special preamplifiers constructed for all core-evaluation equipment were found to have poor recovery after (transient) calibration pulses. This makes them unsuitable for observation of both undisturbed and disturbed ONE core outputs simultaneously with calibrating signals. We are awaiting further circuit changes.

2.2 Group 63 (Continued)

Routine Evaluation of New Magnetic Materials

(P.K. Baltzer, P.A. Fergus, A.C. Switendick, J.R. Freeman) (UNCLASSIFIED)

The routine evaluation procedure of new magnetic materials has been reorganized in order to expedite data processing and presentation of qualitative information. Elimination of redundant records, redesign of data forms and file cards, and improvements in calculation procedures have been instituted. The importance of prompt refiling of magnetic cores not being studied also has been emphasized.

Ferrite Synthesis

(R. A. Maglio) (UNCLASSIFIED)

Stokes Press. Until the Stokes Press operates satisfactorily to produce toroids with the desired physical characteristics, a large percentage of the press production time will succumb to the tooling of compacting dies. There have been various dies made and tested. With each new set, one trouble is alleviated and another taken on. The latest difficulty has been the cracking and lifting at the top of the toroids. We have learned that the small amount of powder which flows and compresses into the clearance space between the die parts produces the cracking when the top punch is removed. A set of dies with less than 0.0005-in. clearance has been machined and tested. The cores formed with this set of dies are the finest up to date; however, because of the reduced clearance the dies bind after forming about 12 cores.

The tolerance of the dies will be maintained, and the material will be worked to overcome the binding problem.

Improvement of Ferrite Powder for Pressing. In order to obtain a clean-cut, well-formed core and overcome some of the existing problems the following improvements are being imparted to the ferrite powder:

1. A wash in alcohol to remove dust from the surface of the particles;
2. The addition of stearate, in solution, to produce a more intimate contact with the surface of the particles;
3. The addition of water. We are determining the effect of the addition of water upon the forming property of the ferrite powder. Water moisture benefits core forming; however, the optimum amount is not known.

Harper Furnace. Test results for cores fired July 28, 1953, have not been received. Temperature variation within the Harper Furnace has increased. This may be due to a change in globar resistance. A complete trace of temperature will be made before a new batch of cores is fired.

2.2 Group 63 (Continued)

Microstructure of Ferrites

(F. S. Maddocks) (UNCLASSIFIED)

Microstructure analysis of the DCL-3-44 series has been completed. Grain patterns were found to vary in a logical manner with both chemical composition and firing conditions. However, little or no evidence of any correlation between hysteresis-loop squareness, coercive force, or switching time with grain size or any other visible surface characteristics have been found.

Where analyses were made, cores of high MgO content showed no change in grain size after refiring, while cores of high MnO content showed a reduction in visible manganese precipitates but no change in grain size.

Cores DCL-3-48 and DCL-3-48A were of particular interest, since it was at this composition that a change in structure from a $MgFe_2O_4$ matrix to a $MnFe_2O_4$ matrix was thought to be observed. A difference of 50 C in firing temperature produced a change in grain size of the order of 30 times, while magnetic properties remained essentially the same, although coercive force decreased slightly. These results were confirmed when the actual cores from which electrical measurements were obtained were examined.

Analysis of Switching

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

The effect of varying the form of the input current upon the form of the output voltage has been studied using a metallic 4-79 mo-Permalloy core and a ferrite MF1326B core. Three different types of inputs were used: (1) an undisturbed (full amplitude) pulse, (2) a full-amplitude pulse preceded by a single disturb (half amplitude) pulse, and (3) a step pulse consisting of a half-amplitude pulse rising directly to a full-amplitude pulse.

A study of the resultant output voltage curves has led to the following conclusions:

1. The voltage output of a half-amplitude pulse in the metallic core is almost completely due to reversible wall motion. It is this reversible motion which gives rise to the first peak in the voltage output of the full-amplitude pulse.

2. The voltage output of a half-amplitude pulse in the ferrite core is largely due to irreversible processes. This can be explained in terms of the high void and inclusion density of ferrites.

2.2 Group 63 (Continued)

(J.B. Goodenough, N. Menyuk, J.D. Childress) (Continued)

3. It has been observed in ferrites that a full-amplitude disturbed pulse switches more slowly than an undisturbed full-amplitude pulse. This can now be explained by the fact that the irreversible wall motion introduced by the half-amplitude pulse inhibits the creation of the new domains upon application of the full-amplitude pulse. For this reason the existent domains of reverse magnetization must travel a greater distance, thereby increasing the switching time.

SECTION III - CENTRAL SERVICES

3.1 Purchasing and Stock

(H. B. Morley) (UNCLASSIFIED)

The magnetic-memory crash-program bill of materials was supplied almost entirely from stock. This was the goal hoped for under a continuous Kardex inventory-control system which, by showing consumption data, would indicate stock needed and allow Purchasing to place orders in advance.

All orders for materials not available from stock and relating to the program have been placed.

The expediting section recorded vendor delivery performance as follows for the period Aug. 3 through Aug. 13:

Orders received complete	--	152		
"	"	on time, as promised	--	63 or 41%
"	"	1-7 days overdue	--	42 or 28%
"	"	8-14 " "	--	23 or 15%
"	"	15-21 " "	--	3 or 2%
"	"	22-28 " "	--	9 or 6%
"	"	30-60 " "	--	9 or 6%
"	"	61 or more "	--	3 or 2%

This reflects a high state of improvement in the expediting section as it now functions after major changes were made in the working method. Although there are no comparable figures for past performance, we estimate that under the old method about 50% of the orders placed were received within two weeks of the target date, against 84% received under the present system.

3.2 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 41 Construction Requisitions totaling 344 items satisfied since July 31, 1953, and there are 27 Construction Requisitions totaling 352 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 11 orders now open with vendors, totaling 746 items outstanding. Deliveries in the past biweekly period have totaled 1320 items. Information on specific orders may be obtained from the writer (ext. 3476).

3.3 Component Analysis and Standards

3.32 Components

(B. B. Paine) (UNCLASSIFIED)

R. J. Biagiotti has transferred from Group 65 to work with me on component evaluation. This should allow faster handling of special test requests.

3.33 Standards

(H. W. Hodgdon) (UNCLASSIFIED)

There is some indication that certain of the new chemical processes for finishing aluminum may be equal to or better than electrolytic anodizing. Details and samples are being procured for evaluation of Alodine 1200, Bonderite 710, Iridite 14, and Chemoxide III. A detailed report will be issued as soon as complete information is available.

Some work has been done for the Lincoln Standards Committee: a proposed form has been prepared and a **draft Standards Sheet for one class of components (Fixed Composition Resistors)** made up.

A large number of revisions of Division 6 Standards sheets are being prepared and, if Multilith printing time is available, will be issued in the next few days.

3.34 Vacuum Tubes

Tube Specifications

(H. B. Frost) (UNCLASSIFIED)

I spent Thursday, August 13, in Poughkeepsie attending a MIT-IBM Tube Committee meeting. We considered a proposal by Sylvania for the development of an octal-based version of the 7AK7. The number assigned to this developmental type is SR1782A. It appears that Sylvania will start work on this tube on or about September 1, 1953. MIT and IBM are supplying equipment to be used in life testing these tubes under pulse conditions.

The general status of the various tube specifications for tubes to be used in the XD-1 system were reviewed and missing information noted. Various missing bits of information will be determined by the tube laboratories at MIT and IBM, either by experimental measurements and life tests of tubes or by direct contact with manufacturers. Most of the tubes now have sufficient information for circuit-design work available, but in many cases limits and ratings are not well established.

3.34 Vacuum Tubes (Continued)Thesis Work

(H. B. Frost) (UNCLASSIFIED)

Good progress is being made on a theoretical analysis of the cathode transients. The equations are almost completely formulated in a form suitable for calculation. This work should be completed in the next several weeks.

An additional tube, RT409, is scheduled for processing on Saturday, August 15. This is the fifth tube to be built for this thesis research. My supply of special tungsten-nickel cathodes is now exhausted. More of these cathodes will be ordered, but in the meantime some work using aluminum-nickel cathodes may be done in order to check the tube designs and fabricating procedures.

Life Tests

(S. Twicken) (UNCLASSIFIED)

The 5965 life test has reached 1000 hours. No interface impedance has been found and both "on" and "off" side currents are substantially the same.

A life test of the 4X150A power tetrode has been initiated. During the first 100 hours there has been in some cases a large change in plate current with the initially low-current tubes increasing considerably and the initially high-current tubes decreasing somewhat. Therefore, this tube type will be preburned for 100 hours prior to service.

In a recent move of some MTC equipment from Whittemore to Barta a large number of 6080's were tested for shorts before reinstallation because they apparently had been merely thrown into a box and transported. Over half of these tubes tested as shorts. Closer inspection showed fairly low-resistance (from 2 to 10 megohms in some cases) leakage paths across the mica between the grids of the two sections. This leakage is due to sublimation of either the cathodes or heaters or both. It has caused no trouble in service since in the circuits involved both grids are tied together. As the tubes in service acquire more life and the sublimation continues, some difficulty may be expected in applications where the tube sections are in independent circuits. RCA will be informed of this problem in the hope that a change in material or processing will reduce the sublimation in future lots. It should be noted that although the method of transport did not cause these shorts in this case, throwing tubes into a box is highly conducive to the production of shorts and should be avoided. It is requested that tubes be shown the courtesy given to eggs and that suitable boxes be obtained from the tube shop when quantities of tubes are to be moved.

3.34 Vacuum Tubes (Continued)

(S. Twicken) (Continued)

During the past several weeks considerable difficulty has been experienced in the Indicator Light Registers with the 5696, a miniature thyratron similar to the 2D21 but with lower heater current. The problem showed itself as self-extinguishing and grid to cathode shorts. Dissection of several tubes showed the cathodes to be badly damaged. Further investigation brought out the fact that for some part of the first 500 hours of service, the tubes in these registers were drawing current with a heater voltage of from 3.5 to 5.5 volts. This is detrimental to vacuum tubes and disastrous for gas tubes. It is recommended that several standard WWI practices be followed more closely: (1) that filament transformers of adequate capacity be supplied for each panel; (2) that types of different heater drain be run off separate transformers; and (3) that the heater voltage be checked when a panel is placed in service. Since all the thyratrons on this panel have deteriorated to some degree, they will be replaced en masse.

3.4 Test Equipment Committee

(L. Sutro) (UNCLASSIFIED)

A loose-leaf manual being completed under the Committee's direction has a page of description and specifications and a circuit schematic for each plug-in circuit that has been used in the Laboratory. Copies of the manual will be placed in the computer room, in the Library, and in the offices of S. Dodd, A. Falcione, and the members of the Committee.

The Committee now reviews at each meeting plans for construction of special test equipment. If you are planning to have such equipment built either by the shop or by assigned technicians, please notify Sutro who will present the details at the next Committee meeting. Two advantages of this review are that a record is printed in the Committee minutes and a check is made to determine if such equipment may have already been built.

Equipment approved for purchase:

<u>Qty.</u>	<u>Model</u>	<u>Type</u>	<u>Manufacturer</u>	<u>User</u>
5	110	Transistor Power Supply	Electronic Research Associates	} Vacuum Tube Circuits Section
3	931	Voltmeter, 750-300-150V	Weston	
3	931	Voltmeter, 75-30-7 1/2V	Weston	
1	931	Milliammeter 150-15-1.5ma	Weston	

3.4 Test Equipment Committee (Continued)

Test Equipment Headquarters

(D. Haigh, L. Sutro) (UNCLASSIFIED)

Each time the -150-v or -300-v supply fails, Mod. V Core Drivers are damaged. As many as five drivers have come into the Headquarters after a power failure, requiring new resistors, crystals, and tubes. John Ackley has designed an interlock to be attached to a Rack Power Control which causes the main contactor of the Rack Power Control to open when either -150 volts or -300 volts fails.

Work completed:

	<u>Video checked</u>	<u>Repaired or modified and checked</u>
Standard test equipment	75	66
Oscilloscopes	1	6

Whittemore D-C Supplies

(R. Jahn) (UNCLASSIFIED)

A number of changes which are intended to increase reliability have been made in the d-c supplies. The 250-v anode fuses, which sometimes exploded with enough force to send parts through the window, have been replaced with 600-v fuses having a higher current rating. A recording oscillograph has been monitoring line and d-c voltage transients. These records indicate that our air conditioning and oven transients cause transients up to 6 or 7 volts on the line, and 1% or fated voltage on the d-c supplies.

The d-c supplies will be shut off occasionally between 1700 and 1900 hours for additional work to improve reliability. Notice will be given over the PA system.

(S. Coffin) (UNCLASSIFIED)

A new all-voltage interlock system is being designed for the Whittemore d-c lab supply, and the new panel is now under construction. This will replace the present troublesome bias interlock. The new system will shut down all voltages if any voltage is lost and will automatically cycle them on again immediately. If the fault has not cleared after two starts, the system will remain on standby. It is planned to have the voltages cycle on in the following order: -450, -300, -150, -30, -15, +250, +150, +120, +90.

3.5 Drafting

Drafting Committee, MIT-IBM

(A. M. Falcione) (UNCLASSIFIED)

Several meetings have been held both at Poughkeepsie and at Cambridge by the Drafting Committee, and three definite proposals have been submitted to the Central Standards Committee for acceptance and approval. The last proposal was submitted July 21; to date no approvals have been received on any of the proposals submitted.

Another meeting was held by the Drafting Committee on August 13 and 14 to review additional proposals which are expected to be submitted to the Central Standards Committee in the very near future.

Work Load

(A. M. Falcione) (UNCLASSIFIED)

The work load on the Drafting Department at the present time consists mainly of making record drawings for many units which were built during the crash program (Cape Cod) from engineer's sketches. The sketches are not to scale and are now being brought up to DCL Standards.

3.6 Administration and Personnel

New Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Mary Culhane, Phyllis Nickerson, Elaine Silk, and George Smith are all new messengers.

Gloria Clark is a new Senior Clerk in the Group 64 records office.

Pearl Edmunds is a new Senior Clerk in the Production Control Department.

Claire Fleming has joined the 6345 Group as a Technical Assistant.

Irma Kushner is a student working in Group 62.

Ruth Stocklan is a new Senior Clerk in the Standards Section.

Terminated Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Geraldine Browne
John Ellsworth
Jeanne Montgomery

Roberta McCluskey
Barbara Ulman
Joel Zigelbaum