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

SUBJECT: DIVISION 6 BIWEEKLY REPORT, July 31, 1953

To: Jay W. Forrester

From: Division 6 Staff

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SECTION I - CAPE COD SYSTEM

1.1 Group 61

1.10 General

(C.R. Wieser) (CONFIDENTIAL)

Considerable effort has been spent to obtain recorded radar data from the CPS-6B radar and two overlapping gap-filler radars because of the proposed shutdown of the CPS-6B. About two and three-quarter reels of tape have been recorded so far, but none of these recordings is completely satisfactory due either to trouble with the gap-filler radars or else to a low blip-scan ratio for the CPS-6B.

A crash program is under way by Division 2 in an attempt to install an FPS-3 radar for the September tests.

Progress on the TWS programs for the 1953 Cape Cod system is satisfactory. Most parts of the program have been combined into a single over-all program and run on the computer without causing any alarms; programs are expected to be operational by the middle of August.

Preparation and testing of the NTWS programs have proceeded at an accelerated pace, but it is estimated that there will be about a one-week delay in the schedule given in the past biweekly. Lack of computer time and tape preparation are causing some delays, but in each case we are receiving excellent cooperation.

1.10 General (Continued)

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

Planning is under way for manning the Cape Cod center this fall, and a tentative list of operators has been drawn up. Group 38 is participating in this work and will carry it further under the supervision of Deegan. Early next year we will probably try to achieve 100% Air Force operators. Also, Deegan will work on an operator's manual, basic-skill requirements, and a training program for future centers.

It has been decided that two banks of magnetic-core memory will be installed in Whirlwind I during the next month. The first bank will be the one now in the Memory Test Computer, and the second will be one already partially completed by Group 62.

Rearrangement of Room 222 to provide better space for observation by visitors has been studied. The plan required moving several consoles, and had to be abandoned because of insufficient time to do the complete job in addition to the installation of magnetic-core storage.

1.11 Equipment Engineering

(N. Alperin) (CONFIDENTIAL)

Light guns have been installed at stations E12, F11, F12, G12, G13. Guy Young's program was used to check them out, and it was found that it is possible to initiate on numbers. I am in the process of finding the cause of the trouble. Four of the five light guns will have to have their cables lengthened. This will be done on August 3.

The Flexichrome process for video mapping has been abandoned. The colors took very easily, but they were too hard to remove. Bob Maglio is investigating a process whereby organic colors will be placed in a clear gelatin sheet and then removed with an organic base. When an area is to be masked an organic acid will be spread over the area thus bringing out the color.

(H. Kirshner) (CONFIDENTIAL)

Construction of new equipment required for installation of the monitor station in Room 224 is nearing completion, and installation of the station is in progress.

Construction of cathode-follower plug-in units for remote viewing of test points of the gap-filler demodulator panels has been requested of the shop.

1.11 Equipment Engineering (Continued)

(H. Kirshner) (Continued) (CONFIDENTIAL)

One solution to the problem of providing adequate light for switches and push buttons on the consoles in Room 222 is being investigated. Standard 2" x 12" mounting panels are being constructed of 1/4" Plexiglas. These panels are to be illuminated from the rear with incandescent light of variable intensity. The panels are to be masked so that individual switches may be outlined with a color code and lettered identification. Should the experiment prove successful, small-size panels can probably be mass produced by molding processes and large-size panels individually manufactured from safety glass.

(B. Morriss) (CONFIDENTIAL)

A procedure for posting a schedule for the equipment used solely by Group 61 has been worked out. It will be maintained by P.F. Dolan and A.P. Hill. This should improve the scheduling of maintenance and checking out of this equipment. A note describing the procedure is being prepared.

A procedure for checking out the equipment in Room 222 has been worked out and about three quarters of the necessary programming completed. Several programs remain to be written, all of the programs must be checked out on the computer, and a manual must be prepared for each station.

Work continued on familiarizing myself with the buffer drum and in performing routine signal measuring at various points in the drum system.

(J.H. Newitt) (CONFIDENTIAL)

Most of the past period I have been on vacation. DuMont has not been able to suggest a remedy for the HV power-supply burnout problem so I will attempt to correct this by myself. I have two concrete methods of solution which I have already started. One will attempt to reduce the incidence of burnout in the present units while the other will be aimed at correcting the basic difficulty. I am quite confident that the second if not the first procedure will solve our problem. Several new requests for control-room modification work have been made, and work on these has been started. The air-conditioning load for the rooms served by the unit in the WWI maintenance room is being reassessed since equipment installation is now considerably different than was originally contemplated in the a-c duct design. A rough estimate indicates an increase over originally contemplated dissipations (due primarily to the non-removal of old equipment) but I think we are not in trouble as yet. Overheating which has occurred to date has been due more to improper distribution than to lack of capacity. Analyses and reports on the above situations will be made.

1.11 Equipment Engineering (Continued)

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

The installation of the mapper scopes in Room 216 is essentially complete with the exception of the phototube pickup for Y33. Most of the past biweekly period has been spent checking out the operation of the mapper scopes with MITE.

Considerable trouble has been experienced with the azimuth-drive synchronizers. The new model appears to be just as sensitive to missing azimuth pulses as was the previous model. A test setup has been installed in Room 216 for checking the effect of missing pulses, but there hasn't been sufficient opportunity for checking this effect.

1.12 Data Screening

(R.L. Walquist) (CONFIDENTIAL)

Considerable effort is being put into an attempt to get decent recorded radar data from the CPS-6B and two overlapping gap-filler radars because of the proposed shutdown of the 6B. About 2 3/4 reels of tape have been recorded so far but none of these recordings is completely satisfactory due either to trouble with one of the gap-filler radars or else to a low blip-scan ratio for the 6B. The recordings also indicate a high level of random returns from the 6B; these returns are believed to be marginal echoes from scattered clouds.

A crash program is under way by Division 2 of Lincoln in an attempt to install an FPS-3 radar for the September demonstration. This set is to replace the 6B and will be completely under Lincoln's control. Since the set has an operating MTI, it is hoped that the data will be much better than that from the 6B.

Progress on the TWS programs for the 1953 Cape Cod System is very satisfactory except for the Trouble Track Display Program by H. Peterson which has not yet been run on the computer. Nearly all other programs have been combined into a single over-all program and run on the computer without causing any alarms. Manual initiation of tracking has been tried successfully. Correlation of radar data with tracks is not operating properly but the exact reason is not yet known. Automatic assignment is also not functioning correctly. Manual assignment of tracks to the monitors and manual dropping of tracks both work satisfactorily. We should be able to start operational tests of the TWS programs before the end of the next biweekly period.

1.12 Equipment Engineering (Continued)

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

Integrated testing of the TWS function has begun, and results for the most part are encouraging. Several programming and tape-preparation errors in various sections have been detected and corrected. A few other strange occurrences remain a mystery so far.

Difficulty in reading-in tapes has led us to believe that all is not the programmer's fault when errors occur. Several times we have been quite discouraged with operation of programs only to find that the cause of the trouble is some random words being read into ES.

(H. Frachtman) (CONFIDENTIAL)

Several errors were found in the trouble-track displays when they were tested on the computer. The programs have been revised and are ready for another test.

The tracking officer's DID display was operated successfully on the first attempt. However, it has been changed to include a three-digit display.

(D. Goldenberg) (CONFIDENTIAL)

The cross-telling problem for a spheroidal earth is still being analyzed.

The quarterly summary report on the earth's curvature problem has been submitted to R.L. Walquist.

An error has been found in the latitude of the Rockport-Pigeon Hill radar site. The correct latitude and the new x,y coordinates of the site have been issued in M-2164 (Supplement #1). The new coordinates should be used, because the difference from the previous y-coordinate is about 2 miles.

(J. Ishihara) (CONFIDENTIAL)

Trouble shooting of the 1953 Cape Cod-TWS program continues. Some of the more obvious errors have been found and corrected. Work has now progressed enough so that a systematic testing of subprograms can now be made.

1.12 Data Screening (Continued)

(J. Levenson) (CONFIDENTIAL)

All of the monitoring programs except light-gun interpretation for trouble-track displays have been checked out individually. During the past week they have been run combined with other TWS programs; I have not yet been able to determine whether they operate satisfactorily in a dynamic test.

Most of my time during the past week has been spent assisting at tests of the TWS program and checking display programs.

(H. Seward) (CONFIDENTIAL)

A program to simulate Non-Track-While-Scan track displays and associated light-gun actions was written, checked out, and incorporated with the Track-While-Scan programs.

(E.W. Wolf) (CONFIDENTIAL)

A program has been written that will transfer any or all of the 1953 Cape Cod System programs from the drum onto magnetic tape. When a particular combination of programs is subsequently transferred back to the drum, the correct setup program for that combination is automatically selected and also transferred.

(W. Wolf) (CONFIDENTIAL)

During the past biweekly period some time was spent with J. Ishihara in matching the Data Collection, Data Analysis, and Data Conversion and Display subroutines with the Correlation program for inclusion in the TWS program for the 1953 September System. In subsequent operation the subroutines performed satisfactorily after one minor modification.

A data count by horizontal and/or vertical four-mile strip was written for the N. Truro data and is awaiting computer time.

A programming error was detected in the correlation program which accounted for the apparent poor correlation mentioned in the previous biweekly report. This error was corrected, and the program now awaits computer time.

Operating instructions were written for Guy Young's tape, T 2699-1, which checks out the light guns, GOC box, display boxes, and real-time clock. A notebook was compiled to satisfactorily contain the operating instructions for the test, calibration, post-mortem, and other tapes carried by the Group 61 computer operators.

1.13 Tracking and Control

(S. Best) (CONFIDENTIAL)

Two new programs will be tried during the next period:

1. A program for optimizing velocity-heading smoothing coefficients. (This tape has now been converted.)

2. A single-aircraft tracking program for N. Truro data which prints out r and θ.

Programming of the Monte Carlo method for investigating crossing tracks is now finished.

(M. Frazier, A. Mathiasen)

It has been found that when tracks are initiated at extreme ranges, NLS-2C behaves as a linear smoothing program with the constants in use at present. This, of course, leads to a slow velocity build-up. Some improvement is achieved by reducing the break point somewhat at extreme ranges; this will be studied further.

(W. Lone)

A parameter, written to test the FTU program, produced unfavorable results and another one was written to more nearly simulate the conditions under which the program will operate. It appears that the program is working successfully although further testing is necessary. This will be done at the FTU console which is now in operation.

A modification to the 5-56 punch-out conversion was made to take care of the "sb" and "md" orders. It is now possible to type over 1000 words without need of feedout.

(A. Mathiasen)

A test of a two-radar tracking program modified for MITE seemed satisfactory, but was not completely conclusive since only one radar, fed simultaneously into two MITE units because of trouble with a radar mapper, was used.

One run of the tracking-study program written by W. Lone and me was entirely successful. A small modification of the program designed to permit use of the drum for read-in after parities was tested at a later run and apparently worked. However, somewhere between the two runs an obscure fault crept in as the earlier success was not repeated under supposedly identical conditions and a farrago of numbers and miscellaneous characters was the only outpouring of the computer other than alarms. This matter is under earnest study.

1.1\ Weapons Direction

(D.R. Israel) (CONFIDENTIAL)

The preparation and testing of the NTWS Programs has proceeded at an accelerated pace. Quite a bit has been accomplished in the past two weeks, yet progress has not been as rapid as it had been hoped. It is estimated that there will be about a one-week delay in the schedule given in the past biweekly. Of the 56 initial programs, 20 have been checked out, 15 are in the checking processes now, and 21 are being written and will be checked within the next biweekly period.

The reason for the delay in the schedule appears chiefly to be a lack of programmer man-hours. Staff members have cooperated splendidly in the testing which includes many late hour and early-morning sessions. Lack of computer time and tape preparation are causing some delays, but in each case we are receiving excellent cooperation.

The testing of the past two weeks has been greatly facilitated by a group of utility programs prepared by Knapp and Gaudette. The major step of the past biweekly period was the merging of several programs, providing a full track-situation display of moving tracks. The speed and heading of these tracks was under the control of the Flight Test Umpire position. Within several days, testing will start on the next merger which ties the Display Make-Up Program together with the above program. After this tie-in, changes in assignment status and identity will be possible from the various operating positions.

Jim Deegan of Group 38 is assisting Group 61 in setting up the operation of the Identification Section. The particular emphasis is upon the data handling prior to its insertion into the machine. Arrangements are being made to conduct daily tests of the data-handling process starting next week.

Bert Green of Group 38 has prepared a proposal for using various shapes, colors, and spacing of the display-line toggle switches. Plastic handles will be ordered, and several stations will be outfitted on an experimental basis.

A number of changes in the equipment layout of the Cape Cod Direction and Combat Center have been proposed. While a number of these changes seem desirable, the time and man-power requirements to effect them are fairly large. The present decision is to make as few changes as possible as follows:

a. Scope J-13 will be removed.
b. Scope S-11 will be moved closer to the wall.
c. One or two display scopes will be installed at Position A.

1.14 Weapons Direction (Continued)

(D. R. Israel) (Continued)

d. The equipment in Room 228 will be removed and one or two display scopes will be installed.
e. Tables will be made to hold the 12-inch frames not now mounted on the sides of 16-inch scope consoles.

The removal of equipment from Room 228 is now feasible inasmuch as the computer schedule does not permit adequate time for further flight-test experiments. The scopes to be installed at position A and in Room 228 will be used for training purposes and for visitor demonstrations.

As a result of several meetings during the past biweekly period, a definite proposal for the initial manning of positions in the Direction and Combat Center has been made. As presently planned, roughly half of the positions will be manned by Group 61 staff members and one half by Air Force personnel. Key positions will be manned by staff members during the initial testing and shakedown phases of operation.

A number of memos are being written to include the most recent changes in the frame and panel layouts, the wiring of panels to intervention digits, and display-line assignments. These revised memos are expected to be issued within the next biweekly period.

Steve Hauser has now completed his indoctrination programs and will help B. Morriss on problems and programs connected with the checking of equipment in the Direction and Combat Centers. Hauser will also work in the geography display of the Cape Cod System.

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

During the past biweekly period, the display group (Benington, Conant, Grandy, and Stahl) has centered its attention on the Display Master Make-Up Program (DMM), the Summary Data Display Program (SDD), and the necessary data tables for testing them. After conferences with the interception section it was decided to incorporate the switch read-in for both the Intercept Director and the Weapons Direction sections into the display program. This has necessitated a radical change in the flow diagram but proves far more effective; for the first time adequate precaution can be taken against illegal switch settings at these stations.

The DMM program (T-2851) has been written and will be tested out early in the next period together with the Master Control Program and the FTU program. As time allows, the SDD and FTU DID will be added.

This chance of emphasis has postponed completion of the M-note Display Categories and Assigned Scope Displays. (M-1999-1, Benington, Grandy).

1.14 Weapons Direction (Continued)

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

The memo will be issued early in the next period. In the meantime, an inter-office memo is available describing all the changes from M-1999.

The junction of the Master Control Program, FTU Program, Switch Read-In Program, and Track Situation Display Program was successfully run on the computer. These programs should be available shortly on one tape (T-2901) for demonstration purposes.

(M. Brand) (CONFIDENTIAL)

During this period this program was checked out satisfactorily. Upon check-out it was joined in the first marriage of NTWS programs. In this marriage difficulty was caused by two facts; one, TWS was not completely filled with data necessary for proper operation of the FTU program. Once the program loaded these registers by itself, operation in this respect was successful. The second trouble was caused by the fact that the FTU program did not have an automatic deinitiation feature. Thus, when tracks started going out of the system, the Track Situation Display program would get an arithmetic-check alarm trying to put track numbers and identifiers on these tracks. This has been remedied by inclusion of an automatic deinitiation feature in the program which is now being checked out.

The correlation program and the ID status-interpretation program are completed and in the process of being checked out. Both are well along in their checking. In conjunction with A. Curby, C. Gaudette, S. Knapp and J. Hayase, a flow diagram for the identification system is being worked out which will show program logic and data-transfer planning.

Considerable time has been spent with J. Deegan of Group 38 in the data-handling and human-engineering aspects of the ID system. A system of data-handling experiments has been set up with some presently underway.

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

The Anti-Aircraft Data Intake Program (T2890-2) and the A-A Rotation and A-A Talker's Digital Information Display Make-Up Program (T2891-2), and the A-ATDID Program (T2894-0) were written by Geraghty, using draft programs done by the writer. Some necessary and/or economical changes were made by Geraghty. T 2894 is checked out. T 2890 has worked for one set of parameters, but gave trouble with a second set due to a misunderstanding regarding the changes desired in the second set. T 2891 has been run and worked satisfactorily except for an Arithmetic Check Alarm and one or two troubles which could be traced directly to the error causing the alarm. The error has been found and corrected, and it is expected that T 2891, as well as T 2890, will be finally checked out during an operation period scheduled for August 2.

1.14 Weapons Direction (Continued)

(John J. Cahill) (Continued)

It was learned that the 2800-series sub-routine tapes should be read in before programs that use them, as they destroy contents of registers following 40 (o).

The 2800-series Height Finder programs are progressing satisfactorily. Geraghty, Rawling, and the writer will be able to put practically all their time on these tapes henceforth. Some, if not all, of these programs should be ready for initial testing the end of next week.

(O.T. Conant) (CONFIDENTIAL)

The FTU and Visitor's Selected Track DID Make-up and Display program is substantially complete, including revisions corresponding to the recent changes in ATDS (Auxiliary Track Data Storage) and availability of only one block of TSDT (Track Situation Display Table) and awaits only assignment of ES and drum locations before being taped.

The preparation of T-2799 p2 has been undertaken in conjunction with F. Webster. This parameter will provide complete information in TDS, ATDS, and TSDT for 20 existing (simulated) tracks and positions and velocity in TDS for 10 tracks to be "initiated". It is to be used in checking out Benington's and Grandy's Display Master Make-up Program in conjunction with Brand's FTU Program and others, and later in checking out other programs (including the FTUDID, above) which require simulated track data.

The Weapons Director's DID'S (selected and "forced" tracks) should be started shortly.

(A.W. Curby) (CONFIDENTIAL)

During the past biweekly period the ID Switch Interpretation Program, T 2851, and the ID Data Processing Program, T 2852, have been run successfully with special-data parameter tapes. The Flight Plan Extrapolation Program, T 2850, has been written and will be tested shortly.

(F.M. Garth) (CONFIDENTIAL)

The Table Make-Up Program to be joined with the Radio Operator and Interceptor Director Display Program is being checked out. The combination of these two programs will include the sending of all data link

1.14 Weapons Direction (Continued)

(F.M. Garth) (Continued)

messages, preferably during the table make-up phase.

Parameters have been completed which simulate FDS (Flight Data Storage) and ATDS (Auxiliary Track Data Storage) tables to be used to check out the final Table Make-Up and Display Program.

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

The Print-Out and Static MIV (Manual Intervention) program (T 2881-5) has been checked out and is available to programmers for checking out NTWS subprograms.

The tape containing Sin-Cos, Radius Vector, Arctangent, and Square Root subroutines, which will replace the Sin-Cos subroutine during the NTWS subframes, is checked out and available for use. This tape number is 2883-2.

The first combination of NTWS subprograms has been tested. This combination includes a Switch Read-In Program, the FTU Program, and the Track Situation Display Program. They were tested in conjunction with the Master Control Program. The test was fairly successful, although minor errors still remain to be ironed out.

1.14 Weapons Direction (Continued)

(M. Geraghty) (CONFIDENTIAL)

Revisions of M-1979, "Frame and Panel Layouts," and M-2185, "Wiring of Push Buttons to Intervention Registers," have been written and should be distributed shortly. M-2185 has the latest available uses for each button listed.

My revisions of the September AA programs were completed last week, and further work on them will again be handled by J. Cahill. See his report for progress in checking them out. The past week has been devoted to Height-Finder programs. J. Cahill had completed rough drafts of the Height Supervisor Intake, Height-Finder Technician Intake, and Altitude Estimation programs prior to his vacation. These programs are now ready to be written up for taping, and work is progressing on the automatic-priority scheme. I hope to have it ready for check-out next week, together with the HFT DID Make Up and DID, the HS trouble detection and the trouble symbol display.

G. Rawling has assisted J. Cahill and me in all the above programming and checking.

(J. Hayase) (CONFIDENTIAL)

Tapes 2855, 2857, 2858 have not been completely checked out yet. Flow diagrams have been completed, and coding has started on the Identification Digital Information Make Up and Display Program.

(W.Z. Lemnios)

The past two weeks were spent writing the Cape Cod Calculations Program. The Program is now almost completed and should be ready for checking out very shortly.

(L.J. Murray) (CONFIDENTIAL)

The Identification Officer and Radio Operator DID Program has been rewritten and is now ready for its "marriage" into the September System.

The Display Table Make-Up Program for the above is now being checked out.

1.14 Weapons Direction (Continued)

(J.F. Nolan) (CONFIDENTIAL)

The first week of this period was spent writing and testing the two Assignment Action programs and the two Assignment Display Request programs. These four programs are now operational. The second week was spent writing the Display Program and the Calculations Program. The Display Program is written but not as yet operational. The Calculations Program is about half written.

(G. Rawling) (CONFIDENTIAL)

The past period has been spent in writing parameter tapes for the AA programs: 2890 AA Intake; 2891 AA Rotation and DID Make Up; 2894 AA Talker DID; and assisting in check out on the computer. Results may be found under the report by Cahill.

The parameters include data on tracks in ATDS (Auxiliary Track Data Storage) and TDS (Track Data Storage) which may be useful to other programmers. Future work will be derivation of flow diagrams for the Height Finder Program.

(B. Stahl) (CONFIDENTIAL)

The Weapons Assigner DID is now written and checked out. In addition, the display program has been written and the make-up program will follow very shortly.

(E.W. Wolf) (CONFIDENTIAL)

About one fourth of the intervention buttons for the 1953 Cape Cod System have been checked out with the Intervention Register Test Program. A number of improvements have been made in this program, and the remaining intervention buttons will be checked out as soon as additional computer time is assigned.

(F.A. Webster) (CONFIDENTIAL)

In collaboration with Conant and Benington, a special version of the first set of 20 simulated tracks has been adapted for a parameter tape primarily designed to test the operation of the Display Master Make-Up Program with Track Data Storage, Auxiliary Track Data Storage, and Track Situation Display Table. It was also planned for use with the FTU program. Cards are being prepared on complete tracks incorporating flight plans and other data to be used in testing the identification function.

1.14 Weapons Direction (Continued)

(C.A. Zraket) (CONFIDENTIAL)

Work is continuing on the Cape Cod Weapons Direction programs mentioned in the last biweekly report. The major part of the past biweekly period has been spent in test checking these programs on the computer. It is expected that all of these programs will be checked out during the next biweekly period with the exception of the main interception program. Initial testing of this program will start on or about August 8. It is hoped that an inter-office memo describing the inputs, outputs, and limitations of these programs can be issued in the near future.

1.15 Direction Center Operations

(M. Brand) (CONFIDENTIAL)

The following is a summary of Group 61 computer time:

Track-While-Scan Programs	25 hrs 0 min
Non-Track-While-Scan Programs	24 hrs 50 min
Tracking Control Programs	6 hrs 0 min
Conversion	3 hrs 30 min
Total used by Group 61	59 hrs 20 min
Time Given to Adams	3 hrs 0 min
Time Lost to WWI	13 hrs 40 min
Total Assigned Time	76 hrs 0 min
Percentage Assigned Time Used	79%

(P. Dolan, A.P. Hill)

The following statistics apply to the last biweekly period:

1. Computer hours scheduled for flight tests	4
2. Computer hours used for flight tests	1
3. Computer hours returned due to flight test cancellations	3
4. Total aircraft hours flown	23
5. Aircraft hours flown by 6520th Wing at Bedford	23

DATE	TIME	SCHEDULED TEST A/C	SCHEDULED TEST Description	TEST ACTUALLY RUN A/C	TEST ACTUALLY RUN Description	REASONS FOR CHANGES OR COMMENTS
7/17	1000-1200	2	3-Radar Tracking	-	Cancelled	No PPI presentation available
	1200-1400	1	CPS-6B Coverage	-	Cancelled	PPI scope inoperative
7/21	1300-1600	1	CPS-6B Coverage	1	As Scheduled	
7/22	1000-1200	3	Single-Pair Intercepts	-	Cancelled	Weather
7/24	1300-1600	1	CPS-6B Coverage	1	Held 2 hrs.	Cancelled last hour to allow technicians to work on mappers
7/28	1000-1200	2	3-Radar Tracking	2	As Scheduled	
	1200-1400	2	CPS-6B Coverage	-	Cancelled	Time needed to work on mappers
7/29	1000-1200	2	3-Radar Tracking	2	As Scheduled	
	2000-2200	2	3-Radar Tracking	2	As Scheduled	
7/30	1000-1200	2	3-Radar Tracking	2	As Scheduled	

* Added to schedule during week of test

1.15 Direction Center Operations (Continued)

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

July 21, 1230-1530, 6B Coverage

One B-29 was used for this test, coverage being obtained from both the NW and SW sectors at an altitude averaging 16,000 ft. Tracking was generally fair throughout the test.

July 24, 1300-1600, 6B Coverage

One B-29 flew the NE and SE sectors, varying altitude between 10,000 and 20,000 ft., from Brunswick, Me., to Montauk Pt. with tracking fair to good.

July 28, 1000-1200, 3-Radar Coverage

Two B-29's were used and directed to fly so as to record crossing tracks on 6B and two gap fillers. Results dubious due to extensive ground clutter on 6B plus the fact that the mappers were not operative and data could not be observed. Sites used were Chatham and Pine Hill.

July 29, 1000-1200, 3-Radar Coverage

Two B-29's on same plan as July 28:
1. Truro - tracking fair to good
2. Chatham - tracked very well
3. Pine Hill - tracking poor, missing synch pulses caused scope shifting resulting in poor tracking.

2000-2200, 3-Radar Coverage

Two B-29's in area south of Chatham at 7500 to 8000 ft. directed so as to cross paths. 6B - fair to good data - tracking fair to good. Fall River - good data - tracking fair to good. Chatham - good data - tracking fair to good.

July 30, 1000-1200, 3-Radar Coverage.

Two B-29's directed so as to cross tracks. 6B, Derry, and Clinton were used for this test but results are dubious due to faulty operation of scope "O" in mapper room, added to power failure at Truro (P-10). Aircraft were run in Derry area with some success.

1.16 FSQ-7 XD-1 Support

(D. R. Israel) (CONFIDENTIAL)

Walker Thomas (IBM) and I have prepared some revised estimates from the personnel and console complements for XD-1 and the production machines. As soon as time permits, a formal memo will be prepared. These figures have already been used in preparing the ADC budget estimates. A portion of my time during the past two weeks has been spent in assisting in the preparing of personnel requirements and floor plans for ADC.

Work on the proposal for the Operators Console for XD-1 is still in progress. It now appears that this console could be merged with the Flight Test Umpire console. One of the questions presently under discussion is the implementation of program-testing and manual-intervention procedures; the present line of thought is to minimize the number of switches and lights and to use punched cards and direct print-outs as much as possible.

(B.G. Farley) (CONFIDENTIAL)

The past period has been spent on the MTC conversion and read-in programs in cooperation with P.R. Bagley and the MTC-WWI conversion program.

The new MTC conversion program with sum check and various new special words is operating properly.

1.17 Associated Studies

(E.J. Craig) (UNCLASSIFIED)

The previous weeks have been spent writing a first draft of the doctoral thesis on iteration procedures for simultaneous equations.

A generalized procedure has been evolved by which N-step procedures can be devised. A new formulation of the author's procedure has been devised which may be simpler than the previous formulation. It is:

$$AX = y$$

$$X_{K+1} = \frac{1}{1+n_{K-1}} \left[X_K + n_{K-1} X_{K-1} - m_K A_t V_K \right]$$

$$n_K = \frac{|V_K|^2}{|A_t V_K|^2}$$

$$n_{K-1} = m_K \frac{(A_t V_{K-1})_t \, (A_t V_K)}{|V_{K-1}|^2} \qquad \text{where } V_K = AX_K - y$$

1.17 Associated Studies (Continued)

(E.J. Craig) (Continued) (CONFIDENTIAL)

It is hoped that roundoff error will be smaller with this arrangement.

In addition an N-step procedure has been devised for skew-symmetric matrices.

Several practical examples in the non-linear equations have been attempted and one is near solution.

A method by which roundoff error can be evaluated will be attempted on Whirlwind I. It is hoped that experimental results will be sufficient to establish the range of effectiveness of these procedures.

1.2 Group 64

(S. H. Dodd) (UNCLASSIFIED)

During the past few months, electrostatic storage has caused appreciable losses in computer time as a result of parity alarms. These have originated because of deflection-shift troubles and positive switching. In addition, electrostatic storage continues to require quite a bit of maintenance time. As the reliability figures show, the maintenance has been effective but is a drain on computer time. Magnetic storage operation has been proven reliable in MTC, and the decision was made in the middle of this biweekly period to replace electrostatic storage in WWI with the magnetic-storage system now operating in MTC. Since MTC only has 1024 registers of storage, an additional 1024 registers will be constructed and added later. In this interim period, WWI will operate with one bank of electrostatic storage and one bank of magnetic storage.

Until magnetic storage has been installed with both banks and has proven its reliability operating with WWI, both electrostatic-storage banks will be maintaned at high reliability. The expected advantages of magnetic storage are:

1. Reduced maintenance time;
2. Fewer computer alarms;
3. A thorough test of magnetic storage with a wide variety of applications programs.

Work is continuing toward reducing display noise and present progress is promising.

1.21 WWI System Operation

Electrostatic Storage

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

Considerable improvement in storage reliability has been obtained by defocusing the writing beam and by the removal of three 715's which appeared to have tap shorts. The stannic-oxide tubes have continued to operate reliably with no indication of positive switching. Several stannic-oxide tubes will be installed next week. The majority of storage errors are being experienced during short, isolated periods of time on block-transfer orders during read-in.

(D. A. Morrison) (UNCLASSIFIED)

The last two weeks have been spent working with W. D. Fisher in an effort to become familiar with storage-tube pre-test procedure. The next two-week period will be spent with A. Roberts working with ES in WWI.

1.21 WWI System Operation (Continued)

Auxiliary Magnetic-Drum System

(K. E. McVicar) (UNCLASSIFIED)

The auxiliary-drum system has required attention on two or three different occasions during the past biweekly period. Most significant is the trouble we have been having with the heads. The work done by ERA's representatives several weeks ago evidently reduced, but did not eliminate, the temperature and aging effects we previously had experienced. We have noticed that several tracks now give low output; these tracks have been concentrated in Group 10. This Group is no longer available to programmers and is currently being used as a source of spare heads and tracks.

One head went completely bad for an unexplained reason. This track was in Group 11 which is used to store the input program and is ordinarily not used for recording. The resistance of the head increased greatly indicating that perhaps there is a poor solder joint between the coil and plug, but this has not been investigated.

There is still some trouble with writing between the slots in the auxiliary system. This has been substantially reduced by causing the WWI voltages to go off in the proper order when the computer is shut down or switched to standby. Since it is a cumulative effect, even a little spurious writing eventually becomes a problem. We are watching the tracks and erasing those which are unusually bad while the matter of eliminating the trouble entirely is investigated.

(P. W. Stephan) (UNCLASSIFIED)

The wiring for the Multiple Terminal Equipment Selector and GSR mixer was laid out and started.

Some marginal-checking lines for the auxiliary drum were changed. Marginal checking of the auxiliary drum is now conducted by the marginal-checking group.

(H. L. Ziegler) (UNCLASSIFIED)

Of the fifty ERA Type 2 chassis (Reading Amplifiers) forty-three have been tested according to specifications established for these chassis. As a result of these tests, five tubes were replaced, two open leads were repaired, and about twelve low margins were found. These margins will be investigated to determine their relationship to acceptable margins as measured in the WWI system where somewhat different operating conditions prevail.

1.21 WWI System Operation (Continued)

Auxiliary Magnetic-Drum System (Continued)

(H. L. Ziegler) (UNCLASSIFIED) (Continued)

The remaining seven chassis now in the Auxiliary-Drum System will be replaced by tested units during the next installation period and will then be tested in the Test Rack.

Some work has been devoted to assembling a convenient and flexible marginal-checking system for use with the Test Rack.

Block Diagrams

(J. H. Hughes) (UNCLASSIFIED)

Tim Leary took over my job in Block Diagrams as of 31 July.

Marginal Checking

(J. H. Hughes) (UNCLASSIFIED)

Don Morrison took over my files on Marginal Checking as of 31 July.

Typewriter and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

During the past two weeks, four more Flexowriters have been torn down for inspection and preventive overhaul.

Three more Flexo tables were equipped with chad-disposal chutes.

Applications personnel planning to photograph printed copy from the Flexowriters are reminded that the carbon ribbon should be used in typing their copy. Bill Walker or Ralph Butt will remove the cloth ribbon and install the carbon ribbon when requested.

1.22 Terminal Equipment

Display

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

A good part of the past biweekly period has been spent looking for a solution to the display-noise problem. It now appears that some measure of success is obtainable by modifying the present decoder-output

1.22 Terminal Equipment (Continued)

Display (Continued)

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

amplifiers to make balanced amplifiers of them and then inserting a filter in the power supply. An additional improvement is possible in that the output of the amplifier can be a plate-loaded stage instead of a cathode follower. This results in an output about ten times as large as is needed. The large output can be transmitted over a single-sided transmission system and attenuated at the receiving end to reduce ground-noise pick-up.

(R. H. Gould) (UNCLASSIFIED)

No helpful advice about the incendiary high-voltage supplies on the 16-inch display scopes has been received from Dumont's representative, the Waters Company. We are investigating possible fire-proof coatings that could be applied to the high-voltage transformer to prevent its burning in case of arc-over. The voltage of all the supplies in Room 222 has been set to 10 KV instead of the normal 12 KV in hopes that the strain on the high-voltage transformer will be lessened.

Buffer Drum System

(K. E. McVicar) (UNCLASSIFIED)

Work on the problem of connecting the buffer-drum system with the computer and MITE is progressing satisfactorily. Part of the necessary cables have been received and installed and the indicator-light wiring is in progress. The mixer panel for the control section of the drum system has been designed and wired. MTES has been laid out, the plug-in units obtained, and work on the mounting panels has started.

The buffer drum has been received from ERA and reinstalled in the drum bay. The drum was shipped with all the heads mounted and set this time although the dual heads had been removed on the previous shipment. We are now in the process of checking the setting and timing of the dual-head tracks. It appears that the timing will have to be touched up on some of the dual heads, but the surface seems to be in good condition on all the tracks so far tested.

One significant improvement in the replacement drum is in the timing track. The track was not perfectly closed on the first drum so that we had rather serious timing problems around the splice. On the replacement drum we are unable to detect the splice so good has been the job of closing the timing track.

1.22 Terminal Equipment (Continued)

Installation in Room 222

(G. F. Sandy) (UNCLASSIFIED)

The new fuse-indication and power-distribution system for the consoles has been designed. Drafting has completed the drawings necessary for the 60 panels to go in the 'scope units. The panel for indicating a blown fuse (panel to be installed in TCO) is still in drafting, but should be completed shortly. Switches for the 60 panels that go in the 'scope units are a critical procurement item.

The "skins" for the 16 inch scopes and the side-frames are in drafting. These should be coming out of drafting soon.

The three voltages required by the console side frames that are now being fed via the RSDB will shortly be supplied via Rack J1 and the wireways.

(R. H. Gould) (CONFIDENTIAL)

Steady progress continues on debugging of Room 222 equipment. Wiring errors and omissions and loose connections are the most frequent troubles. The unsatisfactory intensification of the 5-inch scopes has still to be investigated.

(T. Sandy) (UNCLASSIFIED)

This biweekly period was spent mostly by checking the additional in-out equipment in Room 222 and getting the necessary equipment made to connect the Buffer Drum to In-Out Control.

Wiring Schedules For Room 222

(F. E. Irish) (UNCLASSIFIED)

A new set of wiring schedules is being made for the remote stations in Room 222. A schedule will be made for each of the terminal strips located on the lower front panels of the scope consoles of the remote stations.

The schedules will indicate the connections made between the terminal strips and the various panels mounted in the racks of the remote stations. They will also indicate the junction-box connection between the corresponding terminal strip in the junction box and the various in-out units. The scope-console terminal strips are translated into junction box in cables connecting corresponding terminals of the scope-console strips to those of terminal strips in the junction box.

1.22 Terminal Equipment (Continued)

In-Out Control

(R. H. Gould) (CONFIDENTIAL)

The necessary changes and additions to In-Out Control for the operation of the Ground-to-Air Link will be finished by next week.

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 17 - 31, 1953:

Number of assigned hours	134
Usable percentage of assigned time	84
Usable percentage of assigned time since March, 1951	85
Number of transient errors	142
Number of steady-state errors	3
Number of intermittent errors	12

Storage-Tube Complement in WWI

(L. O. Leighton) (UNCLASSIFIED)

Following is the storage-tube complement as of 2400 July 30, 1953:

Digit	ST Mount	Tubes	Hours of Installation	Hours of Operation
0 B	38	ST-619-1	10069	5496
1 B	15	ST-820-R-1	14404	1161
2 B	5	RT-393	15370	194
3 B	4	ST-821	14226	1339
4 B	33	RT-380	13516	2049
5 B	11	ST-836	14617	948
6 B	3	ST-751	13170	2395
7 B	17	ST-822	14846	719
8 B	6	RT-391	15370	194
9 B	42	ST-720-C	12937	2628
10 B	2	RT-382	13629	1936
11 B	25	ST-753-1	13129	2436
12 B	41	ST-856	15290	275
13 B	27	ST-841-1	14845	721
14 B	24	ST-624-C-1	10507	5058
15 B	16	RT-383	13629	1936
16 B	19	ST-845-1	14886	679
17 B	28	ST-747	13261	2303

1.23 Records of Operation (Continued)

(L. O. Leighton) (UNCLASSIFIED)

Digit	ST Mount	Tubes	Hours of Installation	Hours of Operation
0 A	43	ST-722-C	13130	2435
1 A	20	ST-817	14148	1417
2 A	34	RT-388	15393	301
3 A	23	ST-802	13411	2154
4 A	32	ST-808	13516	2049
5 A	40	ST-525	13389	2176
6 A	8	RT-389	15290	275
7 A	35	ST-800	13340	2225
8 A	45	ST-825	14307	1258
9 A	39	ST-814	13910	1655
10 A	36	RT-401	15534	30
11 A	12	RT-387	15175	389
12 A	13	RT-390	15290	275
13 A	14	RT-381	13581	1984
14 A	29	ST-835	15460	104
15 A	22	ST-805	13457	2108
16 A	9	ST-855	15194	376
17 A	26	ST-847	15062	503

ES Clock hours as of 2400 July 30, 1953	15564
Average life of tubes in service in Bank B	1804
Average life of tubes in service in Bank A	1206
Average life of last five rejected tubes	1220

Storage-Tube Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

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

ST-742 was removed after 2620 hours of operation in order to make room for a stannic-oxide tube.

ST-807 was removed after 15370 hours of operation in order to make room for a stannic-oxide tube.

RT-384 was rejected after 344 hours of operation because of failure to hold a positive array in a small area.

ST-852 was rejected after 291 hours of operation because of failure to hold a positive array following an internal breakdown.

1.23 Records of Operation (Continued)

(L. O. Leighton) (UNCLASSIFIED)

ST-819 was rejected after 1056 hours of operation because of failure to hold a positive array.

ST-801 was rejected after 2172 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 17, 1953:

Component	No. of Failures	Hours of Operation	Reason for Failure
Crystals			
1N38A - diode	1	1000 - 2000	Low back resistance
Potentiometers			
1000-ohm, 2-watt, carbon	1	15000 - 16000	Intermittent contact
Resistors			
100-ohm, 1-watt ±5%, carbon	1	10000 - 11000	Overheated
1200-ohm, 1-watt ±5%	1	18000 - 19000	Overheated
Transformers			
Pulse transformer (193-11) 3:1 1/2:1	1	0 - 1000	Intermittent primary
Tubes			
3D21A	1	5000 - 6000	Short
3E29	1	3000 - 4000	Short
	1	4000 - 5000	Low I_b
	2	10000 - 11000	1 grid emission; 1 low I_b
	1	14000 - 15000	Low I_b
	2	18000 - 19000	1 open cathode; 1 low I_b

1.23 Records of Operation (Continued)

(L. O. Leighton) (UNCLASSIFIED)

Component	No. of Failures	Hours of Operation	Reason for Failure
Tubes			
5696	2	0 - 1000	Open filament
6AS6	1	7000 - 8000	Short
0A2	2	1000 - 2000	Mica leakage
	1	13000 - 14000	Poor regulation
2D21	1	14000 - 15000	Short
2X2A	2	3000 - 4000	1 low I_b; 1 short
829B	1	0 - 1000	Broken envelope
SR1407	1	3000 - 4000	Gas
	1	6000 - 7000	Short
6AS7G	1	4000 - 5000	Low I_b
	4	16000 - 17000	Open heater
6SN7	1	9000 - 10000	Low I_b
	2	10000 - 11000	1 low I_b; 1 short
	1	11000 - 12000	Leakage
	1	17000 - 18000	Short
	1	19000 - 20000	Short
6Y6G	1	7000 - 8000	Short
	1	13000 - 14000	Gassy
	1	14000 - 15000	Short
	1	17000 - 18000	Defective base
	3	18000 - 19000	Short
	2	19000 - 20000	1 short; 1 gassy
6145	5	0 - 1000	3 broken glass; 2 short
	1	1000 - 2000	Short
6136	1	0 - 1000	Short
7AD7	2	0 - 1000	1 leakage; 1 low I_b
	1	4000 - 5000	Low I_b
	2	6000 - 7000	Low I_b
	1	11000 - 12000	Short
	2	13000 - 14000	Short
	3	14000 - 15000	1 leakage; 2 low I_b
	2	16000 - 17000	1 short; 1 low I_b
	9	18000 - 19000	5 short; 4 low I_b
	2	19000 - 20000	1 short; 1 leakage

1.24 General

D-C Power Supplies

(S. T. Coffin) (UNCLASSIFIED)

The 250-v, 50-amp supply being redesigned for WWI will have a new type of thyratron-tube mount and regulator panel. These panels are now in construction. A new type of GE thyratron will be used to replace the ELC16J's, in an effort to reduce tube failures.

1.3 Group 65

1.31 Storage Tubes

(P. Youtz) (UNCLASSIFIED)

Further research and development on the storage tubes which had been curtailed during the previous biweekly period was completely stopped this biweekly period. Personnel associated with that phase of the work will be transferred immediately to other groups. The remaining personnel in the group will direct all of their efforts toward the construction and testing of 800-series storage tubes with stannic-oxide coatings and their installation in ES row.

Work will continue on the research tubes for the cathode investigation of H. B. Frost.

There will be some commitments to Group 25 which will continue.

1.32 Test

Television Demonstrator

(D. M. Fisher) (UNCLASSIFIED)

During this biweekly period the Television Demonstrator was operated at full capacity testing storage tubes for service in WWI.

ST850, which has been mentioned in previous biweekly reports, was given a final test at the STRT. This tube was operated with normal voltages except V_{HG} = 110 v. The tube was classified satisfactory for WWI use. This experiment seems to indicate that probably some of the tubes rejected from WWI, because of internal breakdown and failure to hold a positive array, could be returned to service in WWI.

(C. A. Zacharias) (UNCLASSIFIED)

The past two weeks were spent assisting D. M. Fisher at the Television Demonstrator. The functioning and operation of the Television Demonstrator was studied, and a few tests on storage tubes were completed.

Storage Tube Reliability Tester

(R. E. Hegler) (UNCLASSIFIED)

During this period, work continued on evaluating the spot-interaction characteristics of stannic-oxide tubes. On tubes that were considered satisfactory for WWI use, the margins continue to be larger than normal.

1.32 Test (Continued)

ST850 which was rejected from WWI because of lower stability failure had a usable spot-interaction area but will not be sent to WWI.

(L. B. Martin) (UNCLASSIFIED)

The last two weeks were spent with R. E. Hegler testing storage tubes on the STRT.

1.33 Research and Development

(C. L. Corderman) (UNCLASSIFIED)

Life tests on ST858 have shown that both the high-voltage and the high-velocity-gun heater voltage must be on in order for the internal breakdown to occur. In addition, there is no slow build up of gas pressure in the tube during the period before positive switching and/or internal breakdown. It seems that these phenomena are initiated by an arc-over within the high-velocity gun which causes that gun to release a sudden surge of current.

Stannic-oxide tubes continue to operate without consistent positive switching or breakdown so the role of the coating in the process above is not clear.

(E. J. Stevens) (UNCLASSIFIED)

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

Philip "L" Cathodes

(R. J. Biagiotti) (UNCLASSIFIED)

The past two weeks were spent replenishing the supply of silvered surfaces.

The two Philip "L" cathode tubes remaining in the life-test rack are still operating.

1.34 General

(C. T. Kirk) (UNCLASSIFIED)

As of this biweekly period my work with the Storage Tube Group will be terminated.

1.34 General (Continued)

Beginning with the next biweekly period I will join the Transistor Section of Group 62.

SECTION II - WHIRLWIND II

2.1 Group 62

2.11 Systems

Drum System

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

A review of the XD-1 in-out system is now in process. The last two weeks were spent reviewing the XD-1 drums as specified by the joint MIT-IBM group. The input buffer drum (Radar, Cross Tell, and Manual Inputs) will be ready for acceptance by the next Project Grind meeting.

Comprehensive Block Diagram

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

A comprehensive block diagram of the in-out system is being drawn. This diagram will be an up-to-date picture of the in-out system.

Block Diagram File

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

A file of the partially completed Block Schematics of the central machine is now available in the systems-section office. This file will be kept up to date. When these drawings are made in their final form, masters will be procured for our Drafting Room so that these drawings will be generally available.

Display

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

The block diagram of the display system has not been agreed upon. A study is being made to compare the IBM proposal of storing all track words in a core matrix with a proposal to interleave track words on the drum. The charactron seems to be a strong contender for XD-1

2.11 Systems (continued)

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

display. A display rate of one per two seconds is more desirable than faster rates. At this rate it seems that a P.7 phosphor is most desirable.

Display

(M. Epstein) (CONFIDENTIAL)

The past biweekly period was spent examining the problems of digital display. A preliminary block diagram will be drawn up using a continuous cycle through all the displays.

Display

(R. von Buelow) (CONFIDENTIAL)

A trip was made to Convair to evaluate the charactron. All who saw the tube in operation were favorably impressed. Its speed of writing, high quality of characters, and comparatively small amount of associated equipment make it a very worthwhile contender for a place in XD-1. Quantity delivery times are also reasonable.

Cape Cod's display program and a display program written by Walker Thomas for MTC both tend to verify the fact that a display frequency of about one per two seconds is more desirable than a faster rate until the faster rate reaches a speed of about ten per second which makes it near flicker free with a P.7 phosphor. It is not yet possible to obtain a rate higher than about twice a second for XD-1.

Display

(R. Gerhardt) (CONFIDENTIAL)

Two days of the last biweekly period were spent at IBM in conference with Messrs. Rocco and Butler. The results of this meeting are contained in H-10, an IBM report. This note covers our thoughts on track-word makeup, drum arrangement, intensification amplifiers, console selection, and intensification levels. Any comments will be welcomed so that a more definite proposal may be written at a later date.

2.11 Systems (continued)

(R. Gerhardt) (CONFIDENTIAL)

Our agreement on the manual switching needs for AN/FSQ-7 (XD-1) consoles is very good. We are striving for sufficient flexibility in each console so that any single console may be wired to plug boards. The plug board will restrict the flexibility of the console to the particular needs of the operator. The consoles are, then, interchangeable. The plug boards need to be rewired if they are to be used in another position.

I have been making block diagrams in an effort to get a rather complete equipment count for a system using an interleave on the drum. The track information will be stored in such a manner that history points may be read directly from the drum. Characters are stored in a core shifting register. The characters will then be displayed after the history, present position, and velocity vector.

I have also given consideration to the possibility of displaying history points with a line between points. This could be done by leaving the scope unblanked between points, provided extraneous transients in the deflection system may be sufficiently damped.

Basic Circuits

(A. Heineck) (CONFIDENTIAL)

Jack Jackman, who is in charge of half the IBM circuit group, has become a member of the Basic Circuit Subcommittee (BCSC).

At a joint meeting of the IBM-MIT circuit-design groups several changes were made in the high-speed flip-flop write-up in the Circuit Application Manual. The changes included:

a) Inserting the marginal-check voltage so a swing of $\pm$7 volts around -150 volts is used, saving a resistor.

b) Substituting two 2-watt resistors for four 1-watt resistors.

c) Eliminating decoupling in the +150-v, +10-v, and -30-v supplies on each flip-flop and decoupling only at the base of a panel.

The BCSC will soon publish a list of all circuits under design and the engineers responsible.

2.11 Systems (continued)

(A. Heineck) (CONFIDENTIAL)

A form is also being prepared to help obtain preliminary specifications on circuits which are needed and not included in the above list.

Output to Weapons

(R. C. Hopkins) (CONFIDENTIAL)

Confidential Memorandum M-2296 discussing a first proposal for the transition weapons output system was distributed.

A visit was made to the AAOC at Ft. Banks, Mass., and information was gathered on the data required by the AAA for control of fire.

Meetings were attended with representatives of General Electric at which technical details of the USAF data link were discussed along with possible methods of application and operation of transmitters in the transition system. The general assumptions and outline of an output system in which all ground-air data-link transmitters are operated as one, were discussed. Investigation is now being made of two methods of achieving this, and equipment counts will be compared.

A meeting was attended at which the MX 1179 interceptor flight-control equipment to be used with the F-102 was discussed with representatives of Hughes and Consolidated.

Arithmetic and Control Block Diagrams

(R. P. Mayer) (CONFIDENTIAL)

The note E-560 "Status of XD-1 Internal Logical Design" is nearing completion. It is felt that this report has a lower priority, at this time, than the work on the in-out system.

The note and the drawings attached thereto will not include the circuits as shown on recent drawings obtained from IBM. A supplement to E-560 will describe the newer version of the logic as shown on IBM's drawings.

2.11 Systems (continued)

In-Out Block Diagrams

(R.P. Mayer) (CONFIDENTIAL)

Detailed block diagrams covering many sections of the in-out system, as it is now envisioned, have been collected from people at IBM and MIT. These diagrams are being expressed, in compressed notation, on a single drawing showing all parts of the system at one center, including the internal machine, marginal checking, room lighting, etc. This drawing is to be called "comprehensive logical diagram for one complete center". It has not been made generally available yet because it shows only the SDV system (including mappers and counters), manual inputs (including card reader, keyboards, and light guns), and the drum status and selection circuits for the RIB, XTIB, and MIB fields of the drum. It will become available as soon as some of the circuits are shown for display, output, and computer-control-of-the-drums. (These circuits are available as isolated drawings in other reports, etc.)

One problem is: to what extent should this type of drawing deviate from the logic actually used, in order to illustrate more clearly the logic of the system? Any comments will be welcome.

Drum System

(R. C. Jeffrey) (CONFIDENTIAL)

Proposed specifications for all the XD-1 drums and block diagrams for the input buffer drum were completed in rough form at High Street on July 24. This work is being reviewed here and at IBM and will be presented to Project Grind during the third week in August.

Input Counters

(C. Schultz) (CONFIDENTIAL)

The capacitor storage shift register of the type developed by IBM (and used in the input counter) has been built here in order to obtain more complete information on input pulse limitations and turns-ratio variations. The difficulty in obtaining operating limits which exactly duplicate those at IBM may be due to slight differences in components and current drivers.

2.11 Systems (continued)

Input Counters

(H.K. Rising) (CONFIDENTIAL)

The magnetic-counter test setup is now running with fair reliability with the junction-diode magnetic counter. Although there is still some sensitivity to transients on the d-c supplies, operation over a weekend has shown that the equipment is capable of less than one error in 24 hours at a shifting rate of 60 kc and a counting rate of 2 kc.

The problem of diodes for core counters has been discussed with B. Paine, and he has agreed to test some gold-bonded diodes with high forward current, back-voltage product. It seems fairly certain that the general-purpose diodes will not be applicable for core counters.

J.B. Ricketts has joined this group to make a thesis investigation of the practicability of using ferrite cores for the magnetic counters.

Ferrite Core Stepping Register

(J. B. Ricketts) (UNCLASSIFIED)

Tests on an MF-1312-B, "cheerio" size have been conducted. A study of the heating characteristics shows that the power output of the core when pulsed is not changed, and the "0" to "1" output ratio is quite good. Characteristics as per H. Rising's thesis have been measured and a circuit designed from these measurements which looks promising.

2.12 Magnetic-Core Memory

Miscellany

(W.N. Papian) (UNCLASSIFIED)

The 64 x 64 test plane is almost finished. It will have taken less than two weeks to assemble. We hope to get it tested during the next two weeks.

Design work is underway on the memory which is to replace the one now being removed from MTC. It is to be a 64 x 64 x 17 array using XD-1 type cores. If at all possible it will use pulse-transformer drive from 5998 tubes; as a result there will be only as many terminals and

2.12 Magnetic-Core Memory (continued)

(W.N. Papian) (UNCLASSIFIED)

driver-tube envelopes as in the present MTC memory. The array, or stack, will be no larger, but the memory frame, or rack, will be made taller in order to accommodate the Memory-Address Register physically close to the 64-position crystal matrices it has to drive. New circuit designs are ready for the Digit-Plane Drivers and the Sensing Amplifier/Discriminators. Although this is a "crash" program with a November deadline we are incorporating as many potential XD-1 features (such as pulse-transformer drive) as possible.

Insofar as procurement, construction facilities, and the supply of tested cores are concerned the above memory, MTC Memory, Model II, comes behind the second bank of 32 x 32 being built for WWI by Ted Ogden and the MTC people.

Memory Test Setup V

(E. A. Guditz) (UNCLASSIFIED)

Data is being gathered on the effect of staggered "read" pulses on array operating margins.

Preparations are being made to construct nineteen 64 x 64 memory planes and a new memory rack.

Selection Plane Driving for XD-1

(E. Gates, D. Shansky, J. Mitchell) (UNCLASSIFIED)

A number of memory-driving transformers have been built and are now being tested for uniformity. The first results indicate that the transformers can be reproduced.

A selection-plane-driver breadboard has been constructed and will be tested during the week of 3 August.

Switch Cores

(A. D. Hughes) (UNCLASSIFIED)

A low-impedance source (voltage source) was used to pulse-test switch cores; very good square-wave outputs resulted. The input current was found to vary linearly with time, to a first approximation. From this a linear circuit equivalent was drawn and actual values for the circuit computed for the mo-Perm, 140-wrap metallic core.

2.12 Magnetic-Core Memory (continued)

Switch Cores

(J. Raffel) (UNCLASSIFIED)

Work in preparation for thesis proposal on "Master-Plane" type of memory continues.

An analysis of sensing-winding configurations is being made.

Digit-Plane Driver

(W.J. Canty, D. Shansky) (UNCLASSIFIED)

The circuit for the digit-plane driver of the next memory has been tested and debugged. Thought has been given to the packaging of this unit. In the next week it is hoped to have this circuit built in a package similar to the present MTC Digit-Plane Driver.

Memory Readout

(W.J. Canty) (UNCLASSIFIED)

M-2316 has been written and published. This memo gives a proposed method of winding a 64 x 64 memory plane with 2 sense windings.

Sensing Problems

(S. Fine) (UNCLASSIFIED)

A master's thesis proposal titled "Readout-Noise Reduction in a Magnetic-Core Memory", M-2314, has been submitted to the Electrical Engineering Department. The supervisor is D.R. Brown.

Preliminary data on air-flux pickup for various sensing-winding geometries has been compiled.

An investigation of readout noise coming from a non-cancellation type of sensing winding is being undertaken.

2.13 Vacuum-Tube Circuits

(R.L. Best) (UNCLASSIFIED)

A high-speed flip-flop has been assembled using printed-circuit techniques. This method of assembly looks very promising. Pulse-transformer experiments are still under way, and it is hoped to have a decision on the transformer to be used with gate-tube circuits within a few weeks.

Circuits to be used in driving and sensing the MTC Memory, Mod. II, are quite firm; barring unforeseen difficulties, they will be ready in time to meet the schedule.

We now have built a breadboard circuit which simulates the read-out signal from a drum. This will enable us to experiment with drum sensing amplifiers, even though we have no drum.

Some characters have been generated using the Bell Labs Lissajous figure system, but at 100 kc instead of 10 kc. The characters are very attractive, and the equipment needed for such a system is little enough to be attractive also.

Flip-Flops

(H. Boyd) (UNCLASSIFIED)

The R-report on the Normalized Flip-Flop Chart is nearing completion. The report will be sent to IRE for publication in the PGEC quarterly. It has been tentatively decided that this report will be used for the MIT Course 6.538.

Some time has been spent at Lexington in producing an "etched" circuit of XD-1 High-Speed Flip-Flop. The unit will be given preliminary tests on August 3. A layout will be made of the High-Speed Flip-Flop for application to the IBM row-type construction. The two types of construction will be placed in the same pluggable unit to form a demonstration model of the two methods of manufacture.

Two more experiments have to be performed on the XD-1 High-Speed Flip-Flop before issuing a write-up for the Circuit Application Memo. Experiments indicate that the flip-flop can drive one "active" gate-tube directly regardless of the number of "inactive" gate-tubes (by "active" is meant a "sensed" gate-tube). There aren't any gate-tube noise outputs when GT's are being driven by the High-Speed Flip-Flop in counting applications, indicating that the inherent flip-flop delays are sufficiently adequate to omit delay units.

2.13 Vacuum-Tube Circuits (continued)

(H. Boyd) (UNCLASSIFIED)

No further information has been obtained on the slave flip-flop or on the low-speed flip-flop. These will be retackled upon the completion of the high-speed flip-flop.

Gate Tube Circuit

(H.J. Platt) (UNCLASSIFIED)

An intensive study was undertaken to find an optimum pulse transformer for the high-speed gate-tube circuit. This has resulted in the testing of about 50 transformers. Analysis of this data is in progress.

Two days were spent in Poughkeepsie at a meeting of the Electronic Components Subcommittee meeting. Diodes, potentiometers, and capacitors were discussed.

Pulse Amplifier

(S. Bradspies) (UNCLASSIFIED)

In the last biweekly it was noted that the transmission line driving 32 gate tubes at 16 points looked like 27 ohms if the gate tubes' cathodes were cold. When the cathodes were heated the input impedance of the line decreased as the pulse-voltage increased (due to grid current) and loaded down the pulse amplifier.

We next tried driving 16 tubes at 16 points; when the gate-tube cathodes were cold the line looked like 33 ohms. Heating the cathodes again reduced this impedance--but since only 16 grids were being driven, much greater voltage was obtained for the same inputs (by a factor of over 1.5).

The next step was to drive 16 tubes at 8 points. Since the points being driven were now twice as far apart as they previously were, the "cold" line impedance went up to 39 ohms. Quite huge pulses were obtained when the cathodes were cold. When the cathodes were heated, however, the output sagged. It is interesting to note that the outputs obtained with hot gate-tube cathodes and 16 tubes driven at 8 points are not very different from those obtained when driving 16 points. Thus we may conclude that the output depends very strongly on the number of grids being driven into conduction and very slightly on the characteristic of the transmission line. This indicates that the solution of the problem won't be attained by increasing the "cold" line impedance.

2.13 Vacuum-Tube Circuits (continued)

Selection-Plane Driver

(D. Shansky) (UNCLASSIFIED)

A selection-plane-driver breadboard has been built and is being tested. Layout work on the drivers for the MTC Memory, Mod. II, is in progress.

Digit-Plane Driver

(D. Shansky) (UNCLASSIFIED)

Final debugging on the digit plane driver for the MTC Memory, Mod. II, has been completed. Marginal checking of the circuit will be done next week. Some thought has been given to the packaging of this driver.

Memory Sensing Amplifier

(C.A. Laspina) (UNCLASSIFIED)

Specifications for the MTC Memory, Mod. II, sensing amplifier have been made; a circuit meeting these specifications has been designed and is now being built.

To overcome the prf problem, due to long chains of unidirectional pulses, time constants much larger than the length of the longest burst of unidirectional pulses have been used.

Magnetic-Drum Circuits

(H.E. Anderson) (UNCLASSIFIED)

A suitable read-head simulator has been completed and tested. An investigation of low-level diode switching is being considered now. Some thought is also being given to possible amplifier circuits. Most of this past week has been spent in becoming acquainted with the IBM proposal for drum systems.

2.13 Vacuum-Tube Circuits (continued)

Vacuum-Tube Driver for Shift Register (Magnetic Core)

(J.S. Gillette) (UNCLASSIFIED)

Due to the lack of 7AK7 tube data in the positive-grid region for the tetrode-connected tube, I have started to obtain this data experimentally. It appears that two 7AK7 tubes will be needed to drive one register's shift bus.

Cathode Followers

(B.R. Remis) (UNCLASSIFIED)

A design procedure for capacitive-loaded and diode-loaded cathode followers has been completed. This procedure is to be included in the Circuit Application Manual.

Diode Matrix Switch

(B.R. Remis) (UNCLASSIFIED)

Shunted diodes of a breadboard 8-position switch have been located by a marginal-checking procedure which entails lifting up the cathode supply voltage of individual cathode followers driving the matrix switch.

Intensification Amplifier

(H. E. Zieman) (UNCLASSIFIED)

A new intensification amplifier has been built (but not tested) which will permit several different inputs to result in different intensity levels. It is tentatively planned to use three different inputs which will give respectively a bright display, a dim display, and controlled-intensity display.

The final amplifier will be built in two 2-tube plug-in units for each intensity level desired. Thus, for the above triple input arrangement, 6 plug-in units will be required.

Character Generator

(J. Woolf) (UNCLASSIFIED)

The output transformer supplied by E. Gates appears to put us in the region of operation desired. In the last week, the letters D,O, and P have been generated. Each takes 10 μsec to generate. Some phase compensation will have to be added to the letter P to make it have the desired shape.

2.14 Memory Test Computer

General

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

The temporary loss of its magnetic memory (see below) has, naturally, affected MTC planning and procedure rather drastically; by and large, however, it will only change the sequence of work, enabling us to do things soon that would otherwise have been postponed.

One phase of the program thus curtailed is the display simulation just begun by R. von Buelow of this Laboratory and Walker Thomas of IBM; they had successfully run a program to generate scattered points and vectors with alphabetic and numeric characters. They feel that a little work of this sort can perhaps go on using the 64 registers of panel storage; hopefully, MTC will have its new memory by the time a magnetic drum is ready and the display program shifts into high gear.

It is of course impossible to run the tape programs which we had just encouraged people to begin to write; however, the instruction code can now be expanded to include more terminal equipment and additional instructions, so that when MTC is again available, it will be in a form more useful and convenient for outside programmers.

N. Daggett and C. Corderman spent two days and an evening, more or less, in a "shakedown" of the MTC memory to decide whether to try installing it in WWI. During this time, no errors occurred that could not be attributed to power-supply transients; in fact during the six-hours evening operation no errors at all occurred except those intentionally introduced.

Memory

Transfer to WWI (W. Ogden) (UNCLASSIFIED). The magnetic memory was disconnected from MTC in preparation for its installation in WWI sometime next week (see Section 1.2).

Construction of a Bank 'B' consisting of an additional 1024 registers of magnetic storage also for WWI was started. This unit is scheduled for installation in WWI sometime in September. Progress of this work will be reported in future biweeklies in Section 1.2. Installation and testing of both banks will be supervised by B. Widrowitz and R. S. DiNolfo.

A 17-digit, 4096-register (i.e., 64 x 64) magnetic-storage system is being developed by the Magnetic Memory section and is scheduled for installation and testing in MTC sometime before the end of the year. Progress of this work will appear in Section 2.12.

MTC is now operating using toggle-switch storage but will be more effective when the installation of 32 registers of plug-board storage is completed.

2.14 Memory Test Computer (Continued)

Test Data (B. Widrowitz) (UNCLASSIFIED). Photographs of signals appearing at the sensing-winding terminals of the memory planes show little variation in the sizes of ONES and ZEROS from program to program. The programs tried included those giving checkerboard-type "worst" patterns. This predicts that operating margins should be independent of program. However, margins are known to vary considerably from program to program, and those that run the memory at the highest prf's give the worst margins. This prf sensitivity is believed due to prf sensitivity of the sensing amplifiers and system noises. Most of these noises have been accounted for.

It was found that the post-write disturb pulse is unnecessary. Its beneficial effects upon margins have been very small. Its elimination cuts about 1 μsec from the memory cycle and reduces the sensing-winding noises.

Programs and Logic

Utility Programs (P. R. Bagley) (UNCLASSIFIED). The new read-in and conversion programs described in the previous biweekly have been debugged and are now available for use. A memorandum will be prepared which describes the function and operation of these programs.

A post-mortem program is available to print out as octal constants the contents of any specified group of storage registers. The print-out program itself occupies 79 registers of storage, and it may be read into any 79 consecutive registers of magnetic memory.

Electronic Design and Installation

Magnetic Memory (J. Crane) (UNCLASSIFIED). A digit schematic, SD-55892, showing the connections between the Memory Switch In-Gates, Memory Switch Flip-Flops, Selection-Plane Drivers, and Selection-Plane Control Switch is now available. D-c voltages are shown on SA-55894.

Power (J. Crane) (UNCLASSIFIED). A study of the switching sequence for MTC d-c voltages is being made.

New FF Register (H. Boyd) (UNCLASSIFIED). The line register for MTC (employing the WWI High-Speed Flip-Flop) is in the process of being developed. Upon its completion, work will be begun on an in-out register for MTC. The existing types of gate-tube circuits will be used until such time as a WWII gate-tube type is decided upon.

An attempt is being made to spend an increasing amount of time on MTC assignments, until at length a fairly complete break from "basic circuits" can be made.

2.14 Memory Test Computer (Continued)

Maintenance

Component Failures (R. Hughes) (UNCLASSIFIED). During the last biweekly period the following components have failed in MTC.

Component	Number of Failures	Hours of Operation	Reason for Failure
Miniature Toggle Switch	2	0-1000	Intermittent
Crystal 1N38A	1	0-1000	Open
Pulse Transformer 3:1	1	0-1000	Shorted

Power

Power Supply Control (R. C. Hopkins) (UNCLASSIFIED). Memorandum M-2310 giving operating instructions and drawing lists for MTC Power Supply Control was distributed during the reporting period.

A panel for control of two additional power supplies has been designed and is now in drafting. Check-out of the Power Supply Control System has been delayed until tests on the MTC Alternator have been completed and access is permitted to the alternator regulating and voltage-control equipment. This should occur during the week of 3 August.

MTC Alternator (R. Jahn) (UNCLASSIFIED). Final parameter values have been obtained for the compensation network, filter, and feedback loop of the regulator. Steady-state regulation is less than 0.5 volts for a 100-amp load change. Dynamic load regulation is 1.0 volt for a 10-amp load transient. The duration of the transient is less than 0.06 seconds.

The alternator will be ready for use with the temporary regulator as soon as all control wiring is completed.

Air Conditioning (R. E. Garrett) (UNCLASSIFIED)

The equipment conditioning is nearly complete except for the insulation of piping. This phase has been delayed due to the contractor's labor trouble.

2.15 Equipment Design and Schedules

Miscellany

(A. P. Kromer) (CONFIDENTIAL)

Following the issuance of E-562 which summarizes plans and schedules for construction and installation of AN/FSQ-7 (XD-1), work was started on the breakdown of the items in E-562 to permit more detailed planning. A list of contemplated items was prepared and dates for certain activities programmed. This information is to be reviewed with IBM to obtain their concurrence, but this action must be held pending the completion of the vacation shut-down at IBM.

The initial Biweekly Report from the Scheduling Office (M-2322) was issued during the period.

Activities on all branches of standards work has continued and several memoranda concerning electrical components were released to the design engineers.

Collaboration has continued with IBM regarding action leading to their securing an Air Material Command contract to cover completion of their work on the joint project. This included visits to Rome, N.Y., AMC offices and AFCRC.

Data has been gathered in connection with the preparation of budgetary information to be presented to Air Defense Command at a meeting scheduled for later this month in connection with initial production of the Transition System. (This will follow, but does not include the two prototypes.)

Standards Committee

(C. W. Watt) (UNCLASSIFIED)

The MIT-IBM standards work is divided up among 8 subcommittees, as described in the biweekly of July 3, 1953. These are all active and producing results.

Committee 1, Electronic Components. The publications of this group have been Component Application Memos (CAM's). See Memo M-2297.

CAM's approved by Central Standards Comm.

1 Resistors, fixed composition
2 Resistors, deposited carbon
3A Capacitors, ceramic
3B Capacitors, mica
3C Capacitors, paper tubular

2.15 Equipment Design and Schedules (Continued)

(C. W. Watt) (UNCLASSIFIED)

4 Resistors, power, wire wound
6 Capacitors, electrolytic
8 Sockets, receiving tube
9 Inductors, small solenoid

CAM's awaiting approval by Central Comm.

10 Switches, toggle
11 Switches, sensitive
3E Capacitors, paper, can

CAM's rejected by Central Comm., and being reworked by subcommittee

5 Pulse transformers
7A Diodes, general purpose
7B Diodes, high back resistance

CAM's out for comment

12A Potentiometers

Anyone not receiving CAM's who feels he needs them should contact B. B. Paine, who is in charge of distribution at MIT.

Committees 2, 3, 4. These groups have been active for several weeks, and have produced several proposals which will be acted on by the Central Committee at its next meeting Friday, August 14.

Committee 5, Drafting. Proposals on numbering systems and the makeup of Military Reference Data Book have been made.

Committee 6. A basic circuit application section for the Military Data Book has been made up for the high-speed flip-flop.

A number of other sections are nearly ready for distribution. This is being studied by interested parties at IBM and MIT, and will be presented to the Central Committee shortly for approval, after which it will be given to Everett for final approval.

Committee 7, Tubes. Tube-application memos have been prepared in preliminary form for information and comment. None have been approved by the Central Committee. Contact R. Fallows for copies if needed.

Tube Application Memo 1 - recommended Tube List, XD1.
TAM 2, Data and curves, SR1782 (7AK7 modification)
TAM 3, Data and curves, Z2177 (5965 modification)
TAM 4, Data and curves, 6998
TAM 5, Data and curves, 5727 (2D21)
TAM 6, Data and curves, 4X150A
TAM 7, Data and curves, 6293

2.15 Equipment Design and Schedules (Continued)

(C. W. Watt) (UNCLASSIFIED)

Committee 8, Terms and Symbols. A comprehensive proposal has been prepared on the types of drawings, names, symbols, etc., needed for the logical and circuit designs of the AN/FSQ-7 system. This is ready for Central Standards Committee action on Friday, August 14.

The "Military Reference Data Book" for the AN/FSQ-7 system (the MIT-IBM standards book) should begin to be a reality during August. Much remains to be done, but each section is taking form, the personnel involved are getting trained, and a large body of authorized information should be available soon.

Vacuum Tubes

(R. Fallows) (UNCLASSIFIED)

Preliminary tube-application memos have been prepared for the tubes listed in Memo 1.

A first development proposal for the SR1782 (octal 7AK7) was presented by Sylvania at Poughkeepsie on July 17. A second proposal, revised to satisfy contractual requirements, will be presented on August 10.

IBM's proposed contract with GE for development and initial quantity of tubes is awaiting Air Force approval.

Materials

(J. D. Bassett) (UNCLASSIFIED)

The regular biweekly meetings of the joint MIT-IBM subcommittees on materials and processes and mechanical components were held in Poughkeepsie during the week of July 20.

Preliminary discussion took place on processes for bonderizing steel, anodizing and alodizing of aluminum, cadmium plating, passivation of stainless steels, and paint finishes. More material must be obtained on some of these subjects before submitting a definite proposal to the CSC. This information is being obtained and documented. Proposals for threaded hardware will be completed at the next meeting of the MCSC at MIT during the week of August 10.

Mechanical Design

(W. H. Ayer) (UNCLASSIFIED)

A considerable amount of progress has been made on pluggable-unit design in the past two weeks. Orders are being placed by IBM for

2.15 Equipment Design and Schedules (Continued)

(W. H. Ayer) (UNCLASSIFIED)

sample plugs and component islands with expected deliveries of 4 to 12 weeks. Production tooling will begin as soon as the first sample unit is assembled and approved.

Layouts of the bay design for the arithmetic element are underway and should be finished in about one month. Detail and assembly drawings will follow a month or so after.

A sample pluggable unit containing a high-speed flip-flop using an etched-circuit technique is nearing completion and should be available for inspection and comments this week. As soon as the new circuit layout is tested, another flip-flop will be built in the same frame using the IBM islands for mounting the components. In this way a direct comparison can be made between the two methods of construction.

The mechanical-design standards subcommittee is preparing drafts on proposals concerning the number of changes to be expected between the XD-1 and the production models and on the application of MIL specifications to the XD-1 design. These proposals will be submitted to the Central Standards Committee at its next meeting.

2.16 Transistors

Transistor Accumulator

(D. J. Eckl) (UNCLASSIFIED)

The total operating time has now reached 6600 hours. During the past period two "set" diodes were replaced in the 2^6 counter. In addition, two scalers were replaced. It appears that for satisfactory operation the counter should be checked every 500 hours or oftener.

Two EL-3C's have been inserted in the Burroughs Supply to replace the NL-653 tubes which have caused some trouble. The replacement seems satisfactory.

(E. U. Cohler) (UNCLASSIFIED)

A two-transistor flip-flop of the saturating type has been incorporated into a counter. The counter operates at medium speeds (its top speed has not been determined, but is known to be well over 100 kc). The required input is a 0.5-μsec 8-v pulse. The output is a level change of 20 volts. Only one supply of -30 volts is required. The counter has a complement input and a clear input, both of which are to be fed from a low

2.16 Transistors (Continued)

(E. U. Cohler) (UNCLASSIFIED)

impedance source. The margin on supply voltage is good, the counter remaining in operation for any increase in voltage and going out of operation for a decrease of 50%. A pulse of any height greater than 3 volts will suffice to trigger, and the width of the pulse may vary from 0.2 μsec to 1.5 μsec. Next, marginal checks will be made on component values.

Some thought has been given to a transistor amplifier with feedback in order to obtain a circuit with characteristics somewhat similar to a vacuum-tube cathode follower. However, all the circuits tried so far seem to have an inherent difficulty due to the negative input characteristic of the point-contact type of transistor amplifier. This type of circuit can be used in conjunction with, or as, a gate. Further work will be done on this type of circuit and other gates in the near future.

Minority Carrier Storage

(N. T. Jones) (UNCLASSIFIED)

Early in the experimental work on storage in junction diodes, a delay in forward conduction after forward voltage application was observed in some types of junction diodes. The explanation for this effect indicated that a floating-base transistor would exhibit a similar delay which might be controllable and useful. Tests show that WE 1698 transistors exhibit such characteristics. The extent to which it can be controlled is yet to be determined.

Measurements

(N. T. Jones) (UNCLASSIFIED)

Nine GE G11A transistors were received, measured, and placed in use. The processing time required from receipt of the units to the placing of them in general use averaged 32 minutes per unit on this shipment.

Life Tests

(N. T. Jones) (UNCLASSIFIED)

D. Thompson has nearly completed the panels for the expanded life tests. Most of the components for the power supplies have been received, so construction will begin soon. Technician work on these life tests is now about 70% completed.

2.16 Transistors (Continued)

Transistor Core Driver

(S. Oken) (UNCLASSIFIED)

Four transistors have been run in parallel to produce a 6-μsec, 100-ma pulse across a 10-ohm load resistance. Thus with only one turn per core this driver can supply the current $\frac{Im}{2}$ needed for metallic cores in a coincident-current memory system. The four transistors are connected to 4 input windings of a 4:1 stepdown transformer. A choice between a 1-transistor driver with many turns on the core and no transformer or several transistors in parallel driving a core with one turn will have to be made. The feasibility of using 1 transistor with a transformer will also be investigated.

2.2 Group 63 (Magnetic Materials)

(D. R. Brown) (UNCLASSIFIED)

General Ceramics cores made from the batch of material blended in February have acceptable characteristics. The $V_{r_{hl}}$ and $V_{r_{hz}}$ are approximately 0.1-millivolt higher than for the batch blended in January, but the "delta" voltage, the difference between these two, is about the same. The first lot of the new-size cores, lot A-81 containing approximately 3000 cores, January batch, was received July 30. Lot A-87 (10,700 cores) and lot A-88 (20,100 cores) are expected August 3, both from the January batch. These cores will be tested with the new semiautomatic core tester, which is expected to handle enough cores for several memory planes per day.

Ferrite-Core Pulse Tests

(W. Klemperer) (UNCLASSIFIED)

Attempts at agreement between our equipment and the production core tester were continued. We tried using a Gurley voltage calibrator, and found significant deviations if the two oscilloscopes were run in parallel on the same equipment. Special pre-amplifiers are being built to improve response and eliminate this error. Along the same lines, the 513-D oscilloscope in use on the core-evaluation pulse tester has been carefully readjusted for one-megacycle square-wave response.

For core evaluation of several lots of General Ceramics' February batch at 21 C, we used a one-quart Thermos jar, dipping the cores into precooled silicone fluid. Excellent temperature control, within ± 0.2 C for all measurements, was achieved with this arrangement. These data were taken on about 30 selected cores. For the more precise measurements to be taken later, using 100 cores, we have set up a 1/2-gallon wide-mouth Dewar flask. Because of its larger size, the connectors and sense leads can be plugged directly into the lid.

Preliminary measurements on some RCA Victor cores have also been initiated.

(J. W. Schallerer) (UNCLASSIFIED)

The semiautomatic core tester is operating, and preliminary runs are being made.

The major portion of the last biweekly period was spent in refining the calibration techniques used during testing. A source of voltage-calibration error was discovered in the 513-D oscilloscope. A rectangular-calibrating waveform and a core output were applied to two oscilloscopes with inputs in parallel. The difference in reading was 5 percent. The trouble was traced to the preamp in the 513. Type 12AW6's are used in the preamp, and these tubes develop cathode interface after short periods of operation. Since the calibrating signal and core output are of different frequencies, it is to be expected that two scopes would read differently.

2.2 Group 63 (Continued)

Ferrite Core Pulse Tests (continued)

To remedy this situation, an amplifier was designed and constructed. Measurements have been made on two of these amplifiers, and results were good. The automatic test setup will use this amplifier from now on.

Memorandum M-2319 was written during the last biweekly period. This memo gives a procedure for handling cores during testing programs.

(J. D. Childress) (UNCLASSIFIED)

Equipment to produce δ_1 and δ_R has been assembled and checked out.

Use is made of bucking signals to lower the maximum-signal input and thus prevent blocking of the scope amplifiers. Cancellation is excellent at low temperatures and usable at higher temperatures.

Considerable difficulty is being experienced with noise, mostly pick-up from the current pulse.

(J. R. Freeman and A. C. Switendick) (UNCLASSIFIED)

Evaluation of the pulse characteristics of all DCL cores having squareness ratios of 0.65 or greater has begun. More than 200 cores have been tested. A method of classification based on the shape of the optimum disturbed ONE pulse output has been devised. A study of one classification has been completed.

Automatic Core Tester

(R. F. Jenney) (UNCLASSIFIED)

The logic for the automatic core tester is now working. The IBM core-handling device has been attached and is working well. The machine will be ready to start testing as soon as a sensing panel and drivers are installed and the driving circuits are debugged. This will take one or two weeks.

Ferrite Synthesis

Stokes Press

(R. A. Maglio) (UNCLASSIFIED)

We had planned to press about 20,000 cores for the first test run for the evaluation of firing facility; however, the compounding dies developed a severe degree of galling and required machining. Upon reassembly, a series of diefailures resulted so we decided to proceed with the quantity of cores available. Diefailure has been the result of improper alignment of the punches.

2.2 Group 63 (Continued)

Ferrite Synthesis (continued)

A set of dies has been set aside for chromium plating in an effort to prevent material sticking to the top punch. With a chromium plate a higher degree of polish can be obtained. Magnetic attraction and binder affinity may also be factors in this problem of material sticking and will be investigated further.

Thesis Proposal

(R. A. Maglio) (UNCLASSIFIED)

A preliminary report has been submitted to the Chemical Engineering Department for approval, "The Study of a Continuous Processing of Ferrite Magnetic Cores." This thesis includes the design and modification of apparatus and the assembly and evaluation of a continuous process for producing ferrite cores.

Production of Cores

(R. A. Maglio) (UNCLASSIFIED)

A one-kilogram batch of $MgO \cdot MnO \cdot Fe_2O_3$, comparable to the General Ceramics MF-1326-B composition, was prepared for ferrite-core production. This batch was compounded according to the methods developed at this laboratory which are different in many ways than those developed at General Ceramics.

About 6000 cores of the F-291 size were produced using the Stokes' press. Breakage due to poor forming and improper handling has reduced this total to 3600 completly finished cores. The 3600 cores which were available for firing were distributed over the shelves within the muffle. Aliquot samples were taken from extreme locations of the muffle and will be tested to determine the uniformity of firing. These cores are now being set up for testing.

A second kilogram batch of the $MgO \cdot MnO \cdot Fe_2O_3$ MF-1326-B composition has been prepared and will parallel the handling operations of the first batch to determine the reproducibility of the production method.

This material will also be used to study the effect of moisture upon the compressibility and bonding of cores.

(F. S. Maddocks) (UNCLASSIFIED)

Emphasis during the past two weeks has been placed on determining the best firing conditions for D-394 size cores of the DCL-2-142 batch of material, from which the first large-scale production of cores will be fired.

2.2 Group 63 (Continued)

Ferrite Synthesis (continued)

In addition, a new magnanese-magnesium-ferrite series, DCL-2-128, 15-mol percent deficient in Fe_2O_3, has been prepared.

Ferrite Analysis

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

A determination was made of the variations of the switching coefficient, S_w, and the threshold field H_o in a nickel-zinc ferrite as a function of compression. The change in S_w was found to be small, decreasing slightly as the compression was increased. The threshold field, however, increased sharply on increasing the compression. This latter effect increases the switching time.

Magnetism

(A. L. Loeb) (UNCLASSIFIED)

From July 20-24 a series of lectures on magnetism was given by Professor Charles Kittel of the University of California. A set of notes is being prepared on these lectures, with Group 63 responsible for the lectures on ferromagnetic domains, magnetostriction, etc., and on ferrites and antiferromagnetism.

A program has been written for computing and displaying the "free energy" hysteresis loop (see E-559) on MTC. In view of the impending MTC amnesia, this program will not be run for a while.

A review is being written on the Néel paper (Annales de Physique, 3, 137 (1948). A great many simplifications have been made, which do not alter either Néel's fundamental hypotheses or his comclusions, but which, it is hoped, will make it easier to get a physical insight.

The problem of solving Maxwell's equations for a given hysteresis loop on WWI is being reactivated. It is hoped that a correlation between hysteresis loop and switching time can thus be found.

SECTION III - CENTRAL SERVICES

3.1 Purchasing and Stock

(H. B. Morley) (UNCLASSIFIED)

Orders are being rapidly placed for the magnetic-memory program. Every effort is being made to schedule delivery for the deadline date.

It is too soon to evaluate possible complications. In general, industrial production and inventory are at a seasonally low ebb and will probably continue so at least through the month of August, so that our timing will be affected by this condition.

Deliveries of back orders have been slowed down by manufacturers' vacation schedules but this is expected to improve by mid-September.

3.2 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 21 Construction Requisitions totaling 683 items satisfied since July 17, 1953; there are 21 Construction Requisitions totaling 204 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)

There are 16 orders now open with vendors, totaling 2108 outstanding items. Deliveries in the past biweekly period have totaled 560 items. Information on specific orders may be obtained from the writer (ext. 3476).

3.3 Component Analysis and Standards

3.32 New Components

(B. B. Paine) (UNCLASSIFIED)

Reports have been issued to cover trips to National Research Council of Canada (M-2330), Cinch Manufacturing Company (M-2318), The Gudeman Company (M-2326), and Radio Materials Corporation (M-2309). More trip reports will be issued during the week of August 3.

3.32 New Components (Continued)

(B. B. Paine) (UNCLASSIFIED)

Acceptance tests have been performed on a sample shipment of Hughes type 1N67A diodes. Of the 100 diodes received all met specifications, and 89 had back resistances far exceeding specifications. The price of this diode is $.15 less than the 1N38A, which it may replace in most applications. The fact that all diodes were good on receipt may indicate that constancy of characteristics is better than in Sylvania diodes, of which we have to reject 5 to 15% upon receipt. Hughes diodes may be considered as a replacement for Sylvania diodes in the Laboratory.

3.33 Lincoln Standards Committee

(C. W. Watt) (UNCLASSIFIED)

A Lincoln Standards Committee has been formed, with representatives from all divisions. The first meeting was held in the Whittemore Building, Thursday, July 23. Minutes of this meeting have been written as Memo M-2331. It is hoped that the Division 6 standards work can be coordinated with the Lincoln Committee work so that there will be a minimum of duplication of effort.

Standards

(H. W. Hodgdon) (UNCLASSIFIED)

New (N) or revised (R) standards sheets issued this period:

Introduction		N
6.012 thru -3	Chassis Bases	N
6.046, p. 4	Connectors	N
6.066-5 & -6	Fuse Holders	N
6.076-5 thru -7	Fastening Devices	N
6.021-2	Capacitors	R
6.022-1	Capacitors	R
6.023-1 & -2	Capacitors	R
6.024-1 & -2	Capacitors	R
6.025-2	Capacitors	R
6.026-1	Capacitors	R
6.026-2	Capacitors	R
6.026-3	Capacitors	R
6.152-1 thru -3	Resistors	R
6.155-1 thru -3	Resistors	R
6.161-4	Sockets, tube	R
6.161-5	Sockets, tube	R
6.164-1	Sockets	R

3.33 Standards (Continued)

(H. W. Hodgdon) (UNCLASSIFIED)

6.173, p. 2	Switches	R
6.174, p. 1	Switches	R
6.184-1 thru -4	Terminals	R
6.192-22	Transformer	N
6.192-24	Transformer	N
6.192-25	Transformer	N
6.198-7	Transformer	N

As soon as membership of the reorganized Standards Committee is determined, a meeting will be called to consider several proposals now being prepared. These proposals include:

Protective Finishes for Aluminum
Paint Specs. (Hammertone and Machine Gray)
Laminated Insulating Material
Electron Tubes

For more details on these please contact me.

3.34 Vacuum Tubes

(H. B. Frost) (UNCLASSIFIED)

There are now available through the print room fairly complete specifications on all tubes to be used in AN/FSQ-7. Among these specifications is an excellent application note on the 2D21 by John Geisler of IBM. There will be available shortly specification sheets on the various subminiature tubes used in cathode-follower probes, both the WWI model and the Tektronix 517 model.

Two additional 715C tubes have failed in the WWI storage deflection amplifiers. In both tubes, shorts were suspected and found. One tube had a defective cathode with flaking coating; the other tube had a G_1-K flicker short of undetermined origin.

Requests for the return of 133 defective 6080 tubes have been submitted to the Purchasing Office for action. A lot of fifty 6080WA tubes has been received and tested. These tubes are better than the 6080 for shorts, gas, etc., but have a lower level of plate current. Inquiries will be made of RCA concerning this property, as the distribution of plate current indicates that a selection process has probably taken place. Many of these tubes are below our internal specifications.

3.34 Vacuum Tubes (Continued)

Thesis Research

(H. B. Frost) (UNCLASSIFIED)

During this past period the pulse voltmeter has been further refined. Its accuracy has been improved by reducing the average residual error to zero. For 40-microsecond pulses the error is less than 0.1 volt for 18-volt pulses with duty factors ranging from about 0.05 to 0.0015.

A technique for tracing voltage-current characteristics of the special tubes built by the Storage Tube Group has been set up, and all 4 tubes have been checked in this way. Current pulses 40-microseconds wide are used. It was found that 3 of the 4 tubes exhibited a type of transient decay in pulse current which is caused by an insulating film on the anode--related to the celebrated Whippany effect of WWII. Additional processing on the bench of one of the tubes cleaned up this decay quite well. Another tube was cleaned up with considerable difficulty; this latter tube had been processed with care not to distort the grid, and the grid had not been bombed intensively as in the first case.

This second tube had a fine-mesh grid backed up by a collector. Because the perveance of the grid to the cathode was higher than the design value, only 2 volts could be developed across the G_1-K diode with the available 15 ma of the current pulser. The size of the mesh openings, the space-charge density, and the thickness of the grid combine to allow only a very minor transmission of current by the grid to the collector. Furthermore, the amount of transmission is extremely sensitive to the grid voltage. This tube is entirely unsatisfactory for the purpose intended, and an additional design modification has been made to improve its utility. A tube made to this design will be ready for processing on Saturday, August 8.

3.5 Drafting

New Drawings

(A. M. Falcione) (UNCLASSIFIED)

Title	Cir. Sch.	Assy. & PL.
5-Amp, 350/400-Volt Rectifier, LE	C-54724	E-54729
Core Driver, Mod VH T.E.	C-55627	D-55625
Core Driver, Mod VIH T.E.	C-55665	D-55663
Rack Power Indicator Panel, Mod II, T.E.	B-55706	D-55702
Magnetic Tape Relay Switch Panel WWI	D-55356	R-55581
St. Monitor Intensifier, WWI	C-53681	E-53680

3.6 Administration and Personnel

New Staff

(J. C. Proctor) (UNCLASSIFIED)

Francis C. Ryder graduated from Dartmouth College in 1930. He is a transfer from the DIC office and is now an assistant to Mr. Forrester. Before joining the staff of the DIC office in 1951, Mr. Ryder was assistant to the Director of the Woods Hole Oceanographic Institute for 4 years.

Terminated Staff

(J. C. Proctor) (UNCLASSIFIED)

J. H. Hughes
Hilda Uchiyamada

New Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Arlene Berkman has joined the Drafting Room as a Detailer.

Paul Dyer is a new Group 63 Laboratory Assistant working in the Ceramics Lab.

Betty Kollet has joined Group 63 as a Laboratory Assistant to assist in core testing.

Edmund Landers is a Laboratory Assistant in Group 6345 where he is being trained as a computer operator.

Marion Oken (the wife of Stanley Oken, one of our staff members) is working in the Drafting Room as a Detailer.

James Richard is a Northeastern University Coop student working in Group 65.

Lowell Schwartz is an MIT student in Group 62.

Perry Smoot is another MIT student who has joined Group 62.

David Sternlight is also an MIT student. He is in Group 63.

Minerva Vahan is a Laboratory Assistant in Group 63.

Omar Wheeler is a new Technician in Group 64.

Marlene Wise has joined Group 65 as a Northeastern Coop student.

3.6 Administration and Personnel (Continued)

Terminated Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Leo Sartori
Janet Taylor
Georgette Theberge