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Memorandum M-2507

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

SUBJECT: BIWEEKLY REPORT, November 6, 1953
To: Jay W. Forrester
From: Division 6 Staff

CLASSIFICATION CHANGED TO:
Auth: 00254
By: R. J. Horn
Date: 2/4/66

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SECTION I - CAPE COD SYSTEM

1.1 Group 61

1.10 General

(C.R. Wieser) (CONFIDENTIAL)

The first two of the present series of demonstrations of the Cape Cod System have been held. The first was for Cambridge Research Center and MIT people. The second was for Bell Telephone Laboratories and Lincoln military liaison officers. Both shows were, on the whole, successful. There has been a good deal of difficulty in tracking interceptors because of the absence of any beacon assist. However, the Mark X out at Building B should be connected to the computer in about two weeks.

Summary

(R. J. Horn) (CONFIDENTIAL)

Equipment reliability of the Cape Cod System has continued to improve, with all equipment functioning properly over 50 per cent of the time and complete shutdown only 5.9 per cent of the scheduled time.

Division 2 is correcting the azimuth-calibration difficulties at South Truro. The question of calibration for the Cape Cod radar network is being reviewed.

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1.10 General

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

A recent analysis of South Truro data indicates a ratio of tracks to total radar returns of 59 per cent (75 per cent if stationary clutter is not counted). Comparable figures for North Truro were 34 per cent and 55 per cent.

It should be possible to begin Mark X coverage tests (and possible use with the computer) during the next biweekly period.

The first test of the UHF ground/air data link revealed accurate transmission of data from the computer to a monitor unit located on the ground near Bedford. Except for Time-to-Go messages, the aircraft receiver also functioned properly.

1.11 Equipment Engineering

(N. Alperin) (CONFIDENTIAL)

A breadboard of a new light-gun-amplifier circuit has been built and is being tested. When the tests are completed, the light guns and panels will be modified. It is planned to have a plug on all light guns so they can be easily interchanged.

(H.J. Kirshner) (CONFIDENTIAL)

Some trouble with the new Ampex 14-track recorder was encountered during the week of November 3. The trouble was remedied by lubrication of a dry solenoid plunger shaft. Investigation showed that the older machine was on the verge of giving trouble due to the same cause.

Large-scale angular errors in South Truro data detected here were located by site personnel as being caused by ambiguity in the synchro system which drives the "north-mark" commutator.

With regard to site calibration and performance in general, Charles Zraket and I propose that calibration and performance check flights be held more often than heretofore. In the case of limited operation, such a flight may be run concurrently with or prior to large-scale tests. In the case of a continuously operating system, the flights should be held daily. Provision should be made in the computer program for obtaining calibration and performance data during normal operation. The flight plan of the cooperating aircraft should be the same during each operation and the aircraft type the same for each mission.

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1.11 Equipment Engineering (Continued)

(B. Morriss) (CONFIDENTIAL)

The checking of the equipment in Room 222 has been performed twice a week on a routine basis with considerable success in locating equipment malfunctions. The Air Force personnel carrying out these tests have performed in a highly satisfactory manner.

Considerable time has been spent on the connection of the Bedford Mark X to WWI and the preparation of a note describing how it will be connected to the computer. It should be possible to begin coverage tests during the beginning of the next period and use with the computer may be possible by the end of the period.

(D. Neville) (CONFIDENTIAL)

A "mechanical test-message generation" is now installed in Room 224. It sends a different test message every 10 seconds and repeats a sequence of six messages every minute. Three types of input to the Data Link Coder, which can now be selected are WWI, mechanical test-message generator, toggle-switch test message (repetitive every 16 μ sec or at push-button rates).

Monitoring by a service truck at Bedford of WWI test messages sent by the Data Link has been successful. Monitoring an airborne-aircraft has been accomplished but some of the Data Link instruments did not respond correctly on the first test on November 6, 1953.

(J.H. Newitt) (CONFIDENTIAL)

The past biweekly period has been devoted to miscellaneous improvements in the Special Cape Cod (SCC) control center. We have installed illuminated data shelves in most of the scope consoles and are under way in equipping all operating panels with illuminated labels. Construction of other prototype accessories is under way and will be announced as they become available.

Experiments and improvements in the present center will continue for some time and I intend to carry these on in addition to compiling design requirements for the XD-1 consoles and center. It appears that a rigorous analysis of the operational system requirements (both present and future) should be used as the basis for compiling the design specifications for a future center (or console). I have started to collect this data with an eye toward evolving a list of design features that can be used for the guidance of the Vestal Lab. group.

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1.11 Equipment Engineering (Continued)

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

A preliminary scheme for illuminating the face of the cathode-ray tube has been planned.

All schematics and wiring diagrams pertaining to mappers are in the drafting room.

Plans are being made to install a switch panel so that one of the Pathfinder scopes can monitor filtered data from the Truro mapper or either gap-filler mapper.

Failure of Y33 was traced to the CRT. This tube had developed grid emission and was loading the HV power supply severely. Replacement of the tube removed the difficulty.

(G.A. Young) (CONFIDENTIAL)

A program has been written to aid in checking the Ground-to-Air Data Link. The program continually cycles through six messages with a ten-second period between each message.

Another program has been written to aid in checking the output coder. The program sends out patterns capable of being selected which may be observed on an oscilloscope. This program has been operated successfully with the output coder.

1.12 Data Screening

(R.L. Walquist) (CONFIDENTIAL)

During the past biweekly period additional tests were made of the calibration of the FPS-3 at South Truro. These tests indicated that the synchro system connecting the antenna to the azimuth commutator had slipped out of phase when the power was turned off. As a result one test we ran indicated an error of about 10° in azimuth, whereas the same test run three days later indicated an error of about 20° in azimuth calibration. Division 2 is taking steps to guarantee that such a situation will not recur. The question of calibration for the Cape Cod radar network was also reviewed with respect to the gap-filler radars. As a result it was found that the gap-filler radars have been incorrectly calibrated in azimuth since the spring of 1953, when the new MITE equipment was installed at Whirlwind. Radar-set calibration is being discussed with Division 2 in order that they understand exactly what is desired. A program to assist us in calibration is being written by Eric Wolf. He will be responsible for checking on the calibration of the Cape Cod radar network and making sure that it is calibrated as desired.

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1.12 Data Screening (Continued)

(R.L. Walquist) (CONFIDENTIAL) (Continued)

Programming for the Mark X data input has been started. It is hoped that this program will be available by the middle of the next biweekly period. The plan is to use the Mark X input in place of one of the two gap-filler radars in the present Cape Cod program. Utilization of the data has been planned in such a way that when a Mark X return is received on an aircraft, correlation with radar data from the other sets is not carried out. However, if a Mark X return is not received, radar data is accepted for the target. Using this scheme, it should be possible to track an aircraft with Mark X through regions of high track density and through extensive clutter regions without requiring the presentation of the track to a monitor.

The program which was written to rotate track numbers (see last Biweekly Report, Data Screening Section) was found to contain a rather subtle logical error. This error would give arithmetic-check alarms only when initiating tracking on interceptors and then only for interceptors whose X component of velocity was positive. The combination of the above situations made it very difficult to locate the error and resulting in much confusion when trying to run live interception tests. This error has now been corrected and apparently gives no further trouble.

The systems engineers have found that the present scope jitter in Room 222 is aggravated by the fact that the present Cape Cod program leaves the display decoders set at different values at the end of each 6-second subframe. Gus O'Brien suggested that we might modify our program to return the deflection decoders to the same value whenever possible. A three-order program mod was made which would do this before each program transfer from the auxiliary drum. This has resulted in a marked decrease in the scope jitter. As a result this mod will be made a permanent part of the Cape Cod program.

The program written by H. Peterson which takes pictures of the uncorrelated radar data (when the data-analysis program indicates an abnormal situation) is now operative. Several pictures were taken but were found to be unsatisfactory due to the aperture and intensity settings of the camera scope. A series of tests are in progress to determine what camera settings we should use for best picture results.

Some difficulty was experienced this last biweekly period with the photocell output of one of the mappers. Due to a low intensity on one of the mapping scopes, the photocell would not pick up all the aircraft data being displayed. As a result the computer program did not receive all the incoming aircraft returns. Replacement of the cathode-ray tube gave an intensity which was too bright; as a result the masking material failed to inhibit masked-out data from reaching the computer. These two difficulties indicate that it would be highly desirable to have a monitor scope which can be switched to the output of any one of the mapping scopes. Also, such a monitor scope would be very valuable in checking the mapping procedure during

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1.12 Data Screening (Continued)

(R.L. Walquist) (CONFIDENTIAL) (Continued)

normal operations. Ed Rich has been asked to look into the possibility of modifying the present monitor scope (which can now monitor only the output of the Truro mapping scope) so that it can be connected to monitor the output of any one of the mapping scopes.

In order that the parity check for the auxiliary drum can be installed with a minimum of complexity, the systems group wants to remove the skip feature on the bi and the bo orders. The skip feature is still to be retained on the rd and rc orders, however. As far as is known, only the data-collection and data-analysis programs of the combined Cape Cod program utilize the skip feature of the bi and bo orders. The programs will be modified so that the required change in these orders can be made on Monday, November 16.

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

Study and programming of the breakpoint calculations mentioned in the last Biweekly continue.

(H. Frachtman) (CONFIDENTIAL)

Several additional errors have been discovered in the statistical analysis program.

A second analysis program has been started which will compute the distribution of miss sequences.

(J. Ishihara) (CONFIDENTIAL)

With R.L. Walquist, preliminary planning of incorporating Mark X into the present Cape Cod Correlation Program has been started. Programming of this modification will be done with D. Bailey.

A logical error in the "track number cycle" modification was found and corrected.

(J. Levenson) (CONFIDENTIAL)

Almost half of this biweekly period has been spent at the daily operation of the Cape Cod System, training and supervising initiators.

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1.12 Data Screening (Continued)

(J. Levenson) (CONFIDENTIAL) (Continued)

Work continues on checking out new utility programs. The Parameter Insertion Program is operational and instructions for its use have been distributed. The program for delayed print out of drum contents has been expanded to print the exact address on the drum or any ES address the programmer specifies along with the drum contents. A parameter is being added to allow print out of octal constants as well as orders.

(H. Peterson) (CONFIDENTIAL)

The program for taking pictures of poor data was checked out, and the past-history display program was nearly completed.

About half my time was spent in being available to the Air Force men who were monitoring in order to answer their questions and to see that the equipment used by TWS was operative.

(F.A. Webster) (CONFIDENTIAL)

During flight tests plots have been made of target-aircraft positions. Three sets of data are usually recorded for each run: 1) estimated times at control points as determined by navigators when aircraft reach altitude, 2) actual times at check-points (and short-range extrapolations from these) as given by navigators, and 3) selected track data as observed on 16-inch scopes and digital displays. The tracking of high aircraft in low-density areas is normally adequate to establish unequivocal correspondence between tracks and target aircraft. Incoming tracks that are not picked up before the AD12 boundary, however, often do not give adequate correspondence and tracks that are picked up during maneuvers or near other tracks generally do not provide adequate correspondence. The operating resolution of the system still needs considerable refinements.

(E.W. Wolf) (CONFIDENTIAL)

A program has been written which will aid in the calibration of the various radar sites. The program displays all the returns from any MITE unit and, when tracking aircraft, will store the values of x,y,r, and θ for all returns from that aircraft, as well as the time (Eastern Standard Time) to the nearest minute at which these returns were received. The program is ready to be tested on the computer.

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1.12 Data Screening (Continued)

(W. Wolf) (CONFIDENTIAL)

A program has been written to blow up the displays of the gap-filler data and the South Truro data within gap-filler range to full-scale deflection of the 16-inch scopes.

The Correlation Data Analysis Program was run with the most recent (and most favorable) recording of the S. Truro data.

The data, analyzed for 48 scans, may be summarized as follows:

Tracks/Return	59%
Tracks/(Return minus Stationary Clutter)	75%

The comparable summary for N. Truro data was (see M-2379, p. 7):

Tracks/Return	34%
Tracks/(Return minus Stationary Clutter)	55%

The only mapping done for the S. Truro data was an attempt to map out the North marker which shifted randomly for one-half of the recording.

A percentage breakdown which is the basis for the above summary is of interest. The percentage given in column k (k = 0,1,...,10, greater than 10) is the percentage of returns which correlated within k miles from scan to scan.

0	1	2	3	4	5	6	7	8	9	10	g10
21.8%	23.6%	14.4%	13.3%	7.4%	4.3%	3.0%	2.1%	2.1%	1.7%	0.8%	5.4%

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1.13 Tracking and Control

(S. Best) (CONFIDENTIAL)

A description of the routine which simulates crossing tracks is being written to enable anyone to write parameter tapes for it to try out any smoothing method under various conditions. This will either be made an M-note or be available for ozaliding. The correlation-smoothing method used in the Cape Cod System was tried. Results were that if the magnitude of the difference of their velocities is less than 135 knots and the blip-scan ratio less than 0.9, and an untracked plane passes within 2 mi. of a tracked plane flying at a range of 70 mi. at a speed of 317 knots, then the probability of losing the track is about 0.5. With a blip-scan ratio of 1, this probability drops to about 0.25.

(Wm. Lone) (CONFIDENTIAL)

This biweekly period was spent reading memos on guided missiles to acquaint myself with their proposed use in an Air Defense System.

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

The program for obtaining complete tracking information for various NLS-2c parameters has been checked out except (possibly) for the delayed-print routine. The old program for parameter study has been modified to test other methods of computing break points.

A calibration program is being written to help locate flight paths in relation to four gap fillers, an M-33, and a Raydist unit.

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

Work is continuing on the radar-accuracy test mentioned in the Biweekly Report of 10/23/53. The projected plan is to track the aircraft around the quadrilateral flight plan using two radars tracking simultaneously but independently on each leg of the flight. The choice of radars (which are largely overlapping) is determined by selecting the sites closest to the ends of the leg on which the plane is flying. The program being written will provide data corresponding to that photographed from the dials of the M-33 tracking radar.

More of the previously mentioned tracking-error-distribution graphs have been drawn, although the project is not yet completed.

(S. Best, H.D. Neumann)

See SECRET supplement to biweekly, M-2508.

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1.14 Weapons Direction

(H.D. Benington) (CONFIDENTIAL)

The use of one 16" scope in Room 250 for a composite display of DID's (Digital Information Displays) has been investigated. Since no one seems interested in such a display immediately, the go-ahead is being delayed until other factors are considered.

A study is being conducted on changing the display lines now available on toggle switches in Room 222. Any suggestions would be appreciated by the writer or C. Grandy.

All the suggestions made in inter-office memos for future changes in the Cape Cod System were read. An inter-office memo is being prepared for the committee that will implement the changes.

(M.I. Brand) (CONFIDENTIAL)

In conjunction with A.W. Curby, I have been working on a re-written version of the Identification Memo. I have written the abstract, introduction and will write the display section. Ann Curby is writing the section explaining the input data used and its processing external and internal to the computer.

With M. Geraghty, S. Hauser, and another Group 61 committee, I spent three days at IBM discussing the use of IBM cards for both program and manual inputs to XD-1. The results of this trip will be published in a memo during the next biweekly period.

Work is continuing in conjunction with A.W. Curby on polishing off some of the rough edges remaining in the Cape Cod ID Programs.

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

In the writer's Biweekly Report of November 23, Section 1.14, page 14, for "an error in azimuth of T⁰", read "an error in azimuth of 5⁰".

Since the trouble with the FPS-3 has been found, the height-finding feature of the Cape Cod exercises has been fairly satisfactory. About two-thirds of the attempts to find height have been successful, on the average. Of the remaining one-third of the attempts, about half are directly attributable to failure to track aircraft consistently. Data will continue to be collected, and in the future a more detailed summary of results will be offered.

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1.14 Weapons Direction (Continued)

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

Altitude accuracy has, in general, been within the limits of capability of the various HF. Insufficient data are available to indicate the existence of any pattern among those reports which do not fall within these limits.

No attempt has been made to date to force compliance with the speed requirements of height finding. Beginning next week an effort will be made to learn the full capability for speed of the present system.

Since we now seem to be capable of tracking B-29's in the North-East quadrant of the Cape Cod System, at least, an attempt at an Anti-Aircraft Guidance exercise will be made next week. It is only fair to mention, however, that no reasonable test of the ability of the system to guide AAA can be made until several strikes can be mounted, converging simultaneously on Boston. This, in turn, waits upon the development of an ability on the part of the System to track aircraft consistently in all quadrants.

(F.M. Garth) (CONFIDENTIAL)

In still another attempt to check out the Final-Turn Program while cycling with the Weapons Directions System and using simulated data, some baffling results were noted. A beam attack was first tried, and interception accuracy appeared to be all that could be desired. However, on a nose-attack parameter oscillating headings resulted.

After a small modification was made in the square-root subroutine, the nose attack was tried again - this time it gave stable headings. If the error was in the square-root subroutine, then why was the beam attack successful before the alteration? Evidently more testing of the program is requisite.

Work has been started on an investigation of a sub-altitude final-turn attack which would alter the final-turn equations to include three dimension.

(F. Heart) (CONFIDENTIAL)

Memorandum M-2460 was issued describing "Non-Track-While-Scan (Weapons Direction) Record Forms."

Additional time was spent assisting in the operation of the Cape Cod Direction Center.

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1.14 Weapons Direction (Continued)

(F. Heart) (Continued)

The study of order frequencies in Cape Cod Programs has continued, but no new experimental results have been obtained as yet.

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

During this period the Identification Programs (rewritten) were checked out and run with the System.

Weapons Direction Program NTWS-2a was rerecorded on magnetic tape including new ID programs and modified subroutines.

The second week of this period was spent studying card-handling techniques at IBM in Poughkeepsie.

(W. Lemnios) (CONFIDENTIAL)

A tape error was found in the final-turn program. This error was the cause of the troubles previously encountered with this program. Several successful final-turn interceptions using simulated data were conducted.

Some time was spent in assisting in Room 222 of the Barta Building during flight tests. A two-hour class was held to explain the interception program to Air Force personnel.

Considerations for better return-to-base methods, especially in regard to fuel conservation, have begun.

(L. Murray, J. Nolan) (CONFIDENTIAL)

The training program for the Air Force personnel has completed its first phase. This consisted of familiarization with WWI and external equipment. It should be noted that this material will be constantly referred to and expounded upon when the content of lectures will be clarified by so doing.

At present we are in the second phase of the program. This consists of a general introduction to the Cape Cod System as a whole, followed by a more detailed presentation of the particular sections. This should be completed within the next biweekly period.

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1.14 Weapons Direction (Continued)

(G. Rawling) (CONFIDENTIAL)

Activity in the past period has resulted in the completion of rough-draft sketches of all panels in the Track-While-Scan Section for edge-lighting; they are awaiting final approval of the Chief of Data Screening.

The rough draft models for edge-lit digital information display (or totes) legends are completed.

(C.A. Zraket) (CONFIDENTIAL)

Two tests to check the calibration of the FPS-3 at S. Truro were conducted during the past biweekly period. The first test revealed a 10° error and the second a 20° error in azimuth reports. The cause was found to be slippage in a synchro at the radar site. Subsequent tests showed accurate transmission of azimuth data.

A test to check the operation of the UHF ground/air data link from the computer to an aircraft receiver (one complete loop) was held on November 6 using F-89 No. 802. A series of six test messages requested by Group 22 was transmitted to the aircraft which was flying at 10,000 ft. in the vicinity of Bedford. The flight path was somewhat restricted due to weather conditions. The test revealed accurate transmission of data from the computer to a monitor unit located near Bedford on the ground. Except for Time-To-Go messages, the aircraft receiver also functioned properly. The latter was checked by comparing the pilot's readings with the message being transmitted. Preliminary evaluation of the test shows that the errors in the ground/air loop were probably localized in the transducers in the aircraft receiver. Future tests will be held using different aircraft.

System testing of the Cape Cod System is continuing on a daily basis, weather permitting, with Air Force personnel manning all positions with the exception of the Combat Data Director and Sub-Sector Commander. The cooperation of the Air Force personnel and their operation of the Center has been excellent. A marked improvement in the operation of the Center is shown from day to day as familiarity with the various operating stations increases. Two successful interceptions have so far been conducted. With the introduction of Mark X data, it is expected that the tracking of interceptors will improve considerably.

The Navy teletype and Air Route Traffic Control Center Control line at the Identification Station has been installed. Its use is awaiting the installation of the appropriate lines.

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1.14 Weapons Direction (CONTINUED)

(C.A. Zraket) (Continued)

The last few changes in the Weapons Direction Programs (final-turn interception calculations and new geography displays) have been checked out and will be incorporated in the System Program this week.

The training program for Air Force personnel set up by L. Murray and J. Nolan has been continuing on a daily basis. Memos describing the Cape Cod Programs are being prepared in conjunction with this program.

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1.15 Direction Center Operations

(E.W. Wolf) (CONFIDENTIAL)

The equipment reliability of the Cape Cod System operations continued to improve, with unrestricted operating time exceeding 50 per cent for the first time since the System became operational. The light guns continue to be a source of trouble, but this situation is improving. Individual consoles experience occasional malfunctioning from various sources, but these incidents are sufficiently isolated to prevent over-all system failure.

There were two incidents of phone-line failure totaling 24 minutes and two incidents of trouble from the mapping scopes totaling 130 minutes. The statistics follow.

	Last Biweekly Period		Cumulative Period (since 9/29/53)	
	Hours	Per Cent	Hours	Per Cent
Assigned Time for System Operation	18.7	100.0	60.6	100.0
Unrestricted Operating Time	10.3	55.2	17.4	28.7
Limited Operating Time	7.3	38.9	26.3	43.4
Down Time	1.1	5.9	15.2	25.2
Recovery Time	0.0	0.0	1.7	2.8

Time Lost (hours)	Limited Operations	Down Time	Limited Operations	Down Time
Computer	0.0	1.1	0.0	13.7
Room 222	7.4	0.0	32.4	1.6
Radar & Input	2.6	0.0	24.7	0.0
Misc.	1.5	0.0	13.5	0.0

(M. Brand) (CONFIDENTIAL)

The following is a summary of computer operations for the last biweekly period.

TWS	16 hrs 45 min
Weapons Direction	6 hrs min
Combined TWS & Weapons Direction	32 hrs 05 min
Tracking & Control	18 hrs 50 min
Used Time	73 hrs 40 min
Computer Trouble	5 hrs 20 min
Math Group	3 hrs
In-Out	6 hrs
Total	88 hrs

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1.15 Direction Center Operations (Continued)

(P. Cioffi, P. Dolan) (CONFIDENTIAL)

The following table summarizes the flight-test activity for this period.

Tracking experienced this period has improved over past performance. Though the blip-scan ratio has been low at long ranges (1/3 to 1/2 at about 100 miles), tracking has been conducted so that the scheduled strike aircraft have been in the system longer and are available for intercepts. A greater number of intercepts was undertaken than had been previously. Tracking of interceptor aircraft still continued as a noticeable deficiency. Despite this, of the interceptors scrambled some were tracked when cleared of heavily trafficked areas and directed to interceptions. Observations made at the FTU position and compared with those made at the South Truro radar site indicate that the lack of interceptor tracking is not directly attributable to radar misses but rather to the inexperience of the track initiators working this sort of problem. Track monitoring has been successful to the point of keeping in cognizance track turns and, in most cases, track splits.

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DATE	TIME	SCHEDULED TEST		TEST ACTUAL RUN		REASONS FOR CHANGES OR COMMENTS
		A/C	Description	A/C	Description	
10/27	1330-1630	7	Calibration, Coverage, & Intercepts	2	Intercepts cancelled	Fighters cancelled due to weather
10/28	1300-1600	14	Calibration, Coverage, & Intercepts	0		Cancelled due to weather
10/29	1130-1330	14	Calibration, Coverage, & Intercepts	0		Cancelled due to weather
	1400-1600	1	AAA Calibration	0		Cancelled due to weather
10/30	1330-1630	13	Calibration, Coverage & Intercepts	1	Used to exercise tracking section	Cancellations due to weather and mechanical failures
11/3	1330-1630	12	Calibration, Coverage & Intercepts	6	As scheduled	3 B-29's cancelled due to mechanical failure
11/4	1200-1300	1	Data link Test	0		Cancelled-ground equipment inoperative
	1330-1630	13	Calibration, Coverage, & Intercepts	9	As scheduled	3 B-29's & F-89 cancelled due to mechanical failure
11/5	1230-1530	12	Calibration, Coverage, & Intercepts	12	As scheduled	

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 1.15 Direction Center Operations (Continued) (P.O. Cioffi, P. Dolan)

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* Added to schedule during week of test

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1.16 AN/FSQ-7 XD-1 Support

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

I spent most of the past week at Poughkeepsie studying the IBM punched-card inputs and the 701 and XD-1 programming.

(H.D. Benington) (CONFIDENTIAL)

Work has continued on investigating the display scheme to be used with XD-1. It seems that the system is almost settled on. When this has been done, the first crack at situation displays will be made. Preliminary work has been done on the tables, categories, and organization necessary for the individual displays.

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

It has been decided to develop a semiautomatic height-finding system for the Transition System. Work on this will be begun immediately by Group 24. Group 61 will continue to support the effort, through the agency of the writer. A formal report, containing the recommendations of the committee formed to study HF for the Transition System, is being prepared by P. Sebring (Group 24).

(B.G. Farley, W.A. Clark) (CONFIDENTIAL)

After a careful analysis of the MTC order code and control and working experience with the experimental register, the design and layout of of this new indicator panel for MTC is substantially complete.

(G. Rawling) (CONFIDENTIAL)

The gathering and referencing of information from a systems viewpoint with the ultimate goal of application to equipment design has been started. Flow diagrams of the functions of the stations of the Air Defense Center have been rough drafted, and pertinent information will be added as it may arise.

1.17 Associated Studies

(B. Smulowicz, W. Wells)

See SECRET supplement to biweekly, M-2508.

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1.2 Group 64

(S. H. Dodd) (UNCLASSIFIED)

A significant improvement has been made in the operation of the Core Memory. The rise times of some of the signals into the memory were decreased, and the input to the read amplifier was shunted with added capacitance. These changes broadened the "one" output signals and made them more coincident in time, thus stabilizing the "strobe" time. These and other changes have increased the operating margins.

Another reduction in display noise was made by program changes after it was found that the decoder output amplifiers changed their characteristics if they were left for a relatively long time in the region of high deflection.

Various means of automatic marginal checking of the equipment in Room 222 are still being investigated, and preliminary panels are being built to test some of the ideas.

The buffer drum is operating better since some of the timing troubles were corrected. Turning the power off the drum system causes writing between the slots, and means for correcting this are being studied.

1.21 WWI System Operation

Core Memory

(N. L. Daggett) (UNCLASSIFIED)

Several changes have been made to the Core Memory which seem to have improved reliability.

As originally operated, the memory appeared to suffer from the fact that the "one" outputs were quite narrow and were considerably staggered in time. This meant that a relatively small shift in strobe time could quite drastically alter operating margins. The circuitry of the read-control switch panel aggravated this situation by employing slowly rising waveforms to produce the current gates. As a result, slight variation in supply voltages or tube characteristics caused appreciable shift in the current gates and hence in effective strobe time. In an attempt to improve the situation, rise time of the read currents and of the switching waveforms was decreased by relatively minor changes to the control-switch panel. This caused considerable ringing of sense-winding sense-amplifier input circuit. Shunting the amplifier input with a relatively large capacitor eliminated this effect and in addition gave a broader "one" output pulse, making the strobe timing much less critical.

1.21 WWI System Operation (Continued)

Core Memory

(N. L. Daggett) (Continued) (UNCLASSIFIED)

An attempt to improve the rise time in Bank B (the old bank) yielded a serious increase in delta noise, apparently because of the less carefully selected cores in this bank. Therefore, this bank is being run with approximately the same rise time as before but with additional capacitance shunting the amplifier input and with improvements in the control-switch circuitry.

To further improve tolerance to delta noise, post-write disturb has been added to both banks. A new Core Memory test program of the bootstrap type has proven much more effective in determining operating margins. The net result of the above changes has been operating margins measured with the newer (and tougher) test program which are somewhat greater than those measured before the changes with the easier test program.

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

The majority of low margins in the system have been cleared up. Excursions have been set in on the marginal-checking lines for core-storage control, and all margins are reasonable.

The installation of the parity-check system for the drum has been delayed until November 16.

A program for generating a "worst possible pattern" in the cores should be ready for trial in a few days. It is similar to the double checkerboard used by MTC.

Magnetic Drums

(H. L. Ziegler) (UNCLASSIFIED)

The Buffer-Drum Monitor is progressing satisfactorily with the Coincidence Detector-BA chassis nearly completed. The circuit schematic and the assembly drawings for the Reading-Amplifier crystal-gate chassis are complete, and construction will begin soon.

Two Group-Selector relay chassis have now been adjusted to specifications at a cost of about 70 man-hours labor each. Due to several factors, these chassis are extremely difficult to adjust. Besides the usual interaction of leaf springs in the spring pile-up, lead stresses are transmitted to the contact springs and result in timing changes. This lead-stress problem is further aggravated by the mounting of the relays on

1.21 WWI System Operation (Continued)

Magnetic Drums

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

semiflexible phenolic boards. Satisfactory adjustment of these relays may be obtained only through infinite patience and a prayer for Divine guidance.

Data are still being collected for comparative evaluations of this group-selecting method and others that are being considered.

Auxiliary Drum

(K. E. McVicar) (UNCLASSIFIED)

With the exception of one instance the auxiliary drum has operated without known error during the last biweekly period. On one occasion an intermittent readout was obtained during program operation. The trouble was traced to writing between the slots on the drum surface. A visual check had been made of the drum tracks on the previous day, and no serious defects were noted in the waveforms. It is assumed that the writing between slots was caused by the marginal checking which was done on the morning of the day the readout failure occurred. Investigation of the problem revealed that three lines could cause writing between the slots in case of certain failures caused by varying the operating voltages. These lines have been temporarily removed from the routine marginal-checking procedures. In the meantime work is in progress on a new program for marginal checking the drum on the read operation only, except where the write function itself is to be checked.

Typewriter and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

During the past two weeks we completed routine overhaul on the remainder of our long-carriage Flexowriters.

I have been working with Farnsworth and Perry to locate the cause of intermittent errors appearing recently in both tapes and printed copy produced on the delayed-output Flexowriters. The work is not completed, but it now appears that the trouble is in the magnetic-tape equipment rather than in the Flexowriters.

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1.22 Terminal Equipment

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

One of the sources of display-scope spot jitter has been discovered to be due to duty-cycle sensitivity of the screen grids in the decoder output amplifiers. A change in the programs to prevent the amplifiers from resting in the region of high deflection has eliminated the spot shift.

The illuminated name plates are gradually being installed on all scopes. Their operation is generally satisfactory, but better means of wiring and stopping light leakage are being tried.

A key-operated switch will be installed in the power line to the equipment in Room 250 to prevent unauthorized operation of this equipment.

(R. H. Gould) (CONFIDENTIAL)

Two 16-inch display scopes are now installed in the wall of Room 250. To prevent unauthorized persons from viewing classified displays, a locking switch will control the a-c power to the scopes and will also light a red pilot light over the door to Room 250.

If the covers on the 5-inch display scopes in Room 222 do prevent unauthorized adjustments, there must be some slight random 24-hour drift which necessitates readjustment by the technician. The situation is better, however, than when the knobs were available to any itching fingers. It is requested that all adjustments be made only by the technician in Room 222, Charlie Greim, or myself or persons temporarily deputized during calibration of the scopes.

A meeting of many minds discovered that the "jump" on the display scopes during Walquist's program was due to a very long time constant in the decoder output amplifiers which made the display position dependent on the recent history of the decoders. A program change which left the horizontal decoder cleared between display periods removed the jump.

The equipment in Room 222 has been operating very well. The frequent "no trouble" reports in the log are gratifying.

Marginal Checking

(S. B. Ginsburg) (UNCLASSIFIED)

Consideration has been given to programmed marginal checking of the various circuits now being used in the Cape Cod System.

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SECURITY INFORMATION

1.22 Terminal Equipment (Continued)

Marginal Checking

(S. B. Ginsburg) (Continued) (UNCLASSIFIED)

A circuit was designed and tested which will enable the computer to select all of the insertion switches at once. A variable voltage can be applied to the switch connection at the insertion registers while the computer reads the contents of the registers into IOR. This panel is being constructed in the shop.

Another circuit was designed which will simulate pulling of the light-gun switches. This circuit is being constructed in the shop.

A panel was designed and the breadboard tested which will enable programmed marginal checking of the indicator-light circuits. This circuit is now in drafting.

A panel for mounting the light guns at the scope consoles has also been designed. This panel is being constructed so that a lens system may be placed in series with the one presently on the gun. In this manner the gun will always face a fixed area on the scope.

Consideration was given to marginal checking the activate registers. A means of selecting the activate switches will be tried out in the near future.

Room 222 Installation

(G. F. Sandy) (UNCLASSIFIED)

The two 16-inch scopes in Room 250 now have power to them. It is planned to add a key switch in the filament power line so that unauthorized people cannot turn either scope on.

The teleregister panels have been wired.

The edge-lit panels are being installed as they become available.

The red nite-lights have been removed. The variac that was used for their control will be removed, and this circuit will be used for the clock circuit. A switch will be provided at station "P" so that the umpire can start and stop all clocks at one time.

A revised blown-fuse indicator panel has been installed in station W12 to determine if it can eliminate objectionable transients introduced by the present panels whenever a fuse blows.

1.22 Terminal Equipment (Continued)

MITE

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

The new MITE, known as MITE 3, is nearing completion in Rack L5, Room 156, and should be ready for operation next week if no unforeseen difficulties occur. It will be used as supplement to MITE's 0, 1, and 2 now in operation.

The cables for the MITE's for Buffer Drum have arrived and are now being inserted. The MITE's for Buffer Drum have thus far operated successfully in the testing with the Buffer Drum. MITE unit 5 is now ready for testing upon the insertion of plug-in units and should be ready to be tied in to the Buffer Drum next week.

A special Demodulator to supplant some equipment in Room 224 has been designed and should be constructed during the next biweekly period.

Some time has been spent during the past period in gaining familiarity with the Buffer Drum logic and circuits.

Buffer Drum

(K. E. McVicar) (UNCLASSIFIED)

The operation of the status tracks on the buffer drum has been improved considerably, and this function of the system now operates with good margins. The troubles we experienced were due to timing, low pulse amplitudes, and component failures. The record pulse was delayed by the several chores it has to perform with the result that the write-gate was narrowed, thus reducing the recording current. Low pulse amplitudes were caused by low terminating resistance and high series-limiting resistance. The component failure was one crystal in a flip-flop writer.

We are still having trouble with writing between the slots on the dual tracks whenever the power is turned off. One possible solution is to turn off the power in three steps: the positive voltage to the writer plate, the rest of the positive voltages, and last, the negative voltages. Another solution might be to make the flip-flop writer monostable. We are investigating the relative merits of these and less desirable approaches.

The beta-gate generator has been a source of trouble in the information section of the buffer section of the drum. We have lost four output transformers due to partial shorts. Possibly this is due to the fact that the transformer is being run too close to its power-dissipation limit, resulting in overheating and burning of the insulation. This is being investigated.

1.22 Terminal Equipment (Continued)

Magnetic Tape

(E. P. Farnsworth) (UNCLASSIFIED)

Several defective tubes, crystals, and tapes were located by marginal checking and replaced during this period. Other troubles experienced were caused by a defective paper-tape punch on the delayed-output Flexowriter, and failure of programmers to use the si stop magnetic tape order when recording.

Minnesota Mining is now working on a triacetate tape for us to replace mylar as they have been unable to get a definite commitment from Dupont on the supply of unspliced mylar. Triacetate is stronger than acetate, though not as strong as mylar, but it does not stretch like mylar. Stretching has been the main cause of failure of mylar tape.

We now have an order from Raytheon six more spare triangular-hub reels and another kit to convert a third tape machine to triangular hubs. This will provide six splined reels and ten spare triangular reels. Raytheon is no longer supplying the splined reels.

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 October 23 - November 5, 1953:

Number of assigned hours	139
Usable percentage of assigned time	96
Usable percentage of assigned time since March 1951	85
Number of transient errors	18
Number of steady-state errors	5
Number of intermittent errors	3

Component Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following failures of electrical components have been reported since October 23, 1953:

1.23 Records of Operation (Continued)

Component Failures in WWI

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

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Crystals</u>			
D-358	1	3000 - 4000	Low R_b
<u>Tubes</u>			
C3J	1	17000 - 18000	Broken envelope
6BL7	1	0 - 1000	Low I_b
6YG6	1	3000 - 4000	Leakage
C16J	1	2000 - 3000	Unstable
5965	1	0 - 1000	Short
2D21	1	20000 - 21000	High firing point
7AK7	1	19000 - 20000	Low I_b
7AD7	6	6000 - 7000	Short
	2	10000 - 11000	Short
	2	14000 - 15000	1-short, 1-low I_b
	2	16000 - 17000	1-low I_b , 1-short
	3	18000 - 19000	2-short, 1-low I_b
	3	19000 - 20000	Short

1.24 General

Equipment Conditioning WWI

(R. E. Garrett) (UNCLASSIFIED)

The condenser-water drainage system functioned during the last biweekly period. Its purpose is to drain the condenser water as the outside temperature drops toward freezing. This system will also refill the condensers as the temperature rises, thereby relieving an operator of this task.

Cape Cod Equipment Conditioning

(R. E. Garrett) (UNCLASSIFIED)

An additional 20-ton air-handling unit is planned for installation within 3 months; however, for the present an overheat situation exists due to the additional load in Room 222. This is being taken care of by the installation of a duct from a 10-ton unit located in Room 026. This duct will remain only until the new 20-ton air-handling unit is operative.

1.24 General (Continued)

Cape Cod Lighting

(R. E. Garrett) (UNCLASSIFIED)

The low-level indirect-lighting system was installed during the last biweekly period. The system has sufficient flexibility to provide any desired level of illumination.

General

(D. A. Morrison) (UNCLASSIFIED)

The major portion of this biweekly period was spent in working with the CM group.

The remainder of the time was used in obtaining information relative to the construction of a voltage Interlock Panel to control the "cycling on" power sequence of WWI Power.

1.3 Group 65

1.31 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

Three members of Group 65, T. F. Clough, A. Zacharias, and E. H. Harvey, were transferred to Group 60 to aid in the receiver-tube program. More active work will be done on that program during the next few months. The preproduction models of the improved versions of the 5965 and 7AK7 will be received at High Street within the next biweekly period. This work is progressing satisfactorily. Trips to Tung-Sol and Sylvania will be made this next biweekly period in support of the reliable-receiver-tube program.

Experimental work for Group 25 is continuing in the vacuum-tube laboratory.

One experimental Charactron was processed this last period. Two more experimental Charactrons are scheduled for the next period. These tubes were proposed and will be evaluated by G. L. Corderman.

Several trips in support of the display program are planned with members of Group 25 for this next period.

Storage Tubes

(A. Zacharias) (UNCLASSIFIED)

During the past biweekly period final disposition of storage tubes was completed.

Seven stannic-oxide tubes, ST881, ST883, ST884, ST885, ST886, ST887, and ST888 are located in the computer room. They are satisfactory and are available for WWI use.

Other tubes that have been saved are located in Rack X. They are ST889, ST890, ST891, ST892, and ST893. These are new stannic-oxide tubes; all are satisfactory.

ST619-C and ST847 are satisfactory dag tubes which were removed from WWI for replacement by stannic-oxide tubes.

ST742, ST744-1, ST624-C, and ST808 are marginal dag tubes which were removed from WWI for replacement by stannic-oxide tubes.

1.33 Research and Development

(J. S. Palermo) (UNCLASSIFIED)

During the past biweekly period work was started on the sublimation of cadmium sulphide onto glass for Group 25.

1.33 Research and Development (continued)

Several satisfactory samples have been produced and submitted to photoconductive tests and measurements. At this point, however, it is considered necessary to obtain more accurate equipment if uniform and reproducible coatings are to be expected.

During the next biweekly period we plan to sublimate cadmium sulphide onto stannic-oxide coated glass.

SECTION II - AN/FSQ-7

2.1 Group 62Summary and Activities of Group 62

(N. H. Taylor) (CONFIDENTIAL)

A decision has finally been reached to pursue the Charactron as the method of displaying characters for the output-display console on AN/FSQ-7. As soon as we can decide on the size and shape of the tube to be used in XD-1, it will be possible to move ahead in the actual construction of this portion of the system.

The first IBM drum is being tested by Anderson and Boyd, and as soon as suitable read-and-write amplifiers can be connected it will be tested with MTC.

A review of drum systems to indicate the advisability of pursuing larger-diameter drums for XD-1 has resulted in a substantial decrease in the number of tubes necessary to run the XD-1 system. A study was made assuming fairly successful switching of the read-and-write amplifiers to four of the six drum spinners. It appears that between 400 and 700 tubes can be saved by using large drums. Discussions are continuing.

A first review of the output system was presented to a combined Division 6, Division 2, IBM group. A schedule of output plans has been issued by R. C. Hopkins in M-2491.

A two-day meeting with R. A. Sidur and C. A. Smith of Project Ada has revealed an intense interest in our AN/FSQ-7 development on the part of this Project. Particular attention is being paid to the grouping of computers within a sector and our plans for crosstelling and switching during periods of shutdown. It appears that considerable discussion will be forthcoming on these subjects.

A recent tube count of the AN/FSQ-7 was received from Poughkeepsie, indicating that 12,000 tubes would appear in the central machine, including the drums, and an additional 10,000 in the peripheral equipment, including phone-line input, video-mapper display consoles, magnetic-tape units, card machines, etc. This gives a total of 22,000 tubes in one AN/FSQ-7 installation. Studies to reduce this tube count are continuing on all fronts. It appears that an additional saving of several hundred tubes will be possible in the central control by the use of a new basic circuit--namely, a high-powered cathode follower.

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SECURITY INFORMATION

2.12 Magnetic-Core Memories

Miscellany

(W. N. Papien) (UNCLASSIFIED)

Schallerer of Group 63 and Di Nolfo of this section will work with Daggett over the next few weeks in the attempt to get experimental data on WWI core storage. We will try to keep up to date on all the circuit and layout changes and readjustments being made on the WWI memory.

E.R.A. has some interesting sensing and driving techniques which will be studied here as time permits.

64 x 64 Memory

(E. A. Guditz) (UNCLASSIFIED)

Six planes for the 64 x 64 MTC memory are completed. Three of these are ready for use and three have not yet received a final visual inspection. Seven more planes are partially completed.

The present Memory Test Setup is sufficiently different from the previous tester that the name has been changed from MTSV to MTSVI.

Completion of the memory, excepting planes, awaits delivery of the following:

Selection-plane drivers,
Transformers for selection-plane drivers,
Read/Write gate generators,
Memory-driving-line terminating resistors,
Decoder panels.

It is expected that all of these items will be delivered within the next three weeks.

Readout-Noise Reduction

(S. Fine) (UNCLASSIFIED)

A probability-distribution curve of the amount of ONE's held in storage for certain percentages of total time is being compiled. A study of the probability of having random or orderly arrangements of ONE's in the memory is also being undertaken. The information will be used in a Master's thesis for a chapter pertaining to "worst" patterns for various sensing-winding geometries.

2.12 Magnetic-Core Memories (Continued)Switch Cores

(A. D. Hughes) (UNCLASSIFIED)

A thesis proposal is being written and is almost complete. The thesis will be primarily concerned with a large-scale "Olsen" switch. W. K. Linvill has agreed to supervise the thesis.

Preliminary tests of a 16-position metallic switch have been very satisfactory.

Test Setup VI

(R. S. Di Nolfo) (UNCLASSIFIED)

Additional block diagrams have been drawn for Memory Test Setup VI (formerly V) and have been submitted to the drafting room. MAR (Memory Address Register) has been installed and is being checked out.

"Shmoos" were taken on bank A and plane 13A of magnetic-core storage of Whirlwind I.

Core Memory, Mod. II

(W. Canty, J. Mitchell) (RESTRICTED)

Digit-plane-driver plug-in units are being delivered from the shop. Plans are being made to test these units shortly.

The Memory Address Register and the cathode-follower panels have been received from the shop. These panels and the crystal matrix are now being tested. The selection-plane-driver panels and the read-write generator are due in from the shop next week.

On October 29 we visited IBM at Poughkeepsie and worked with the memory group on XD-1 problems. We came to an agreement on a circuit for the selection-plane-driver buffer amplifier.

On November 2 and 3 we visited Engineering Research Associates, St. Paul, Minn., to see their 32 x 32 array tester. Due to the splendid cooperation of their engineers we were able to examine their system closely. Of particular interest was their driver and sense-amplifier transformers which will be investigated here for use in XD-1.

~~RESTRICTED~~UNCLASSIFIED
SECURITY INFORMATION

2.13 Vacuum-Tube Circuits

Summary

(R.L. Best) (UNCLASSIFIED)

Very bad prf response of the input circuit for a flip-flop when a multiple-input "or" gate is used was found to be caused primarily by the circuit rather than by diode recovery time. Several simple modifications are being tried to eliminate the trouble.

We are doing some basic drum investigation with the aid of a core tester which can drive a write head without an intervening transformer. This enables us to observe the effect of changing write-current rise time, amplitude, and pulse length.

Sixteen slave flip-flops are being constructed for a life test. Logically, the circuit is very desirable, since its transition time is only that of the triggering-pulse rise time. It is hard on diodes, however; hence the life test.

Basil Remis is in Poughkeepsie helping to design the high-power cathode follower into control. A modification on this cathode follower was proposed at IBM which gave the circuit gain of greater than unity. This makes the circuit even more attractive.

Slave Flip-Flop

(Hal Boyd) (UNCLASSIFIED)

A slave-flip-flop life-test rack is being constructed and will contain 16 slave flip-flops driving capacitively loaded cathode followers. The purpose of the test is to observe the effects of the slave on its hard-worked clamping diodes and vice versa.

Drum Read-Amplifier

(Hal Boyd) (UNCLASSIFIED)

A read-amplifier containing only two 5965's, one 7AK7, and an input transformer was designed and is being constructed for tests. Gordon Smith of IBM has a copy of the schematic and is also going to experiment on the circuit. Five cathodes represent a considerable saving over the original estimated 9 cathodes.

Specifications will now have to be written on the input transformer to assure working on the flat portion of the gain-vs-frequency curve. Tolerances (tube and component) and marginal checking should be tackled without further delay.

2.13 Vacuum-Tube Circuits (Continued)

Sense Amplifiers

(C.A. Laspina) (UNCLASSIFIED)

The sense amplifier is being modified to accommodate a 6072 in the first stage. The general problem of stability, bandwidth, and feedback is being reviewed.

Simulating bad tubes by means of filament voltage does not give proper characteristics in all type circuits. In circuits where u and r_p are of prime importance, variation of filament voltage is not a good simulation procedure.

Operating at constant bias or constant grid current did not improve the performance of down tubes, while operating at constant plate current did.

Flip-Flop

(S. Bradspies) (UNCLASSIFIED)

It has been found that as extra diodes are placed across the existing High-Speed Flip-Flop the pulse-repetition sensitivity becomes excessive for 2-megacycle bursts.

With no extra diodes placed across input, I found the droop in a chain of pulses to be about 8.5 per cent. Adding one diode increases the droop to 14.5 per cent. Five added diodes means that the droop is 30.5 per cent and 10 extra makes the droop almost 35 per cent. In all cases the first pulse in the chain is the same height no matter how many diodes are added.

A preliminary investigation of moving the damping from the secondary to the primary of the FF input indicates that the results will be far better using this setup. However, it appears that the individual pulse shapes are not very good. This remains a problem to be worked out.

5998 Power Cathode Follower

(D. Shansky) (UNCLASSIFIED)

The absolute margins of this circuit are being taken, the intent being to plot a curve of tube and component "percentages" vs marginal-check voltage. A good portion of the data concerning aging tubes has already been taken.

2.13 Vacuum-Tube Circuits (Continued)

Mod. VII. Core Driver

(D. Shansky) (UNCLASSIFIED)

The "negative half" of this unit is still being debugged.

High-Speed Gate-Tube Circuit

(H.J. Platt) (UNCLASSIFIED)

An M-note is being written describing the investigations carried out on the high-speed gate-tube circuit.

Some of the experience with this circuit is also being written into an experiment on coincidence circuits for Course 6.538.

Single-Shot Multivibrator

(H.J. Platt) (UNCLASSIFIED)

Delay circuits with delays ranging from 3 to 500 μ seconds are needed in some of the input equipment. A search is being carried on to find methods of stabilizing the single-shot multivibrator so that it will not be extremely sensitive to tubes and supply voltages.

Magnetic Drum

(H.E. Anderson) (UNCLASSIFIED)

Intensive work is being done on the timing track circuitry. As soon as 0.4 μ sec pulses which are synchronized with the drum are available, the drum will be moved to the MTC computer room. It is anticipated that this will take place within the next biweekly period. Work on a single track will continue under control of the computer at that time.

IBM has tentatively decided to develop junction-diode write switching for XD-1. An increasing amount of time will be spent in cooperating with this development work.

Delay-Line Circuits

(J.S. Gillette) (UNCLASSIFIED)

No more work has been done on the memory pulse distributor due to lack of pulse transformers. These transformers were ordered over a month ago.

2.13 Vacuum-Tube Circuits (Continued)

Delay-Line Circuits (Continued)

(J.S. Gillette) (UNCLASSIFIED)

More accurate pulse-width measurements were made using the 517 D scope. Pulses at their worst specifications acceptable tend to standardize.

Mr. Hart and Mr. Rasmussen from IBM Circuits Group visited us. They have suggested the possibility of using some "M" derived lumped lines for pulse dodging. Such a line would be a small "component" that could be placed on the end of a 100-drum line and would give a small delay with no additional vacuum tubes.

Shift-Register Core Driver

(J.S. Gillette) (UNCLASSIFIED)

Work on this circuit has been resumed.

Pulse Transformers

(E. Gates) (UNCLASSIFIED)

We expect to receive the first transformers for memory driving from Sprague next week. These will be tested before the transformers are put into production.

I received information on pulse transformers used for memory driving and sensing amplifiers at E.R.A. from Mitchell, Canty, and Ogden who visited there last week.

I am now writing a proposal for my thesis on design and evaluation of transformer drive for a magnetic memory.

2.14 Memory Test ComputerGeneral

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

Details of the control system for selecting among Panel (test) Storage, the two halves of the 64 x 64 magnetic-core array, and the 12 eventual drum fields have been pretty well frozen and put down on paper over the past two weeks. This system is of course necessary in order to operate either the array, which is still expected some time in December, or the drum, one field of which will probably be working some time in January.

The system, known as Group & Field Control, will consist when complete of about one 6-foot x 19-inch rack full of plug-in units, using in all some 110 tubes, plus 86 gating diodes. Drawing SB-47038 is a block diagram of it, and a block schematic will be finished early next week.

New instructions incidental to this system will be: fs, "select field," #21; ft, "transfer field," #17, and fn, "transfer field on negative," #19. The manner in which these instructions function will be explained in a new edition of the MTC Guide to Coding, along with two other new instructions: to, "transfer on overflow," #22, and ic, "index camera," #31.

Success of the Charactron tests over the past two weeks has led to a decision to incorporate a Charactron demonstration console into MTC; further use of MTC to test the Charactron will for the most part await the availability of sufficient storage to program more realistic displays.

Construction and Installation

(R.A. Hughes) (UNCLASSIFIED)

The drum-write gate-buffer panel and the memory address-register gate-buffer panel were installed during the last biweekly period.

Work has started on the standard plug-in mounting panels for drum control and for group and field control

General Circuits

(J. Crane) (UNCLASSIFIED)

The design and physical layout of crystal matrices used in Group and Field Control, MTC, are now completed.

An experimental test model of the Memory Display Scope for MTC is being made.

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2.14 Memory Test Computer (Continued)

MTC Power Supplies

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

Three more supplies have been completed during this period, the -180-v, -140-v, and +10-v. Two supplies remain to be finished.

The -30-v supply is awaiting the arrival of a rectifier unit. The -450-v system will be installed shortly.

The current capacity of the +150-v supply is being increased from 12 amp to 15.6 amp. The capacity of the -150-v supply is being increased from 18 amp to 19.2 amp.

The circuit schematics of the amplifier sections in the entire installation have been brought up to date.

MTC Alternator

(R. Jahn) (UNCLASSIFIED)

The 60-cycle signal in the feedback loop has been reduced by substituting GE IN92 germanium diodes for the original selenium rectifiers. For balanced loads and no load the 60-cycle component is virtually eliminated. Unbalanced loads will cause the noise signal to increase.

MTC Records

(L. Sutro, B.J. Kollet) (UNCLASSIFIED)

Drawings in the MTC Service File are being marked up to be sent to Drafting, where, after revision, they should correctly represent the circuits and assemblies in MTC. Marking up of prints has been completed for nearly all of the Accumulator.

Cards are being prepared showing the Tube Complement of each panel in MTC. When these are completed, cards will be prepared to hold the history of each panel.

2.15 Equipment Design and Schedules

(J. D. Bassett) (CONFIDENTIAL)

A visit to High Street during the week of October 26 showed that the video-mapping program is rapidly approaching the end of phase one in the subcontract with Bendix. Most of the circuitry is essentially complete, and transfer of responsibility to Bendix should go smoothly when the due

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2.15 Equipment Design and Schedules (Continued)

(J. D. Bassett) (Continued) (CONFIDENTIAL)

date arrives. Lack of a final pluggable-unit design has slowed packaging decisions for data counters and SDV demodulator equipment somewhat, but a final pluggable-unit design was scheduled for engineering release on Monday, November 2.

A second meeting of the Lincoln Laboratory Standards Subcommittee on good construction practice (GCP) was held on Monday, November 2. J. Bassett was nominated chairman of the committee, which will produce manuals on accepted shop practices consistent with good engineering methods and an engineering design manual crossreferencing military specifications and requirements.

Considerable effort has been spent on a study of methods for illuminating the pushbuttons to be used in AN/FSQ-7 manual-input panels. This work is being done in cooperation with J. Newitt in order to avail Group 62 of experience gained in the Cape Cod experimental system.

J. Newitt, C. Corderman, and J. Bassett tentatively plan to visit the IBM Vestal Lab on November 18 in connection with the output-display console subcontract. Anyone wishing to transmit information or materials to R. Mork's group in this connection may contact one of the three above-named men during the week of November 9.

(W. Ayer) (UNCLASSIFIED)

The floor plan of the basement of Building A has been completed and has received the approval of R. Crago and the Engineering Design Office at High Street. As soon as final approval is obtained from the interested people here the drawings will be turned over to the cooling equipment consultants to allow them to lay in the ductwork. Estimates of the partitioning cost will also be drawn up in the near future.

Power Supplies

(J. J. Gano) (UNCLASSIFIED)

We are collecting information to determine what effect the addition of equipment to permit paralleling of primary-source transformers and motor-generator sets may have on reliability. We are also trying to determine whether this feature may substitute a more frequent disturbance on the system than the omission of paralleling. It is also planned to itemize costs of components for the consideration of the economics of frills. A trip to Pittsburgh to talk with representatives of Westinghouse, the supplier of the a-c controls, is scheduled for the week of November 9.

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SECURITY INFORMATION

2.16 Transistors

Trip to Whippany

(D.J. Eckl) (UNCLASSIFIED)

On October 28 and 29 I. L. Lebow of Group 24 and I attended a symposium on the Tradic Computer being constructed at Bell Laboratories. The highlights of the trip will be described in a memo which should be available soon.

Transistor Accumulator

(D.J. Eckl) (UNCLASSIFIED)

The accumulator has been in operation a total of 8340 hours. The recent substitution of plug-in VT flip-flops and gates for the low-speed 2⁵ counter has improved operation. In the past weeks errors have ranged from 0 to 10 per day. However, the removal of a 6Y6 with a very touchy top short from a regulated power supply connected to the transistor gates should improve matters.

Transistor Delay-Line-Type Core Driver

(S. Oken) (UNCLASSIFIED)

A method for stabilizing the amplitude of the output from the core driver has been devised. The idea is somewhat like that used in base stabilization except that in this case the diode, battery, and resistor combination is placed in the emitter circuit. The I_e maximum is limited. This in turn limits the output-voltage pulse.

Some transistors give extended output-pulse widths when used in this circuit. The probable cause for this is the "hole storage" in the transistor. I will try to correlate the transistors which give this large width with a bad "storage coefficient".

A large number of RCA TA165's and new 611A transistors have been and are still being tested in the circuit to determine the output-pulse variations and the parameters which make a transistor work well in this circuit.

Minority Carrier Storage

(N. T. Jones) (UNCLASSIFIED)

The p-n grown junction diode mentioned in the last Biweekly was manufactured by Western Electric, not Westinghouse Electric as it appeared in the Biweekly. A paper on the forward conduction delay in these diodes

2.16 Transistors (Continued)

Minority Carrier Storage (Continued)

(N.T. Jones) (UNCLASSIFIED)

is now being prepared by Kingston of Group 35, Lincoln. This will be co-authored by myself and Neustadler of Group 35.

Samples of five special transistors from Bldg. 22 have been tested and are undergoing several extensive storage experiments. It is planned to continue receiving these samples in the course of studying storage. In every case, however, these will be returned and not used for general circuit work for some time yet.

Life Tests

(N.T. Jones) (UNCLASSIFIED)

R. Burke has begun the final assembly of the new transistor-life-test racks and equipment. Within a very few weeks these new life tests should be under way.

Transistor Gates

(C.T. Kirk) (UNCLASSIFIED)

The regenerative transistor gate mentioned in the previous Biweekly has been found to work satisfactorily. The circuit is being analyzed to determine the optimum circuit parameter values. Some difficulty is being experienced in determining the analytical conditions for which the transistor, once turned "on," turns "off".

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2.17 Display

(C. L. Corderman) (CONFIDENTIAL)

A meeting was held at Project High on November 4 to choose a character-display method. The decision was made that Charactron tubes would be used. This decision was based upon the superior character quality obtained and the fact that distribution-system requirements are less stringent than in a dual deflection system in which characters are formed by a serial display of dots. The present disadvantages of Charactron tubes are the longer display time required, a slight misregistration between characters as they move over the tube face, and the requirement of post-matrix acceleration.

The display time is longer for Charactron tubes because for each character selected a correction signal must be applied through the magnetic yoke. It is felt that a small-angle electrostatic deflection system might be installed in the yoke region. This system would be used for character compensation, character position, and for making the vector. The time required per character would be halved by using this arrangement. Character misregistration can be improved by using a smaller character matrix and by making slight changes in tube and convergence-coil geometry. A maximum error of 0.2 character height is felt to be acceptable. This assumes a character height between 0.08" and 0.10". The problem in post acceleration is to be able to cover the entire tube face without requiring excessively high deflection angles, i.e., getting the required over-all voltage without serious loss of deflection sensitivity. It may be possible to obtain all or part of the required acceleration between the matrix and the deflection yoke. Two tubes will be reprocessed by Group 65 during the week of November 9 to evaluate this scheme and electrostatic compensation.

After some minor equipment changes a Charactron console will be left connected to MTC pending additional display tests with the high-speed memory and magnetic drum. A second Charactron setup is being assembled in Barta for demonstration and further tests. This should be operating with a limited display selection by November 13.

(R. von Buelow) (CONFIDENTIAL)

Minutes of the meeting on console design were published in Memorandum M-2499.

Memorandum M-2502 on a tentative value of console and display-system power is coming out early next week.

Comparison was made between the Charactron and dot sequential system of character generation. The Charactron was selected as the system to be used in XD-1. Development will continue on the other system, however, as a precautionary measure. Charactron was selected on the following points:

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SECURITY INFORMATION

2.17 Display (Continued)

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

1. Better quality of characters.
2. Greater ease of transmission from the central display control of character-deflection data.

The only real advantage of the dot sequential system was its greater speed, and this could not be an influencing factor since the Charactron can display all required data in 2.4 seconds. (This is using pessimistic parameters.) With the other system the rate could be dropped to about 1.8 seconds which is no more desirable than a rate of 2.4 seconds.

There was considerable discussion on M-2453, "Track Situation Scope Displays for XD-1." A revised and more flexible system has been agreed upon by IBM, Group 61, and Group 62. A memorandum will be published shortly explaining this new proposal.

(L. B. Martin) (UNCLASSIFIED)

Charactron amplifier cooling-air blower mounts and flanges were designed. The chassis and associated sheet-metal work for a second Charactron display was followed through the shop and partially assembled.

Preparations have been started for setting up a display in Barta Building.

(R. H. Gerhardt) (CONFIDENTIAL)

D. C. Ross of IBM was here September 28 to discuss display problems.

It appears that pyramid configurations of the category "or" circuits at every display console will reduce the driving current on every category considerably. Pyramid configurations of "or" gates require additional diodes, however.

The latter part of this biweekly period was spent examining the digital-expansion scheme suggested by K. Olsen. A proposal covering the methods of digital expansion will be written.

(J. Woolf, H. Zieman) (UNCLASSIFIED)

The magnetic amplifiers have been modified to increase the loop gain in order to reduce the distortion introduced in the Charactron. Noise introduced through 60-cycle pickup was minimized by adding a 60-cycle signal out of phase with the noise signal.

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2.17 Display (Continued)

(J. Woolf, H. Zieman) (Continued) (UNCLASSIFIED)

The selection amplifier was modified to give rotational control of the selection axes.

A new decoder preamplifier is being designed which will convert a single-sided signal into a push-pull output.

(M. Epstein) (CONFIDENTIAL)

Work was continued on studying digital-display requirements of individual consoles. A report was written on a method of digital display which allows the computer to change display arrangements in a flexible manner. It will be published in the next biweekly period.

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SECURITY INFORMATION

2.2 Group 63 (Magnetic Materials)

(D. R. Brown) (UNCLASSIFIED)

Continued breakdown of both the MIT core handler and the IBM core handler has caused a delay in the core-testing program for Core Memory, Mod. II. Testing is expected to require until November 13.

Core testing for AN/FSQ-7 has begun at High Street. Sample tests are being made for all batches received from General Ceramics.

A new General Ceramics body, MF-1393, has low coercive force, approximately 0.5 oersted, and high squareness ratio, 0.95.

Ferrite cores having 0.080-in. outside diameter and 0.050-in. inside diameter and suitable for use in AN/FSQ-7 have been made in our ceramics laboratory. The pulse characteristics seem to be somewhat better than those of General Ceramics.

Tests on WWI Magnetic Storage

(J. W. Schallerer) (UNCLASSIFIED)

Digit 13 in Bank A has had several parity alarms in the last few weeks. In an effort to track down the cause two marginal-checking diagrams were taken this week. One was taken on the whole memory and the other on digit 13 only. Results indicate that digit 13 set the limits of operation when $I_x = I_y = I_z \approx 475$ milliamp.

All currents were set to 425 milliamp. This setting gave wide margins on both the alternate- ONE's -and- ZERO's and the inchworm programs.

Plane Tests for Core Memory, Mod. II

(J. R. Freeman) (UNCLASSIFIED)

Twelve planes have been tested for replacement of irregular cores prior to installing the sense and the digit-plane windings. Considerable improvement has been made in the testing equipment and technique. Approximately three hours are now required to test one plane. Cores are checked for uniformity of output throughout the plane. Uniformity in disturbed-ONE output is kept to approximately +15 millivolts, and overdriven cores which exhibit differences of approximately 20 millivolts or more between the undisturbed ONE and the disturbed ONE are also replaced.

Photographs of the outputs of all marginal and replaced cores are made. After removal all replaced cores are checked under a microscope for physical damage. To date nearly half of the replaced cores have been chipped. The source of chipping will be investigated. An average of approximately six cores per plane is being replaced.

2.2 Group 63 (Continued)

Ferrite-Core Pulse Tests

(J. W. Schallerer) (UNCLASSIFIED)

Approximately 65,000 cores have been turned over to the array-construction group to date. About 20,000 more cores are needed to complete the Core Memory, Mod. II. These cores are to be tested and turned over before the end of the next biweekly period.

The semiautomatic core tester has been working well the last week. The automatic core tester has had only two days of satisfactory operation in the same period. Most of the trouble seems to be cleared up at present, and it is expected that the tests per day will increase.

(E. J. Stevens) (UNCLASSIFIED)

Core evaluation was continued during this period. Two DCL samples (DCL-2-281D-1, DCL-2-281E-1) were evaluated and it was observed that the deltas at strobe time appeared nil. The actual values of the half selects were too low for measurement (whl, whz < 0.02 mv). In all other respects the two DCL samples were comparable to General Ceramics cores.

Time was also spent with semiautomatic and automatic core testers.

Ferrite Synthesis

(J. Sacco) (UNCLASSIFIED)

Test results of the latest firing of F-394 cores from batch DCL-2-281 show that this material may be suitable for computer applications.

Two new MnO.MgO.Fe₂O₃ series are now being prepared in an endeavor to compile further data in this ternary system. Cores from one series will be fired and ready for testing within a week. Meanwhile, whenever processing facilities are available, a number of large batches are being prepared for the production of F-394 cores.

Pilot-Plant Production of F-394 Cores

(R. A. Maglio) (UNCLASSIFIED)

Approximately 13,000 cores have been formed of the F-394 size from the DCL-2-281 composition. These cores will be fired on Monday, November 9, according to a firing cycle derived from initial test firings of small batches of these cores.

2.2 Group 63 (Continued)

(R. A. Maglio) (Continued) (UNCLASSIFIED)

There are a number of large batches of $MgO.MnO.Fe_2O_3$ mixtures under preparation for use in the production of F-394 cores. These batches are of composition such that they are located slightly to the right of the $MnO.MgFe_2O_4$ line and close to the 0.9 squareness region as indicated in Memorandum M-2442, "Ferrite Synthesis," by Frank Vinal.

These materials are being prepared to intensify the study of this region of composition as well as to have a stockpile of good material on hand.

Differential Thermal Analysis Study of the $MgO.MnO.Fe_2O_3$ System

(R. A. Maglio) (UNCLASSIFIED)

Compounds which have been tested are: kaolin, quartz, MnO_2 , $MnCO_3$, Fe_2O_3 , and $MgCO_3$. The kaolin and quartz were tested for the purpose of checking the instrument and apparatus arrangement. The other materials have produced information which conforms to the literature as far as indication of thermal change is concerned. However, the change of chemical composition or phase has not yet been identified.

Chemical Analysis

(F. S. Maddocks) (UNCLASSIFIED)

A preliminary chemical analysis of General Ceramics MF-1331 microwave gyrator body material has been completed.

Difficulties with the determination of manganese ion have been cleared up, permitting purity checks of ingredient manganese carbonate.

A chemical analysis of material in use by RCA for ferrite-core production has been started.

Single Crystals of Ferrites

(F. E. Vinal) (UNCLASSIFIED)

The past, present, and future of this topic have become the subject of an evaluation program. The past phase offers little information about ferrites but an abundance about crystal-growing techniques, at least a portion of which will be applicable. The present phase calls for meetings and discussions with those already engaged in attempts to synthesize ferrite crystals. The most important of these meetings are scheduled for the next two or three weeks.

2.2 Group 63 (Continued)

(F. E. Vinal) (Continued) (UNCLASSIFIED)

The interest in such crystals is to permit evaluation of certain physical constants of ferrites. It is necessary to consider whether or not the great interest and activity with crystals presently available would require repetition in the event of availability of crystals with improved stoichiometry. Also it may be desirable to concentrate on certain crystals in preference to others for physical or chemical reasons.

Studies on Mn₃O₄

(J. B. Goodenough, A. Loeb) (UNCLASSIFIED)

The major outline of the chemical and physical processes affecting the structure, electric conductivity, and magnetic properties of Mn₃O₄ has been worked out. A note covering the theoretical considerations is being written.

Arrangements have also been made to measure the magnetic susceptibility of Mn₃O₄ from liquid He temperatures. An investigation as to whether or not there is a ferrimagnetic Curie point at low temperatures or an antiferromagnetic Curie point at high temperatures is planned.

The Switching Coefficient

(N. Menyuk) (UNCLASSIFIED)

As reported in the previous Biweekly Report, an investigation is being made to determine the corrections which must be made to the switching coefficient S_w $((H-H_0)\tau)$ when dealing with ferromagnetic materials with nonsquare hysteresis loops. This corrected value can then be used to determine various fundamental parameters of the material. For this purpose the behavior of a ferrite core has been investigated under various stress conditions, and the data is now being correlated and compared with theoretical predictions.

A preliminary survey of the data indicates that the measured value of S_w does not differ markedly from the corrected value which should be used in its place. This agreement, however, is somewhat accidental. The value of the threshold field is found to vary with the magnetization of the material; therefore, considerable care must be taken in interpreting the parameter.

SECTION III - CENTRAL SERVICES

3.1 Purchasing and Stock

(H. B. Morley) (UNCLASSIFIED)

An itemized inventory of about 2200 Standard Stock components and about 250 stationery items, with dollar value of every item, is scheduled for completion 6 Nov. for forwarding to Lincoln Property Officer. The Kardex inventory-control system, showing individual costs per item, provided the bulk of the basic information and again proved its value to us.

This department continues to cooperate closely with Standards personnel in both Division 6 and the new Lincoln Standards Committee. We have taken great pleasure in assisting and watching the Standards Program grow from its beginning in this department in 1948 to its present status as a fundamental to sound engineering and procurement practice, which will eventually embrace all the Divisions of the Lincoln Laboratory.

The October 1953 activities analysis shows an increase of 29% in orders placed and an increase of 26% in their dollar value over September 1953.

For October, the following is the tabulation of orders received:

<u>Month of October</u>		
<u>Total Orders Received-402</u>		
Received on time	166	41%
Received 1-7 days overdue	113	28%
Received 8-14 days overdue	43	11%
Received 15-21 days overdue	21	5%
Received 22-28 days overdue	14	3%
Received 1-2 months overdue	24	6%
Received 2-3 months overdue	10	3%
Received 3 or more months overdue	11	3%
	402	100%

3.2 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 25 Construction Requisitions totaling 381 items satisfied since October 23, 1953, and there are 24 Construction Requisitions totaling 1650 items under construction by the Group 60 Electronic Shops.

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

3.2 Construction (Continued)

Outside Vendor

(J. V. Mazza) (UNCLASSIFIED)

There are 5 orders now open with vendors, totaling 438 items. Deliveries in the past biweekly period have totaled 814 items. Information on specific orders may be obtained from the writer (Ext. 3476).

3.3 Component Analysis and Standards

3.33 Standards

(H. W. Hodgdon) (UNCLASSIFIED)

Standard Sheets issued this period were:

6.200	Electron Tube Test Specifications	(Rev.)
6.200-1	Tube Connections	(Rev.)
6.201	Vacuum Tubes, Preferred Types	(Rev.)

An additional clerical employee is being obtained for this office. She will take over the task of indexing and distributing the IBM Military Reference Data Books. As this work tapers off, it is anticipated that standards work will be increasing in about the same proportion.

The proposal on Fixed Composition Resistors submitted to the Lincoln Standards Committee is now in final form and will be issued shortly. The draft on Fixed Film Resistors is still being considered.

Since the Lincoln Standards will supersede Division 6 Standards when issued, I propose to call brief meetings of our own Standards Committee to consider each Lincoln Standard as soon as it is drafted in final form. This will acquaint our people with the form of Lincoln Standards and determine whether it will be necessary to make any special provisions to cover the needs and interests of Division 6.

3.34 Vacuum Tubes

(H. B. Frost) (UNCLASSIFIED)

During the past few weeks the receiving-tube engineering and research section has undergone considerable revision. Ted Clough, Al Zacharias, and Earl Harvey have been transferred from Group 65 to this section. These transfers were made in order that sufficient manpower could be available for evaluation and testing work in conjunction with the tube-development contracts for AN/FSQ-7.

3.34 Vacuum Tubes (Continued)

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

A visit was made to the General Electric Tube Plant in Owensboro, Kentucky, on October 22 and 23. Conferences with the GE engineers on specifications, construction, and testing of the Z-2177 revealed considerable progress. There is reason to believe that the Z-2177 will be a very good tube. Any improvements lacking will be those that GE does not know how to provide.

A very useful group of progress reports on vacuum-tube development programs was received through the Armed Services Technical Information Agency. These reports revealed the modi operandi of various tube companies. Such information is very useful in evaluating the work done on tube-development contracts.

A new method of determining interface impedance has been developed by Prof. Walter Jones at Cornell. I have made an analysis of this method which reveals an inherent error of 50 per cent for values of interface impedance that are small compared to the dynamic conductance of the tube under test.

A life test of six 5899 tubes has completed about 5600 hours. At this time one tube is inoperative due to excessive cathode flaking. All others are in excellent condition with less than 0.5 ohm of interface resistance and good maintenance of transconductance. These tubes use a relatively new cathode alloy, Superior A-31. This alloy is active but contains little silicon, the basic cause of interface impedance. Thus it appears that a material for cathodes is now available that will not cause interface impedance but which does not possess the objectionable features of 499 alloy. Four-nine-nine alloy is free of interface impedance, but it is very difficult to "activate" in manufacture. The flaking tendency of A-31 alloy was peculiar to one melt and has been corrected.

A considerable part of my time remains devoted to thesis research, and progress in most areas continues. During the past several weeks the diffusion equation which describes processes taking place in oxide cathodes has been coded by Jack Porter. Three short 5-minute runs were made to eliminate tape and programming errors. On November 6 a run of 90 minutes was made. This run was successful, but only about one-third of the calculations for one parameter were made. This rather slow performance is caused by the length of time (0.1 second) required by the present square-root subroutine for 24-6 numbers. Special information available in this problem allows a simplified and faster subroutine to be used for the square-root operation. This modification will probably be tried out in the very near future.

Tests on RT413 have shown that it was not seriously affected by exposure to air while being processed.

3.34 Vacuum Tubes (Continued)

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

Repeated difficulties have been encountered in efforts to evaluate the coating resistance by the retarding-potential method originally proposed. The problems are quite basic being associated with trajectory and space-charge potential conditions. A discussion of these problems with Dr. Nottingham has resulted in some new avenues of approach which may give the needed answers. This evaluation of coating resistance is basic to my thesis research.

One result shows that major changes can take place in a cathode even though the potential applied to the tube is less than that required to decompose contaminating films within the tube. This result indicates that a diffusion process is operating, but it is not sufficient to verify my theoretical results.

A technique has been found for investigating the effects of steady-state current on a cathode. A fixed pulse is superimposed on a variable steady-state base. Changes in pulse current as a function of the steady-state current should yield information on the change in emission with steady-state current through the cathode.

Two additional tubes will be constructed in the near future with heavy cathode coatings. These tubes will be useful in verification of the theory.

(S. Twicken) (UNCLASSIFIED)

The major portion of the past biweekly period has been spent in debugging the new Tube Tester, Mod. III. It should be in operation during the week of 9 November.

(T. F. Clough) (UNCLASSIFIED)

During this biweekly period I was transferred from Group 65 to Group 60.

I have spent my time becoming familiar with procedures in this section, administrating the tube shop, keeping records, and assisting other members of the section as the circumstances required.

(A. Zacharias) (UNCLASSIFIED)

For the past two weeks I have been working with Saul Twicken on the Tube Tester.

3.4 Test Equipment

Test Equipment Committee

(L. Sutro) (UNCLASSIFIED)

Coordination with the test-equipment program in the other divisions of Lincoln Laboratory is beginning. On October 20 members of the Committee met with Mr. G. O. Johnson who is in charge of the construction and maintenance of test equipment in all Divisions except Division 6. It was agreed that the commercial test equipment belonging to Division 6 as well as that belonging to other Divisions could probably be maintained and distributed entirely by Johnson's men, while standard test equipment would continue to be maintained by Division 6. On November 12 the Committee will visit the instrument rooms in Buildings 22 and E.

Test Equipment Headquarters

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

October 23 was spent at IBM's High Street laboratory where we conducted a seminar on the use of standard test equipment and gave advice on how to maintain both standard test equipment and scopes.

Seventy-six pieces of standard test equipment are being made ready for shipment to Ken Olsen who will assemble them into an arithmetic element at IBM.

3.5 Drafting

Illustrations for Drawings for Professional Journals and Trade Magazines

(A M Falcione) (UNCLASSIFIED)

There have been several instances in the past where engineers have brought drawings to the Drafting Department to be used in a Project memorandum. The drawings were completed by DCL standards. At that time the engineers submitted copies of these drawings to a Professional Journal for publication and discovered that the drawings were not acceptable and had to meet a specific set of rules. It was therefore necessary that these drawings be redrawn to the publication standards, which entailed many hours of extra drafting work. It is very important that engineers notify Drafting that the illustrations which they desire are to be used for publication in a professional journal or trade magazine in addition to a Project Memorandum. With this information available the Drafting Room will make the drawings in accordance with the prescribed standards required by that journal or magazine.

3.5 Drafting (Continued)

Drawings for AN/FSQ-7

(A. M. Falcione) (UNCLASSIFIED)

Inasmuch as the Project is now working on drawings for various systems such as WWI, MTC, TE, etc., it is very important that engineers notify Drafting whenever any drawings are to be made for AN/FSQ-7 which require special drawing formats, as referred to in Memorandum M-2484, it will also insure that the drawing receives the proper drawing number which has been assigned to AN/FSQ-7.

"MIT Drafting Procedures for AN/FSQ-7," now being written for distribution to staff members in Groups 60, 61, and 62.

Whittemore D-C Supplies

(S. T. Coffin) (UNCLASSIFIED)

A new regulator panel is being designed for the Whittemore +250-v lab supply. This regulator will have high gain and high speed similar to our other new supplies and will serve as a prototype for all of the other old WWI rack-mounted supplies.

3.6 Administration and Personnel

Terminated Staff

(J. C. Proctor) (UNCLASSIFIED)

G. A. Murdoch
D. Goldenberg

New Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

James Mahoney has returned to the Laboratory and is now a member of the Whittemore Building janitor crew.

Charles Muhle is a new technician in Group 64, temporarily assigned to the Construction Shop.

John A. O'Brien is a new technician in the Construction Shop.

Ralph Porter is another new technician in the Construction Shop.

3.6 Administration and Personnel (Continued)

Terminated Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Gordon Kane
Michele Rheume
James MacDonald

Open Non-Staff Requisitions

1 Clerk (Ditto Machine Operator)
1 Clerk Typist
1 Laboratory Assistant for Group 63
1 Laboratory Assistant for Group 6345
1 Messenger Girl
2 Technicians for Group 64
2 Technicians for the Inspection Department
1 Senior Detailer