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Memorandum M-2550

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

SUBJECT: BIWEEKLY REPORT FOR DECEMBER 4, 1953

To: Jay W. Forrester

From: Division 6 Staff

CLASSIFICATION CHANGED TO:
Auth: <u>DD 254</u>
By: <u>KL Everett</u>
Date: <u>2/1/60</u>

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SECTION I - CAPE COD SYSTEM

1.1 Group 61

1.10 General

(R.J. Horn, Jr.) (CONFIDENTIAL)

A general plan for the new radar-mapper installations to be set up in Room 228 has been worked out. Several new features are included: redisplay of unmasked data, light-splitting mirror to eliminate parallax, tilted surface, and improved calibration marking system.

Various minor changes in the control-center equipment continue to be designed and installed.

Equipment reliability reached a new high this period; 93.6 per cent of the time operations were completely unhampered by equipment troubles.

A Navy picket vessel will commence operations in an area under Cape Cod surveillance around 14 December.

The experimental schedule is limited at the moment by the availability of aircraft and by the heavy demonstration schedule.

A new smooth-and-predict program has been finished and has passed initial tests.

Considerable attention is being devoted to XD-1 problems - order code, card preparation, displays, personnel organization, and so forth.

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1.11 Equipment Engineering

(E.S. Rich) (CONFIDENTIAL)

A general plan has been worked out for the new radar-mapper installation to be set up in Room 228. This plan concentrates most of the electronic circuitry in Room 156 in plug-in units to minimize the amount of video cabling and to facilitate maintenance work. The mapper consoles, which are relatively inaccessible for maintenance, will contain only the high-voltage power supply, the azimuth drive motor and synchros, the sweep circuits, the cathode-ray tube, and the phototube pickup circuits. The Room 156 installation is being coordinated with Group 64 so that it will be properly integrated with the MITE and the SDV demodulator installations.

The following are some of the features planned for the new mappers:

- a. Redisplay of unmasked data so an operator can accurately determine the boundaries.
- b. A light-splitting mirror associated with the phototube pickup to eliminate parallax errors in mapping.
- c. Calibration circle and north strobe can be superimposed on the data display without being picked up by the phototube as data.
- d. Push button will give automatic north alignment for initial synchronization of the azimuth unit. Subsequent azimuth adjustment will be by a handwheel as at present.
- e. Mapping surface will be tilted instead of horizontal.

(N. Alperin) (CONFIDENTIAL)

The new light-gun plug-in circuits are under construction.

(H.J. Kirshner) (CONFIDENTIAL)

Two demodulator panels have been modified for use as a new Truro demodulator. Substitution of this equipment for the present Truro demodulator will be undertaken as soon as video cabling from the two units is complete.

A relay switching panel has been installed for the purpose of directing demodulator output pulses from Room 156 to Room 224. When video cabling is complete, this panel and associated equipment will permit the comparison of input phone-line signals with the demodulator video output signals.

Compilation of all available data relative to Cape Cod System telephone lines and equipment in one document is in progress.

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1.11 Equipment Engineering (Continued)

(D. Neville) (CONFIDENTIAL)

Considerable time has been spent in locating transmission trouble in D/L (Data Link) between here and Prospect Hill. It has been definitely located as the F-M receiver at Prospect Hill. Steps to eliminate this weak link in the system have been taken and consist of a receiver modification, correct receiver alignment, and a standby receiver at Prospect Hill.

Arrangements have been made with AFCRC for our equipment to transmit from 0800 to 1700 Tuesday through Friday, except when they make arrangements for special tests with their equipment. Our transmissions will be test messages, except when flight tests with WWI are made, from this date on.

(J.H. Newitt) (CONFIDENTIAL)

Part of the period was spent making a questionnaire-outline of the system data to be considered in relation to the XD-1 console design. The latter part of the period was spent with IBM personnel and members of Group 62 attending indoctrination lectures and demonstrations on the TWS (Track-While-Scan) operation. Further investigation of non-TWS features of SCC (Special Cape Cod System) is planned by J. Bassett and myself as soon as time will allow.

In addition to the above, work on SCC improvement continues. A new type speed and heading panel assembly is being designed and will be available for trial soon. This assembly will provide a heading-selector switch of the rotary type (8 positions) while the speed switch will be a 5-push-button affair. An order has been placed for 16"-scope implosion protectors made of light yellow Plexiglas. Tests have shown these to be quite effective in reduction of the blue flash (about the same reduction as afforded by orange cellophane) without impairing the light-gun operation.

The fabrication of mechanical switch stops (for unused switch positions) has been started. Instead of merely stopping a button from working (as originally contemplated) these will completely replace the regular button and thereby produce a different "feel" for ease of identification. In addition to their action of obviating the use of the position, they will allow positive and rapid identification of a stopped position without visually distracting the operator.

The installation of illuminated panels in the control center has been somewhat behind expectations due to large order revisions in the engraving nomenclature. This has imposed a heavy load on the Lexington engraving facilities, and other cleared sources are now being sought for this work. The display and insertion switches should all have illuminated labels within the next few weeks (although revisions will continue indefinitely). Other items such as the DID scopes, the indicator lights, and other miscellaneous items will be provided with illuminated labels as soon as possible thereafter.

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1.11 Equipment Engineering (Continued)

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

Installation of the monitor scope is awaiting construction of the switch panel. Drawings for this panel have been completed and graded, and the panel should be installed on December 21 at the latest.

An experimental scheme for illuminating the CRT face with polarized light should be installed on Y33 next week. This scheme will also reduce parallax by lowering the safety glass.

(G. A. Young) (CONFIDENTIAL)

The equipment in Room 222 and adjacent areas was checked out three times during the last biweekly period with Air Force personnel manning the stations. These checks have been very successful in pointing out faulty equipment. Few errors have been detected, and most of these have been fixed on the spot or immediately following the checkout.

The programs recorded on magnetic-tape unit 0 now include all of the latest modifications brought about by equipment changes and refinements in the checking procedure.

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1.12 Data Screening

(R.L. Walquist) (CONFIDENTIAL)

Discussions have been held with E. Rich on the layout of the mapping area in Room 228. A supervisory position is to be included where it will be possible to see the results of the mapping operation for any one of the input radars. Communication to the mapping room will be through this position. The possibility of presenting the mapped-out areas to the operating personnel in the Combat Center was also discussed. It was decided that equipment would be installed in order to try this on a long-range set.

Nothing has as yet been done on calibrating the radar network, even though the necessary program has been available for several weeks. Aircraft availability has been a big bottleneck along with the large number of demonstrations of the Cape Cod system. Calibration will not be possible during the next two weeks due to the schedule of three demonstrations per week taking almost all daytime computer time and all available aircraft. Part of our difficulty with tracking aircraft near Otis and Bedford is due to this lack of calibration. One flight test this past biweekly period indicated that Chatham and S. Truro were out of calibration by about 4 miles. Failure of consistent returns from both radar sets and the difference in antenna speeds caused the tracking program to jump between the returns from Chatham and S. Truro. The 4-mile difference in the returns coupled with nonlinear smoothing raised havoc with the resulting track velocity and position carried by the computer.

A considerable part of the biweekly period was spent on reviewing the XD-1 order code and the proposed track-display system. In conjunction with D. Israel and other programmers in Group 61, several possible modifications were proposed.

A new speed and heading switch arrangement for the TWS positions has been discussed with J. Newitt. The present switches use an 8-position pushbutton switch for speed and another 8-position switch for heading. The proposal is to use an 8-position rotary switch for heading and only a 5-position switch for speed. These two switches would be mounted one above the other on a 4 in. x 12 in. panel instead of separately on two 2 in. x 12 in. panels as is now done. The 5-position speed switch would allow speed to be inserted to the nearest 100 mph and should be adequate for initiation and monitoring.

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

The new Smooth and Predict program has been finished and has passed initial tests with the rest of the Cape Cod program. I am now working on an analysis program to compare the presently used Smooth and Predict program with the new Smooth and Predict program which incorporates a different type of breakpoint calculation.

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1.12 Data Screening (Continued)

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

Training of the Air Force personnel has not proceeded as well as it should. The primary reason for this is lack of programmers' time for training the airmen. Several constructive suggestions have been made by the airmen as well as the programmers regarding equipment and procedures. Some of these suggestions await discussion for clarification and refinement, particularly suggestions concerning telephone communication within the system.

(D.L. Bailey) (CONFIDENTIAL)

Writing of the Buffer Drum Program was completed during this period, and the program will be tested beginning the week of Dec. 7.

(H. Frachtman) (CONFIDENTIAL)

A record of Track While Scan performance data has been started.

Some thought has been given to the problem of evaluating the transient response of the TWS system.

An exploratory program which will record the monitor situation has been planned.

(J. Ishihara) (CONFIDENTIAL)

Considerable effort has been made in setting up a Pre-Operation Check Schedule. The first week's operation of this setup on flight-test days was very satisfactory, thanks to the full cooperation of operators and all others concerned. A revision of the "Operator's Checklist," "Program Error Report," and "Post-Operation Checklist" are being drawn up in an attempt to further improve operations.

"Up to Date" Manuals, Program Copy, and Logs for the 1953 Cape Cod System are being completed with the assistance of Knapp and Gaudette of the Weapons Direction Section. Since no further major modifications are contemplated some headway can be expected in this effort.

Preliminary "static" test of the Mark X Correlation Program has been completed; no obvious errors were detected. A short "dynamic" test was unsatisfactory; the trouble has not been localized so further testing will continue.

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1.12 Data Screening (Continued)

(H. Peterson) (CONFIDENTIAL)

This biweekly period was a continuation of work done during the previous period: observed equipment checkout, instructed monitors, worked on data-photographing program and on post-history display program.

(H.H. Seward) (CONFIDENTIAL)

A program for clearing (to *0) all or individual drum groups is now available. Peterson's camera-control program and Bailey's buffer-drum test program are being checked prior to initial computer operation. Part time was devoted to thesis work.

(E.W. Wolf) (CONFIDENTIAL)

Memorandum M-2498, entitled "Storage of Programs on Magnetic Tape," has been issued. Good progress has been made in the writing of the dual-tracking calibration program mentioned in earlier reports. A number of refinements in the single-tracking calibration program have also been made.

(W.M. Wolf) (CONFIDENTIAL)

The calibration program for offset controls on the 16-inch scopes has been checked out as has the Group 0 utility start-up program.

A discussion was held with Jim Uskavitch of Group 22 concerning combined efforts of analyzing data. The correlation-data analysis program was run with the data from Nov. 13. The results are forthcoming.

A renewed attempt has been made to improve the mapping material used in the Cape Cod System mapping room.

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1.13 Tracking and Control

(J. Arnow)

See M-2251 (Secret) for this entry.

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

The special calibration program mentioned a month ago has been checked out completely; the radar timing program only partially (due to equipment difficulties).

Certain anomalies in the n/s-2c parameter determination program data have come to light. Furthermore, it is felt that the criteria used for selection of parameters were not sufficiently comprehensive. Therefore, a new and more thorough program is being undertaken.

(H. Neumann)

See M-2551 (Secret) for this entry.

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1.14 Weapons Direction

(D. R. Israel) (CONFIDENTIAL)

Progress in the evaluation and study of the operation of the 1953 Cape Cod System has been severely restricted during the past two weeks. At the present time, the heavy demonstration schedule and the scarcity of flight-test aircraft limits our experimental program. A review of the aircraft requirements for the next year indicates that a minimum program should include two flight tests per week. A small test involving five target aircraft would be conducted on demonstration days; a large test involving ten or more aircraft would be conducted for experiment purposes.

The Weapons Direction Section of the 1953 Cape Cod System has now been frozen, and the correct version of the program has been recorded on magnetic tape. It is not contemplated that further changes will be made to this program. Memos describing the operation of various sections of the program and the duties and functions of associated personnel are in various stages of completion. A memo specifying the drum and magnetic-core storage allocation and the numbers of the tapes which make up the over-all program will be issued shortly.

Plans for major revisions to the Weapons Direction Sections of the 1953 Cape Cod System are currently being made. It now appears desirable to include in this revision a number of changes which will permit the testing of items and proposals planned for XD-1. As now planned, this major revision of the Cape Cod Program could not be put into operating condition until the late spring of next year.

The visitor scopes previously located in the Flight Test Umpire Room have now been moved into position A in the main Operations Room. This change should make these scopes more suitable for assisting in visitor demonstrations.

(H. Benington) (CONFIDENTIAL)

The A-Station console has been wired for visitors. Toggle switches control a weapon-assignment-type display and a selection-track Digital Information Display is available. The 16-inch scopes have identical displays. It is hoped that the console may prove useful during guided tours while a test is in progress.

An inter-office memo was completed giving suggestions for revisions of the Cape Cod displays.

The edge-lit panels for 5-inch scopes are being designed.

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1.14 Weapons Direction (Continued)

(M. Brand) (CONFIDENTIAL)

The memo, "Description of the Identification Function of the 1953 Cape Cod System" has been completely rewritten by A. Curby and myself. The final version is now being smoothed out prior to publication. The final drawings are now being made in the drafting room.

The identification programs seem to have stabilized into a final version. No further modifications are now contemplated until such time as major modifications are included early next year.

Arrangements have been made through Captain Bergeson of the Naval Liaison Office to have the Navy picket vessel now operating off the New Jersey coast operate in an area under Cape Cod surveillance for an extended period. The vessel will commence operations in this vicinity about the week of December 14. Several early-warning tests are being planned.

Arrangements have been made with Captain McGrath of the GOC filter center for Cape Cod - GOC tests to be held in the near future. These tests will probably be held at the same times as the early-warning tests.

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

An AAA-Guidance Test was run as part of the demonstration of December 3. Despite the poor data from the FPS-3 of the six tracks passed to AAOC, three were acquired by the batterie. Of these three, the two which flew within gun range were "destroyed." The other three tracks faded from the FPS-3 before they entered acquisition range.

The only height-finder activity of this period was also on December 3. Of the 199 height requests, 134 (67 per cent) resulted in height reports. There were 30 negative reports due to poor tracking, noise, clutter, etc.; and if these are deleted from the total requests, the percentage of successful reports is 79. Altitude accuracy was fairly good, and there were no sudden "jumps" such as were previously noted. A pattern was noted in the altitude errors which leads one to believe that neither Nantucket nor Pigeon Hill is properly leveled. This information was passed to the Group 22 people who are interested.

(F. M. Garth) (CONFIDENTIAL)

Factors to be considered in the development of a return-to-base path of most economical fuel for interceptors was discussed with Lt. Col. Waterhouse, Captain Quilter, Captain Murdock, and Lt. Burdock of Bedford Air Force Base. Views and reference material given on this subject material given on this subject were very helpful but for any workable equations to be developed a good deal more will need to be obtained. Other contacts have been made toward this objective.

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1.14 Weapons Direction (Continued)

(C. Gaudette, S. Knapp)

The weapons direction program was re-recorded on magnetic tape and an inter-office memo issued listing the paper tapes and manual interventions included on this recording.

Work has begun on a memo which will describe the weapons-direction program.

(M. A. Geraghty) (CONFIDENTIAL)

The memo on height-finding mentioned in the last report is available in draft form. It describes in full the height and raid-size functions in the Cape Cod System.

(J. Hayase) (CONFIDENTIAL)

As a possible field in which to do a thesis, the following Digital Computer Laboratory reports are being studied:

Report R-170 "Analysis and Design of Sampled Data Control Systems," June 30, 1949

Report R-225 "Treatment of Digital Control Systems and Numerical Processes in the Frequency Domain," July 1, 1953

(F. E. Heart) (CONFIDENTIAL)

Work continued on study of various sets of Library Accessions Lists.

Attempts at analysis of the Cape Cod program were revived during the last biweekly period. A method was successfully tried which allowed dynamic order counts to be procured for almost all of the combined track-while-scan and non-track-while-scan program. Only the data collection program and small pieces of the timing-buffering program are now exempt from this technique. Preliminary results for a "No load" case were obtained, and further work is expected in the next two weeks.

A small amount of time was spent considering Non-TWS record form revisions.

(W. Lemnios) (CONFIDENTIAL)

A group consisting of F. Garth, W. Lemnios, L. Murray, and J. Nolan has begun a detailed study of methods of recovering interceptors. At present a program is being prepared which will compute the path for minimum fuel consumption for return-to-base. Completion of this program is contingent upon receipt of fuel-consumption characteristics for various

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1.14 Weapons Direction (Continued)

(W. Lemnios) (CONFIDENTIAL) (Continued)

types of interceptors. It is hoped that this data will be obtained in the near future. The paths of minimum fuel consumption will be found by numerically solving the problem by a variational method.

After completion of this phase of the problem it is hoped to relate the results with some method of traffic control.

(L. Murray) (CONFIDENTIAL)

Another meeting was held with Group 22 concerning the Data Link. The results were as follows:

- a. A plan was devised for preflight checking interceptor's data-link receiver.
- b. A test procedure for aircraft aloft was defined.

The results of the above seem to have paid off. A Data-Link controlled interception has been successfully conducted since these were introduced.

(J. Nolan) (CONFIDENTIAL)

The second of the two indoctrination programming problems was successfully operated on WWI during the past biweekly period. This marks the completion of the general indoctrination program. The special indoctrination for the men of the Weapons Section has been organized, and the first class will be held on Tuesday, December 8.

The inter-office memo describing the operation of the Weapons Director and Combat Operation Officer positions has been completed.

Time has been spent in conjunction with F. Garth, W. Lemnios, and L. Murray in acquiring data for and beginning investigation of the return-to-base fuel-consumption problem.

(G. Rawling) (CONFIDENTIAL)

During the past week some equipment modifications in Room 222 have been tested. The tubular shelf lights for 5-inch scope talkers have not been satisfactory due to space requirements and excess light. They will not be installed. Interim battery installation of the edge-lit shelves also proved insufficient, and R. Gould will modify the shelves. Several lucite filter-implosion protectors will be available shortly.

The remainder of the edge-lit-panel drawings are being completed, and new modifications are in process. Drawings for edge-lit telephone labels are completed.

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1.14 Weapons Direction (Continued)

(F. A. Webster) (CONFIDENTIAL)

Work has been continued on three previously-mentioned discussions. These, as a whole, comprise an attempt to illustrate simply, and within the framework of a general unified plan, the method of operation of a Whirlwind-type computer in real-time-control situations involving the detection and control of aircraft with radar data.

One discussion deals with the general functional problems and some of the more specific procedures involved in the above type of control situation. This arose from the comments of a number of persons to the effect that certain desired requirements were not fulfilled by existing discussions.

There is, for example, the matter of classification. With a few exceptions, all material dealing with radar data and aircraft control is classified. But for a number of purposes classified documents introduce difficulties: such documents cannot be carried outside the laboratory without special precautions; they cannot be used to introduce potential laboratory personnel (uncleared) to the nature of the work; and they cannot be used for discussion with uncleared persons or groups who are so related to the Project that such discussion would be of value. It has been suggested, therefore, that a tentative paper be prepared that would contain the orienting essentials without indicating the specific details of application used in an Air Defense System. Hypothetical air-traffic-control problems -- adapted for illustrative methodology rather than practical results -- seem to represent a reasonable area for such analysis.

Second, there is the matter of relating functional flow diagrams to computer operation. The need has been felt for descriptions and examples at a level that is neither too general nor too specific. Those that are too general give no picture of the actual nature of computer operation. Those that are too specific generally appear to untrained persons far removed from the over-all operating scheme. Also much difficulty is encountered in trying to relate programs to what sorts of things the computer does in executing them. Some controversy exists as to the feasibility of making composite diagrams that represent the relation between the basic mechanisms of a digital computer, a representative program and a functional situation of the real-time-control type. Such a representation, however, appears to have considerable value.

Third, there is the problem of providing a good picture of the successive levels of operating detail. Most present sources do not provide an orientation to the system as a whole that will also provide representation of the functional significance of the various more specific operations that make it up. Somehow the basic functional design of a tracking-and-control system tends to become lost in the tremendous amount of superimposed detail. It turns out that, at best, considerable confusion exists as to just what constitutes a given "closed loop of interception." What is a useful way of representing this seemingly basic unit? How are the many categorizing and modifying relations tied to it? Are there simplified ways of representing these? This discussion is necessarily classified.

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1.14 Weapons Direction (Continued)

(F. A. Webster) (CONFIDENTIAL) (continued)

This latter problem is, of course, related to the important matter of the functional organization of communication within the system and between the system and external sources and receivers. Greater capacity and efficiency in future systems can undoubtedly be gained from proper functional grouping and sequencing of all communication mechanisms. A suitable communication flow diagram must, therefore, be developed. This is another portion of the plan which will be undertaken.

(C. A. Zraket) (CONFIDENTIAL)

System testing of the Cape Cod Center has continued during the past biweekly period, weather and aircraft availability permitting. For the demonstration of December 3, only two interceptions were attempted. The first was our initial successful data-link interception. Transmission of messages was accurate except for time-to-go. It was later ascertained that the particular aircraft receiver being used was not receiving time-to-go messages correctly. The second interception was unsuccessful due to poor tracking of the interceptor.

In conjunction with P. Cioffi, I revised the log and summary sheets for Cape Cod operations according to the various recommendations received. This is to permit a summary of each day's test to be completed by noon of the next day. It is hoped that the evaluation of the System performance can be improved in this manner.

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1.15 Direction Center Operations

(P.O. Cioffi) (CONFIDENTIAL)

The attached table summarizes the flight-test activity for the past period. Except for tests involving one aircraft for the purpose of testing newly installed equipment (Mark X) and for radar coverage checks and calibration, large-scale systems operations continued to be curtailed due to aircraft availability. Aircraft availability and utilization by groups in Lincoln was the subject of a recent meeting attended by representatives of Bedford, the Director's Office and some groups in Lincoln, including R.N. Davis representing Group 61. The results of this meeting affecting the priority and the procurement of aircraft for use by groups in Lincoln will be reported separately by Davis.

The extraction of summary data from the mass of data accumulated since the installation of Center operations mentioned in the last report has been held up temporarily pending the completion of the redesign-of-the-data-forms movement which got under way simultaneously. This postponement seems justified since the configuration of the summary data will be determined by the data forms being shaped now. The redesign of these forms and the necessity for the introduction of others became evident after the experience of operations thus far. Actually, the task of consulting the various people concerned, coming to format agreements, and drawing up original data sheets turned out to be a much more sizeable job than first appeared. It is expected, however, that the new complement of forms will be ready soon and that compilation of summary data will be completed thereafter.

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1.15 Direction Center Operations (Continued)

DATE	TIME	SCHEDULED TEST		TEST ACTUALLY RUN A/C Description	REASONS FOR CHANGES OR COMMENTS
		A/C	Description		
11/20	1300- 1500	1	Mark X Calibration	- Cancelled	Aircraft mechanical
11/25	1300- 1600	10	Combined Mission	- Cancelled	Weather
12/1	1300- 1600	10	Combined Mission	- Cancelled	No target aircraft available
12/2	1300- 1600	10	Combined Mission	- Cancelled	Insufficient target aircraft available
	1500- 1600	2	Coverage	1 Held with 1 air-craft	1 F-89 aborted mechanical
12/3	1200- 1500	10	Combined Mission	10 As Scheduled	
12/4	1300- 1600	10	Combined Mission	- Cancelled	Insufficient target aircraft available
	1300- 1400	1	Mark X Coverage	- Cancelled	Aircraft airborne 1 hour but returned to base due to aircraft's Mark X inop.

* Added to schedule during week of test

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1.15 Direction Center Operations (Continued)

(E. W. Wolf) (CONFIDENTIAL)

Equipment reliability for Cape Cod System operations reached a new high during the past biweekly period, Unrestricted Operating Time accounting for 93.6 per cent of all time assigned for System Operations. The statistics follow:

	Last Biweekly Period		Cumulative Period (since 9-29-53)	
	Hours	Per Cent	Hours	Per Cent
Assigned Time for System Operations	10.5	100.0	85.3	100.0
Unrestricted Operating Time	9.9	93.6	29.1	34.0
Limited Operating Time	0.0	0.0	36.3	42.6
Down Time	0.5	5.1	18.1	21.2
Recovery Time	0.1	1.3	1.8	2.2
	Limited Operations	Down Time	Limited Operations	Down Time
Time Lost (hours)				
Computer	0.0	0.4	0.0	16.1
Room 222	0.0	0.2	40.1	2.2
Radar & Input	0.0	0.0	28.3	0.0
Misc.	0.0	0.0	22.8	0.0

(W. Vecchia) (CONFIDENTIAL)

Group 61 Computer Operation

Total Assigned Time 75.5 hours

Weapon Direction 2 hours 05 minutes
Track While Scan 26 hours 35 minutes

Combined Weapons Direction }
Track While Scan } 24 hours 35 minutes

Tracking and Control 11 hours 10 minutes
Total 64 hours 25 minutes

Time to Math Group 3 hours 10 minutes
Time to In-Out 1 hour 15 minutes
Lost to Computer 6 hours 40 minutes

Total 11 hours 05 minutes

Grand Total 64 hours 25 minutes
11 hours 05 minutes
75 hours 30 minutes

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1.16 WWII Support

(D.R. Israel) (CONFIDENTIAL)

The XD-1 order code described in TR-7, "Programmers Reference Manual" (D.C. Walston, 15 October 1953), has been reviewed in considerable detail by Arnow, Attridge, Gaudette, Knapp, Lone, Walquist, and me. The result of this study was the preparation of a memo in which the orders described in TR-7, as well as additional items proposed by the above group, are classified into 10 categories indicating their expected utility in the programs to be operated in XD-1. This memo, which has not yet been issued, was discussed with Astrahan, Sarahan, Housman, and Thomas of IBM on 2 December in Poughkeepsie. The present decision appears to be to include all orders described in TR-7 and to give careful consideration to one or two of the suggestions made by Group 61. This matter is undergoing further consideration, and the final results will be described in the next biweekly.

Initial requirements of IBM accounting and card machines for the XD-1 card-preparation room and computer room are described in M-2541, "IBM Accounting Machines for XD-1 Card Preparation" (D.R. Israel).

A large part of the past two weeks has been spent in discussion and consideration of items and proposals for the track-situation displays and the digital-information displays for XD-1. Excellent progress was made, and firm proposals on each item were agreed to at a meeting in Poughkeepsie on 3 and 4 December. Several additional points regarding the track-situation display are currently under study.

The requirements for indicator lights, the amount of traffic to be expected in the manual-input card readers, and the use of light guns at weapons-direction positions are currently under study. Preliminary decisions on these matters will be made within the next two weeks.

A point has now been reached where it becomes necessary to prepare a firm proposal on the personnel organization and operating responsibilities within the XD-1 center. Once this is done, more realistic equipment requirements can be made, and the preparation of detailed floor plans can be undertaken.

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

I contributed several ideas to a proposal for the XD-1 order code.

Training of several IBM and Group 62 engineers for the monitoring positions occupied some time of Levenson, Ishihara, Peterson, and Attridge. These engineers are primarily interested in the problems of display in the AN/FSQ-7 system.

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1.16 WWII Support (Continued)

(H. Benington) (CONFIDENTIAL)

The Display meeting held in Poughkeepsie, December 3 and 4, was attended. The Track Display format was agreed on so that many of the smaller concomitant problems will now be studied, particularly display category allocation, Display Assignment Bit displays, console control of displays and feature selection.

(M. Brand) (CONFIDENTIAL)

Work has progressed in the study of manual inputs to the XD-1. A memo describing the modified O26 reader is being rewritten. A proposal for the number of O26's necessary for the proposed system has been worked out. It is hoped that the results of this survey will be published soon.

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

The first week of this period was spent studying the proposed XD-1 order code for the purpose of suggesting modifications to it. Several meetings were attended to discuss the problem and to draw up a proposal for the modifications.

(M.A. Geraghty) (CONFIDENTIAL)

An estimate of the card machines needed for manual input to XD-1 was completed and submitted by the Manual Inputs Committee. An outline of a scheme for card flow and card verification was developed to facilitate this estimate.

(C. Grandy) (CONFIDENTIAL)

No further progress has been made on the floor plan for the XD-1 installation. The specifications for personnel are being reviewed, and a closer examination of the physical size of the consoles and auxiliary equipment is being made. Work along these lines will continue into the next biweekly period. The last comprehensive listing of personnel and consoles is recorded in M-2409, Supplement 1, "Revised Estimates of Personnel and Console Requirements for AN/FSQ-7 XD-1 and Production Installations," issued during the past period.

A preliminary study of manual inputs for the XD-1 system was made in conjunction with several other staff members. The results of this study indicate the need of about 10 modified IBM O26 machines. This study of manual inputs will continue.

~~CONFIDENTIAL~~

SECURITY INFORMATION

1.16 WWII Support (Continued)

(S.J. Hauser) (CONFIDENTIAL)

An analysis of a manual-input system for XD-1 has been made and, based upon this analysis, an estimate of necessary equipment was made.

A memo on the description and operation of a modified O26 as a manual-input device is written and ready for review.

(J. Levenson) (CONFIDENTIAL)

During the past week I spent time with several people from the Lab and IBM who were interested in learning the display requirements of Track-While-Scan. Each of the men was given an opportunity to man the Monitor Stations, and I think they now understand more fully our display problems and are better able to plan for future systems.

Further thought is being given to an evaluation of the present monitor program.

(W. Lone) (CONFIDENTIAL)

Most of the first week of this biweekly period was spent in conferences attempting to fix the order code for XD-1. The remainder of that week was used in preparation of the items to be discussed the second week at IBM.

At IBM I became acquainted with the card-punching machines and techniques in the preparation of cards for the IBM 701 computer. Ideas in the setting up of a card room for XD-1 were exchanged. Discussions also centered about utility programs for XD-1 with the result that the program-writing load will be shared by both groups.

1.2 Group 64

(S. H. Dodd) (UNCLASSIFIED)

Computer operation during the past biweekly period has been good. There were no parity alarms reported during this time and transient errors were few. The high number of "no trouble encountered" reports entered in the WWI log by computer operators is encouraging.

The present reliability of computer operation is no doubt due, in part, to the comprehensive marginal-checking procedures being used. Extension of marginal checking to more of the equipment in Room 222, now in progress, should improve the reliability of that part of the system. Programmed marginal-checking techniques, now being developed, should reduce the time required to check individual sections of WWI and increase the number of these sections which can be checked in the scheduled time.

A parity system has been installed and is now operating with the auxiliary drum.

Cables are being installed to the buffer drum so that its MITE units can be operated in parallel with the present MITE units. The drum-MITE system should be ready for testing with data from the demodulators the week of December 7.

1.21 WWI System Operation

Core Memory

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

The drum parity-check system has been installed and has been functioning since the early part of this week. Drum parity alarms should occur only on the bi or rd orders. Core Memory alarms should not occur on these orders.

Two spare parity registers are being modified to provide d-c coupled flip-flops. The first d-c coupled parity register should be installed on December 12.

Installation of the modified control switches for Core Memory will be completed by December 6.

1.21 WWI System Operation (Continued)

Auxiliary-Drum System

(K. E. McVicar) (UNCLASSIFIED)

The parity system has been installed for the auxiliary drum, and parity checks are now made on all transfers from the drum.

Work is in progress to simplify the power-supply control for the auxiliary drum. The circuits worked out for the auxiliary drum will then be adapted to the buffer-drum system. The new controls should eliminate many of the unnecessary relays now in use and make the entire power system more similar to that used in the computer.

An attempt is also being made to revise the paperwork for the drum so that it fits into the Whirlwind system. This includes the compilation of parts lists, making of wiring schedules, and use of WWI modification notices for all drum-system changes.

Magnetic Tape

(E. P. Farnsworth) (UNCLASSIFIED)

Minnesota Mining and Manufacturing has finally received a shipment of mylar from Dupont and expects that 80 percent of the tape we have on order will be shipped splice-free. They have just developed a new splicing tape having less than one-tenth the stretch of the standard 41 splicing tape; splices made with a sample of the new tape appear to be usable but may cause trouble after a few months storage or use. Three-M has also advised that tri-acetate base tape is not adequate for our application. Audio-tape is shipping us two sample reels of unspliced high-output mylar-base tape.

The adapters necessary for converting Unit 2 to triangular-hub reels were completed by the shop and are ready for installation. Panels for operating a second printout on Unit 2 are being installed. Replacement of a pair of electrolytic capacitors in the servo-chassis which caused instability with Unit 0 previously and Unit 2 presently has apparently cleared the trouble. These capacitors are being checked for intermittent leakage.

A trouble-report sheet has been prepared, and the marginal clutch test program has been modified to correct for the change in computer speed.

1.21 WWI System Operation (Continued)Typewriter and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

Recent carriage-return troubles on the delayed-output printers were apparently caused by extra "start tape" pulses originating in the magnetic-tape printout-control register. Farnsworth has modified his circuits to correct this condition.

1.22 Terminal Equipment

(R. H. Gould) (UNCLASSIFIED)

The application of power to the Translite switch-label strips on the consoles in Room 222 will be speeded up by the installation of blank strips where the appropriate engraved strips have not been received. Each frame will be completely wired with the proper load, and power can then be applied.

The edge-lighted Plexiglas shelves under the 16-inch display scopes should have power in two weeks. The shelves must be modified by frosting the plastic and painting its edges. New bulbs may then be necessary to get sufficient light to read what may be put in the middle of the sandwich. Such material should be thin with transparent or translucent lines or letters on an opaque background.

Unused buttons on the pushbutton panels in Room 222 will be replaced with short plastic rods which will look and feel quite different from the buttons and will mechanically prevent pushing of the particular switch.

A copy of the Block Diagram of In-Out Control will be filed in the WWI file in the Test Control Room. With it will be a table listing gate tubes and flip-flops in IOC associated with display. This table lists function and physical location. The diagram and table used together may be more useful in trouble shooting than the somewhat unwieldy Block Schematic. If this proves to be true, similar tables will be made for the other types of in-out equipment.

Wiring changes have introduced some troubles; otherwise the equipment in Room 222 has been operating quite well.

Display

(T. S. Sandy) (UNCLASSIFIED)

In-out switch lines have been provided for the marginal-checking of the terminal equipment used with the equipment in Room 222.

Most of the biweekly period was spent designing a balanced deflection system for the display scopes. I have a prototype balanced decoder ready to be tested.

1.22 Terminal Equipment (Continued)

Marginal Checking

(S. B. Ginsburg) (UNCLASSIFIED)

The "holding and driving circuits for display-switch bias control" panel was mounted in Room 156 and will be cabled during the next installation period. We should be able to marginal check the insertion registers sometime during the week of December 7.

It was necessary to modify the "holding circuits for the light-gun switches" to comply with the changes in the light-gun system. These changes are now being done in the shop.

MITE

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

The switch which will allow MITE 3 to be switched over to the buffer drum and become Unit 4 has been constructed and mounted in Rack L6 in Room 156. It is now required that some existing cables be rerouted through the switch and connected to the storage insertion register input mixer, and that cables carrying special MITE-buffer drum test orders be inserted. This will be done during the next installation period, at which time MITE 0 in L1 should also be ready. The test program for programmed debugging of this equipment is now being written.

The programs for the checking of MITE's 0, 1, 2, and 3 without the use of the buffer drum have been combined in our program as T3144 Mod 8.

Buffer-Drum System

(K. E. McVicar) (UNCLASSIFIED)

Tests on the operation of the buffer-drum system with the MITE units and the computer continues. In the near future a test program will be ready which will enable us to work with recorded data instead of the computer-simulated data we have heretofore used.

There seems to be some question as to the reliability with which ERA flip-flops work on pulses less than 0.1 μ second in duration. We have had some trouble with MITE units using unmodified plug-in units because these units tend to narrow pulses under certain conditions.

1.22 Terminal Equipment (Continued)

Magnetic Drums

(H. L. Ziegler) (UNCLASSIFIED)

One difficulty with the buffer drum has been spurious writing by the dual-head flip-flop writers when power is being removed from the drum. Preliminary investigation of these writers in a test-rack setup indicates that this circuit is quite sensitive to variations in the +200-v supply. The cause of this oversensitivity has not yet been determined.

Testing and repairing of the reading amplifiers are continuing.

Ferranti PETR

(F. E. Irish) (UNCLASSIFIED)

Sketches for the mechanical and electronic assembly of the amplifier circuits of the Ferranti PETR and a sketch of the control circuits have been given to the drafting room.

According to the present schedule, one Ferranti PETR will be installed in a temporary fashion during the next two weeks. The construction of the final amplifier units for the three Ferranti PETR's, and the control circuits for one unit will be completed by February 1, 1954. The final installation will follow that date.

(J. P. Stirman) (UNCLASSIFIED)

The revision of Ferranti PETR and the construction of the associated equipment has now been completed.

It is hoped that the equipment will be installed in WWI on Monday, December 7, and tested on Tuesday, December 8.

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 November 20 - December 4, 1953:

Number of assigned hours	140
Usable percentage of assigned time	93
Usable percentage of assigned time since March, 1951	86
Number of transient errors	1
Number of steady-state errors	5
Number of intermittent errors	9

1.23 Records of Operation (Continued)Component Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following failures of electrical components have been reported since November 21, 1953:

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Crystals</u>			
1N38A	1	3000 - 4000	High forward resistance
	1	6000 - 7000	Low R_b
1N34A	1	0 - 1000	Low R_b
<u>Tubes</u>			
6145	9	0 - 1000	Short
	2	1000 - 2000	1-short 1-gone to air
5963	2	1000 - 2000	Low I_b
5881	1	0 - 1000	Short
715C	1	0 - 1000	Open filament
6080	1	1000 - 2000	Short
5670	1	9000 - 10000	Short
7AD7	1	3000 - 4000	Short
	3	11000 - 12000	Short

1.24 GeneralWWI Service File

(D. A. Morrison) (UNCLASSIFIED)

Plans are under way to relocate the WWI Service File in WWI Test Control to allow the Flexowriter console to be moved out of the passageway. The contents of the steel cabinets are to be consolidated into a smaller cabinet, and the WWI Service File and the smaller cabinet will occupy the space now used by the steel cabinets. The upper left-hand drawer of the desk in Test Control now contains the test tapes.

Work continues on the voltage-interlock panel layout.

1.24 General (Continued)

D-C Power Supplies

(S. T. Coffin) (UNCLASSIFIED)

The old WWI +150-v regulated d-c power supply has been removed for redesigning. When this work is completed, the WWI +90-v supply will be improved.

1.3 Group 65

1.31 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

Three Charactron tubes were reprocessed with a small-angle electrostatic-deflection system in the deflection-yoke region for character compensation, character position, and making vectors. These tubes were evaluated during this biweekly period. Two of the tubes became gassy before adequate tests could be made on them. The third tube demonstrated that the small-angle electrostatic-deflection system had to be redesigned. This work will be given highest priority during the next biweekly period so that this electrostatic-compensation system can be evaluated as soon as possible.

The work on the helical dag coating which permits a low voltage in the deflection region and a very high voltage at the phosphor screen has been progressing slowly. Several pen designs have been used during this period in an endeavor to coat a spiral with the helical ink. During this period we have been unable to develop a satisfactory pen.

Work on transparent phosphorescent films for Group 25 was continued during this period. The nature of this work is described in the previous biweekly report.

A two-day trip to IBM at Poughkeepsie was made during this period in support of the reliable-receiver tube program.

SECTION II - AN/FSQ-7

2.1 Group 622.11 SystemsManual Inputs

(H. K. Rising) (CONFIDENTIAL)

A meeting was held at Poughkeepsie on Wednesday to discuss the manual-input system. W.M. McMillan presented two system proposals, one with relay switching and core storage, the other with diode switching and flip-flop storage. In view of the data-rate estimates on various inputs, it was felt that the proposals should be reevaluated and possibly simplified.

Shift-Register Evaluator

(C.J. Schultz) (UNCLASSIFIED)

A reasonable degree of linearity in the automatic variation of advance pulse width and amplitude has been obtained. The limits of operation of the 4-stage core shift register as displayed on the evaluator scope do not coincide completely with those obtained during the manual variation of pulse width and amplitude. The evaluator produces limits over a narrower pulse-width range and a greater pulse-amplitude range. The difference may be due to the advance pulse fall time and the length of the shift register, although this has not yet been verified.

Output Shift Registers

(I. Aronson and H. Rising) (CONFIDENTIAL)

An 8-position core switch for selecting the output shift register has been built and tried out. Results show adequate regulation and zero-to-one ratio for 1/2 selection.

A shift-register driver panel and one shift register are now being constructed. Cores for this register should be tested and installed this coming week of 7 December.

~~CONFIDENTIAL~~

SECURITY INFORMATION

2.11 Systems (continued)

Drum Write Switching

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

Various methods of switching are being compared on the basis of tube count. The field switching drivers contribute the most to the tube count; therefore, any scheme that lightens the current load on the drivers will materially reduce the tube count.

Delay-Line Adder

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

Construction of the adder has been completed and initial testing started.

Military Reference Data Book (Circuit Application Section)

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

The Delay Unit, Model A, currently in the MRD Book is being withdrawn. It will be replaced by a two-tube delay unit developed by J. Gillette.

Outputs

(R.C. Hopkins and R.C. Jeffrey) (UNCLASSIFIED)

M-2525, "Output Buffer Drum Specifications," has been distributed to interested persons for criticism or concurrence. The specifications have been tentatively accepted and turned over to IBM for implementation, pending official concurrence of Forrester or Everett.

Dan Ross of IBM is taking responsibility for planning a program which will lead to an acceptable set of specifications for the equipment outside the output-buffer drum by February, 1954.

2.12 Magnetic-Core Memory

Miscellany

(W.N. Papian) (UNCLASSIFIED)

I am giving a paper, "The MIT Magnetic-Core Memory," at the Joint Eastern Computer Conference in Washington, D.C., on December 8. It will also be published in the proceedings of the conference. I am very grateful to all the members of the laboratory who cooperated and participated in the core-memory work and in the preparation of the manuscript.

2.12 Magnetic-Core Memory (continued)

64 x 64 Memory for MTC

(W. Canty and J. Mitchell) (UNCLASSIFIED)

Power has been applied to the shower stall. Checking of the circuits is proceeding in a satisfactory manner. When the pulse transformers are completed we will be able to test arrays in the system.

The digit-plane-driver gate-generator panel for MTC has been laid out and is now under construction in the sheet metal shop.

(E. A. Guditz) (UNCLASSIFIED)

Fourteen of the 19 planes for the 64 x 64 MTC Memory are completed and ready for use. The other 5 are under construction.

Power wiring on the memory rack has been completed and the panels are being checked out.

One hundred twenty-eight pulse transformers for the selection plane driver panels are being constructed here to cover a possible delay in delivery of the original order from the vendor. It is expected that these will be ready to install the week of December 7.

Planar Core Switch

(J. Raffel) (UNCLASSIFIED)

The frames and mounting panels for the 246-position switch have come back from the shop.

Testing of switch cores will begin during the week of December 7.

Consideration is being given to memory construction, and the decision has been made to use a common sense and inhibit winding of about 4 turns. This should simplify both sense-amplifier and digit-plane-driver design.

2.13 Vacuum-Tube Circuits

General

(R.L. Best) (UNCLASSIFIED)

We have developed a drum timing-track generator which appears simple and inherently reliable. Initial investigation continues on this

2.13 Vacuum-Tube Circuits (continued)

(R.L. Best) (UNCLASSIFIED)

and the write switching problem for drums, and for the MTC drum in particular.

Life data on the 7AK7 as a cathode follower in WWI has turned out to be of doubtful value, since the tubes were used with so little dissipation there. At least there were no failures.

Drum Circuits:Timing-Track Time-Pulse Generator

(H. Boyd) (UNCLASSIFIED)

A time-pulse generator containing 8 bottles (12 cathodes) has been designed and given preliminary tests. An entirely different logical circuitry scheme was exploited that would allow output pulses of constant amplitude and relative time position (5 μ seconds between separate output lines having pulses 10 μ seconds apart) and occurring at 0.1 ± 0.1 μ second after input signals zero crossover, for input signals of from less than 50 millivolts p-p to more than 300 millivolts p-p. The unit can drive less than 43 ohms, thus allowing parallel cable loads with receiving ends terminated, or single cable loads terminated at both ends of greater than 200 feet in length, or various combinations of loading much like that of a register driver.

Magnetic Drum

(H. E. Anderson) (UNCLASSIFIED)

A technique for writing the index pulse in the gap of the timing track has been worked out. Timing-track tests have been started using the IBM time-pulse generator. The MTC angular position counter is being used and the logic of the test is the same as will be used in the computer.

Bob Callahan, Art Heineck, and Sydney Bradspies are starting to work on the write-switching problem.

Write Circuits

(S. Bradspies) (UNCLASSIFIED)

Several methods of driving the write heads for the MTC magnetic drum have been investigated on paper. This drum has 11 fields and 17 digits. It is supposed that the write current required by a head is

2.13- Vacuum Tube Circuits (continued)

(S. Bradspies) (UNCLASSIFIED)

200 milliamperes. If we use a 7AK7 and assume that 100 milliamperes can be drawn by it, a 2:1 stepdown transformer is required. Thus it is seen that the driver in the selected field must supply $17 \times 100 = 1700$ milliamperes of forward current. But there is also leakage current that must be supplied through the back resistance of the diodes in the unselected fields. There are 16 of these fields. If the diodes are 1N93 and they draw twice as much current as is indicated on their characteristics this reverse current can be cut to about 130 milliamperes by properly grouping the diodes. This can be done by using 28 diodes per digit. Another method of grouping promises to cut this current down by much more, but this method has not yet been investigated.

Tests are being run on the 7AK7 to see what it can do when the plate is below 250 and the suppressor below 10 volts.

Pulse Transformers

(E. Gates) (UNCLASSIFIED)

Due to a delay in shipment of transformers from Sprague, the memory-driving transformers are being fabricated here. They will not be potted but will be mounted on terminal boards with a bolt and nut. The rush is necessary since the memory will be ready for testing shortly.

I have ordered some hypersil cores for experimental purposes since the ferrite cores do not have high enough permeabilities for the long pulse lengths needed in magnetic-drum applications.

Delay-Line Circuits

(J. S. Gillette) (UNCLASSIFIED)

No more work has been done on the memory pulse distributor because we are still waiting for the delivery of 4:1 pulse transformers from the Sprague Co. Delay circuits using 0.5- μ sec lines which are sealed in plastic, and all other components mounted on etched cards are working satisfactorily. A note, M-2493, has been distributed which describes these delay-line circuits.

Shift-Register Core Driver

(J.S. Gillette) (UNCLASSIFIED)

I have been working on a simple circuit to drive one complete register (11 coils). The plan for using a one-bottle 5998 tube driver has been laid aside until more information can be obtained on the 5998 tube. The best circuit which I have found uses two 5965 tubes and one 5998 tube for driving two complete shift registers.

2.13 Vacuum Tube Circuits (continued)

High-Speed Gate Tube

(H. J. Platt) (UNCLASSIFIED)

An M-Note on this subject progresses. A first draft has been completed and drawings are being brought up to date.

7AK7 Tube

(H. J. Platt) (UNCLASSIFIED)

Some question as to dissipation had arisen in setting up life tests for the SR1782 version of the 7AK7.

Measurements were run of screen dissipation with plate current cut off by the suppressor grid as a function of duty factor with the input pulse amplitude to the circuit as parameter. In the extreme case of 40-v input pulses at a 2-mc repetition frequency, the screen grid is an unlikely occurrence.

A technique for measuring dissipation in the suppressor grid when the tube is tetrode connected is being developed.

Sense Amplifier

(C.A. Laspina) (UNCLASSIFIED)

Data on the sense amplifier was taken, and an M-note on the sense amplifier is almost completed.

Magnetic-Deflection Amplifier

(B. Remis) (UNCLASSIFIED)

To determine the waveshape at the plate of the output stage of the deflection amplifier when a plate current of 250 milliamperes flowing through the yoke is suddenly interrupted, a transient analysis was started. The lack of a yoke with parameters close to those of the final design prompted the paper analysis instead of an experimental approach.

7AK7 Medium-Power Cathode Follower

(B. Remis) (UNCLASSIFIED)

An attempt was made to gather life-test data from the files of WWI on the use of the 7AK7 as a cathode follower. In the two places where the tube was used as a cathode follower (the EST output panel and the ESD decoder), no instances were recorded of any tubes being removed for failures. However, in the majority of cases the tubes were worked relatively lightly so that no positive conclusions can be reached.

2.14 Memory Test Computer

General

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

Installation work for Core Memory, Mod. II, and the drum is proceeding apace: group & field control and drum-control racks are substantially wired in and partially tested for static voltages.

The shop has already produced the memory "shower stall" framework, so we have been able to start putting this unit in place. As other hardware becomes available, it will be installed and wired in, so that probably little more than the core array proper will need to be brought up from Papian's section when they feel the memory is ready to try out.

Alteration of MTC Central Control to accommodate the new units (as explained in more detail below by Phil Bagley) is reasonably complete on paper; pending a few physical necessities such as receipt of hardware and measurement of cable lengths, this alteration is expected to be carried out by the end of the next biweekly period.

Attention of interested parties is called to the fact that this control alteration will mean shutting down MTC for about a week, presumably the week of December 14.

The computer has continued in part-time application to Charactron circuit development.

Forthcoming Changes in Central Control

(P. R. Bagley) (UNCLASSIFIED)

I have revised the block-diagram, block-schematic, and rack-layout drawings of MTC Central Control in order to provide for the following changes to be made in the computer:

a. The installation of a 4096-register magnetic-core memory. The memory cycle time will be the same for all instructions except ra, replace address.

b. The installation of a magnetic-storage drum with provision for 12 fields of 2048 registers each.

c. The installation of a group and field control system to provide access to more storage addresses than the 11-bit address part of an instruction allows.

d. The installation of a button to start the computer at address 40 (octal), the first address of plugboard storage.

2.14 Memory Test Computer (Continued)

(P. R. Bagley) (UNCLASSIFIED) (Continued)

e. The revision of the circuit which automatically provides a scope display of the contents of a selected memory plane.

f. The revision of the alarm system, which makes possible the shortening of the execution times of nearly all instructions.

g. The installation of 5 new instructions:

17	<u>tro</u>	transfer out
19	<u>tno</u>	transfer on negative out
21	<u>sof</u>	select operation field
22	<u>to</u>	transfer on overflow
31	<u>ic</u>	index camera

The instructions tp and mp which now occupy positions 17 and 19 will be discontinued.

These new instructions are described in detail in M-2527, "Memory Test Computer Programming Manual."

The equipment for implementing the above changes has been ordered. To list and requisition the necessary video cables is the next immediate task.

New Read-In Program

(P. R. Bagley) (UNCLASSIFIED)

I have written several versions of a read-in program. Wes Clark and I are currently debating which features, if any, should be sacrificed in order to make the program fit entirely into plugboard storage.

Panel Storage

(J. Crane) (UNCLASSIFIED)

Additional mounting units needed for video-cable installation in panel storage have been made and will be installed during the next bi-weekly period.

2.14 Memory Test Computer (Continued)

Memory Display Scope

(J. Crane) (UNCLASSIFIED)

The first amplifiers tested for use in the 10-inch display scope were not satisfactory, and new amplifiers will be constructed.

Photoelectric Tape Reader

(R. Hughes, B. Farley) (UNCLASSIFIED)

The photoelectric reader is undergoing tests before being installed in the computer.

Drum Circuits

(H. W. Boyd) (UNCLASSIFIED)

A dual-buffer circuit was designed and drawings have been made. The unit can drive up to 200 feet of 93-ohm coax.

Drum Field Switch

(H. Henegar) (UNCLASSIFIED)

It has been decided to construct a 4-bit, 4-word model of the magnetic-drum field switch. Arbitrary 4-bit words, selected by toggle switches, will be read into each of the fields in a cyclic manner. It is hoped that this model will show up any "noise" problems and also give some information as to the requirements of the various drivers. The cores will be ferrites, 1312's, F 262.

A switch panel and driver have been designed and will soon be breadboarded.

MTC Power Supplies

(D. M. Fisher) (UNCLASSIFIED)

Now that all MTC power supplies are in good working order, my efforts are directed towards completing the MTC power-supply-control system begun by Bob Hopkins. The power supplies are controlled manually at the present time.

2.14 Memory Test Computer (Continued)

(D. M. Fisher) (UNCLASSIFIED) (Continued)

The old system is now being modified to accomodate additional supplies that have been added. Before the system is installed, conferences will be held with MTC personnel and persons familiar with WWI's control system, for the purpose of incorporating new ideas into the system to insure satisfactory control.

MTC Alternator

(R. Jahn) (UNCLASSIFIED)

The permanent regulator panel has been installed. Failures of the 1N9L feedback rectifiers should be eliminated now that the inverse voltage per diode has been reduced by the addition of another series diode to every diode in the original rectifier.

The complete system is scheduled for testing in the next few weeks.

MTC Logbook Summary

(B.J. Kollet) (UNCLASSIFIED)

Filament Clock Hours (A-C):	1814.6 to 1878.7	(64.1 total hours)
Plate Clock Hours (D-C):	1557.8 to 1608.7	(50.9 total hours)

Breakdown of D-C Hours

*Development:	30.3 hr
Installation:	1.1
Routine Checking Programs:	11.5
Marginal Checking:	1.4
Trouble Shooting:	6.6
Programs:	--

Total D-C Hours	50.9
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*Development:	Charactron -----	25.4 hr
	IBM Printer-----	4.9

Total ----	30.3
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2.15 Equipment Design and Schedules

(A. P. Kromer) (CONFIDENTIAL)

Principal attention has been devoted to plans in connection with the manufacture of equipment and establishment of CIC's in the initial Air Division. This equipment is an addition to the two prototype models. Conferences with IBM and Project ADES representatives have been held to discuss various phases of this program. This work is in anticipation of a contract from the Air Force early in 1954.

A meeting was attended with IBM in connection with revision of AFCRC Exhibit No. 1 which covers the general specifications for the AN/FSQ-7 (XD-1 and XD-2) Systems. An amendment to the present Exhibit will be prepared to serve as a basis for the cost quotation which IBM will submit to AMC covering the prototype program.

(J. D. Bassett) (CONFIDENTIAL)

A trip to the IBM Vestal Lab was made during the week of Nov. 16 with a group of other interested Division 6 personnel to hold a first round of discussions regarding the output-display console. A confidential trip report, M-2534, has been published.

A group from IBM spent 3 days here during the week of Nov. 23 to make a detailed study of operational problems related to display consoles. The group included R. Mark and C. Mankiewicz of Vestal Lab and P. Rocco of High Street.

A mock-up of the display console will arrive at the Barta Building for preliminary observation and comment on Monday, Dec. 7.

E. Quick and A. Di Marco of IBM met with W. Ayer and John Bassett of Group 62, R. Enticknap and P. Rosen of Division 2, and P. Taber of Francis Associates on December 3 to discuss communications-equipment design and cooling requirements. A report will be published after the work has progressed further.

IBM Parts Procurement

(C. W. Watt) (UNCLASSIFIED)

Several orders for reliable parts for XD-1 have been placed by Project High.

a. Composition resistors - some have been delivered and more will be due soon.

b. Tube sockets - order placed this week.

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SECURITY INFORMATION

2.15 Equipment Design and Schedules (Continued)

(C. W. Watt) (UNCLASSIFIED) (Continued)

- c. Paper capacitors - orders placed this week, Sprague & Fast.
- d. Diodes - partial order placed on Hughes for type Y diodes. Delivery from stock expected soon.
- e. Film resistors - order placed on Stemag.
- f. Pulse transformers - ordered from Sprague.

Commercial grade parts have been ordered for the nine-module setup.

2.16 Transistors

Transistor Accumulator

(D. J. Eckl) (UNCLASSIFIED)

The transistor accumulator has been in operation 8990 hours to date. Further modifications are being made in the control system. Driver circuits which produce a 0.3- μ sec pulse are now in use. Plans are proceeding to replace a good part of the Burroughs equipment with plug-in units.

Semiconductor Physics

(D. J. Eckl) (UNCLASSIFIED)

The fifth note on semiconductor physics, entitled "Properties of Semiconductors," is in the final stages of typing and should be finished soon.

G11A Transistors

(D. J. Eckl) (UNCLASSIFIED)

A note describing the properties of the General Electric G11A point-contact transistor is nearing completion. The last 100 of the transistors seem to have many desirable properties and are a considerable improvement over earlier units of this type.

2.16 Transistors (Continued)The Point-Contact Flip-Flop

(E. Cohler) (UNCLASSIFIED)

The last biweekly period was spent largely in a complete mathematical analysis of the point-contact flip-flop. This study has run into a difficult point at the critical stage. It seems that the equation which determines the operation or nonoperation of the flip-flop is of the sixth order and not obviously factorable. In the meantime empirical tests are being conducted by Jim Ahlgren to check the theory and confirm the optimum triggering methods.

Diode Minority Carrier Storage

(N. T. Jones) (UNCLASSIFIED)

A real effort is being made to complete a memorandum discussing reverse-recovery characteristics and measurements in diodes. This material has been accumulating for several months and is now in shape for such a memorandum. Included will be relative ratings on all point diodes tested to date.

Transistor Minority Carrier Storage

(N. T. Jones) (UNCLASSIFIED)

Experimental transistors from Group 35 are being extensively tested for storage characteristics. A program has been devised to test transistors as completely as now appears desirable. The first tentative conclusion to be drawn is that storage is not a surface effect but occurs in the bulk material. This resulted from the tests on three samples with various treatments.

Diode Testing

(N. T. Jones) (UNCLASSIFIED)

Seventy Sylvania IN34A's were measured for Hal Boyd for installation in slave flip-flops to be life tested. Remeasurements of reverse recovery after this life test is completed will be very interesting.

2.16 Transistors (Continued)Visit to IBM

(N. T. Jones) (UNCLASSIFIED)

On Friday, November 20, various semiconductor groups at IBM were visited with Prof. Thomas, group leader of Group 35, and E. Dillaby of that Group. The discussion centered around diode and transistor problems in general.

Visitors from IBM

(N. T. Jones) (UNCLASSIFIED)

Visits to this Laboratory were made on Tuesday, November 24, by F. Grace and A. Berger and on Thursday, December 3, by H. Heath and A. Gayle. In both cases the subject of reverse-recovery measurements and results were discussed.

Transistor Core Drivers

(S. Oken) (UNCLASSIFIED)

Four Mo-Permalloy cores connected in series were driven by the delay-line-type transistor core driver. All the cores were simultaneously switched from one saturated state to the other for one week, at a read-write cycle repetition rate of about 36 μ seconds (-27.7kc).

Since the x and y plane drivers in a 4x4 coincident-current memory will be called upon to drive 16 cores, this condition was simulated. The worst condition to be encountered, i.e., 4 cores switching and 12 cores with half amplitude pulses, was also simulated. As the driver was capable of driving the aforementioned load, it should be able to drive a memory plane. The main trouble will probably be that of regulating the battery voltages in the transistor circuits.

A transistor core driver using junction transistors was studied. The problem here resolves itself into obtaining the desired current for the first μ second of the switching time. This is because the back voltage from the nonswitching cores has dropped to glow value after ~ 1 μ second.

Transistor Gates

(C. T. Kirk) (UNCLASSIFIED)

A life test of the proposed transistor gate was started early in this biweekly period. The results after 10 days running time have

2.16 Transistors (Continued)

(C. T. Kirk) (UNCLASSIFIED) (Continued)

shown that the load requirements are excessive.

Accordingly it has been decided to reduce the load criteria.

The initial load requirements were that the gate must drive two flip-flops and another gate. These requirements were reduced by inserting a buffer amplifier between gates, thus reducing the load criteria to two flip-flops and a high-input-impedance buffer amplifier.

2.17 Display

(C. L. Corderman) (CONFIDENTIAL)

We have as yet been unable to evaluate electrostatic compensation in a 19-inch Charactron because of trouble with two tubes and an inadequate original design. During the week of Dec. 7 CHT-11 should be available for test. This scheme makes use of a second set of deflection plates ahead of the magnetic yoke. It is proposed that these plates be used for character compensation, character spacing, and for making the vector.

(R. von Buelow) (CONFIDENTIAL)

A memo on light-cannon investigation is now available. Its number is M-2542. Before a system is adopted, further investigation into the input system and input load is necessary.

A meeting was held at Poughkeepsie to get general agreement on a number of points discussed for the past two weeks with Group 61 personnel. A memorandum will be forthcoming shortly describing these agreements in detail. Briefly, the agreements were on drum, word layout, track-situation display, required number of drum fields, number of categories and feature selection switches, and arrangement for DID (Digital Information Display).

The possibility of having the feature-selection and category-selection circuitry at the main display frame was brought up. The possible advantage of this sort of arrangement is reduction of necessary drivers and elimination of a large amount of coax running to each console. This is being investigated further.

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Memorandum M-2550

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2.17 Display (Continued)

(M. Epstein) (CONFIDENTIAL)

During the past biweekly period the digital-display system began to approach final form. A preliminary equipment drawing was sent by IBM. On December 4 a proposal for the DID format and layout on the drum was made and tentatively accepted. The proposal will come out in memorandum form next biweekly period.

Some work was done on a comprehensive file of all display drawings.

(R. H. Gerhardt) (CONFIDENTIAL)

Some time was spent examining IBM drawing 5001-17001 which concerns the logic of the track-situation display system.

M-2537, "A Proposal for Digital Expansion of Displays for XD-1," was issued.

December 3 and 4 were spent at Poughkeepsie discussing the logic of the display system. Digital expansion was adopted. It was also decided at this meeting that most of the intensification-pulse gating could be done at the display frame. I will revise the digital-expansion scheme of M-2537 to accommodate this feature.

(J. Wpolf, H. Zieman) (CONFIDENTIAL)

The MTC Charactron and associated logical equipment have been rearranged to present a more orderly display. Some difficulty was experienced in obtaining correct timing of control pulses but everything appears to be in good working condition now.

A new magnetic-deflection amplifier is being designed to incorporate a low-noise triode in the input stage, pentodes in the intermediate stages for higher loop gain, and a new high-power triode (6161) for the output stage.

A new electrostatic control system is being designed to reduce the number of cathodes per console. It now appears that the electrostatic controls may not require any vacuum tubes if interaction between consoles will not be too objectionable. The new system should show us if this is the case or not.

Preliminary investigation of a decoder to be used in the Charactron console seems to indicate that some voltage reference source better

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SECURITY INFORMATION

2.17 Display (Continued)

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

than a 5651 will be required. The Kay Lab d-c power supply, which is reputed to be better than 0.01-per-cent stable, will be investigated.

(L. B. Martin) (UNCLASSIFIED)

Preparation for the Charactron display have been completed except for the installation of the magnetic-deflection amplifiers. These amplifiers are awaiting test.

Work and tests are in progress for displaying the Hughes tube.

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2.2 Group 63 (Magnetic Materials)

(D. R. Brown) (UNCLASSIFIED)

Core testing for XD-1 has been underway for several weeks at High Street and is now starting at MIT. Preliminary tests by IBM indicate that the second shipment of cores from General Ceramics will have a very low yield when tested according to the specifications. The time schedule for the core-testing program set up by IBM calls for 160,000 good cores by January 15, 1954.

We continue to obtain information on pilot production of ferrite memory cores. All the problems associated with this have not yet been solved.

A study of the phase diagram of the $MgO \cdot MnO \cdot Fe_2O_3$ system is bringing about a much clearer understanding of the square-loop ferrites.

Ferrite Synthesis

(J. Sacco) (UNCLASSIFIED)

Work has been started on a $NiO \cdot MnO \cdot Fe_2O_3$ series. Plans for the immediate future call for the preparation of series of $CuO \cdot MnO \cdot Fe_2O_3$, $CoO \cdot MnO \cdot Fe_2O_3$, lithium ferrite, and lithium-zinc ferrite. At the same time a number of $MgO \cdot MnO \cdot Fe_2O_3$ series will be reprocessed in an endeavor to improve the electrical properties.

Pilot-Plant Production of F-394 Cores

(R. A. Maglio) (UNCLASSIFIED)

A batch of 14,000 F-394 cores of the DCL-3-70 composition have been pressed. Test firings on small quantities of these cores have indicated an optimum in properties at a firing temperature of 1450 C. The firing time has not been definitely established since the driving current increased after refiring. Firing time is estimated at one to two hours.

Cores of this composition are rejected for computer use due to a high half-selected ONE pulse; however, they are useful for analyzing core firing within the Harper Furnace.

Three new batches of DCL-2-281 have been started for F-394 core production. Batches DCL-3-67, DCL-3-68, and DCL-3-69 are nearing completion. These batches, whose compositions are in the 0.9 squareness region where other electrical properties are predicted as being comparable to present memory cores, have been prepared especially for F-394 core production.

2.2 Group 63 (Continued)Differential Thermal Analysis Applied to MnO·Fe₂O₃ System

(R. A. Maglio) (UNCLASSIFIED)

It has been determined that the decomposition of MnCO₃ in a binary mixture of MnCO₃·Fe₂O₃ begins at about 325 C when the mixture is fired in air. The decomposition is practically complete at the normal calcining temperature of 500 C at a heating rate of 12.5 C/min. When the same mixture is fired in nitrogen, calcination does not take place until 500 C.

Differential-thermal-analysis curves have been obtained for binary mixtures of manganese oxide and iron oxide using MnO, MnO₂, Mn₃O₄ as starting materials with Fe₂O₃. All of the thermal changes have not been definitely identified. Samples are being prepared for X-ray study so as to identify the changes.

Curves are being taken for MnCO₃·Fe₂O₃ mixtures in which the ratio of MnO to Fe₂O₃ is being varied from 0-100 percent.

Magnetic Anneal of Ferrites

(P. K. Baltzer) (UNCLASSIFIED)

Ferrites in the MnO, MgO, Fe₂O₃ triaxial diagram, with constant 25-mole per cent of MnO, have been given a magnetic anneal. In the compositional region where maximum squareness of 0.20 or greater already existed, the maximum squareness was significantly improved, the greatest change being from 0.55 to 0.75. In general the change in squareness was less for the refired samples than for the unrefired samples.

The ratio of B/H for the maximum squareness loop also was increased in the same compositional region.

Since there were no samples annealed without a magnetic field, it is possible that the changes observed were not due to the field. This possibility will be checked by submitting the same samples to the anneal without an applied field. If the change in parameters is due to the field, the change should be reversible.

Production Testing

(E. J. Stevens) (UNCLASSIFIED)

The period was used in moving and modifying core-testing and core-evaluation logic. Two semiautomatic testing machines will eventually be put into operation in the air-conditioned room along with the core-evaluation logic. The automatic logic was moved outside the room and the core-

2.2 Group 63 (Continued)

(E. J. Stevens) (Continued) (UNCLASSIFIED)

handling machine installed in the temperature-control unit. At present the automatic core tester and the semiautomatic core tester are in operating order.

Core-Counting Circuit

(B. M. Gurley) (UNCLASSIFIED)

A photoelectric core counter has been developed. Tests are being made on the circuit.

Voltage Calibrators

(B. M. Gurley) (UNCLASSIFIED)

Six voltage calibrators, Mod. III, have been completed by our shop and Lincoln Laboratory wiring shop. These units, while designed primarily for core testing, may be of use elsewhere. An accurate voltage pulse from 3 millivolts to 10 volts is provided; these pulses may be of any duration and either polarity.

Core-Selection System

(R. F. Jenney) (UNCLASSIFIED)

An investigation of core selection in memories revealed that 1:0 selection is impractical. A scheme more general than present selection schemes was used. It is, however, difficult to extend to other than 1:0 selection.

Automatic Core Tester

(R. F. Jenney) (UNCLASSIFIED)

Most of the drawings of the automatic tester are in the drafting room. A report on all the production test equipment is to be written.

2.2 Group 63 (Continued)Thermal Effects - Nickel Ferrite

(N. Menyuk) (UNCLASSIFIED)

An investigation of the pulse response of nickel ferrite as a function of temperature will be under way shortly. In order to reduce the coercive force of available nickel ferrite, two toroids originally fired at 1350 C have been refired at 1450 C. This has resulted in a decrease of the coercive force from approximately 4 oersteds to 3 oersteds.

Microstructure Studies

(T. Maddocks, J. B. Goodenough) (UNCLASSIFIED)

A series of zero percent Mn cores, a series of zero percent Mg cores, a series of MgOFe₂O₃-MnO cores, a series of 20 percent Mn cores, and a series of 15 percent Mg cores have been polished and etched. The following information is immediately apparent: (1) MgO precipitates to cause the steep drop in squareness in Mg-rich samples. The ferrite grains are imbedded in the MgO matrix. (2) α -Fe₂O₃ precipitates as lamellar precipitate. This causes an abrupt reduction in squareness in Fe-rich samples. The voids in the Fe-rich samples are larger. This may be due to reduction of some Fe³⁺ to Fe²⁺ with subsequent trapping of O₂ in gas pockets. (3) There is no apparent change in microstructure due to a refiring in N₂ which causes the squareness ratio to increase from 0.3 to 0.8

Stress Effects in Ferrites

(N. Menyuk) (UNCLASSIFIED)

A memorandum entitled "Stress Effects in Ferrites and Generalization of Switching Coefficient for Non-Square Materials" has been written and is now being typed. It will be available in the near future.

SECTION III - CENTRAL SERVICES

3.1 Purchasing and Stock

(H. B. Morley) (UNCLASSIFIED)

A special expenditure appropriation request for 10 Raytheon Pathfinder Indicators is in process. The order will be placed when approval for the purchase is received.

Dumont replacement K1084P7M CRT's for the Ratheon units have been ordered. Dumont, as in the past, promises to make every possible effort to meet our delivery requirements.

Ward-Leonard's delivery failures of power resistors slowly ceases to plague us as good deliveries arrive from Hardwick, Hindle for similar material.

The adoption of the Lincoln system of numbering components in accordance with new standards creates the problem of renumbering our entire Kardex system and stock bins to coincide accurately. This problem is being carefully studied.

A revision of the manufacturers' index (a long-range program) has been started, with the objective of bringing it up to date, and accurately listing the manufacturers' representative for each manufacturer.

Month of November

Total Orders Received - 372

Received on time	165	44%
Received 1-7 days overdue	116	31%
Received 8-14 days overdue	42	11%
Received 15-22 days overdue	15	4%
Received 23-30 days overdue	11	3%
Received 1-2 months overdue	14	4%
Received 2-3 months overdue	4	1%
Received 3 or more months overdue	5	2%
	<hr/>	
	372	100%

3.2 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 33 Construction Requisitions totaling 383 items satisfied since November 20, 1953; and there are 31 Construction Requisitions totaling 1811 items under construction by the Group 60 Electronic Shops.

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

Outside Vendor

(J. V. Mazza) (UNCLASSIFIED)

There is 1 order now open with vendors totaling 332 items. Deliveries in the past biweekly period have totaled 30 items. Information on specific orders may be obtained from the writer (Ext. 3492).

3.3 Component Analysis and Standards

3.33 Standards

(H.W. Hodgdon) (UNCLASSIFIED)

Distribution of all available copies of IBM Military Reference Data Books has been completed, and files of extra copies of individual sections are being set up. Additional complete books will be distributed as soon as received.

A meeting of the Division 6 Standards Committee was held on December 3 to discuss the adoption of the proposed Lincoln Lab Standards on fixed-composition and fixed-film resistors as replacements for the present DCL Standards. It was decided that this could be done, provided key offices such as Drafting, Production Control, Procurement, and Stock keep adequate cross-references. Provision is being made for this.

It was also decided at this meeting that, in general, no new Division 6 standards will be prepared and issued, but that the effort will be directed toward writing a Lincoln Lab Standard to meet the same requirement.

Further meetings of the Division 6 Standards Committee will be called as necessary to pass on the acceptability of proposed Lincoln Lab Standards.

3.34 Vacuum Tubes

(H. B. Frost) (UNCLASSIFIED)

During this past week some tests have been run on the samples of Lot K2 of Z-2177-1 tubes. These tubes have been tested for contact potential and interface impedance. They have gold-plated grids which give a positive contact potential. The Class "A" condition shows lower plate current. The positive-grid current conditions are nearly the same, and the cutoff is better than the 5965 tubes. The Z-2177-1 tubes have the equivalent of 5 to 10 ohms of interface impedance (time constant $10/\mu\text{sec}$ -onds). However, temperature variations show no change in the value of impedance. The impedance probably results from a resistive film on the anode. Such a film will not cause trouble on life, but it will prevent sensitive measurements of interface impedance early in life.

Curves for the 7AK7 tubes are being taken by Al Zacharias for positive grid conditions. Ted Cohen will assist with this work in the next few weeks. Pentode curves are nearly complete.

(S. Twicken) (UNCLASSIFIED)

The program for obtaining characteristic curves of the 7AK7 in the positive grid regions has been delayed somewhat by equipment difficulties. Half the curves have been taken, and the remainder will be completed the week of December 7.

In an evaluation of the 7AK7 as a cathode follower, triode-connected curves have been taken and are available in the Print Room.

The 5965 life test has reached 3000 hours. No interface impedance of consequence has been observed. The droop in d-c plate current observed in two tubes and reported previously is still present in about the same amount.

Contact-potential measurements on the Z-2177-1 (GE's improvement of the 5965 for XD-1) indicate a positive shift of about 0.8 volts from that of the 5965. This shift is due to the addition of a gold-plated moly grid. The effect of this shift on the operating point of the interface test and on zero-bias plate current has not been completely determined as yet.

On December 2 a meeting was attended at GE in Clifton, New Jersey, on the progress of the Z-2177-1. On December 3 and 4 meetings were attended in Poughkeepsie with the Project High tube group.

3.34 Vacuum Tubes (Continued)

(T. F. Clough) (UNCLASSIFIED)

The dissection program referred to in the Biweekly Report of November 20, 1953, is continuing. Considerable data has been evaluated on the 5998 tubes. This data will be useful for evaluation of present tube types as well as those tubes under development.

A visit to the GE Tube Office at Clifton, New Jersey, was made on December 2 to discuss the present status and future plans for the Z-2177 tube type.

(A. Zacharias) (UNCLASSIFIED)

During this period the pulse equipment for obtaining tube characteristics in the positive grid region was set up. A set of characteristics for a 7AK7 was taken; additional 7AK7's will be tested by T. Cohen.

The 7AK7 exhibited Barkhausen oscillations when G_1 was pulsed above +5 volts, with G_2 at +90 volts, and G_3 at cathode potential. However, no such oscillations are observed with G_3 up to or above +5 volts to cathode.

Thesis Studies

(H. B. Frost) (UNCLASSIFIED)

Continued tests on RT 414 have shown that it is a very satisfactory tube. The cathode is quite active and has 120 μ amperes of current at 360 C; successful measurements of the cathode resistance have been made.

The theoretical relationship between pure emission, d-c emission, and coating resistance has been reduced to a curve using implicit functional relationships. Scatter plots of RT 413 and RT 414 show many points on or close to the curve with others off the curve. My analytical treatment of the diffusion theory is not proven, but the results thus far look promising. Such divergences as exist appear to be explainable.

A considerable amount of effort has been devoted to debugging a new computer program for the diffusion equation. The new program was run successfully December 4. Further results will appear in the S&EC Biweekly Report.

Some data has been analyzed for diffusion-constant determination. The first results show a much higher constant than has been reported in the literature. This work will be continued.

3.4 Test Equipment

Test Equipment Headquarters

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

Tests were performed under the guidance of Jack Gillette and Dick Best to determine the best circuit for a delay-line amplifier to be used as standard test equipment. Testing and experimenting began with the circuit developed for MTC. The grid circuit of the delay-line driver was modified to make the unit useful at higher frequencies. An amplitude control was put in the cathode of the output amplifier. Adel clamps were placed within the chassis to support delay lines of any length up to two microseconds.

Maintenance test specifications for standard test equipment, in preparation for over a year, are now complete. The "spec book" now contains maintenance specs for 14 Burroughs and 15 Whirlwind units as well as acceptance-test specifications for most of these. Specs are available at Test Equipment Headquarters.

3.5 Drafting

AN/FSQ-7 Drawings

(A.M. Falcione) (UNCLASSIFIED)

The original intentions of IBM were to issue experimental drawing numbers for all drawings being made for XD-1. At the conclusion of the experimental stages on XD-1, the plan was to assign production drawing numbers to the XD-1 drawings which would be used for production purposes. The changeover of drawing numbers from the experimental stage to the re-production stage would involve a considerable amount of drafting time. Therefore, IBM has issued production-drawing number series for XD-1 drawings now being made. The assignment of production numbers at this time will be a considerable saving when XD-1 is approved for production. The production-drawing-number series assigned are as follows:

3,000,000 through 3,999,999

A comparison between the present drawing-number system and the new system would be as follows:

5001 - 00006 is a present drawing number.

3,000,006 is the new drawing number.

This means that the (5001-) has been replaced by figure (30). The basic drawing number remains the same.

3.5 Drafting (Continued)

Drafting Procedures Meeting at IBM

(A. M. Falcione) (UNCLASSIFIED)

A meeting was held at IBM on November 23, 24, 1953, to discuss inconsistencies in drafting standards and procedures which have slowed down our Print Room operations. As a result of the meeting it is felt that definite progress is being made to comply with drafting standards and Air Force Regulation.

3.6 Administration and Personnel

Terminated Staff

(J. C. Proctor) (UNCLASSIFIED)

Richard Farmer

Terminated Non-Staff

(R.A. Osborne) (UNCLASSIFIED)

Assunta Aprile
Nancy Jones
Athena Korologos
Esther Sidman

Open Non-Staff Requisitions

(R. A. Osborne) (UNCLASSIFIED)

1 Clerk-Typist for Group 62
1 Laboratory Assistant for Group 63
1 Laboratory Assistant for Group 6345
1 Messenger Boy
1 Messenger Girl
2 Electronic Technicians for Group 64
1 Senior Detailer