

Memorandum 6M-3075

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Division 6 - Lincoln Laboratory
Massachusetts Institute of Technology
Lexington 73, Massachusetts

SUBJECT: BIWEEKLY REPORT FOR SEPTEMBER 24, 1954

To: Jay W. Forrester

From: Division 6 Staff

Approved: for John B. Bennett *(JWB)*
John B. Bennett

CLASSIFICATION CHANGED TO:
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SECTION I - CAPE COD SYSTEM

1.1 Group 61

1.10 General

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

Group 61 has now been reorganized into the following six Sections. The Sections are further broken down into Subsections with an Assistant Section Leader in charge of each one. The following table outlines this new breakdown:

- System Operation - G. Zraket
- Training - G. Zraket
- Test Coordination - R. Davis
- Direction Center Operation - G. Zraket
- Data Analysis - G. Zraket
- Programming - G. Zraket
- XD-1 Programming - R. Walquist
- Air Surveillance - J. Ishihara
- Weapons Direction - G. Grandy
- Identification & Manual Inputs - R. Walquist
- Master Control & Display - H. Benington
- Utility Program Card Preparation - C. Gaudette

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1.10 General (Continued)

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

Training & Battle Simulation - Personnel not yet available

- SAGE* Planning - J. Arnow
- Duplex Operation - W. Attridge
- Combat Center - W. Lone
- Special Studies - J. Arnow
- Test Program Planning - D. Israel
- Analysis and Simulation - W. Wells
- SAGE Training - Personnel not yet available

Since Group 61 personnel are currently engaged in the completion of the programming for the 1954 Cape Cod System, this biweekly continues the previous organization.

1.12 Data Screening

(R.L. Walquist) (CONFIDENTIAL)

Major group activity still lies in writing and checking out the TWS program for the 1954 Cape Cod System. The present status of this program is indicated below.

1954 TWS Program

Section	Percent Completed			
	Memo	Initial Coded Program	Initial (Unit) Testing	Final Individual Testing
Radar-Data Input	Issued M-2922	100%	60%	0%
Tracking	80%	60%	40%	0%
Monitoring	90%	80%	0%	0%

Considerable time has been spent on three XD-1 problems:

1. FGD Transmission. I attended a conference between Group 24 and the Division 6 Systems Office at which different types of FGD equipment were discussed. The major unresolved problem is the allowable time delay produced by the buffer storage at the radar site. Coupled with this problem is the question of the point in the input system at which clock time should be associated with the radar data.

* Semiautomatic Ground Environment system, new name for Transition System.

1.12 Data Screening (Continued)

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

2. Mapped-Out Area Transmission. Group 61 is studying the operational benefits that arise if the boundaries of the coverage area which is mapped out at the heavy-radar site could be transmitted to the Direction Center. From an operational point of view, manual designation of this boundary appears desirable.

3. XD-1 Floor Plans. The plan for the second floor of the XD-1 Building has been revised and appears satisfactory except for the Manual Inputs Room. Equipment in this room was rearranged to allow greater flexibility for expansion and to reduce the problem of lighting the punch-card equipment and reading the DID scope on the supervisor's console.

(D.L. Bailey, H. Seward) (CONFIDENTIAL)

The Track-Sort Program and the Correlation Program are both ready for unit testing (testing with the remainder of the Tracking Programs).

Two of three tapes involved in the Smoothing and Prediction Programs are ready for parameter testing.

(F. Heart) (CONFIDENTIAL)

Parts of 3 days were spent in attendance at an IRE Symposium on Information Theory held at MIT on 15, 16, 17 September.

On 13 and 14 September Robert Simon from Engineering Research Associates visited the Laboratory to discuss various aspects of a tactical-air-control (TAC) problem. ERA is working on an Air Force contract let by Rome, and this contract apparently involves somewhat more than just paper study. According to Mr. Simon, present tentative TAC thinking at ERA involves use of a reasonably large-scale digital computer and includes many problems with which Lincoln is familiar. In addition to discussions regarding the Cape Cod and XD-1 Systems, Mr. Simon also spoke briefly to H. Sherman (Group 24) I. Reed (Gr.124) and D. Israel

(D. Bailey, J. Ishirara, H. Peterson) (CONFIDENTIAL)

Compilation of 1954 Cape Cod System tracking program tables and data storage is nearing completion. Internal storage allocations are complete, and assigning of drum storage has begun. A memorandum covering the foregoing will be ready within the next week.

Preliminary planning for combining and testing tracking sub-programs has been completed. Present plan is to test the data-input sub-programs as an entity. The program will then be retested after first adding that part of the tracking subprograms for tracking "established" track, again after adding the monitoring subprogram, and finally after the addition of "tentative" tracking.

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1.12 Data Screening (CONFIDENTIAL) (Continued)

(J. Levenson) (CONFIDENTIAL)

6M-3052, "An Analysis of Automatic Initiation in the 1953 Cape Cod System" has been issued. Data on other phases of Track-While-Scan operation in the 1953 Cape Cod System have been processed and are ready to be organized. A memo containing these results should be issued in about 2 weeks.

(S. Manber) (CONFIDENTIAL)

The operation of the program which compares successive scans of gap filler SDV (scan-to-scan correlation) has been improved and rechecked. Proper operation of this program is now insured even with the saturated condition of 100% returns.

(H. Peterson, H. Frachtmen, F. Heart) (CONFIDENTIAL)

The monitoring program for 1954 Cape Cod is 60% done. A descriptive memo is nearing completion

(E.W. Wolf) (CONFIDENTIAL)

The radar-data input program is now substantially complete; however, only the data-collection section of the program has been checked out.

I attended several preliminary conferences pertaining to my new duties in the Test Program Planning Section.

1.13 Tracking and Control (CONFIDENTIAL)

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

My proposals for integrating AAA within SAGE, to be discussed shortly with Signal Corps representatives, were discussed during this period with J. Arnow, A. Favret, H. Sherman (Group 24) and J. Jacobs (Group 62). The proposals were acceptable, in general, and agreements were reached where differences of opinion existed. Work is now progressing on a final draft to be considered by the above and finally by the Signal Corps representatives.

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1.14 Weapons Direction (CONFIDENTIAL)

(D. Israel) (CONFIDENTIAL)

The past 2 weeks have been largely devoted to the organization and orientation of the newly formed Test Program Planning Section. This work has generally been on a piecemeal basis, since of the five staff members assigned to the Section, only two -- Jack Nolan and myself -- are immediately available; by virtue of vacations and commitments to the 1954 Cape Cod programming, Bill Lemnios, Judy Levenson, and Eric Wolf will not be available for assignments until the middle of October.

The most positive results of the first 2 weeks' work have been discussions of problems of common interest with Walter Wells and Alex Nedzel. In general, it was agreed that as a basis for future test programs and related analysis and simulation studies, a concentrated attack on the problem of describing the characteristics of radar-track data and radar noise should receive high priority. These matters were discussed with Herckmans and Ennis of BTL who visited the Laboratory on 21, 22, and 23 September.

Another result of the initial planning has been the decision to place more emphasis and attention on certain aspects of interception techniques and results. A first item for consideration is the "vectoring limit" method for describing interception results. These matters were discussed with representatives of BTL and Convair during the past two weeks, with plans for closer liaison among Lincoln, BTL, Hughes, and Convair being formulated.

(J. Cahill, Jr.) (CONFIDENTIAL)

A successful raid-size-estimation flight test with B-47 targets was performed on 16 September. This ends the present test series; I will prepare a final report within the next few weeks. The tests as a whole were sufficiently successful and the results sufficiently consistent to permit a considerable reduction in the number of tests which it was initially felt were required.

This fact is largely due to the fine cooperation extended by Group 22, the 6520th Flight Test Squadron, and the various SAC units which participated.

(A. Chandler, S. Manber) (CONFIDENTIAL)

The 1954 CCS equipment checkout programs (less the intervention-register check) were operated successfully. Some minor equipment defects were found and reported. The preparation of the instruction manuals which contain the step by step procedures to be followed by the operator at each station during the equipment checks has been started. The logic of the program which checks the intervention registers has been checked out. The computer-storage tables required to perform this test at all stations are now being compiled.

CONFIDENTIAL

1.14 Weapons Direction (CONFIDENTIAL) (Continued)

(R. N. Davis) (CONFIDENTIAL)

The Test Coordination Subsection assisted and supported the raid-size assessment tests conducted at the S. Truro radar site on 10 and 16 September.

Operational activities for the 1954 Direction Center were started on 23 September by coordinating scheduling and participating in mapper-tracking test which utilized data from all of the radar sites. Mission Specification 6 was produced, outlining the requirements and purpose of this test.

This section has also formulated standard documents to be produced for the 1954 Direction Center Operations (see 6M-3021). The scope of the Test Coordination Subsection's activities and the assignment of responsibilities for fulfillment of these responsibilities has been defined.

(A. G. Favret) (CONFIDENTIAL)

Flow diagrams have been completed for the height-finder program of the 1954 Cape Cod System, and coding of the program has been initiated.

(F. Garth, S. Hauser) (CONFIDENTIAL)

Only a cursory coverage of the 1954 Cape Cod Identification Station could be presented in the lecture given this past week to the Air Force personnel. The allotted hour and a half posed the problem of extensive condensation; but since the actual lecture time was reduced from this by 15 minutes, serious omissions resulted.

6M-3030, "Geography Display Program Specifications for the 1954 Cape Cod System," was issued.

The coding of the identification program for the 1954 CCS is about two-thirds completed.

(E. McEvoy, E. Bedrosian, C. Gaudette) (CONFIDENTIAL)

The control program and the subframe timing program for the 1954 Cape Cod System have been checked out and are available for use with other System programs. The utility programs which will be stored on the auxiliary drum with the System programs are now in process of being checked out; they should be ready for use in a week. The specifications for the recording program, the simulation programs, and the start-over programs will be issued during the coming period. One mode of the start-over program is already checked out and may be used with other programs.

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1.14 Weapons Direction (CONFIDENTIAL) (Continued)

(J. H. Newitt) (CONFIDENTIAL)

Construction of the prototype situation-display console is under way, and the mechanical details of design are being made final in completed production drawings.

Design of the auxiliary console has not yet started but will get under way very soon. Preliminary planning for the auxiliary console is being carried out at present. This console does not present the complexity of the situation-display console, and it is expected to move much faster through its developmental stages.

I have two prototypes of an r-f type high-voltage power supply available for test. It is hoped that the presently planned 60 high-voltage supply of the situation-display console can be replaced by a supply patterned after this design. B. Paine is preparing a life test setup for this and other purchased supplies that we have collected.

Some time was spent considering the problem of large-scale situation-display projection.

I am cooperating with Degan and Corderman to use the mock-up with a Charactron display and with simulated display (by 35-mm projection) under room-lighting conditions that will closely simulate those expected in the operations center. In this way we hope to finally evaluate the flat vs. the curved implosion screen, the new light-gun design, glare problems, and paint shades for panels and equipment. These very controversial points have never before been settled to the satisfaction of all concerned since no really conclusive experiments have been conducted to date by either IBM or MIT.

(C. A. Zraket) (CONFIDENTIAL)

The 1954 Cape Cod System is expected to be fully operational about the first week of November. 6M-3063, "Organization and Schedule of Program Checkout," 20 September 1954, has been issued to this effect. The efforts of the section are now being directed along the following lines:

- 1) A training program for the operational Air Force personnel. A 2-week general orientation course has just been completed. The preparation of operating manuals and courses in the operation of each station of the Direction Center will be completed by the end of October. Officers of Section 8, 6520th AC&W Squadron, are taking an active part in this program.

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- 2) The organization of equipment-checkout procedures, programs and manuals, and the consolidation of console layout and switch-panel assignments.
- 3) The completion and checkout of computer programs.
- 4) Preliminary tests with the mapping scopes utilizing live data from all of the radar sites.
- 5) The formulation of a calibration program for the orientation of the radars by the use of Raydist data.
- 6) The specification of operating procedures for the Direction Center and the initial liaison with external units for the use of aircraft, equipment, etc.

The major effort of the Section during the next month will be the checkout of the 1954 Cape Cod System Program. Literature concerning the 1954 Cape Cod System can be found in 6M-2706 series.

L17 Associated Studies (CONFIDENTIAL)

(V. Walls) (CONFIDENTIAL)

Planning for the radar-interceptor simulation project was discussed with Richmond, Davis, Newberger, and Galt of the Ball Laboratory. These discussions have pointed to the need for further study of radar-data statistics. In particular, it is necessary to make measurements and analyze them which will confirm the statistical models of clutter and miss-son sets proposed by Galt of Ball Lab. Galt and Naitchik of Ball Lab will assume the responsibility for writing computer programs for this purpose, continuing the work begun by Dr. Fisher.

(D.B. DeLong) (CONFIDENTIAL)

The computer program for the radar-interceptor simulation has been considered in eight separate sections to facilitate testing and provide flexibility. Six of these have been written. The remaining two will be written as soon as the first six can be checked out on N70. Testing of the first section was begun but had to be discontinued because of computer troubles.

(E. S. Taylor) (CONFIDENTIAL)

Studies have begun on three different...
 1. To determine the proper...
 2. To determine the proper...
 3. To determine the proper...

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1.15 Center Operations (CONFIDENTIAL)

(W. Vecchia) (CONFIDENTIAL)

TOTAL ASSIGNED

60 hr 30 min

	hr	min
Data Screening	40	
Weapons Direction	3	30
Equipment Check (Rm. 222)	1	45
	<hr/>	
Total	45	15
Time Given to Systems	5	
" " " Math Group	4	15
" " " Ackley	2	
Time Unassigned	3	30
Time Lost to Computer (Malfunction)		30
	<hr/>	
	15	15
	<hr/>	
	45	15
	<hr/>	
	15	15
	<hr/>	
GRAND TOTAL	60	30

1.17 Associated Studies (CONFIDENTIAL)

(W. Wells) (CONFIDENTIAL)

Planning for the manned-interceptor simulation project was discussed with Herkmans, Ennis, Bomberger, and Giloth of the Bell Laboratories. These discussions have pointed to the need for further study of radar-data statistics. In particular, it is necessary to make measurements and analyses which will confirm the statistical models of clutter and blip-scan ratio proposed by Olmstead of Bell Labs. Curran and Meinholtz of Bell Labs will assume the responsibility for writing computer programs for this purpose, continuing the work begun by St. Manber.

(H.D. Neumann) (CONFIDENTIAL)

The computer program for the manned-interceptor simulation has been considered in eight separate sections to facilitate testing and provide flexibility. Six of these have been written. The remaining two will be written as soon as the first six can be checked out on MTC. Testing of the first section was begun but had to be discontinued because of computer troubles.

(R. Sittler) (CONFIDENTIAL)

Studies have begun on three different projects:

1. To determine the probability of a successful initiation on an aircraft having a blip-scan property as specified by Olmstead's blip-scan ratio model.

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1.17 Associated Studies (CONFIDENTIAL) (Continued)

(R. Sittler) (Continued) (CONFIDENTIAL)

2. To determine the vulnerability of the initiation program to ~~initiation~~ on clutter, as specified by Olmstead's clutter model.
3. To determine the stability of the control loop as represented by a linear approximation to the complete interceptor-control problem including the smoothing equations.

(B. Smulowicz) (CONFIDENTIAL)

The report on the Bomarc studies may be found in the Secret Supplement to this Biweekly Report.

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1.2 Group 64

1.21 WWI System Engineering Program

(E. S. Rich) (CONFIDENTIAL)

In preparation for full scale use of the 1954 Cape Cod System facilities within the next several weeks, schedules are being set up to exercise those parts of the System which are independent of the central computer. This is directed primarily toward the radar-data inputs where operational, as well as equipment, problems exist and where preventive-maintenance techniques are less well developed than in the computer. At the same time an attempt is being made to develop a more critical attitude on the part of the systems engineers and technicians toward detection and elimination of weaknesses. Some new summaries of computer performance are being worked out to better indicate the condition of the system.

WWI System Operation

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 10 - 23 September 1954:

Number of assigned hours	119
Usable percentage of assigned time	93
Usable percentage of assigned time since March 1951	88
Usable percentage of assigned time since September 1953	92
Number of transient errors	5
Number of intermittent errors	2
Number of steady state errors	3

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1.21 WWI System Engineering Program (Continued)

WWI System Operation (Continued)

Analysis of WWI Interrupting Failures

(L. O. Leighton) (UNCLASSIFIED)

The following is a breakdown of interrupting failures in the WWI System since 10 September 1954:

Interruption of System Operation	Attributable to New Installations or Modifications		Chargeable to System			
	Number	Time lost (min)	Explained		Unexplained or in doubt	
			Number	Time lost (min)	Number	Time lost (min)
Blown fuse of circuit breaker	2	30	1	5		
Intermittent or open wire or cable	1	37	2	60		
Component failure			1	270		
Unexplained alarm					2	17
Design weakness			2	100		
Failure induced by marginal checking					1	180
Freon leak in air-conditioning system	1	180				
Totals	4	247	6	435	3	197

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

The percent reliability of the computer system decreased considerably during the recent biweekly period. The down time was the result of diverse troubles. Some of the failures are as follows -

- (1) Three incidents of undersized fusing of new power wiring;
- (2) One case of improper checkout of completed computer modifications;
- (3) A Freon leak in the newly installed piping for the modifications to the Room 222 air-conditioning system;

1.21 WWI System Operation (Continued)

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

- (4) An intermittently open video cable resulting in the erratic clearing of the A-register;
- (5) A loose power connection resulting in improper displays;
- (6) A faulty 5687 tube used as a cathode follower causing the undesirable selection of the mechanical reader whenever other input-output equipment was being used.
- (7) Two core-memory parity alarms due to a fault with the sensing amplifiers.

As a result of the above troubles, several corrective measures have been taken. The engineers and technicians of Group 64 were reminded by Ed Rich of the standard procedures required for new installations and modifications. Technicians who are on duty whenever troubles occur have been requested to spend less time by themselves fixing the failure and to seek the assistance of a system engineer after a reasonable time of troubleshooting has elapsed. The core-memory sensing amplifiers have been modified to correct for excessive grid current present in some stages. The strobe pulse for core memory was increased in amplitude.

1.22 Terminal Equipment

Data Inputs

(N. N. Alperin, A. V. Shortell) (CONFIDENTIAL)

In conjunction with Groups 61 and 22 a series of tests of the data-input equipment has been scheduled. Initially these tests will include only phone-line inputs, demodulators, CRT filter control, and the mappers. Later they will be expanded to include the MITE equipment and the buffer drum.

The first of these tests was held from 0930 to 1200 on September 23. At this time the Truro signal was unusable because of phone-line noise. Of the eight gap-filler sites, Scituate and Nantucket were not operating and Martha's Vineyard data, while usable, was not used by reason of difficulties here. The remaining five gap fillers had usable signals.

A comparison of the data taken on these five sites during the line test and the recorded test shows that the data and scope operation were very good during the line test. During the playback, however, the results were poor because of tape dropouts. This was manifested on the scopes by noise, extra north strobes, and loss of azimuth synchronization.

1.22 Terminal Equipment

(A. M. Werlin, L. D. Healy) (UNCLASSIFIED)

The test record synchronizers of the MITE's have been modified to include FGD synchronizers to permit programmed checking of these new MITE's. All of the drawings, temporary cabling, and labels for the MITE's, filter control, and associated equipment are being checked and brought up to date. The MITE section of the Technician's Manual has been completed and is now in draft form.

Work is being done on gate writers for use in the status channels of the buffer drum to see if it is feasible to use this circuit to replace the existing FF writers which are prone to cause writing between slots.

Magnetic Drums

(H. L. Ziegler) (UNCLASSIFIED)

A chapter entitled "Erasing the WWI Magnetic Drums" has been written and submitted as part of the "Magnetic Drums Technician's Manual".

The magnetic-drum Mod II test rack is now complete and is in full-time use. Efficiency and convenience of chassis testing is considerably improved over that of the Mod I test rack.

Output Coder

(E. B. Paddock) (UNCLASSIFIED)

The output coder has been operated successfully with WWI using an old coder test program. Although the test-message equipment lacks one item for operation, the coder now can be used with WWI. It is expected that the coder will be completely operational in the near future.

Test Programs

(D. A. Morrison) (UNCLASSIFIED)

The following WWI Test Programs have been modified for use with the new sequence of flip-flop storage registers:

T-3432 Consolidated Test Program
T-3218-21 Arithmetic Element Check
T-3372 Magnetic Tape Test

Modification of the other commonly used test tapes was not necessary.

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1.22 Terminal Equipment (continued)

Power Supplies

(E. W. Pughe) (UNCLASSIFIED)

A control for a d-c standby generator is under construction. The generator is to be able to substitute for any one WWI d-c supply should the need arise.

The possibility of using Weston "Sensitrol" relays on each of the WWI d-c supplies is being investigated.

A ground detector for the 550-V distribution in the Barta Bldg. is to be constructed.

1.23 AN/FSQ-7

Duplex Central

(B. E. Morriss) (CONFIDENTIAL)

An approach for the marginal-checking system for the simplex equipment in the duplex has been tentatively agreed upon with IBM. Marginal checking will occur only on units which have been switched to the standby computer and a reserve power supply and which have been specified by a marginal-checking switch provided for each unit. Design is proceeding on such a system in which only one of the two simplex power supplies can be used for marginal checking, but, time permitting, the possibility of making the two power supplies interchangeable will be investigated.

A set of specifications for the motor-generator sets has been prepared and is now being reviewed.

A problem has developed in adapting the XD-1 warning-light frame for the duplex. Because of the need for balancing neons in the present design it appears that either the flip-flop in the warning-light memory must be redesigned or additional edge connectors be provided through mechanical redesign if duplicate warning-light neons are to be furnished on the maintenance console. Because no method of checking the warning lights exists at present (other than observing the neons), it would appear necessary to have a set of lights at the maintenance console.

The addition of a second elevator in the Direction Center running from the basement to the command-post projection room has required moving the maintenance-console room on the first floor and has reopened the first-floor layout question. This layout has been reviewed again, and it appears to be generally agreed that it is adequate but might be improved by moving the console power-distribution equipment to the second floor. This is being investigated.

Work on maintenance consoles, Combat Center, and the question of the compatibility of the output system with EIC data link are reported in following sections. Since the maintenance consoles are to be eventually redesigned, any suggestions for improvements should be forwarded to the Systems Office immediately.

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1.23 AN/FSQ-7 (Continued)Maintenance Console (UNCLASSIFIED)

(R. H. Gould, K. E. McVicar)

The design of the duplex maintenance console is under discussion with representatives of IBM. The facilities to be provided are being considered in detail in an attempt to come up with a console which will provide the maximum amount of information for trouble shooting with a minimum of confusion.

The section of the maintenance console concerned with the central computer has been given a good deal of thought so that in most cases we feel the facilities are adequate, but some differences of opinion have arisen as to how the various lights and switches should be arranged and as to just which equipment should be emphasized as the primary trouble-shooting tools.

The section of the maintenance console concerned with the terminal equipment is in a much more nebulous state and present work in this area is concerned with what facilities should be provided. The questions of arrangement and emphasis have not yet arisen.

Discrete-Address System

(H. K. Rising) (CONFIDENTIAL)

A meeting was held 23 September at the Bell Telephone Laboratory, Whippany, New Jersey to discuss the discrete-address system. BTL engineers described the system logic and word structure, and ways were proposed to make this system compatible with our needs. A future meeting is planned to further discuss compatibility and the results of the above evaluation.

Maintenance Consoles

(C. W. Watt) (UNCLASSIFIED)

Study and intensive discussion with the IBM Planning Group and IBM mechanical designers led to the following general conclusions on the over-all mechanical design of the duplex maintenance console.

1. The present XD-1 maintenance-console design will be scrapped.
2. The duplex and simplex maintenance console will be constructed of more or less identical modules or frames which can be combined in any necessary fashion.
3. The arrangement of controls and lights will be thoroughly revised to provide more intelligible presentation of the trouble-shooting information.
4. Sufficient flexibility will be designed into the wiring and the structure to permit future changes.

1.23 AN/FSQ-7 (Continued)Maintenance Consoles (Continued)

(C. W. Watt) (UNCLASSIFIED)

IBM is now making layout proposals for discussion; on the basis of these it is hoped that the go-ahead can very shortly be given to the mechanical designers to start detailed design of these consoles.

It is understood that all of the desirable changes may not be incorporated in the first two production machines, but as much will be done as is possible within the limited time available. Achieving the decisions now being made should at least be possible after the first two or three machines.

No detailed planning has as yet been done on the simplex maintenance console but it is expected that the modular-design idea will be carried over into this work thus keeping the drafting time to a minimum.

Duplex Centrals

(F. E. Irish) (UNCLASSIFIED)

A memorandum, "Physical Characteristics of AN/FSQ-7 Direction Center Equipment - Supporting Assumptions", has been issued as 6M-3009.

This memorandum contains the assumptions that were made while arriving at the physical characteristics of the Direction Center equipment.

A tentative floor plan of a Combat Center has been sent to IBM for comments. This floor plan is identical with that for the Direction Center except for some frames (MRI and Mapper Counter) which are not included and others associated with the input equipment and the display equipment which are shortened by one half.

Power SystemPower Sources and Prime-Power Distribution

(J. J. Gano) (UNCLASSIFIED)

Memorandum 6M-3031 describes this portion of the system for the first three installations. Generation at 2400 volts will be performed by four Diesel-driven generators connected to operate in parallel with a utility source. Duplexing philosophy is employed so that failure of any individual piece of power equipment will remove power from only one computer and its auxiliary equipment.

Motor-Generator Sets

There will be five 400-HP motors each driving two generators. The sets are assigned to provide power to each of the two computers, the active simplex equipment and the standby simplex equipment. One set is a spare.

1.23 AN/FSQ-7 (Continued)

Mapper Supervisor's Console

(S. B. Ginsburg) (UNCLASSIFIED)

The basic requirements of the mapper supervisor's console were determined in conjunction with Group 61. Problems to be considered involve:

1. A method of reducing the synchronization time when selecting a channel to be monitored;
2. The method of selecting a channel;
3. Fine-Grain-Data requirements;
4. A method of mounting and operating a camera on a console;
5. Location of switches.

AN/FSQ-7 Schedules

(T. R. Parkins) (UNCLASSIFIED)

Work was started 21 September at High Street on a detailed set of engineering schedules for production FSQ-7's. A target date, 1 November 1954, has been set for issuing these schedules.

During this period, "Project High Progress Report for August" and XD-1 schedules posted 1 September were distributed to personnel concerned.

Phone-Line Requirements

(H. J. Kirshner) (UNCLASSIFIED)

Meetings were attended on 8 and 9 September at the Bell Telephone Laboratories, Murray Hill, New Jersey and at the American Telephone and Telegraph Company, New York. XD-1 and SAGE system telephone requirements were discussed. These meetings are reported in an M-series memorandum.

Specifications for a multi-track voice and data recorder were reviewed. An M-series memorandum was written on this subject.

Discussions were held with IBM relating to a maintenance intercom system for XD-1. Further discussions will be held on 28 September.

An ADES document covering SAGE system leased-line requirements is being reviewed.

1.23 AN-FSQ-7 (Continued)Power Distribution

(G. F. Sandy) (UNCLASSIFIED)

It has been generally agreed that insofar as possible, the marginal-checking and distribution (MCD) frames for the production machine will be the exact duplicate of those for XD-1. This definitely includes the computer and drum MCD frames. The display and manual-inputs MCD frame for XD-1 will be built in two sections so that the duplex portion of this frame can be separated from the simplex portion and used with very little mechanical redesign for the production machine. The outputs (duplex), will probably not be included with the display and manual-inputs MCD because the detailed information about the outputs power requirements will not be available in time. The duplex inputs MCD will be a separate frame although its load is small, so that it can be physically located in the room with the simplex equipment. It will be a completely new frame. The simplex distribution will consist of:

1. Two power-control and distribution (PCD) frames, which will feed power to
2. Four circuit-breakers (CB) frames, which will feed power to
3. Two power-distribution (PD) frames.

Marginal-Checking Distribution

(G. F. Sandy) (UNCLASSIFIED)

The marginal-checking distribution will be the same for each of the duplex portions of the production machine as for XD-1. A third marginal-checking system will be provided for the simplex portion.

No marginal-checking facilities will be provided for the display PD frame. The marginal-checking system for the simplex units in the other PD frame will not be duplexed, but will consist of one distribution system. Most of this equipment will be housed in a separate marginal-checking (MC) frame.

It has not been decided whether the marginal-checking system for simplex will be capable of being connected to either of the two power supplies or to only one of them.

Power Control

(G. F. Sandy) (UNCLASSIFIED)

The power control for the duplex portions of the production machine will be the same as that used for XD-1.

The power control for the simplex portion of the production machine will, in so far as possible, follow the simplex-duplex philosophy set up for the power distribution i.e., trouble in the master control for one power system will not affect the power control for the other except on a per unit (Simplex) basis.

1.24 New Computer Design

(N. L. Daggett) (UNCLASSIFIED)

The work of this group has been concentrated on developing simpler means by which terminal devices can be connected to a central machine. It seems fairly clear that a machine can be built which uses no drums, relying on direct accesses to a very large core memory for communication with input-output devices. One way in which the control problem can be handled is to let terminal units execute single instructions on a demand basis (instructions which would not affect contents of registers used by the main program). By sacrificing some operating speed, a system such as this offers considerable simplicity and flexibility in terminal equipment.

1.3 Group 651.31 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

The week of 13 September 1954 was spent on the west coast on problems associated with the Charactron and Typotron tubes. Together with H. Beatty of the IBM High Street Tube Group, C. L. Corderman, L. B. Martin, Frank Rodgers, and I spent 14, 15 September at Hughes and 16, 17 September at Convair.

At Hughes there was a discussion and evaluation of the latest proposed electron optical system for the Typotron. Test results indicated that the proposed optical system would be adequate after a few modifications. Hughes made one tube after our visit and telephoned the results to MIT. It will require at least one more tube to get the final optical system. Their most recent tube met all of the objective specifications except for the sensitivity of the compensation plates. An effort is being made to freeze the design of the electron optics so that production jigs and fixtures can be fabricated. These fixtures will be used to make the preproduction tubes for IBM's evaluation and production release.

Leroy Record, former head of all cathode-ray tube engineering at General Electric in Syracuse, has joined the Hughes Tube Group. At the moment he is working in the tube plant. These facilities are being used to make Memotron tubes. They will be converted to Typotron tubes as soon as IBM approves the proproduction tubes.

Considerable time was spent with Leon Yaggey and W. J. Cronin of Hughes discussing test specifications, test procedures, and test equipment. L. B. Martin reported on MIT's Typotron life-test results. W. J. Cronin discussed Hughes proposal for life-testing production Typotrons in the plant. All agreed that the work at IBM, Hughes, and MIT would be closely coordinated and frequently correlated.

Hughes and IBM have not yet signed a contract for the Typotron tubes in XD-1 and XD-2. Negotiations have been completed, and a contract should be signed within a week.

The design of the electron optics for the 19-inch Charactron has been frozen since 1 August 1954. Both Convair and MIT have each made at least five tubes to this design. Convair's early tubes indicated the need of well-aligned jigs. They have designed production jigs and expect to receive and use them the first of October. Tests on the preproduction model of the Convair Charactron showed that their aluminizing techniques are not adequate. This was discussed at Convair, and an intensive research and development program was begun at MIT. Present results indicate that the problem is under control and complete specifications for the aluminizing process can be written by 11 October 1954.

1.31 Activities of Group 65 (Continued)

(P. Youtz) (UNCLASSIFIED) (Continued)

Simultaneously work is continuing on optimizing the P7 screen for the AN/FSQ-7 application.

Some work was done in furtherance of the projection display development. Cadmium sulphide plates were prepared and sent to Group 25 for evaluation. A 19-inch Charactron tube with an aluminized P11 screen was made and sent to C. L. Corderman. Lloyd Sanford will photograph situation displays on this tube to evaluate certain photographic techniques to be used in projection display systems.

Saul Twicken attended two meetings of the JETEC on computer tubes. Saul Twicken and A. Zacharias visited DuMont with the IBM High Street Tube Group to review DuMont's progress and engineering specifications on the video mapper tube and the photomultiplier tubes.

Some attention was given to Sylvania program on the SR-1782A. A trip will be made to Poughkeepsie early next week to discuss this with the tube group.

1.33 Research and Development

(P. C. Tandy) (UNCLASSIFIED)

Life-test equipment for three 19-inch Charactron tubes was set up.. Equipment for more tubes will be available in a few days.

One tube has already completed 278 hours, while the other tube has been on life test 76 hours. The difficulty encountered with transfer-characteristic measurements has been resolved, and more curves will be taken shortly. As soon as a third tube is received, it will be put on life test.

(A. Zacharias) (UNCLASSIFIED)

The SR1782A life rack was submitted to Production Control, and delivery is expected by 1 October 1954. The telescope frame for Charactron face testing has been designed, and the sketch was given to Production Control and the machine shop.

The aluminizing process was investigated further. As it stands now, the remaining problem is keeping aluminum on the sides of the envelope during lacquer bakeout. On 16 September, a trip was made to DuMont where inquiries concerning this trouble were made. On the basis of these discussions, an experiment is being conducted to test the effect of the

1.33 Research and Development (Continued)

(A. Zacharias) (UNCLASSIFIED) (Continued)

cushion solution on aluminizing the glass sides. Preliminary results show that two buffers (separate phosphor and lacquer cushions) gain no advantage. The third part of the experiment is still being carried out. This involves the extra step of baking the phosphor after it has been laid down, then applying a cushion for lacquer. The experiment should be completed by 28 September.

(L. B. Martin) (UNCLASSIFIED)

On 14 and 15 September I visited Hughes Aircraft and reported on the MIT Typotron Life Test. This covered the logical design, periodic tests, summary of failures, and plans for expansion. During the discussions it became clear that some uniform terminology should be agreed upon among Hughes, IBM, and MIT. I examined the newly-completed Typotron production-line tester and life-test units under construction. Their life test will have 10 tube positions. Conversations with W. J. Cronin, in charge of life test at Hughes, have resulted in an agreement of closer cooperation that will save much duplication of effort as well as opening a channel of communication for minor technical details. In addition to the above, I participated in the conference on test specifications for the Typotron.

On 16 and 17 September I sat in on the discussion at Convair of the Charactron test specifications and life test. Their life test had been in operation 1700 hours at the time. At present they are life testing with a 50% duty cycle. However, P. Youtz and C. L. Corderman convinced them that a duty cycle of less than 1% would yield more significant results. Convair has agreed to take periodic pulse-transfer tests with the new duty cycle. For comparative purposes the pulse-transfer curves of the Typotron tubes are now being drawn from MIT life-test data. Copies of these curves will be sent to Convair.

Preliminary work has been started with H. Beatty to coordinate the planned Typotron life test at IBM with the life test at MIT.

A 4000-hour report, 6M-3032, on the Typotron life test is now available. A progress report on the life-test expansion is now in preparation.

1.33 Research and Development (Continued)

(L. B. Martin) (UNCLASSIFIED) (Continued)

The following tubes are now on test:

<u>Tube</u>	<u>Hours</u>	<u>Condition</u>
265	4472.0	marginal
280	3654.0	satisfactory
335	2837.0	"
366	2135.2	"
389	2051.4	"
390	2135.2	"
392	2135.2	"
394	1353.1	marginal

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SECTION II - AN/FSQ-72.1 Group 622.11 SystemsSystems Office and System Evaluation Committee

(J.F. Jacobs, P.R. Bagley) (CONFIDENTIAL)

Below is a brief summary of progress in the tasks currently undertaken by the System Evaluation Committee:

7. Test of Digital Data Link using MTC. Buzzard completed the logical design of a pulse distributor to connect the phone-line demodulator to the transmitter. A program to test the link as far as the demodulator output is also completed, and a second program involving a random-number check to test the entire phone line and radio link is being written.

14. Confirm Height-Finder Word Structure. Feldstein will soon publish an M-note on height-finder word structure in response to an inquiry by Paul Sebring. In preparation is a related memo describing the operation of the height-finding system.

18. Output-Frame Compatibility with BTL Discrete Address Data Link. Before the Systems Office can concur on the output specifications for production of FSQ7's, we must determine whether a change from the GE Ground-to-Air Data Link to the BTL Discrete Address Ground-to-Air Data Link would require a major redesign of the output section. Ten methods of incorporating this link into the system are being considered and evaluated by H. Anderson and H. Rising. Tentative results of the study indicate that the necessary change to the output system, if and when we switch to the BTL discrete-address data link, would be:

- (1) Addition of an extra buffer-core plane;
- (2) Modification of the method of loading data on the phone lines.

19,20,21,22. Review of 4 IBM Test Programs. Comments on all four IBM test programs submitted to us by the IBM Diagnostic Programming Group have been received and returned with comments to R. Pfaff at IBM.

24. MRI and FGD Problems. Platt is writing the minutes of a meeting held to discuss some outstanding problems of the miscellaneous radar input (heavy radar, Mark X beacon, and height finders) and the FGD specifications. The most important problem is that of the time delay of the radar data in the FGD system. This delay may be the major fraction of a scan. The clutter map at the heavy-radar site may have to be brought into the Direction Center. Platt and Hughes have prepared 6M-3062,

2.11 Systems (Continued)

Systems Office and System Evaluation Committee (Continued)

(J. F. Jacobs, P. R. Bagley) (CONFIDENTIAL)

"Proposal for Transmission of FGD Map."

A slight modification in existing FGD equipment (two or three flip-flops) makes it possible to send points (about 600) which represent the edge of the clutter map through existing communication channels in one or two scans.

25. Survey of current work relating to reliability and maintenance. Farley, Vanderburgh, and Bagley made a "get-acquainted" trip to IEM on September 23. They met with L. Walters, R. Pfaff, R. Douglas, and E. Goldman.

Systems Office activities during this period have included:

1. A program to resolve the outstanding joint Div. 2, Div. 6 problems with respect to AN/FSQ-7 (XD-1) production has been started. These problems include the following:
 - (a) Logical problems such as time delays in FGD, number of phone lines, target width;
 - (b) Joint maintenance and checking procedures;
 - (c) Time phasing of XD-1 testing, Building F construction, and radar-site tie-in.
2. Lincoln release has been given for:
 - (a) IM-67-2, Equipment List for XD-1 and XD-2;
 - (b) MRI Performance Specifications for XD-1 and XD-2;
3. The MIT-IEM method of operation for DDR, DDT, and SDV demodulator has been reviewed and approved.
4. A letter of intent to use MRI coverage mappers for XD-1 and XD-2 has been written to IEM.
5. Proposals for the location of clocks and for wall color of Building F are being circulated to opinion leaders before IEM-SO concurrence and Lincoln release.
6. Estimates of full space requirements for Building F are being gathered by the SO.

2.11 Systems (Continued)SDV and Digital Data Receivers

(I. Aronson) (CONFIDENTIAL)

SDV back-panel and pluggable-unit drawings have been received from IBM and checked for errors. Back-panel-wiring layouts for the digital-data receivers have been done for service, marginal check, yellow wire, and co-ax.

Digital-Data Transmitters

(I. Aronson) (CONFIDENTIAL)

Tentative etched-card and pluggable-unit wiring drawings have been made. These drawings will remain tentative until the circuits work is completed.

Receiver Test Monitor

(I. Aronson) (CONFIDENTIAL)

Preliminary design has been started on a dual-beam scope arrangement for monitoring SDV and digital-data receivers in operation. This device will be similar to that used at Whirlwind for checking SDV receiver performance.

Prospect Hill Data-Link Test

(I. Aronson) (CONFIDENTIAL)

We have modified and debugged one digital-data transmitter and receiver for this test. As soon as MTC can give us a test pattern, we will be ready to test the units on a phone line.

Display Tester

(B. G. Farley) (UNCLASSIFIED)

Investigation of the specifications and function of an XD-1 display tester has begun. A trip to IBM was made with P. Bagley and A. Vanderburgh to begin to orient ourselves with respect to the XD-1 test-program situation.

2.12 Magnetic Core Memory

Miscellany

(W. Papien) (UNCLASSIFIED)

An interesting comparison between random-access, high-speed (6 μ sec) core memories may be made by using the figure obtained when the number of useful memory bits is divided by the number of cathodes in the memory (from the address register to, but not including, the buffer register). On this basis, the WWI banks yield about 19 bits per cathode, MTC yields 53 bits per cathode, XD-1 about 85 bits per cathode. The proposed 256 x 256 x 32 now under study would have as its goal approximately 700 bits per cathode.

The new staff member of the Section, Don Ellis, will break in on the core-matrix-switch work which was stopped when Art Hughes was transferred to another Section. An additional man is needed to take over the work on sensing problems which Bill Canty covered before his transfer.

The Transistor Section of Group 63 is collaborating on the design of a gating or mixing front end for sense amplifiers.

XD-1 Memory

(J. L. Mitchell) (UNCLASSIFIED)

The memory frame is now being tested on a three-shift basis at IBM. According to the latest reports, some information patterns have been stored in all 36 planes.

128 x 128 Memory Plane

(J. L. Mitchell) (UNCLASSIFIED)

Bench testing of the 128 x 128 plane has started. The tests should yield information on expected signal-to-noise ratios and driving impedances for larger memory planes.

Memory Test Setup VI (64 x 64)

(E. A. Guditz) (UNCLASSIFIED)

The memory tester continues to be used for sense-winding investigations. It was also used for short periods by the Transistor Section for transistor sense-amplifier experiments. Tests have been started to determine the effectiveness of the post-write disturb pulse as a function of its length. An M-note on MTS VI is near completion.

2.12 Magnetic Core Memory (Continued)

Printed Wiring

(E. A. Guditz) (UNCLASSIFIED)

Progress continues to be made on printed wiring of planes and plane frames. Design of a 32 x 32 modular plane frame has been completed. Design of a 64 x 64 modular plane frame is under way.

Simultaneous dip-soldering of over 800 memory-plane connections has been accomplished with encouraging results.

New Techniques

(J. Raffel) (UNCLASSIFIED)

An investigation is being made of the feasibility of mixing core-memory outputs nonlinearly in order to discriminate against noise and provide a better signal-to-noise ratio at the sense amplifier. The nonlinear forward-resistance characteristic of diodes is being used for this purpose.

A nondestructive readout, which relies essentially on "delta," provides positive outputs for ONEs, negative outputs for ZEROS. Preliminary experiments with the required two-core cell have been encouraging.

Core Memory with External Selection

(S. Bradspies) (UNCLASSIFIED)

Four core drivers for the proposed memory are nearly built. They exhibit rise and fall times considerably shorter than 0.1 μ second and are expected to deliver about 1.5 amperes each.

2.13 Vacuum-Tube circuits

Special Circuits Released

(R. L. Best) (UNCLASSIFIED)

The following special circuits were released for XD-1 by the IBM and Lincoln Basic Circuits Sections: encoder matrix; set driver for output core buffer; MRI tape-core shift register and driver; and the manual-input shift-register loading and reset circuits.

2.13 Vacuum-Tube Circuits (Continued)

DD Erase Gate Generator

(R. L. Best) (UNCLASSIFIED)

The original breadboard circuit exceeded the allowable negative grid voltage on a Z-2177. An attempted modification will use no more tube sockets than were used before.

Typotron Intensification, MTC

(R. C. Zopatti) (UNCLASSIFIED)

The 5965 tube has now been replaced by a Z-2177 tube. I have also tried using the standard voltages available on the amplifier tube (7AK7 - tetrode connected). I was able to get a 100-v pulse output with an acceptable rise and fall time for a 0-10 volt input pulse but upon marginal checking found that the output voltage varied too greatly with changes of screen voltage. This appears to be due to insufficient feedback; a modification of this circuit is now being tested.

256 x 256 Core Memory Circuits

(D. Shansky) (UNCLASSIFIED)

It has been demonstrated fairly conclusively that one 5998 cathode per memory line will be all that is necessary to drive the load presented by the selection-plane winding of the memory.

Design work on a digit-plane driver has begun.

Limiting the Register-Driver Output

(B. Barrett) (UNCLASSIFIED)

Two racks of equipment which simulate operating conditions have been set up, and I am now debugging them. It is necessary to limit the register driver output when driving a large number of diode-capacitor gates which may be turned on or off in a random manner.

Phone-Line Demodulator

(E. B. Glover) (UNCLASSIFIED)

After a good deal of time lost in locating an intermittent component fault, it was found that the circuit was operable as is. Several improvements which became obvious during the test work were, however,

2.13 Vacuum-Tube Circuits (Continued)

Phone-Line Demodulator (Continued)

(E. B. Glover) (UNCLASSIFIED)

incorporated and added to the latest schematic. Important data on check voltages and wave shapes were obtained.

2.14 Memory Test Computer

General

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

Considerable progress was made in testing and applying the computer.

The Charactron has been lined up and tested with about 6 test programs.

Two memory test programs have been run successfully: MP-27 (inchworm) and MP-60 (checkerboard bootstrap).

An arithmetic check program was run, and margins were taken. The octal-constant and basic conversion programs were checked out.

New marginal-checking forms were prepared, and an attempt to simplify the marginal-checking procedure is under study.

Drum

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

Work is again in progress on the magnetic-drum memory. Two fields of 2048 registers each will be back in operation shortly. This will be followed by a study of the effect of temperature changes on the head spacing; if all goes well the remaining 10 fields will be put into service.

Card Equipment

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

A type-513 automatic reproducing punch has been ordered from IBM for study and eventual installation as a card reader and punch. Cards for the proposed system would contain 48 words of 16 bits and would be read or punched at a rate of 100 cards per minute.

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2.15 System Liaison

General

(A. P. Kromer) (CONFIDENTIAL)

A weekly status meeting is held at Western Electric - ADES office to discuss changes in the Status Report issued during the previous week. This covers planning for production systems including contracts, budgets, schedules, site selection, buildings, and equipment. Starting in October, a monthly meeting will fully review these matters in detail. Items of interest to Lincoln can be presented or reviewed at these meetings. Also, the obligations arising from Lincoln's over-all system responsibility are of interest to other groups present.

FY '55 funds are allocated for the construction of Direction Center Buildings and the procurement of five additional AN/FSQ-7 systems.

The Air Force JPO is studying possible use of the Technical Information Release issued by the PCO as a medium for coordinating action between Western Electric, IBM, Lincoln and the Air Force for design changes in production which arise out of test and operation of the XD-1 System.

SAGE System Equipment

(P. J. Gray) (UNCLASSIFIED)

Draft No. 3 of the Functional Responsibility chart for the SAGE system implementation is being distributed for comments on 24 Sept. to interested parties in Lincoln, Western Electric, IBM, and the JPO.

An AFCRC Exhibit number has been assigned to the Combat Center. This will be Exhibit AFCRC-18. CRC is taking the necessary steps to obtain an "AN" designation for this equipment. This will probably be another AN/FSQ-() designation. This information is required in order that AMC may issue a contract to IBM for the construction of equipment for the first Combat Center.

A revision of Exhibit AFCRC-1 is being prepared at CRC. Copies are expected to be available next week for review by Lincoln and IBM personnel. This review will assure that the revision represents an accurate description of the XD-1 system. This will allow the definitive version of IBM's prototype contract to be brought to completion. The revision will include Amendments 1,2,3, and 4 to the original exhibit of 30 June 1953.

2.15 System Liaison (Continued)

Production Coordination Office

(P. Bragar) (UNCLASSIFIED)

1. TIR's issued during the past two weeks:

1-21, "D. C. Equipment Layout, First Floor" - E 60004-1

1-22, M-2926-1, "D. C. Lighting Requirements"

1-23, M-3031, "D. C. Prime Power Dist. System"

1-24, M-3041, "Acoustic Criteria for D. C. Buildings"

1-25, M-3034, "Sub-Sector Command Post Requirements"

1-26, "Third Floor Equipment Layout, D. C. Building" -
D 59757

1-27, "Floor Opening Layout - First Floor, D. C. Building" -
D 60208

2. Plans are being made to issue all specifications for the AN/FSQ-7 production centrals by means of TIR's.

3. The present considerations of the Combat Center (Air Division) will lead to conclusions which must be incorporated into TIR's which outline requirements for the building and associated service facilities for the Combat Center. Western Electric -- ADES requires this information by 8 Oct. 1954 to permit architectural design work to be completed on schedule.

Direction Center Construction

(W. H. Ayer) (UNCLASSIFIED)

The meeting in New York with IBM, Lincoln, ADES, Burns and Roe, and the Air Force was held as scheduled to review and give preliminary approval to the drawings for the first Direction Center building. 6M-3044 contains the comments that Lincoln presented to the group. In addition, information regarding layout, lighting, and acoustic treatment of the Direction Center building were presented and discussed.

Line diagrams of the cooling system and its associated controls have also been reviewed and transmitted to Burns and Roe. A separate cooling-failure warning system is now in preparation.

2.16 Display

General

(C. L. Corderman) (UNCLASSIFIED)

A prototype 19-inch Charactron is now running with MTC and is available on a routine basis for output displays. A camera attachment is being made which will allow a 12-inch square area in the center of the tube to be photographed. This should be installed by MTC personnel the first week in October.

Experiments are now in progress to determine the light output from Charactrons with P7 and P11 screens. This information will determine the proper camera film to be used and serve as a basis for choosing a large display system.

Plans are being made for two display units to be assembled during October. The first is a unit to connect a Typotron tube to MTC. The second unit, which will operate a Charactron in a limited mode, is to be installed in a console mockup. This setup will be installed in a dark room having the egg-crate-lighting arrangement to test the Charactron in its final operational environment.

A trip is planned for 30 Sept. to the Vestal Lab. Discussions will be held leading toward the finalization of the engineering specifications for the 19-inch Charactrons to be used in XD-1.

SD Generator Schematic

(R. H. Gerhardt) (UNCLASSIFIED)

About three-fourths of the section block schematics for the timing and control section of the situation-display generator element have been laid out with the help of Bob Buzzard. The fact that the marginal-check breakdown has not been completed means that pin numbers cannot be completely assigned.

Situation Display System

(R. J. Callahan) (UNCLASSIFIED)

The load on the input gates, which read from the drums to the situation-display system, is being checked by R. Nienburg's group at IBM.

2.16 Display (Continued)

Testing

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

The Charactron display has been installed and debugged in MTC and is operating satisfactorily. Based on tests made with MTC, some modifications will be necessary in the XD-1 decoders. Plans are now under way to connect a Typotron display to MTC in the near future. Some modification of the character-positioning decoders will be necessary to adapt the present unit to operate both the Charactron and Typotron tubes simultaneously.

Equipment Drawings

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

The drawings for all cards and plug-in unit assemblies have been completed for the line driver, vector generator, 2-3 bit/1-6 bit decoder, and character-positioning decoders and are now being redrawn by Drafting. Some of the card assemblies have already been completed by the shop and are ready for assembly into the plug-in units.

2.2 Group 63 (Magnetic Materials)2.21 Magnetic Cores

(D. R. Brown) (UNCLASSIFIED)

Four new Research Assistants have started work in Building 10, Mel Cerier, Paul Griffith, Leo Jedynak, and Ken Konkle. They will be doing research on basic components and techniques as a part of the Division 6 advanced-development program. Main emphasis will be placed on magnetic-core circuits and transistor circuits. The work in Building 10 will be to create new ideas and demonstrate feasibility of new components and techniques, rather than any system development. Close coordination with related work in Lexington will be maintained by direct contact between individual Research Assistants and interested staff members in Lexington. Room number at MIT is 10-397; telephone, 51-679.

A new rectangular-loop ferrite has been created here with very low coercive force. Curie temperature also appears to be low. Our ferrite-core pilot plant is ironing out last wrinkles in process to make cores for a 256-by-256 memory plane.

Group 63 now has a Raytheon Ultrasonic Machine Tool set up and operating in Room B-189.

Ferrite Memory Cores

(J. R. Freeman) (UNCLASSIFIED)

The paper "Pulse Responses of Ferrite Memory Cores" will be distributed during the next week as laboratory memorandum 6M-2568-1. This paper supersedes the previous one of the same title, 6M-2568.

Incremental Permeability

(J. B. Goodenough) (UNCLASSIFIED)

P. H. Haas of the Diamond Ordnance Fuze Laboratories, Washington, D.C., came to consult with us for help in finding a magnetic material with a large change in incremental permeability per change in biasing field. Some preliminary ideas on this subject were written up as 6M-3059.

Curie Temperature Calculation

(N. Menyuk) (UNCLASSIFIED)

A theoretical study is being made of the effect of compositional changes on the Curie temperature of magnesium-manganese ferrite. In the initial phase of this study, the spinel structure is assumed inverse and the manganese in the system is taken as Mn^{+2} . With these assumptions, the relative Curie temperature of the system $Mg_{(1-f)}Mn_fFe_2O_3$ can be determined as a function of f , as f is varied from 0 to 1.

2.2 Group 63 (continued)2.21 Magnetic Cores (continued)Four-Probe, High-Resistance Measurements

(J. D. Childress) (UNCLASSIFIED)

Electrical design of a four-probe, high-resistance instrument for measuring the d-c resistivity of hausmannite and other high-resistance spinels is complete. Components have been purchased, and some thought is being given to the mechanical design.

D-C Fluxmeter

(R. A. Pacl) (UNCLASSIFIED)

Work is proceeding on the design of the current drive mechanism of the d-c fluxmeter.

Production of Memory Cores

(J. Sacco) (UNCLASSIFIED)

Test firings of memory-core batch DCL-2-720 are nearing completion. This batch was prepared in order to improve by compositional revision the electrical properties shown by the DCL-1-180 cores used for a memory test plane. One duplicated firing has already yielded cores which pass the new specifications in all respects. However, it is believed that some slight revision of the heating cycle will increase core operating margins even further, assuring very high yields of acceptable cores. At the present time, this run is under way. Current plans call for the production of enough cores to build the second DCL memory test plane in the very near future.

New Materials

(J. Sacco, P. Fergus) (UNCLASSIFIED)

D-262 cores from about 70 compositions in the $\text{MgO}\cdot\text{Fe}_2\text{O}_3\text{-ZnO}\cdot\text{Fe}_2\text{O}_3\text{-Mn}_3\text{O}_4$ system are being processed, fired, and tested. The compiling of test data in this system is approximately two-thirds completed.

Automatic Core Tester

(J. Schallerer) (UNCLASSIFIED)

The driving and decision logic for the automatic core tester is now working. The final design of the control panel is being completed. The sensing circuits are partially designed. At least one month will be required to complete the assembly and testing of the automatic core tester.

2.2 Group 63 (continued)

2.21 Magnetic Cores (continued)

Automatic Core Tester (continued)

(R. A. Pacl) (UNCLASSIFIED)

The machine shop has finished the pieces for the new three-channel selector which will separate the rejected cores from the accepted cores which fall in high-and low-voltage bands. The assembly will be completed in several days.

New Cores

(J. Schallerer, P. Fergus) (UNCLASSIFIED)

One thousand General Ceramics S-1 memory cores from their current production have been received. B-H loop, pulse test and other data will be taken for comparison with older lots.

Chemical Analysis

(D. Wickham) (UNCLASSIFIED)

Trial analyses of ferrites have been carried out by revised analytical procedures. Such revision permits the use of one sample for the determination of both manganese and magnesium and improves the ease of determination for magnesium.

(E. Keith, P. Reimers) (UNCLASSIFIED)

The analysis of sample DCL-2-418, a sample of magnesium-manganese ferrite, which approximately duplicated the General Ceramics cores, was completed. Sample DCL-2-720, also a magnesium-manganese ferrite, has been started.

Two lots of Fe_2O_3 , MAPICO 110-2 and C. K. Williams TS-1332, two lots of $MgCO_3$, B2062KSO6 and Y1459ER12, and one lot of $MnCO_3$, 5531, were assayed for use in ferrite compositions.

Pure Ferrite Synthesis

(D. Wickham, F. Maddocks) (UNCLASSIFIED)

A study is in progress of the physical and chemical nature of ferrites, with emphasis on the chemical properties which directly influence the preparation of high-purity, stoichiometric ferrites. Preliminary trial preparations by coprecipitation methods are underway for magnesium ferrite and manganese ferrite.

2.2 Group 63 (continued)2.21 Magnetic Cores (continued)Ferrite Crystals

(D. Wickham) (UNCLASSIFIED)

A small crystal-growing furnace is under construction to permit experiments in the growth of ferrite crystals from a salt flux.

Differential Thermal Analysis

(F. S. Maddocks) (UNCLASSIFIED)

Rebuilding of the thermal-analysis furnace has been completed, with the exception of thermocouple installation. With this revised equipment, a new study of oxide and ferrite heating curves may be undertaken.

2.22 Computer Techniques

(D. J. Eckl) (UNCLASSIFIED)

The Transistor Section has officially become known as the Computer Techniques Section and has as its purpose the development of logical circuits using cores and transistors. We have at present started the development of printed-circuit transistorized pluggable units which will tend to serve the same purpose "transistorwise" as the Burroughs test equipment. The first of these should be available for testing shortly.

Several of the new research assistants in Building 10 have expressed interest in transistors. Leo Jedyak is going to look into the transistor digital-to-analogue decoder problem. He has had some experience with transistors during the past summer at IBM.

Transistor Gates

(D. J. Eckl) (UNCLASSIFIED)

As part of his thesis work on gate circuits employing transistors C. Kirk has been making measurements on the time delay encountered by a pulse passing through various types of transistor gates. These range from 0.02 to 0.07 μ second for point-contact gates and from 0.3 to 1.7 μ second for junction gates. This appears to be a serious problem with most of the transistors presently available.

2.2 Group 63 (continued)2.22 Computer Techniques (continued)Transistor Sense Amplifiers

(D. J. Eckl) (UNCLASSIFIED)

At the suggestion of Bill Papiian some preliminary investigations have been made on the problem of designing a transistor sense amplifier which would be capable of gating out noise signals at low levels. Initial tests were unsuccessful because of the low input impedance of the transistor circuits. This difficulty has been alleviated, and a new design shows some promise. The design is still in its very early stages.

Transistor Flip-Flop Triggering

(E. U. Cohler) (UNCLASSIFIED)

The completed tests on our transistor flip-flops show that junction circuits will operate best with pulses of the order of 0.4- μ sec width. The maximum prf was dependent both on the circuit used and on the transistor types. The fastest circuit we tried was the four-transistor design of R. Baker. Using the new Texas Instruments n-p-n silicon transistor we obtained operation up to 900 kc in this circuit. In order of decreasing speed we tested: the p-n-p four-transistor circuit; the n-p-n silicon two-transistor circuit; the n-p-n germanium two-transistor circuit; and the p-n-p germanium two-transistor circuit. The slowest of these circuits runs at a maximum prf of about 200 kc.

Diodes for Shift Registers

(E. U. Cohler) (UNCLASSIFIED)

The new test devised for reverse-recovery measurements has great possibilities. It is a fast, flexible method of measuring minority carrier storage. It can be used to measure the forward recovery characteristics. Finally, it provides an excellent measure of the diode's merit for shift-register circuits.

The results of the tests with some of our diodes have shown that grown or diffused junction diodes are very bad in reverse recovery but that gold-bonded or point-contacts are entirely satisfactory in this respect for present-speed circuits.

Robert Rediker tried out one of his diodes (grown junction) on the tester, and it was found to have poor reverse-recovery characteristics. He is going to attempt some special fabrication techniques which promise to improve the conductance and reverse-recovery characteristics of these diodes.

SECTION III - CENTRAL SERVICES

3.1 Material Requirements & Stock

(H. B. Morley) (UNCLASSIFIED)

Division 6 Material Requirements Section is established to coordinate the material requirements of this Division with Division 1 Purchasing, Stockroom, Receiving, and other related Departments. By our efforts much time is saved to the members of this Division by centralizing requests and information. Cooperation is necessary to provide a workable system.

Considerable effort was made to establish a procedure whereby an extra copy of the receiving slip was run off by Bldg. E Receiving Room in order that both the originator and this department would have a record of incoming material. In some cases the originator has refused his copy. Although this copy is not always necessary, we recommend that it be accepted in order that the validity of the system shall not be questioned and thereby discontinued.

Much progress has been made in the disposition of surplus material stored at Ft. Heath. Efforts are being continued in this endeavor; with the continued cooperation of all concerned, we expect to have Ft. Heath cleared out very shortly.

3.2 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 31 Construction Requisitions totaling 738 items satisfied since 10 Sept; there are 24 Construction Requisitions totaling 691 items under construction by the Group 60 Electronic Shops.

Outside Vendor

(J. V. Mazza) (UNCLASSIFIED)

There are 3 orders outstanding totaling 132 items. Sixty items have been delivered during the past biweekly period. Information on specific orders may be obtained from the writer, Ext. 863.

3.3 Mechanical-Engineering Service

(J. C. Proctor) (UNCLASSIFIED)

It appears that some persons are unaware of the mechanical-engineering service available from the General Engineering Section of Group 60. Problems of a mechanical nature may be discussed with Allan or Lloyd Smith, Room D-109C. They can give advice on shop practices and procedures or will assume complete responsibility for mechanical design if desired.

3.31 Components

(B. B. Paine) (UNCLASSIFIED)

An interesting meeting with members of Group 22 and with Messrs. E. Ennis and A. Herckmans of Bell Laboratories Project ADES was attended this week. It appears that the equipment-trouble report system which ADES has prepared for the use of the Air Defense Command is very similar to the system developed here for use with the Whirlwind I and Memory Test Computers. It was agreed that the extra detail recorded in the MIT system was worthwhile for the first FSQ-7 equipments, but that it was most likely that the record system would have to be simplified for use in production CIC installations. The ADES system should be most effective for installations serviced by military personnel.

3.4 Test Equipment Committee

(L. Sutro) (UNCLASSIFIED)

The Committee has approved purchase of four more Simpson Multi-meters, Model 262, for use of the Inspection Shop where the 0-50 megohm resistance range of these meters is needed to check incoming megohm resistors and to inspect etched circuits where the resistance between adjacent wires should measure megohms. The committee has further approved a G.E. current-limited high-potential tester to be used by B. Paine to observe the susceptibility to corona of capacitors, cable, transformers, etc.

3.5 Drafting

Reproduction of XD-1 Drawings

(A. M. Falcione) (UNCLASSIFIED)

For the past several months, the work load on the Print Room on reproducing IHM brownlines for the XD-1 system has been extremely heavy. It was necessary to send much of the reproduction work to the Division 7 Print Room in order to keep up with the work load. Arrangements to ship

3.5 Drafting (Continued)

(A. M. Falcione) (UNCLASSIFIED) (Continued)

brownlines to MIT twice a week by an IBM plane will prevent serious accumulations of reproduction work in our Print Room and enable us to furnish engineers with up-to-date drawings at a much faster rate. A request has been made to IBM to submit a forecast as to the number of brownlines yet to be delivered to MIT to complete the drawing file for XD-1. Indications are that additional manpower will be required to handle the work load in the Print Room.

Multilith Checkoff

(A. M. Falcione) (UNCLASSIFIED)

The Document Room has now instituted a preliminary check of all Multilith masters to insure that proper procedures and instructions have been followed by the secretaries, prior to the reproduction of the memorandum. Any errors or omissions are returned to the secretary for correction.

Central Display, XD-1

(A. M. Falcione) (UNCLASSIFIED)

High priority is being given to all logic diagrams for Central Display Rack 25. The pluggable-unit block schematic and logic diagrams for this frame will be completed within the next 2 weeks. At that time we will start processing the similar drawings for Frame 24. IBM has informed us that because of the unstable quality of Ozalid-paper brownlines, they will not accept any such masters from MIT. IBM has requested us to furnish them with either vellums, photacts, or brownlines made with Bruning 139 Copyflex cloth. Arrangements have been made with Division 7 to have the 139 Copyflex cloth available.

3.6 Administration and Personnel

New Staff

(J. C. Proctor) (UNCLASSIFIED)

Bruce Barrett is a new DDL Staff member in Group 62. He received his BA from Bowdoin and until recently was employed as an engineer by Raytheon.

Donald Ellis is a new DDL Staff member in Group 62. He received his BS from Clemson College and until recently was employed as an engineer by the E. I. Dupont de Nemours Company.

3.6 Administration and Personnel (Continued)

(J. C. Proctor) (UNCLASSIFIED) (Continued)

Carl Friedman is a new DDL Staff member in Group 61. Mr. Friedman received his BS from Columbia in June of this year.

David Latimer is a new DDL Staff member assigned to Group 61. Mr. Latimer received his BS from the University of Utah and was a computer at the Western Geophysical Company, Los Angeles.

Norman Ockene is a new DDL Staff member assigned to Group 62. He received his MS from the Newark College of Engineering and until recently was a design and development engineer for the Bendix Corporation.

Melvin Cerier is a Research Assistant working for Professor Linvill. He received his BS from MIT this year.

Paul Griffith is a Research Assistant working for Professor Linvill. He received his BS from Texas Tech.

Leo Jedynak is a Research Assistant working for Professor Linvill. He received his BS from Michigan State.

Remick Konkle is another Research Assistant working for Professor Linvill. He received his MS from MIT this year.

Transfers

(J. C. Proctor) (UNCLASSIFIED)

Frederick Sarles has transferred from DDL Staff to MIT Staff.

Terminations

(J. C. Proctor) (UNCLASSIFIED)

Edward Stevens

Frederick Webster

New Non-Staff Personnel

(R. A. Osborne) (UNCLASSIFIED)

Lionel Boisvert is a new technician in the Construction Shop.

Donald Dewey is a new member of the Group 64 technician group.

Dominic DiLuca has returned from the Service to work once again in the Drafting Room.

3.6 Administration and Personnel (Continued)

New Non-Staff Personnel (Continued)

(R. A. Osborne) (UNCLASSIFIED)

Frederick Garside is in Group 61 where he will train as a Computer Operator.

Jeanette Morniau has joined Group 61 as Mr. Israel's secretary.

Joseph Ricchio has come from RLE to become a technician in the Standards Group.

Eugene Robinson is another technician who has joined Group 64.

Elizabeth Searle is a new clerk in the Tube Testing Section of Group 65 at the Barta Bldg.

Robert Smith is in Group 61 where he is an administrative assistant.

Terminated Non-Staff Personnel

(R. A. Osborne) (UNCLASSIFIED)

Jane Aldenberg

Andrew Bowen

John Donohue

Frank Turman

Richard Gloor

Robert Hoffman

Robert Thornton

Open Non-Staff Requisitions

(R. A. Osborne) (UNCLASSIFIED)

1 Clerk (Multilith Operator)

1 IBM Key Punch Operator for Gr. 61

1 Part Time Student for Gr. 65

3.6 Administration and Personnel (Continued)

Open Non-Staff Requisitions (Continued)

(R. A. Osborne) (UNCLASSIFIED)

1 Technician for the Construction Shop

6 Technicians for Gr. 64