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Memorandum 6M-3405

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

SUBJECT: BIWEEKLY REPORT FOR 25 FEBRUARY 1955

To: Jay W. Forrester

From: Division 6 Staff

CLASSIFICATION CHANGED TO:  
Auth: DD 254  
By: RRG  
Date: 3-21-60

C O V E R   S H E E T

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SUBJECT: BIWEEKLY REPORT FOR 25 FEBRUARY 1955

To: Jay W. Forrester

From: Division 6 Staff

Approved: *J. B. Bennett*  
John B. Bennett

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Section II - AN/FSQ-7  
Section III - Advance Development  
Section IV - Central Services

#### INTRODUCTION

##### College Recruiting Program

(R. J. Horn, Jr., W. A. Kates) (UNCLASSIFIED)

The first-phase college trips have now been completed. Second-phase trips--for the presentation of technical talks and interviewing--are beginning. Arrangements for these will be coordinated through the Personnel Advisory Committee and will involve greater participation by other Divisions.

The Personnel Advisory Committee is composed of representatives from Divisions 2, 3, 4, 6, and 7; J. W. Forrester and M. M. Hubbard are chairman and vice-chairman, respectively. A representative of the Personnel Office is a member of the Committee ex officio. The functions of the Committee are to consider personnel policies and procedures and to provide Division assistance to the Personnel Office where needed.

The following is a list of the trips made during this biweekly period:

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| <u>Representative</u>      | <u>College</u>   | <u>Date</u>  |
|----------------------------|--|--|
| D. Brown and J. Goodenough | U. of Oregon<br>Oregon State<br>Reed   | 14 Feb.<br>15, 16 Feb.<br>17 Feb.                              |
| W. Lone and F. Ryder       | Montana State<br>U. of Idaho<br>Washington State<br>Gonzaga U.               | 14 Feb.<br>16 Feb.<br>17 Feb.<br>18 Feb.                       |
| S. Manber                  | Clark U.   | 17 Feb.  |
| F. Heart                   | UCLA<br>USC<br>California Tech<br>USC<br>U. of California<br>California Tech | 18 Feb.<br>21 Feb.<br>21 Feb.<br>23 Feb.<br>24 Feb.<br>25 Feb. |
| H. Boehmer and C. Grandy   | New Mexico U.  | 23 Feb.  |
| R. Walquist                | California Tech  | 24, 25 Feb.  |

(C. C. Grandy) (UNCLASSIFIED)

My activities in connection with the college recruiting program have been turned over to Francis Garth and Homer Peterson of Group 61. The outline of the technical talk prepared by F. Heart, Dr. H. Boehmer, and myself is being prepared for distribution.

(W. J. Canty) (UNCLASSIFIED)

On 24 February 1955 I gave a talk on the subject of "Digital Computers" before the Boston College Chapter of Sigma Pi Sigma (Physics Honor Society). This was given as a part of the Lincoln Laboratory recruiting program.

(D. R. Brown, J. B. Goodenough) (UNCLASSIFIED)

During the weeks of 7 and 14 February we visited the University of Washington, the University of Oregon, Oregon State University, and Reed College. Four lectures were given, contact was renewed with key professors, and students were interviewed. In Seattle advertisements of Lincoln Laboratory job opportunities were placed in the daily papers; this resulted in many inquiries, but only a few were at all qualified for the work. The immediate fruit of the trip will probably be reduced to four candidates for Group 61; a professor at Reed College and an instructor at the University of Washington are interested in summer employment.

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I - SYSTEM TEST & PLANNING

1.1 Air Defense

1.1.2 Cape Cod System Operation

(C. A. Zrakat) (CONFIDENTIAL)

Three formal demonstrations of the Cape Cod System were held on 15, 16, and 17 February. Members of the Air Force, Army, Navy, Western Electric, IBM, and other agencies attended. Simulated interceptors were used in all tests.

An informal demonstration was conducted for Gen. Powers of ARDC and his staff on 24 February. This was a live test.

The quality of Mark X data improved significantly during the week of 21 February after modifications were made to the equipment at S. Truro by Group 23. Two good interceptions were conducted on Tuesday and Thursday of that week. The remaining interceptions that were attempted were aborted because of aircraft equipment failures.

Liaison with A. Bark of Division 5 has been initiated for the purpose of planning jamming tests against the Cape Cod System.

Some thought has been given with other members of the group to planning a schedule for the programming for the AN/FSQ-7. An attempt is being made to determine as closely as possible the manpower and time requirements for this job.

(W. Vecchia) (CONFIDENTIAL)

|                     |           |            |
|---------------------|-----------|------------|
|                     | <u>hr</u> | <u>min</u> |
| Total Assigned Time | 122       |            |
| Extra Assigned Time | <u>3</u>  |            |
|                     | 125       |            |

|                   |           |            |
|-------------------|-----------|------------|
|                   | <u>hr</u> | <u>min</u> |
| Analysis          | 9         | 35         |
| Tracking          | 22        | 10         |
| Weapons Direction | 25        | 30         |
| Raydist           | 8         |            |
| Equipment Check   | 8         | 05         |
| Mark X            | 1         |            |
| System Operation  | <u>41</u> | <u>35</u>  |
| TOTAL             | 115       | 55         |

|                     |   |    |             |           |            |
|---------------------|---|----|-------------|-----------|------------|
| Time Given 6345     | 3 | 25 |             | <u>hr</u> | <u>min</u> |
| Time Given Systems  | 1 | 50 | Total       | 115       | 55         |
| Time Lost Computer  | 3 | 50 | Total       | 9         | 05         |
| (malfunction) TOTAL | 9 | 05 | GRAND TOTAL | 125       |            |

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(W. F. Harris) (CONFIDENTIAL)

During the past 2 weeks I successfully completed the programming requested by Group 31 and am now taking the 1954 Cape Cod System familiarization course.

(E. Bedrosian) (CONFIDENTIAL)

At present I am working on the association program which is part of the system-simulation program. I expect to check out the association program during the next biweekly period.

I am also attending some of the lectures given in the 1954 Cape Cod System familiarization program.

(A. E. Budd) (CONFIDENTIAL)

I have resumed work on the data-reduction program to compare tracking accuracy of the 1954 Cape Cod System with Raydist tracking.

Also I have been attending some of the lectures given by Group 61 personnel on the 1954 Cape Cod System familiarization program.

(S. Manber) (CONFIDENTIAL)

I spent some time correcting and documenting the Cape Cod System tracking program.

(R. Smith) (CONFIDENTIAL)

The 1954 Cape Cod Equipment Notebook was issued to the interested Group 61 personnel; five other copies were given to the Air Force personnel. I am working on an addendum to the notebook to keep it up to date.

(H. Frachtman) (CONFIDENTIAL)

Work is progressing smoothly with the Test Program Section on specifications for the data-generation program.

An M-note describing the recording program for the Cape Cod System is being prepared.

(O. T. Conant) (UNCLASSIFIED)

I completed annotation of situation display I-2, the light-gun interpretation program. I hope to complete flow diagrams soon for all my programs.

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

A modification of the Raydist conversion program to read in height and lane-count zero corrections is giving trouble. However, if these are inserted manually, the program does convert correctly. Some trouble exists in incorrectly prepared data tapes. These will have to be edited before being converted.

A parameter to the program to find range and azimuth from a given point has been written by B. Stahl at the request of E. Rawson of Group 24. This has been partially checked out.

Memorandum 6M-2776-1 by A. Mathiasen, giving the coordinates of significant points in the Cape Cod System, has been issued.

(D. L. Bailey) (CONFIDENTIAL)

I have concluded my work on the tracking programs for the 1954 Cape Cod System; in the future I will be available for consultation on problems related to these programs.

(R. Davis, A. Smalley, P. Dolan, A. Hill) (CONFIDENTIAL)

Test Coordination Sub-Section scheduled three Raydist orientation, one Mark X, one equipment-confirmation, and three demonstration tests. A track-accuracy test was scheduled but converted to a training accuracy test for a special demonstration.

One Raydist and the Mark X test were cancelled because Mark X was operationally unsatisfactory. One Raydist was cancelled so that the computer time could be used to check Mark X equipment and performance. Satisfactory results were obtained from the one Raydist conducted.

The equipment-confirmation test showed that the Mark X was not operationally satisfactory for good interception control. This cancelled all aircraft scheduled for the first day's demonstration, which was conducted as a completely simulated demonstration.

Five strike aircraft were flown for the second demonstration. All interceptors were simulated because of Mark X unreliability. Weather cancelled aircraft for the third demonstration. This was conducted by utilizing the Ampex tape containing the five strike aircraft flown on the previous day. Interceptors and supplemental strike data were simulated.

The two Raydist-equipped strike aircraft scheduled for the track-accuracy test were flown for the special demonstration. Four interceptor sorties were utilized. Only one intercept was satisfactory because of Mark X failure, weather and radio difficulties. In flying the two Raydist-equipped aircraft it was determined that Raydist tracking was consistent from key point to key point.

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1.1.3 XD-1 Programming

(C. C. Grandy) (CONFIDENTIAL)

The staff of the Weapons Direction Subsection have been assigned responsibilities in the following areas:

- P. Vance - weapons assignment and direction
- E. McEvoy - height finding
- O. Conant - point-defense weapons
- A. Chandler - intercept direction

These individuals together with myself are preparing preliminary operational specifications for the related areas of the XD-1 System. Consideration is being given to previous work by other staff members, and the specifications will be circulated for comment when fully prepared.

Division 6 Memorandum 6M-3399, "Nomenclature for XD-1 Console Labels," has been prepared and issued. The nomenclature agrees with that used in the draft of the "Joint Operational Plan" (SAGE System) or accepted variations thereof.

(F. F. Gucker) (CONFIDENTIAL)

Documentation for the digital-display program in the 1954 Cape Cod System is now complete. Since 23 February I have been studying the monitoring function for XD-1. During the next biweekly period I plan to gather rough notes for operational specifications on monitoring.

(D. Latimer) (CONFIDENTIAL)

I have been gathering information to revise the Memorandum 6M-3078 ("Program and Storage Organization For 1954 Cape Cod Tracking Program"), and I have been studying the over-all organization of the Cape Cod System Program.

I am also checking out indoctrination programs.

(E. McEvoy) (CONFIDENTIAL)

I have spent some time modifying the start-over program in order to have it operate correctly with the recording program. The major part of my time has been spent doing preliminary work for XD-1. I have been reading the SAGE manuals and literature on height finding.

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(P. R. Vance) (CONFIDENTIAL)

The past 2 weeks have been devoted to obtaining background information concerning the weapons-direction problem in the XD-1 System, attending the CCS familiarization lectures, and studying the XD-1 training problems.

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

We are at present concerned with two problems relating to the design of a manual-inputs system and to equipment specifications for this system. We are seeking to determine the following:

1. What is the latest and most authoritative estimate of the number and kinds of manual-input sources for Subsector 1?
2. What is the expected rate of card output from each 026 card punch?

To answer the second question we have progressed in the tests described in our previous Biweekly Report and expect to attain concrete results within the next month.

The results of our inquiry into these two questions will be contained in a memo on the subject of manual-inputs system and equipment requirements.

(W. E. Ball, Jr.) (CONFIDENTIAL)

For the past 2 weeks my time has been divided between background reading on the XD-1 System and attendance at 1954 Cape Cod System lectures. Attendance at these lectures will continue to receive top priority during the coming biweekly period.

(L. B. Collins) (CONFIDENTIAL)

I am now checking out a utility program for the 1954 Cape Cod System designed to display any 200 (octal) storage registers as alpha-numerical instructions or octal constants. I am also attending the course on the 1954 Cape Cod System.

(D. L. Bailey) (CONFIDENTIAL)

I am beginning to consider air-surveillance problems in the XD-1 Experimental SAGE Subsector. The initial goal is an operational specification for those functions related to radar-data input and automatic tracking programs.

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(H. Benington, A. Chandler) (CONFIDENTIAL)

Consolidation of the final 1954 Cape Cod System weapons-direction program was completed during this biweekly period. This program, which contains about 19,000 instructions and constants, contains the following functions:

Digital display  
 Situation display  
 Recording  
 Utility  
 Master control and timing  
 Weapons assignment  
 Intercept direction  
 Antiaircraft liaison  
 Height  
 Identification  
 Simulation  
 Start-over  
 Geography

These functions are performed by 39 subprograms which were written, checked out, and documented by 20 programmers during the past year. During the first week of the next biweekly period, the complete records will be transferred to C. Zraket. After this time, we will devote our full time, except for occasional consultation, to R. L. Walquist's XD-1 Section.

(F. Brooks) (CONFIDENTIAL)

A few trial programs have been written in XD-1 code for each of the following functions: track sorting and correlation, dividing the Subsector into either strips or boxes, and conversion of fine-grain data, by several different methods. For each program, accuracy, average time required, and storage space required have been estimated.

(C. Gaudette, R. Gildea, S. Knapp, J. Yienger) (CONFIDENTIAL)

Recently it has come to our attention that the IBM accounting machine type 402, now installed in the Card Room, is inadequate for our needs. The principal reasons for this are:

1. There are only 43 alpha-numeric printing positions on the 402.
2. The 402 will not list any special characters, which are very useful in program listing.

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If the 402 is replaced by an IBM type 407, then 120 printing positions which will print all characters will be available. Furthermore, the 407 and the XD-1 718 printer have basically the same plugboard. An inter-office memo containing our recommendations has been submitted to R. L. Walquist.

The binary punching, binary-octal card input, and tracing of in-out instructions programs have been coded. They will be checked out on the IBM 701 in New York City. Some thought has been given to improvement of the methods of approximating trigonometric functions by subroutines.

(I. Hazel) (CONFIDENTIAL)

During the past biweekly period, I spent part of the time reading the SAGE reports and background material on XD-1. The remainder of the time was spent in completing the flow diagrams for the situation-display programs for CCS 54.

1.1.4 SAGE Planning

(J. A. Arnow) (CONFIDENTIAL)

H. Bramson of Hughes Aircraft was at the Laboratory on 24 February to discuss a number of questions concerning the integration of the F-102B with MX-1179 in the SAGE environment. Tentative plans were made to continue such meetings in the future so that a joint technical plan for use of the F-102B can be written by Lincoln and Hughes.

I attended a meeting with Sherman, Davenport, and Granlund of Division 3 at the General Electric Company in Syracuse to discuss ways of using the G.E. data link modified to a time-division system in the SAGE System. A meeting with BTL was held on 25 February to discuss possible modifications to the discrete-address link.

(H. Peterson) (CONFIDENTIAL)

I have formed a tentative list of DID slots for the SAGE System which is now being reviewed by the XD-1 people. I have also started consolidating the needed basic displays for the purpose of assigning display bits.

(W. Lone) (CONFIDENTIAL)

H. Seward, H. Kirshner, and I attended a meeting at the American Telephone and Telegraph Company, 195 Broadway, New York City, on 24 February for the purpose of discussing a preliminary ADES-BTL proposal for Combat Center communications.

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

I have spent most of this period preparing notes and charts for two talks I am giving in the SAGE familiarization program currently being conducted by Group 61. The talks will be on AA guidance in the 1954 Cape Cod System and on point-defense weapon systems.

I am reconsidering the target-battery evaluation program that I have written to see what can be done without undue complication to counter the effects due to the bias in favor of targets with low track numbers, which currently exists when the number of targets exceeds the number of batteries. When this problem is resolved, I shall proceed to code the program for XD-1.

(A. G. Favret) (CONFIDENTIAL)

On 21 February I visited the Raytheon Missile and Radar Division in Bedford and discussed the Hawk missile project. This visit is reported in 6M-3395.

(H. Seward) (CONFIDENTIAL)

A list of operational functions which have been considered, although not specified, for the SAGE System was compiled and forwarded to J. Jacobs for inclusion in 6M-3391, "Increase in AN/FSQ-7 Auxiliary Memory." Assistance in editing this note was also given.

A meeting to discuss external communications requirements for the Combat Center was attended by representatives of ADES, Bell Telephone, and A.T. & T. in New York, 24 February. R. Enticknap, W. Lone, H. Kirshner, and I represented Lincoln.

Steps are being outlined to obtain a reliable estimate of SAGE computing-time requirements.

(A. R. Shoolman) (CONFIDENTIAL)

I have nearly completed preparation of the draft of 6M-3330, tentatively entitled "Auxiliary Console and Wing Unit Equipment Allocation and Layout for AN/FSQ-7 Direction Centers," to be issued during the week of 28 February 1955.

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

I have attended several meetings concerned with the general manpower requirements for the operational installation of all Direction Centers and Combat Centers as well as detailed planning for the first Direction Center.

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1.1.5 SAGE Training

(S. B. Hibbard) (CONFIDENTIAL)

On Monday, 7 January, Lee Murray and I attended a meeting at Randolph Air Force Base, Texas, to discuss with AFPTRC what progress had been made with the D.C. training program for Air Force Personnel on the SAGE System and to assist them in writing a report to Hq., ARDC, that summarized the problems confronting the training program and problems related to qualitative analysis of operations personnel.

The past 2 weeks have been spent analysing the training situation for the Cape Cod 54 System and working with ARDC, Air Force personnel, and Group 61 personnel to establish a training program.

1.1.6 Test Program Planning

(D. R. Israel) (CONFIDENTIAL)

The major part of the past biweekly period has been concerned with the planning and scheduling of test-program activities. This has taken the form of numerous meetings, both at the Laboratory and at BTL, Whippany. Tangible results of this work are outlines and lists of work items for the test program. This material has been issued in draft form for further consideration within Groups 61 and 22.

As a result of the scheduling activity, it is clear that the major shortcoming at present is a lack of sufficient programming manpower to complete data-recording, data-generation, and data-reduction programs necessary before live systems tests can be conducted. Following the completion of these programs, currently scheduled for April and May, a shortage of sufficient personnel to plan and analyze tests will become evident. The first milestone and first actual flight test of the program is expected to occur late in March and will be the first of a series of tracking-accuracy tests.

(J. F. Nolan) (CONFIDENTIAL)

Investigation has begun on three aspects of the radar inputs to the Cape Cod System:

1. The correspondence of SDV track data with Raydist track data;
2. The scan-to-scan correlation between sequences of hits and misses from a track when it is in a radar overlap area;
3. The dispersion of returns for an aircraft from two radars when the data is converted into a single coordinate system.

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(J. Levenson) (CONFIDENTIAL)

The simulated-data-generation specifications are being re-designed to provide facility for generation of track data and noise data which will be of use in program checkout as well as for systems tests and training.

Some time was spent with visitors from Rand Corporation, who wished to see the 1954 Cape Cod System and also to discuss requirements for simulated data in the SAGE System in the event that they might supply this data.

(E. Wolf) (CONFIDENTIAL)

A draft of the specifications for the initial mapping experiments has been completed. The lack of a suitable camera at the monitor scope in the mapping room continues to be the principal factor delaying the start of these operations.

A statement of the Raydist data-conversion problem has also been formulated in cooperation with G. B. Harris, Jr., of Group 22.

(W. Z. Lemnios) (CONFIDENTIAL)

The copying of the flow diagram for the intercept-calculations and weapons-assignment program has been finished. Finished copies will be available soon.

I finished writing the specifications for the programs required in the tracking-accuracy study.

1.1.7 Analysis and Simulation

1. Schedules for Future Work

(W. I. Wells) (CONFIDENTIAL)

As a result of meetings with Messrs. Herckmans and Ennis of Bell Telephone Laboratories and Mr. Israel of Lincoln, work schedules for the test program have been agreed upon. The portion of the test program that involves analytical studies or simulations is now being broken down into individual work projects, and the corresponding time schedules are being ironed out.

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2. Manned-Interceptor Simulation

(H. D. Neumann) (CONFIDENTIAL)

The manned-interceptor-simulation program (MISP) has been tested and modified, but, because of computer trouble, it could not be checked out.

(B. Smulowicz) (CONFIDENTIAL)

The manned-interceptor-simulation evaluation program has been completed and checked out. A new program is being planned to simulate weather clutter and track correlation for the MISP.

3. Charactron Display

(H. D. Houser) (CONFIDENTIAL)

A program has been written which displays a moving tabular message on the XD-1 display console connected to MTC. This program is being modified to give geographic and radar-data displays.

4. Numerical Evaluation of Markov Processes

(C. Friedman) (CONFIDENTIAL)

The basic program for the evaluation of first-order Markov processes has been checked out. At present a program to determine transition probabilities is being checked out.

5. Blip-Scan Investigation

(R. W. Sittler) (CONFIDENTIAL)

A program is being written to compute certain small-sample statistics for use in testing blip-scan models.

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1.2 Whirlwind I1.2.1 Cape Cod System Engineering

(E. S. Rich) (UNCLASSIFIED)

A general plan for recording and analyzing performance data for the entire Cape Cod System operating as a unit has been worked out and agreed on by members of Group 61 and Division 2. A memo describing the plan will be published soon. Principal goals are to determine causes of all equipment failures that occur during Cape Cod operational tests, to reflect the effects of these failures on the operational mission, and to improve the over-all system reliability by calling attention to any weak elements. This program is a cooperative effort among Groups 22, 61, and 64.

A successful mission was run the week of 21 February using Mark X data. A modification in logic recently made by Group 23 gave significantly better data at the computer. Further work is planned by Group 23 to improve the azimuth-pulse takeoff from the antenna.

1.2.2 WWI System OperationRecords of Operation

(M. F. Currier, B. H. Jacobs) (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 11 - 24 February 1955:

|  |     |
|--|-----|
| Number of assigned hours                                   | 192 |
| Usable percentage of assigned time                         | 96  |
| Usable percentage of assigned time<br>since March 1951     | 89  |
| Usable percentage of assigned time<br>since September 1953 | 94  |
| Number of transient errors                                 | 11  |
| Number of steady-state errors                              | 5   |
| Number of intermittent errors                              | 7   |

Analysis of WWI Failures

(A. R. Curtiss) (UNCLASSIFIED)

The following is a breakdown of interrupting and potentially interrupting failures occurring in the WWI computer system for the bi-weekly period, 11 - 24 February 1955, inclusive:

|                                       |     |
|---------------------------------------|-----|
| Total Number of Failures              | 34  |
| Total Number of No-Lost-Time Failures | 3   |
| Total Number of Lost-Time Failures    | 31  |
| Total Lost Time in Hours              | 10  |
| Total Operating Time in Hours         | 272 |

| Class of Failure                 | Essential Maintenance |           | Chargeable to System |           |             |           |
|----------------------------------|-----------------------|-----------|----------------------|-----------|-------------|-----------|
|                                  |                       |           | Explained            |           | Unexplained |           |
|                                  | No.                   | Min. Lost | No.                  | Min. Lost | No.         | Min. Lost |
| Tubes                            |                       |           | 1                    | 10        |             |           |
| Passive Electrical Components    |                       |           | 1                    | 30        |             |           |
| Fuses                            |                       |           |                      |           | 1           | 0         |
|                                  |                       |           | 1                    | 4         | 2           | 8         |
| Alarms                           |                       |           |                      |           | 2           | 0         |
|                                  |                       |           | 17                   | 167       | 4           | 35        |
| Design Weakness                  | 1                     | 233       | 1                    | 28        |             |           |
| Miscellaneous                    | 1                     | 10        | 1                    | 15        | 1           | 60        |
| Number of Lost-Time Incidents    | 2                     | 243       | 22                   | 254       | 7           | 103       |
| Number of No-Lost-Time Incidents |                       |           |                      |           | 3           | 0         |

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

An intermittent failure in the auxiliary-drum system caused the majority of down time during this period. The trouble was traced to a faulty cathode follower in the coincidence circuits for the drum. Marginal checking did not uncover this fault.

A failure of the -300-v supply resulted in the loss of half an hour of applications time. Four hours, scheduled for computer testing, were used to repair the supply.

The number of core-memory parity alarms declined sharply during this period. The increase in reliability may be the result of the installation of a new amplifier in the -450-v supply.



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Power Supplies

(E. W. Pughe, Jr.) (UNCLASSIFIED)

The -300-v power supply failed several times during the past 2 weeks. The 1000-v capacitors subject to the peak inverse voltage of the thyratrons were being operated too near their rated voltage. Capacitors rated at 1500 volts are now being used.

An interlock circuit to prevent voltage from being put on the bus during maintenance periods was installed on the -450-v supply.

1.2.3 Terminal Equipment

Ampex Recorders

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

The breadboard preamplifier was tried out and showed considerable promise of alleviating our dropout problem. However, further study is needed before the amplifier design is frozen and sent to Drafting.

CRT Filter Sweep Circuit

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

The breadboard has been debugged, and a marked-up schematic has been sent to Drafting. This modification will minimize sweep jitter and prevent destruction of 2D21's.

Fairchild Camera for Mapping Monitor

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

The experimental mount is being installed. Pushbutton operation of the camera should be available by 1 March.

Output Coder

(L. H. Norcott) (UNCLASSIFIED)

The test-message generator is now operable.

Power wiring for the output coder is being modified so that the coder can be broken up into smaller blocks for marginal-checking purposes.

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(T. Sandy) (UNCLASSIFIED)

The panels necessary for the automatic WWI computer signal to Building B for the height circuit have been installed and are working.

Maintenance Programming

(J. N. Ackley) (UNCLASSIFIED)

Four more test programs, the buffer-drum clear and complement check, the auxiliary-drum SAR check, the buffer-drum SAR check, and the buffer-drum WBS check, have been added to the Room 156 consolidated test program. The control program was also modified to make it respond faster and to allow the operator greater freedom in his actions to prevent stopping the program because of operator error.

The proposal for two new instructions for WWI appeared as 6M-3359 during this period.

Four more M-notes are partially completed and should appear during the next biweekly period as follows:

|         |  |
|---------|--|
| 6M-3394 | Description of LSR3613m5 and T-3693  |
| 6M-3393 | Rules for Programming for the Room 156 Consolidated Test Control Program   |
| ----    | Description of the Room 156 Consolidated Test Control Program              |
| ----    | Description of the Test Programs of the Room 156 Consolidated Test Program |

The ninth and last test program for the consolidated test, the MITE control check, has been written and partially checked out.

Plagued with status trouble in the buffer-drum system, I have written and checked out a test program which will aid in locating the trouble. The program prints out the contents of buffer storage by address even though buffer storage may not be directly read by address.

(L. Healy, C. S. Lin) (UNCLASSIFIED)

A new program for checking FGD MITE 0 is being written. This program checks MITE 0 with a variety of test messages generated by the computer, and all recordings on the buffer drum are accomplished through the normal MITE 0 recording channel. No test recording is used. It's believed that this new program will give a more thorough check of MITE 0 than the present test program.

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II - AN/FSQ-7

Group 62 Summary

(N. H. Taylor) (UNCLASSIFIED)

A demonstration of the Charactron display console was given on 21 February for Group Leaders of Division 6 and others interested. It is apparent that those responsible for Charactron development have successfully met the target set for them 2 years ago.

It was agreed by those attending the demonstration that the situation-display console as it now stands is a usable piece of equipment. New aims for future work include increasing legibility, brightness, and flicker.

We can now say that the Charactron endeavor has been quite successful and that significant improvement over the Cape Cod display system is evident.

Delivery of the XD-1 drum system has been delayed to allow sufficient time for frame-testing in Poughkeepsie. Delivery is expected about 11 March.

A document justifying the amount and kind of additional auxiliary memory needed has been submitted to the Joint Project Office of the Air Force, and approval has been indicated.

2.1 Liaison2.1.1 SystemAdditional Auxiliary-Memory Drums

(A. P. Kromer) (CONFIDENTIAL)

A conference at the ADES office on Thursday, 24 February 1955, reviewed the results of the study of this matter by all organizations. These were as follows:

1. Lincoln indicated that AN/FSQ-7 operational capability will not meet that outlined in the ADC Operational Plan without additional auxiliary-memory capacity.
2. AFRC concurred with the Lincoln presentation.
3. ADC reaffirmed their desire to maintain the operational capability and capacity of the SAGE System as outlined in the Operational Plan.

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4. IBM stated that their study was not yet completed, but they now believe that the schedule for delivery of all AN/FSQ-7 systems will be delayed 1 month (i.e., 1 July 1956 to 1 August 1956 for first system, etc.) and that additional cost will approximate \$400,000/system plus \$277,000 additional engineering and start-up expense.

5. Western Electric reported that the change would not delay completion of the building but would increase the cost approximately \$7500 for each of the first two sites but nothing thereafter.

Based on these findings, the Air Force Joint Project Office authorized (a) the change to add the frame and six additional drums for auxiliary memory and the accompanying MCD frame in all AN/FSQ-7 systems; (b) necessary changes in ducts and air handlers for Direction Center buildings; (c) necessary provisions for the added equipment in Combat Center buildings; and (d) study of need for additional equipment in AN/FSQ-8 system (pending the study the AFRCR Exhibit 55-18 will not specify the added equipment).

Engineering-Installation Committee

(A. P. Kromer) (CONFIDENTIAL)

Based on above-mentioned conclusions, the Committee met to establish a plan for evaluating the effect of the added equipment on the desired operational date for the Maguire Subsector (i.e., 1 March 1957). This study is to be completed 16 March.

Also, a program was established to develop a schedule for installation and test of the Stewart Subsector and Hancock Combat Center. Target dates of 14 April and 19 May, respectively, were set for completion of these schedules.

Technical Information Releases

(P. Bragar, E. D. Lundberg, J. J. Carson) (UNCLASSIFIED)

The following material has been released as engineering data for AN/FSQ-7 and SAGE System.

| <u>TIR</u> | <u>M-Note</u>             | <u>Subject</u>   |
|------------|---------------------------|--|
| 1-58       | Group report 20-3 revised | SAGE Equipment List for Combined Heavy Radar and Radio Site                              |
| 1-60       | GM-3198-1                 | Master Reference List, Lincoln Laboratory Requirements for Combined C.C. & C. Buildings. |

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| <u>TIR</u> | <u>M-Note</u>     | <u>Subject</u>   |
|------------|-------------------|--|
| 1-61       | Group report 36-3 | Communications: Texas Tower to Shore via U.H.F. Tropospheric Scatter |
| 1-62       | Group report 20-4 | SAGE Equipment List for Surveillance Radar Station                   |

SAGE System and XD-1 Schedules

(W. H. Ayer, J. J. Carson, F. F. Manning) (UNCLASSIFIED)

We have been studying methods of schedule charting and posting of SAGE progress in order to facilitate a coordination and follow-up service for the XD-1 and duplex planning groups.

This program is to amplify alarm points where engineering investigation will be required to maintain the planned system satisfactorily.

(E. L. Smiley, W. H. Ayer) (UNCLASSIFIED)

Computer floor layouts for the D.C. buildings have been agreed upon by IBM and Lincoln. This layout includes hole changes caused by:

1. The new auxiliary memory;
2. The loss of the air duct in the power module of the frames;
3. Increased flexibility;
4. Movement of holes under frames.

XD-1 Command Post layout and construction drawings are being circulated for concurrence within the Laboratory.

Work has been started to construct a light-proof booth around the prototype situation console in MTC to provide the optimum viewing conditions for a systems-type display. Group 38 will conduct tests to evaluate this display.

2.1.2 Technical

(K. McVicar, C. Watt, J. Mazza, T. Parkins, R. Jeffrey) (UNCLASSIFIED)

We have begun collecting schedule data covering Systems Office responsibilities; this information will be issued in an M-note during the week of 28 February. A summary schedule for the first Subsector is about two-thirds complete. A survey of expected capacity and reliability of the subsystems (radars, AN/FSQ-7, communication equipment, etc.) of SAGE has begun and will continue through March.

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2.2 XD-1, XD-22.2.1 SystemsSage Experimental Subsector Planning Section

(H. E. Anderson, L. Aronson, H. J. Platt) (UNCLASSIFIED)

The first Approval Committee meeting will be held on Monday, 28 February 1955. We have prepared an equipment schedule for 1955, which will be discussed at the meeting. A study of specification changes needed for the Experimental Subsector is being compiled so that adequate plans for incorporating these changes will be made.

Logical Services Committee

(R. P. Mayer, N. T. Jones) (UNCLASSIFIED)

Auxiliary Memory. The Auxiliary Memory Study Group is preparing a memo summarizing the data collected by the Group. The memo is in two parts, 6M-3349 (unclassified) and 6M-3350 (confidential), and is nearly ready for publication. It is based on an inter-office memo published 19 January. Although comments on the latter memo were requested from IHM, none have been received.

It is hoped that concurrence can be reached on 6M-3328 "Proposed Specifications for Auxiliary Memory Expansion of the AN/FSQ-7" by 1 March.

Training Programs. The schedule for the Systems Office Training Program has been revised slightly in 6M-3348-1. A. Vanderburgh has published lecture notes, in rough-draft form, for the first five lectures. These notes will soon be issued as memoranda for general distribution.

A training program is being organized for the first group of ten ADES people. This program will be an expansion and acceleration of the Systems Office Training Program. It is tentatively planned to have A. Vanderburgh give the lectures and to make extensive use of IHM preliminary manuals.

Drawings. The Logical Services Committee file of IHM block schematics is organized by logic numbers and is filling rapidly.

An experimental drawing for the coordinated set of block diagrams has been completed and will be included as a sample in a forthcoming memo explaining the new series.

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Command Post DD Desk

(R. D. Buzzard) (UNCLASSIFIED)

The facilities to be provided at the Command Post DD desk for AN/FSQ-7 were discussed with Bill Lone of Group 61 and members of the IBM System Planning Group. A proposed specification will be published during the week of 28 February.

Warning Lights and Manual Inputs

(R. D. Buzzard) (UNCLASSIFIED)

I participated in studying the requirements of Group 61 for the use of warning lights and manual-input switches on the auxiliary consoles and the wing units attached to situation-display consoles. These requirements are incompatible with the present cabling plans of IBM. Discussions are in process to resolve the difference.

XD-1 System

(J. McCusker) (UNCLASSIFIED)

An IRI monitor scope is required to display IRI information. The main problem being investigated is conversion of r- $\theta$  data into a form suitable for display.

Telephone Communications

(C. J. Carter, H. J. Kirshner) (UNCLASSIFIED)

A meeting was held on 17 February at Western Electric Company, New York, between ADES, ADC, IBM, and Lincoln to discuss the production-machine maintenance intercom system. The purpose of the meeting was to discuss the relative merits and costs of a separate manual maintenance intercom system as compared to a maintenance intercom system incorporated in the dial PBX.

A meeting was held on 16 February with interested persons in Group 61 to discuss requirements for external voice circuits for XD-1. As a result of this meeting, the external voice telephone traffic diagram was revised and will soon be published as 6M-3000, Supplement 5.

Requirements for all XD-1 external circuits, including data, teletype, voice, keying, and ground/air radio, have been discussed with Group 61 and Group 22 and will be published as 6M-3275. A preliminary study has been made to determine the approximate cost of these circuits.

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A meeting was held on 24 February at AT&T in New York between AT&T, BTL, ADES, and Lincoln to discuss external-communication requirements for Combat Centers.

2.2.2 Installation

Display Frames

(R. Fallows) (UNCLASSIFIED)

Frame 25 wiring has been checked out. Wiring corrections have been made except for some new coax lines which were ordered from IBM. Corrections to charts are being held until up-to-date drawings are obtained from IBM. The power module has arrived and is being wired in. The first shipment of pluggable units has been received, but frame testing will be held up until more PU's arrive.

Frame 24 will be shipped in the next biweekly period. This frame will require extensive wiring before frame tests can be performed.

XD-1 Cabling

(R. C. Jahn) (UNCLASSIFIED)

A brief investigation to determine the effect of pickup when combining a-c and d-c power cables for the short run between termination boxes and consoles was made.

Calculations and verifying experiments show that with a 5-ft run of 15 amperes, 120 volts, the worst possible cable layout has a pickup of 15 millivolts. Ordinary installations should not give more than 2 millivolts pickup.



### 2.2.2 Installation (Continued)

#### XD-1 Installation Information - Report 29 (Extract)

(H. Mercer, P. Morrill, H. Wainwright) (UNCLASSIFIED)

#### I. Building Construction

We were told during the week of 14 February that the Air Force hoped to conduct their inspection for final acceptance of the interior of the building on 28 February. At that time it was anticipated that all work under the general contract, with the exception of the louvered ceiling, would be completed.

It would appear that the interior will be essentially complete by 28 February, but final acceptance will probably have to be delayed pending completion of a "punch list" of deficiencies likely to be a result of the inspection.

#### III. Equipment Cooling

Testing of the chilled-water line was started this week and is expected to be completed 25 February. The line will be insulated the week of 28 February. Chilled water will be piped to the air handlers for the central-computer frames by about 7 March. Balancing of these frames is expected to start at about the same time.

#### IV. Cabling and Method of Distribution

##### B. Cabling

Job II, power cabling PCD to MCD's - as last reported, all cables are in place, but completion of the work must await delivery of the remaining MCD frames, 29, 31, 37, and 48.

Job III, power cabling MCD's to end modules - cabling should be completely prefabricated during the week of 28 February.

Console power and signal cabling will be started about 1 March. Signal cables for the first-floor display frames are being expedited.

##### V. Equipment Layout

IBM basement - drawings were received on 21 February but had to be revised as a result of IBM's decision to eliminate the mezzanine because that area would be unsuitable for Charactron storage. New drawings are expected by 2 March.

Second floor - Projection room. The Production Control and Systems Offices are trying for approval and concurrence of these drawings.

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## VI. Lighting

Delivery of the louvered ceiling and fittings has been very poor. Clips, part of the hanger-system fittings, finally arrived 25 February. Installation of the louvers will start 28 February; completion of the installation in any one room, however, is dependent on completion of the sprinkler-system testing.

## VII. Telephones

Cables have been pulled between the basement frame room and the switchboard room on the second floor.

Console cabling will start as soon as installation of the suspended trough system permits--probably during the week of 28 February.

## VIII. General

Performance by the general contractor has again been disappointing. His three-part promise of:

1. Turning over a block of six rooms on the second floor on 4 February;
2. Turning over all rooms within the building on 11 February;
3. Turning over the complete balance of the building interior on 18 February

was kept only as far as part 1, above. An inspection trip indicated that a fair amount of work on the corridors, lighting and sprinkler systems remains to be done.

2.2.3 TestingXD-1 Evaluation

(W. Canty, J. Crane) (UNCLASSIFIED)

A trial evaluation of the XD-1 central computer has been made. For this evaluation, techniques discussed in 6M-3226, "Central Computer Evaluation," were used, and emphasis was placed on methods of data collection and presentation.

(J. Crane) (UNCLASSIFIED)

A study of the manual-inputs system for the AN/FSQ-7 is being made so that procedures for evaluating this system in XD-1 can be determined.

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XD-1 Drum

(S. L. Thompson) (UNCLASSIFIED)

The drum-system study was completed, and a note describing the evaluation procedure was prepared. This note will not be circulated until the drum-system reliability programs to be used during the evaluation have been chosen. (These programs have not been written yet.)

XD-1 Magnetic Tape

(S. L. Thompson) (UNCLASSIFIED)

A study of the magnetic-tape system was started, but the block-schematic drawings for the tape equipment have not yet been received from IBM. Therefore, this project was temporarily dropped, and the gap-filler-radar input equipment was studied instead.

XD-1 D-C Supplies

(S. Goffin, J. Clarke) (UNCLASSIFIED)

We have conducted regulation tests on all the d-c supplies in bank A except the -48-v and +600-v supplies. The regulation in several of the supplies fails to meet our purchase specifications, but in no case is it off by more than a factor of 2. This can be corrected by making proper adjustments in the control circuits.

Studies are being made of the inrush current which flows when the full input voltage is suddenly applied to the supplies. The results will be used to determine the method of applying voltage to the supplies in the duplex AN/FSQ-7. Excessive inrush must be avoided, since it would make it necessary to use oversized circuit breakers, thus reducing protection during normal operation.

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2.3 Production System

(M. Feldstein, S. Ginsburg, H. Rising) (CONFIDENTIAL)

A draft of the AN/FSQ-7 output specifications for the duplex system was written and submitted for IBM-SO concurrence. Concurrence is being delayed until agreement on the details of the test facilities can be reached. It is expected that concurrence will be rendered within the next week.

Consideration was given to various methods of modifying the ground/air section in order that an adequate computer loop test can be made in conjunction with the LRI section.

Present work is directed towards establishing a schedule which estimates the future possible requirements of the output system.

(R. H. Gould) (UNCLASSIFIED)

The necessity has arisen to rejustify the telephone equipment planned for use of the duplex Central maintenance personnel. Analysis of the cost of the various possible systems and determination of the maintenance requirements will show the desirability of the presently planned system.

Digital-Data Circuits

(F. E. Irish) (UNCLASSIFIED)

The Bell Telephone Laboratories have published a report, "Fundamental Technical Requirements for Digital Data Transmitters, Receivers, and Associated Equipment." This document outlines a number of the requirements influencing the design of the terminal equipment (DDR's and DDT's) for the data circuits. The purpose of this document, other than defining equipment specifications, is to show what will be included in the digital-data-service package if it is leased from the Bell System.

This document has been reviewed by the Communications Committee of Division 6 and by members of Division 2, and their comments have been transmitted to the BTL. In general, it specifies a data-transmission system which is in accord with the system expected by Lincoln and IBM.

Auxiliary-Memory Justification

(P. Bagley, J. Jacobs, L. Jeffery, R. Mayer) (UNCLASSIFIED)

Work continued on the justification for additional auxiliary memory for FSQ-7. The conclusion was that a new frame containing six

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additional drums should be supplied for the production machines. The results of the study have been prepared in draft form and will soon be published as 6M-3391, "Justification for Increase in Auxiliary Memory and the Method of Increasing It."

FSQ-8 Specifications

(W. Lone, P. Bagley) (UNCLASSIFIED)

A committee consisting of W. Lone (Group 61), B. Housman (IBM), and P. Bagley (Group 62) has undertaken a study of the Combat Control Center. The aim is to prepare a specification of the AN/FSQ-7 by the tentative date of 1 April 1955. The results of a preliminary study are contained in Memorandum 6M-3388, "Preliminary Study of FSQ-8." Detailed answers to specific questions affecting specifications are currently being sought from Group 61 and the Air Force. A major question exists concerning the auxiliary-memory requirements for the FSQ-8 operational and standby programs.

FSQ-7 Reliability and Maintenance

(P. R. Bagley) (UNCLASSIFIED)

Memorandum 6M-3341, mentioned in previous Biweeklies as "Maintenance Requirements for FSQ-7 Based on Predicted Computer Performance," is undergoing further rewriting. I hope it will be published about 11 March under a more appropriate title, "Predicted Computer Performance and Maintenance Requirements for XD-1 and Production FSQ-7."

AN/FSQ-7 Standby Computer Program

(P. R. Bagley) (UNCLASSIFIED)

Memorandum 6M-3389, "Description and Estimated Storage Requirement of the AN/FSQ-7 Standby Computer Program," presents a broad outline of this program. Thoughtful consideration and comments are earnestly solicited, since many details must be worked out jointly by Groups 61, 62, 64, and IBM within the next 4 months.

Long-Range-Radar Inputs (LRI)

(A. Hughes, J. May, A. Werlin) (CONFIDENTIAL)

Supplement 1 to 6M-3276 has been published to correct, delete, and add to the specifications (6M-3276). IBM and Systems Office concurrence was effected by 6M-3386, "Long Range Radar Input Specification for the Initial AN/FSQ-7's."

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Memorandum 6M-3396, "Number of Data Circuits from a Long Range Radar Site," was published to be used in a Technical Information Release (TIR) stating the decision to have two data circuits from each site.

Gap-Filler Inputs (GFI)

(A. Hughes, J. May, A. Werlin) (CONFIDENTIAL)

The specifications for the gap-filler-input equipment for the first AN/FSQ-7 have been concurred upon by IBM and the Systems Office.

Cross-Telling Inputs (XTI)

(A. Hughes, J. May, A. Werlin) (CONFIDENTIAL)

The crosstelling-input specifications for the first AN/FSQ-7 have been concurred upon by IBM and the Systems Office.

Power Generation

(J. J. Gano) (UNCLASSIFIED)

The first draft of 6M-3378, "Power Generation and Distribution for the Fourth Site," has been circulated to interested parties. The power-dissipation figures for the load frames which were obtained from a table received from the power group of IBM differ from those obtained by Francis Associates through another source at IBM. The discrepancies will be investigated because of the importance of the values in the design of the equipment cooling.

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## 2.4 Vacuum Tube Circuits

### Duplex Circuit Approval

(R. L. Best) (UNCLASSIFIED)

Schedules call for release of many circuits for duplex machines before they have been tested in XD-1 or XD-2. This is not a desirable situation, but neither is it bad enough to warrant delaying the schedules. The practice of the IBM and MIT Basic Circuit Groups has been to approve circuits as the schedule requires when there appears to be a good chance that the card details will not need to be changed. Card-assembly changes can be made relatively easily at a later date, in the form of engineering changes.

### Flip-Flop, Model A

(N. J. Ockene) (UNCLASSIFIED)

The upper-level delay for complementing action varies between 0.1 microsecond and 0.25 microsecond, depending upon the amplitude of the triggering pulse. This relationship of delay to pulse amplitude was investigated and found to depend essentially on the discharge time of the capacitance in the cathode circuit. Values of capacitance as low as 10 micromicrofarads in the cathode circuit cause the flip-flop to be delay-sensitive to variations of trigger amplitude. Complete elimination of all capacity (with the exception of interelectrode and wiring capacity) in the cathode circuit eliminates variable delay sensitivity. However, this remedy also decreases the margin at higher trigger amplitudes as well as making the flip-flop too sensitive at low trigger amplitudes.

### Sensing Amplifiers for Memory Planes

(R. C. Zopatti) (UNCLASSIFIED)

In order to expedite the further development of a transformer-input sense amplifier, the equivalent source impedance of a memory plane must be synthesized. Since the source impedance of a memory plane is unknown, various circuit configurations have been tested without too much success. Work is continuing along these lines.

### High-Speed-Memory Selection-Plane Driver

(D. Shansky) (UNCLASSIFIED)

An effort is being made to develop a pulse transformer which will provide a current stepup of approximately 1:2, rise and fall times of 0.05 microsecond for a 3-amp pulse, and a "flat" top of 0.25 microsecond. The secondary of the transformer will be required to present an impedance of

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a few hundred ohms to the load. A driver (vacuum tube) which will enable the study of various transformers has been designed and will be bread-boarded shortly.

Poughkeepsie Trip - XD-1 Drum Heads

(D. Shansky) (UNCLASSIFIED)

A trip was made to IBM to determine whether the IBM people who have been working on the drums are cognizant of the difficulties we have been having with the heads in the MTC drum and to ascertain whether they were having similar difficulties. We found that they were aware of the inadequacies of the mechanical design of the present heads. Some steps are being taken by them to correct these deficiencies.

Phone-Line Demodulator and Modulator

(E. B. Glover) (UNCLASSIFIED)

We have received the first modulator, built in pluggable units. It is being type-tested at present.

The M-note entitled "Digital Data Transmitter" (6M-3402) has been completed and will be sent to the Duplicating Room 28 February. The M-note concerning the demodulator is in the rough-draft stage and should be completed within the next biweekly period.

Pulse Converter

(W. F. Santelmann, Jr.) (UNCLASSIFIED)

Experimentation with delay-line-controlled monostable pulse generators continues. The goal is to develop a circuit which can be triggered by a standard 0.1- $\mu$ sec pulse and which will produce a 0.05- $\mu$ sec to 0.2- $\mu$ sec variable-duration output pulse with a duty factor up to 50%.

Of the three circuits considered, the delay-line-controlled blocking oscillator has been discarded as unsuitable for high-duty-factor operation, and the current-driven, shorted-delay-line circuit has been temporarily discarded in favor of the delay-line-controlled multivibrator. The multivibrator circuit produces excellent pulses, and, although it is not free of difficulties, it promises to solve the problem.



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Pulse Amplifiers

(B. Barrett) (UNCLASSIFIED)

The pulse-amplifier report has been finished and the drawings checked, and it should be issued shortly as an M-note.

Another high-speed (10-mc) flip-flop has been designed and is being constructed as a breadboard for test.

2.5 DisplayDisplay Console

(C. Corderman, J. Woolf) (UNCLASSIFIED)

The circuitry associated with the situation display in the display console has been debugged. Some work remains to be done on the yoke amplifier in order to attain proper settling time. A simulated XD-1 program was supplied by H. Houser of Group 61 for demonstration purposes.

The necessary hardware to mount a Typotron in the console will be received 2 March, and the remainder of the console will then be checked.

Vector Generator

(J. Woolf) (UNCLASSIFIED)

A new card layout for the sweep generator will be made in order to incorporate modifications to minimize prf sensitivity of the vector generator.

Display-System Test Planning

(R. H. Gerhardt) (UNCLASSIFIED)

C. Hesner, H. Rotticci, and D. Williams of IEM came to Lexington to discuss the digital-display (DD) test planning with Dick Fallows and myself. The test seems adequate to detect any design error. We also considered some aspects of diagnostic programs for the DD. The aim of a diagnostic program is to detect and locate any single failure caused by weak tubes or open or shorted diodes.

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MTC Connection to the XD-1 Display System

(R. H. Gerhardt) (UNCLASSIFIED)

A. Bedard has written construction requisitions for all cables and panels to be made in the shop. He has also made rough layouts of the panels in each rack. We plan to have all equipment assembled and checked prior to 1 April.

Situation-Display Generator Element

(R. Callahan, B. Gurley) (UNCLASSIFIED)

As stated in the last Biweekly, most of our time has been spent in planning the test procedure for frame 24.

We are developing an installation procedure that details the order in which pluggable units will be added and describes the signals expected at each step of the installation. This phase of the planning will be finished in the first week of March.

It is now expected that frame 24 (minus all intermodule wiring) will arrive during the first week of March.

Display DecoderVoltage-Reference Circuit

(H. E. Ziemann) (UNCLASSIFIED)

Marginal checking of the decoders has revealed that the output of the voltage-reference circuit would vary almost 0.1% for a 2% change in the -300-v supply voltage and would vary 2% with a 60-v excursion on the -300-v marginal-check line. A new circuit has been designed which will hold this reference within 0.1% for a 10% change in supply voltage and will hold to 1% for 135-v swing on the marginal-check line.

Constant-Current Source

(H. E. Ziemann) (UNCLASSIFIED)

With the new voltage-reference circuit the outputs of the constant-current sources remain within 0.1% for a 2% variation in the marginal-check line and within 1% for 60-v swing in the same check line.

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Current Gate Tubes

(H. E. Ziemann) (UNCLASSIFIED)

A study of the current gate tubes shows that the current output remains within 0.1% for a plate-voltage variation from 80 to 400 volts. The dynamic resistance of this circuit is in the order of 50 megohms. Since the output of the decoder is variable, studies are now being made of the variation of current-gate-tube plate voltage as a function of the decoder-output voltage.

SD Camera and Camera Control

(L. L. Sutro) (UNCLASSIFIED)

The camera and its hood will be mounted on the face plate of console 5. A. Smith and L. Prentice are designing the hood and a bezel to attach the hood to the face plate. Between the bezel and the Charactron there will be a rubber seal to exclude ambient light from the camera.

The logic of the camera control has changed again. Since there is danger of a light leak through the rubber seal mentioned above, provision is now made to close the shutter after every intensification of the scope. Previously, it had been planned to leave the shutter open when multiple exposures of a single frame of film were required.

Fairchild Camera & Instrument Co., supplier of the camera, has been asked to recommend both the distance at which the camera should be mounted from the Charactron and the change in the lens mount to focus the camera at this distance.

Design of the pluggable units comprising the camera control is in progress.

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2.6 Vacuum Tubes2.6.1 Activities of Group 65Charactron Program

(P. Youtz) (UNCLASSIFIED)

During the past 2 weeks time was spent experimenting with constructional techniques and processing procedures proposed by Convair for their production line. As yet we have not received the manufacturing and processing specifications from Convair. They have completed their specifications through the bulb processing, and very favorable production reports have been received from them. C. W. Williams of IBM, J. S. Palermo, and I will visit Convair on 26, 28 February and 1 March 1955 to review Convair's present manufacturing procedures and to study their new manufacturing specifications.

C. L. Corderman of Group 62 and F. L. Holmes of IBM have been observing astigmatism and beam-center shift on guns in the Charactrons. A number of special research experiments were constructed at MIT and tested to study these phenomena. C. L. Corderman and F. A. Rodgers of Group 25 participated in these investigations. Work will continue on this program next period, and A. Zacharias will conduct these studies for Group 65.

Five more life-test positions have been started for the Charactron life-test rack.

Typotron Program

(P. Youtz) (UNCLASSIFIED)

Twenty convergence coils have been received from Hughes for the life-test racks. Several coils were damaged during shipment because of faulty packaging. Ten tubes have been received from Hughes' production line for life tests.

Receiver-Tube Program

(P. Youtz) (UNCLASSIFIED)

I attended a meeting with the IBM Tube Group on second source. I made a trip to Tung-Sol to review progress on the improved 5998. The program to polycast 2420 tubes was given second priority this period.

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### 2.6.2 Tube Research and Development

(S. Twicken) (UNCLASSIFIED)

I attended a meeting at Tung-Sol with the Project High Tube Group to review progress of the DT-438 (improved 5998) program. Mounting and handling facilities are nearing completion, the reworked exhaust machine is being shaken down, and parts for two alternative anode redesigns are on order. The causes of grid-cathode shorts in the prototype 5998 were reviewed and plans outlined to eliminate them in the DT-438. Plans to reduce cathode temperature, high in the 5998, were also reviewed. The necessity for maintaining a 5998 delivery schedule compatible with IBM's needs was discussed with Dr. Wright, vice-president in charge of research and engineering, and passed on by him down the Tung-Sol organization.

Early indications in the 7AK7/2420 polycasting program are that the screen grid-to-cathode spacing of the later 7AK7's was smaller than the spacing of present 2420's. More dissections are necessary to confirm this. If so, the greater spacing in the 2420's would, of course, cause lower plate currents.

Pulse-characteristic testers have been completed and set up in the Barta and Lexington tube laboratories. A correlation of the two equipments will be made this period.

(D. C. Lynch, J. S. Palermo) (UNCLASSIFIED)

During the past 2 weeks work has continued on the construction of 19-inch Charactrons. One tube with a standard P7 phosphor and a second with a P16 modification have been completely chemically processed and are ready for further processing. A series of 19-inch bulbs with P7 screens was prepared to evaluate different aluminizing techniques and heaters.

A group of 7AK7 tubes was polycast and forwarded for dissection and measuring.

(L. B. Martin) (UNCLASSIFIED)

Ten of the 12-plate Typotrons received from Hughes will be tested for leakage and gas and then started on life test. The production test will be omitted for the present as facilities at Lexington are overloaded. We also received ten type 12280-1 convergence coils and ten Typotron sockets.

Three coils were damaged, two because the leads were sheared off where they emerge from the cylinder and one because of an open main-coil winding. The impregnating varnish used makes the leads brittle. It is believed that substantial improvement on the lead arrangement could be effected with little effort. The inductance and resistance of the coils were measured. The trimming windings averaged about 316 millihenrys and

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220 ohms; the main windings were about 7.15 henrys and 1575 ohms.

The first 12-plate Typotron (i.e., one with compensation plates) was set up in the 16-position life test. It was found that more selection-centering range was required than provided, while less compensation gain was needed. The mounts will be modified to accommodate these conditions. At present it is not known if tube 474 has unusual centering and gain requirements. In any event, the mounts will be modified as it is expected that some tubes rejected by the production test because of over-specification centering or gain voltages will be satisfactory for life test. The mounts will also be modified so that minimum flood-gun bias is -50 volts.

The following is a list of Typotrons, their condition, and total hours on life test:

| <u>Tube</u> | <u>Total Hours</u> | <u>Condition</u> |
|-------------|--------------------|------------------|
| 265         | 7477.2             | marginal         |
| 280         | 6659.2             | satisfactory     |
| 389         | 5056.6             | satisfactory     |
| 390         | 5140.4             | satisfactory     |
| 392         | 5140.4             | satisfactory     |
| 394         | 4358.3             | marginal         |
| 11601       | 453.3              | satisfactory     |
| 11521       | 208.5              | satisfactory     |

(T. F. Clough) (UNCLASSIFIED)

During the past 2 weeks progress has been made in the reorganization of the specifications for our 19-inch Charactron display tube. I have had several discussions with the tube-construction section on aluminizing procedures.

(P. C. Tandy) (UNCLASSIFIED)

Nine 19-inch Charactrons, CHT-61, CHT-62-1, CHT-68-1, CHT-72-2, CHT-73, CHT-75, CHT-80, Convair 7-1, and Convair 0082, have completed from 56 to 3000 hours on life test.

Two tubes were taken off life. CHT-74 was retired after 1780 hours, and Convair 0074 was retired for the second time after 2360 hours. CHT-74 broke down twice when first turned on, and the pulse-beam current curve showed a hump. The hump disappeared by 350 hours at 20% pulse-duty cycle, but it soon returned when the tube was operated at d-c zero bias. By 1111 hours a pulse-matrix current of 50 microamperes could not be obtained. Convair 0074 had poor emission when it was received for life test, and it never improved. It was operated at d-c zero bias during the last 1169 hours. The zero-bias cathode current at the end of life test was only 250 microamperes.

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CHT-72-2, CHT-75, and CHT-80 have shown no appreciable change or improvement on life test. The ratio of pulse-cathode current to pulse-matrix current of CHT-61 and CHT-62-2 has risen to approximately 23 maximum after 2980 and 2871 hours, respectively. In a good new tube this ratio is slightly greater than 10. Convair 7-1, recently received for life test from C. L. Corderman, has shown a drop in pulse-matrix current at zero bias from 350 to 35 microamperes after 288 hours.

The screen backing aluminum, leakage, and ion current of CHT-68-1, CHT-72-2, CHT-73, and Convair 7-1, recently started on life, were able to meet specifications. The  $A_2$ -matrix leakage of CHT-73 is 0.55 microampere, which is within specifications but higher than the usual 0.04 for a new tube. The Convair tubes 7-1 and 0082 showed ion currents of 0.024 and 0.016 microampere, respectively. This is within the specification of 0.1 microampere.

## 2.7 Memory Test Computer

(W. A. Hosier) (UNCLASSIFIED)

Testing of the XD-1 display system in various aspects continued to occupy the major portion of machine time and staff time. A very successful demonstration of the prototype XD-1 console was made by Corderman and Woolf on 21 February, simulating a tracking-situation display with moving aircraft by means of a program written by Harold Houser of Group 61. Category and feature selection incorporated into this program worked out very well.

Substantially all the hardware which we undertook to supply for the XD-1 liaison system outlined in the 11 February Biweekly has now been put into the shop or at least into Drafting, and delivery dates have been obtained for all special purchases involved. Of these latter, the worst is that for 60,000 feet of modified RG-62A/U cable from Plastoid, expected about 8 April.

In the program to improve the circuitry of the MTC display system to make it more useful to Group 61 and other programmers, an intensification amplifier was installed on the console scope. The next step will be new decoders for horizontal and vertical deflection. The schematic for these decoders has been completed, and the Drafting Room is now working on layout. Construction can be started in about a week.

Tests made on the card reader and punch have been quite satisfactory; we consider this terminal equipment now available for general use, although full utilization will require more utility programs, such as an IBM-to-binary conversion program.

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## Distribution of computer time, 14-25 February, inclusive:

|                       | <u>Hours</u> | <u>Per Cent</u> |
|-----------------------|--------------|-----------------|
| Development           | 39.6         | 30.2            |
| Programming           | 58.9         | 44.9            |
| Scheduled Maintenance | 26.5         | 20.2            |
| Installation          | 3.6          | 2.8             |
| Interrupting Failures | <u>2.5</u>   | <u>1.9</u>      |
|                       | 131.1        | 100.0           |

MTC Drum

(E. Gates) (UNCLASSIFIED)

The new heads for the drum are being tested at Kingston and should be delivered to MTC the week of 28 February. The new heads will enable us to increase drum memory to 12 fields and to read independently out of two 32-bit fields for testing the XD-1 display system.

MTC Technician Training

(A. Vanderburgh, Jr.) (UNCLASSIFIED)

The outline for the MTC Technician Training Manual has been revised. The new outline is as follows:

|             |                          |
|-------------|--------------------------|
| Chapter I   | Introduction             |
| Chapter II  | Overall Description      |
| Chapter III | Programming              |
| Chapter IV  | MTC Operating Procedures |
| Chapter V   | MTC Circuits             |
| Chapter VI  | Maintenance              |

Chapters I and II have been finished. Chapter III is currently being covered in class, and the notes will soon be printed. The rest of the manual is in the study and planning stage.

MTC Power

(R. C. Jahn) (UNCLASSIFIED)

Trouble with MTC power-supply control was caused by inadequate fusing in a power-distribution circuit and subsequent improper operation of power-supply control during the voltage cycling period of the generator. Avoiding the use of control switches during the cycling period eliminates this trouble.



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Analysis of MTC Tube & Component Defects

(E. Albanese, B. Searle) (UNCLASSIFIED)

The following is a summary, for the period 14-25 February, of defects found in tubes and in components in MTC:

| <u>Tube or Component</u> | <u>Defect</u> | <u>Number</u> | <u>Hours Lost</u> |
|--------------------------|---------------|---------------|-------------------|
| Toggle switches          | Intermittent  | 2             | 0                 |

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## SECTION III - ADVANCE DEVELOPMENT

3.1 Magnetic Materials3.1.1 ChemistryAuxiliary Storage for New Computer

(F. E. Vinal) (UNCLASSIFIED)

Contemplated auxiliary storage for the new computer to replace some drum storage used in the past may be brought about by the use of small high-speed core-memories.

Two proposals have been advanced, one for a very high speed coincident-current memory, with access time of perhaps 1 or 2 microseconds, and the use of a three-core-per-bit system, involving two switch cores and a smaller memory core. Experiments are contemplated with both methods. These problems were discussed with General Ceramics representatives during their visit of 15 February; it was agreed that General Ceramics would expend efforts in the direction of supplying suitable cores for experimental three-core-per-bit work, and that the Group 63 ferrite laboratory would work toward supplying cores for the very high speed random-access memories.

Production of Memory Cores

(J. Sacco) (UNCLASSIFIED)

Approximately 225,000 F397 memory cores have been pressed from batch DCL-2-832. Of these, 150,000 have been fired.

Preliminary processing of three duplicate batches has been completed, and they will be test-fired in the near future.

Chemical Analysis

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

Quantitative analyses of the following have been completed:

1. DCL 2-825 special and DCL 2-826, both memory-core compositions;
2. A sample of ferrous zirconate;
3. A sample of ferrous germanate;
4. A sample of magnesium ferrite.

Quantitative analyses of DCL 2-827, DCL 2-832, memory-core compositions, and a sample of lithium ferrite are in progress.

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Ferrites for Magnetostriction Measurements

(D. L. Brown) (UNCLASSIFIED)

The series DCL 3-121 to 133 CR and DR were refired, completing the nickel ferrite plus  $Mn_3O_4$  series. DCL 3-185 to 193 A and B, nickel-manganese ferrites, and DCL 3-155 to 165 C and D, nickel-zinc ferrites, were fired.

Lithium Ferrite

(D. L. Brown) (UNCLASSIFIED)

Attempts to prepare a high quality lithium ferrite have not thus far been successful. Samples made to date have not been single-phase material.

X-ray Diffraction

(F. S. Maddocks) (UNCLASSIFIED)

X-ray diffraction patterns have been made for the series DCL-2-396 thru DCL-2-400 to determine the results of refiring in nitrogen. Two samples, DCL-2-399 and 400, were poorly crystallized tetragonal spinels before refiring. After refiring, both samples were much better crystallized, sample DCL-2-399 had changed to cubic symmetry, and 2-400 showed far fewer twin planes. The remainder of the series displayed well crystallized cubic symmetry before and after refiring. Lattice parameters were changed little, if at all, but changes in X-ray reflection intensities indicate a rearrangement of ions within the spinel lattice.

Inorganic Chemistry

(D. Wickham) (UNCLASSIFIED)

In analogy to the zinc-germanium-iron spinels being prepared (compositions within the system  $ZnFe^{III}_2O_4-Fe^{II}Ge^{IV}_2O_4$ ), an attempt has been made to prepare  $Fe^{II}ZrO_4$  (ferrous zirconate) and a 50% solid solution of this substance with zinc ferrite. Up to 1000C FeO and  $ZrO_2$  apparently do not combine to form a ferrous zirconate. When a mixture of FeO and  $ZrO_2$  with the empirical composition of  $Fe_2ZrO_4$  is mixed and ignited with  $ZnFe_2O_4$ , a magnetic phase is formed, but an X-ray powder pattern of the product obtained at 1000C shows the presence of some unreacted  $ZrO_2$ .

Automatic Core Tester

(J. Schallerer) (UNCLASSIFIED)

The sensing circuits for the automatic core tester have finally been refined to the point where radar interference is negligible. Calibration of the tester has started, and a good idea of the reliability of the system should be known soon. It is expected that the tester will be usable in the next few days.

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Cores for 256 x 256 Memory

(J. W. Schallerer) (UNCLASSIFIED)

We now have on hand 32,000 single-tested cores and 37,000 double-tested cores for this memory. All testing thus far has been on the semiautomatic core tester.

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### 3.1.2 Physics

#### Magnetization of Ultra-Thin Metal Tapes

(N. Menyuk) (UNCLASSIFIED)

A study is being made of the magnetization process in ultra-thin metal tapes assuming nucleation at grain boundaries. This process must be calculated in three distinct steps: First, there is the growth of cylindrical domains; second, the growth of neighboring domain walls until they meet at the tape surfaces; and third, the collapse of essentially elliptical domains. The first and third steps have been calculated previously. The second step has now been calculated by an approximation method. The resultant equation for the switching coefficient has a form which differs somewhat from that previously obtained. Work is continuing to determine if the results obtained are compatible with experimental evidence.

#### D. C. Fluxmeter

(R. A. Pacl, Jr.) (UNCLASSIFIED)

The power-output stage of the amplifier is being modified to provide higher gain, better stability, and improved linearity.

#### Incremental Permeability

(J. D. Childress) (UNCLASSIFIED)

Calculations show that the incremental permeability at remanence of a magnetic material is caused by

1. Growth of domains of reverse magnetization;
2. Nucleation of domains of reverse magnetization; and
3. Rotation of the directions of magnetization of the domains.

Only the contribution of magnetization rotation is significantly dependent (in magnitude) upon the direction of the applied field. Hence, the rotation mechanism is responsible for "delta" noise. Further, delta noise can be reduced by alignment of the directions of magnetization and by increasing the anisotropy constant.

### 3.2 New Components and Circuits

#### 3.2.1 Transistor Circuits

##### Emitter Follower

(A. L. Pugh) (UNCLASSIFIED)

Emitter followers were investigated for general circuit use and in particular for driving 90-ohm lines. Driving with a rise time of

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15 millimicroseconds, the difference between the rise times of the input and output pulses was barely discernible. In the case of a 90-ohm load the emitter follower has a voltage gain of  $3/4$  and an input impedance of about 1500 ohms.

Summary of Transistor Production

(D. J. Eckl) (UNCLASSIFIED)

A final report on the present status of transistor production should be available at the end of the next biweekly period. This report will not be generally distributed, because some of the information contained therein is of a proprietary nature.

Transistor Core Drivers (D.J. Eckl) (UNCLASSIFIED)

At the request of Carlo Bocciarelli of Philco, I have been discussing with Bill Papiian the requirements for a transistor to drive present and future core memories. The problem is a very complex one, and the transistor type required depends on the memory driving scheme.

SBT Frequency Response (D.J. Eckl) (UNCLASSIFIED)

Preliminary measurements on swept-frequency response curves for grounded-emitter SBT's have not been consistent with measurements supplied from Philco based on maximum oscillating frequency.

Transistor Symposium (D. J. Eckl) (UNCLASSIFIED)

I attended a symposium on transistor circuits at the University of Pennsylvania on 17 and 18 February. Philco's method of measuring  $f_{\beta}$  was described. Some work with field-effect transistors at Sylvania (Ipswich) was also discussed. This is apparently going to become an annual conference.

Visit to Philco

(E. U. Cohler) (UNCLASSIFIED)

On 16 February Donald J. Eckl and I visited two installations at Philco. They have discovered a simple figure of merit for the hole-storage characteristics of surface-barrier transistors which is constant over a wide range of operating conditions. The chief difficulty with their figure of merit lies in its inability to predict quantitatively operation in a given circuit. However, it does give us a method of comparing transistors without reference to any circuit. In addition, we were given a preview of certain circuits and packages that will be revealed to the public in the near future. These comprised the bases of a transistorized computer.

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Flip-Flops

(E. U. Cohler) (UNCLASSIFIED)

In some experiments with the rise time of grounded-emitter circuits employing surface-barrier transistors, I have found that the load resistance is definitely affecting the rise time. This means that the collector-capacity effect is not negligible. While this may not seem likely at first blush, because of the extremely small collector capacity of these transistors (less than 6 millimillifarads), when one considers the effective increase of collector capacity in a grounded-emitter operation, it becomes quite evident that load resistances of the order of 1K can have a definite effect on the rise times involved in these circuits. New experiments with flip-flops employing lower supply voltages and lower load resistances give promise of considerably faster operation, on the order of 50- $\mu$ sec turn-over time.

Basic Circuit Work in General

(E. U. Cohler, K. Konkle) (UNCLASSIFIED)

We have investigated the following phenomena:

1. Saturation beta of surface-barrier transistors;
2. Reverse-recovery characteristics of surface-barrier transistors;
3. Rise time characteristics of surface-barrier transistors;
4. Interconnection of alloy transistors in relay-like circuitry.

Since this work has only now been completed we are not quite in a position to give results in an organized form. We are proceeding to the consideration of specific circuitry at this point.

(Melvin M. Cerier) (UNCLASSIFIED)

A list is being made of characteristic curves that various people have taken on SBT's. Time has been spent becoming familiar with SBT circuitry.

(M. E. Petersen) (UNCLASSIFIED)

The variation of surface-barrier-transistor parameters with operating conditions is being measured.

The data accumulated on SBT characteristics vs ambient temperature is being assembled.

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(J. R. Freeman) (UNCLASSIFIED)

The use of a center-tapped transformer to drive the one-digit shift register with a sine-wave generator has yielded further confirmation of the operating limits measured with pulses. The circuit operates with complete reliability with rms signals of 0.25 volt over the range extending from 0.1 to 4.8 megacycles.

It has been decided to defer extensive margin tests on the eight-digit shift register pending development of a suitable driving circuit.

(P. Griffith) (UNCLASSIFIED)

Static characteristics were obtained for the surface-barrier transistor operating as grounded base and grounded emitter.

A study of the variation of transistor collector resistance versus collector voltage (operating at 1.0 milliamperes and 2.0 milliamperes, respectively) was made for five transistors.

From the above data a grounded-emitter amplifier was constructed. The voltage gain versus load resistance curve was linear from 0 to 2500 ohms and became almost constant for greater load resistance.

Next a grounded-base amplifier was designed and constructed according to characteristics obtained previously. The gain versus load resistance curve was linear from 0 to 4000 ohms.

#### Tetrode-Transistor Switching Circuits

(C. T. Kirk) (UNCLASSIFIED)

Further investigation of the tetrode transistor as a switching element has been delayed pending receipt of ten high-frequency tetrodes from Germanium Products.

#### Single-Rank Surface-Barrier-Transistor (SBT) Flip-Flop

(C. T. Kirk) (UNCLASSIFIED)

An experimental single-rank SBT flip-flop has been designed and built. Transient storage (delay) in this flip-flop is accomplished by a simple LC network. Since this type of network yields only a second-order response in the output for a step input, an amplifier was inserted in the output of this network to improve the over-all delay and rise-time characteristics of the network. The experimental results of this flip-flop are now being studied.



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Voltage-Type Decoder

(L. Jedynak) (UNCLASSIFIED)

The voltage-type decoder uses circuitry such that the operation switches from emitter-follower to grounded-emitter when the emitter voltage reaches the reference voltage. This is accomplished by the switching of a T-7G diode. It was found that by inserting a small resistance -- 400 ohms -- in the emitter lead and removing the large base resistance, emitter-follower action is retained in a final circuit much less dependent upon the alpha of the transistors. The frequency response of the system has been adversely affected by this modification. The present problem is to improve this response to an acceptable value.

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### 3.2.2 Magnetic-Core Circuits

#### Stepping Registers

(G. Davidson) (UNCLASSIFIED)

A report on "The Design of Two-Core-Per-Bit Magnetic Core Stepping Registers" is being completed. Tests on an actual stepping register are being compared to the design values.

### 3.2.3 Memory

(W. N. Papian) (UNCLASSIFIED)

As part of the space reshuffling necessary to accommodate the increased activity of Group 63, the Memory Section is giving up its plane-assembly area in B-147. The equipment and technicians will be moved to B-170, which will then contain all of our effort. The memories now being designed will have to be assembled and tested elsewhere, probably right on the floor of the computer for which they are meant.

About 32 of the 600 unit planes we expect to assemble over the coming months are slated for delivery to Group 24 for their development work.

Visitors last period included two representatives of Mullard, the large British manufacturer of vacuum tubes, magnetic devices, and other electrical equipment. They are now producing reasonably good ferrite memory cores and are also developing some core-memory systems. Louis Nofrey of the University of California Radiation Laboratory was also here; they are about to request bids on a large computer for their government work and are anxious to have it include the largest, fastest core memory possible. We gave them as much advice as we could; Mr. Nofrey promised to keep us informed of their progress.

Jack Mitchell is now in California; his visits will include International Telemeter Corp. and Rand, with intent to find out the latest information on the Johnnie and other core-memory developments.

#### Mechanical Design and Layout for 256 x 256 Memory

(E. A. Gudtitz) (UNCLASSIFIED)

Twelve of the 16 memory-plane modules required for the first 256 x 256 plane are partially completed.

A schedule has been worked out for the construction of 35 more 256 x 256 planes. These should be completed in February 1956.

Design of a plug-in unit and mounting subrack is almost completed.

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Printed Plane

(E. A. Guditz) (UNCLASSIFIED)

A visit was made to Electro-Tec Corporation, South Hackensack, New Jersey. The electrodeposition of metal on printed conductors in the memory plane was discussed.

Experiments are being conducted to determine if it is practical to do our own laminating of copper to base material. Results to date are encouraging.

Talk

(J. Raffel) (UNCLASSIFIED)

A paper entitled "Experiments On A Three-Core Cell For High-Speed Memories" has been prepared in collaboration with S. Bradspies for the I.R.E. Convention, 23 March.

Memory with External Selection

(S. Bradspies) (UNCLASSIFIED)

A detailed comparison between the features of the high-speed memory with external selection and of a proposed high-speed coincident-current memory has been completed. An evaluation of the results has not yet been made.

(D. H. Ellis) (UNCLASSIFIED)

The new cores with lower switching coefficient ( $S_w$ ) were received from General Ceramics. Tests are in progress to determine the smallest value of driving current that can be used to drive an externally selected memory core through a complete cycle in 1 microsecond.

With the substitution of the new cores, a new trouble has been encountered. The ZERO outputs are disturb sensitive. This could be attributed, in part, to the lower coercive force of the material. Also, the effect of reducing the size of the memory core with acid is a factor to be considered.

3.2.4 Systems3.2.4.1 Design

(N. L. Daggett, J. W. Forgie, W. A. Clark) (UNCLASSIFIED)

We have re-examined the design for a machine based on the "program on demand" idea and conclude that the basic flexibility afforded by this

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system justifies going ahead with the preparation of detailed block diagrams.

3.2.4.2 Planning

(K. H. Olsen) (UNCLASSIFIED)

A proposal for the mechanical design of the experimental computer is being prepared. Loren Prentice has delivered a device that welds polystyrene handle and base to the transistors we are using.

(J. Fadiman) (UNCLASSIFIED)

In order to gain experience with transistors and transistor circuitry, I have been experimenting with a transistor flip-flop circuit and associated gating device.

(R. Sawyer) (UNCLASSIFIED)

A block diagram of the Burroughs equipment necessary for the operation of the 8-digit multiplier has been prepared.

This equipment has been assembled and rack mounted and is now being tested.

(R. Hughes) (UNCLASSIFIED)

A block schematic has been made of the proposed paper-tape-reader logic. The drawing number is SB-61943.

## IV - CENTRAL SERVICES

4.1 Material Requirements & Stock

(H. B. Morley) (UNCLASSIFIED)

The Air Force FY 56 Financial Plan Schedule of Non-Standard Mission Support Items of equipment for Division 6 has been completed.

We are setting up a central file of transistor information composed of the latest catalogs and data sheets from every transistor manufacturer in the country.

By popular demand goldenrod pads have been reinstated as a standard stationery item. They are available at Bldg. B Stationery Stores.

4.2 Engineering Services4.2.1 Components

(H. W. Hodgdon, C. Morrione, R. J. Biagiotti) (UNCLASSIFIED)

During the next few weeks R. J. Biagiotti will spend a large percentage of his time working with W. Mitchell of IBM, setting up details of the failure-recording and reporting system for XD-1.

Examination of a failed capacitor rack from an XD-1 power supply disclosed inadequate mechanical design in the unit, rather than faulty components.

Satisfactory progress is being made in the development of a diode curve tracer. This equipment will enable us to make comparative measurements, acceptance tests, and other checks on many different types of diodes.

4.2.2 Test EquipmentTest Equipment Committee

(L. Sutro) (UNCLASSIFIED)

The Committee is following reports of use of the DuMont 338 oscilloscope. It has offered to IBM 90 Burroughs flip-flops received nearly a year ago from Group 24 and never used. The committee has approved purchase of:

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| <u>Item</u>                     | <u>Mfr.</u> | <u>Model</u> | <u>Qty.</u> | <u>Use</u>                                  |
|---------------------------------|-------------|--------------|-------------|---|
| Multimeter                      | Simpson     | 260          | 15          | Testing in Division 6                       |
| Dual Trace<br>Preamplifier      | Tektronix   | 53C          | 1           | Measure signal ratios in<br>Cape Cod System |
| Wide-Band Diff.<br>Preamplifier | Tektronix   | 53G          | 1           | Transistor-circuit<br>measurements          |
| Milliammeter<br>0/0.03/0.3/3.0  | Weston      | 931          | 1           | Component tests in Group 60                 |
| Voltmeter<br>0/10/100/500       | Weston      | 931          | 1           | Component tests in Group 60                 |

Test Equipment Headquarters

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

In addition to maintaining all the test equipment in Division 6, we have been checking and repairing IHM's oscilloscopes as they arrive for use in Building F. All five of the 18-mc-bandwidth DuMont type 336 oscilloscopes ordered for Division 6 have been received and checked. Four are in use and one is available for anyone who needs it.

4.2.3 Mechanical Engineering

(A. R. Smith, L. B. Smith, L. B. Prentice) (UNCLASSIFIED)

A multicam recycling timer has been designed to activate eight separate thyratron circuits with a 1% to 99% on and off time per circuit, a sequencing range of 100%, and a cycle time varying between 0.028 second and 1 minute. Modular-type construction permits the expansion to additional circuits and a wider range of cycle speeds, its limiting factors being available space, driving force, and inherent switch characteristics.

4.3 DraftingInter-Office Memoranda

(A. M. Falcione) (UNCLASSIFIED)

The improper use of inter-office memoranda results in a large amount of valuable information for which we have no appropriate identification or filing system. Close scrutiny of all inter-office memoranda will be maintained to insure proper use. If there is any reason why applying an M-number delays the process of getting the material out, please bring it to my attention.

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Positive-to-Positive Reproduction

(A. M. Falcione) (UNCLASSIFIED)

The Ozalid Corporation recently developed an "Ozalith" sensitized plate for Multilith reproduction. This plate enables us to make a positive-to-positive Multilith plate for 8 1/2 x 11 size only from a good clear vellum original. This process eliminates the use of photographic negatives and enables us to reproduce material much faster than heretofore. Through this medium we can reproduce large numbers of sketches and drawings, providing that the vellum original is clear and sharp. Care should be taken to allow spacing on the vellum original (1/2 inch all around) to provide for security classification and the gripper margin required by the Multilith machine.

IBM Print Distribution

(A. M. Falcione) (UNCLASSIFIED)

The following print-distribution list for XD-1 drawings has been established. If new files are to be established, please bring it to my attention.

| Issue To                                | No. of Prints | Description  |
|---|---------------|--|
| (Systems Office)<br>Nolan Jones         | 1             | Block schematics of PU (sheet 2 of wiring diagram, only) All diagrams on logic, block, element, system, etc.   |
| XD-1 PU<br>Maint. File<br>(R. Porter)   | 1             | All PU wiring diagrams & schematics (sheets 1 & 2)<br>All card details & card assemblies (furnish these flat--not folded)  |
| Print Room                              | 1             | All drawings   |
| Design                                  | 1             | All drawings   |
| Display - 1<br>Display - 2<br>(Fallows) | 2             | Card details & card assembly for central display.<br>PU wiring diagram & block schematics central display (sheets 1 & 2). Logic diagram of display.<br>(List of dwgs. has been furnished.) |
| Lincoln Stds.<br>Office<br>(Gentile)    | 1             | All component drawings<br>All specifications   |
| Div. 6 Stds.<br>(Hodgdon)               | 2             | All specifications   |
| DDR-DDT File<br>(Aronson)               | 1             | List furnished of required drawings  |

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4.4 Administration & Personnel

4.4.2 Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

New

Donald Bresette is a new clerk in the Duplicating Room where he will help operate the Multilith machine.

Patricia Golden is a new secretary in Group 61 working for R. J. Horn.

Mrs. Adella Rich has joined Group 62 as a clerk.

Terminations

Lionel Boisvert  
George Hanlon  
Mildred Hanlon

Open Requisitions

1 Clerk for the Print Room, Group 60  
1 Clerk-Typist for Group 62  
1 Electro-Mechanical Checker  
1 Layout Draftsman  
1 Technical Assistant for Group 61



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Accessions List

(D. B. Helwig) (CONFIDENTIAL)

The Following documents were published by Division 6 or received from IBM During the period 15 February - February 1955:

Division 6 Reports

| <u>NO.</u> | <u>AUTHOR</u>             | <u>TITLE</u>   | <u>CLS.</u> |
|------------|---------------------------|--|-------------|
| 6M-3288    | P. Gray                   | Synchronized clock system for SAGE System<br>Combat Center   | U           |
| 6M-3311    | A. Zacharias              | An Investigation of CRT Problems<br>( $\mu$ S Thesis Prop.)  | U           |
| 6M-3359    | J. Ackley                 | Proposal for two New Instruction for Whirlwind I   | U           |
| 6M-3368    | H. Boyd                   | Redesign of the Drum Read Driver   | U           |
| 6M-3369    | A. Smalley                | Mission Specifications (17-55) for Raydist<br>Orientation on 23 and 25 Feb. 1955                     | U           |
| 6M-3370    | P. Gray                   | Report of Committee on SAGE System manual Inputs<br>and Miscellaneous Outputs                        | C           |
| 6M-3371    | A. Kromer                 | Division 6 Production Coordination Office  | U           |
| 6M-3372    | H. Boehmer                | Radar Data Link Orientation in the SAGE System   | C           |
|            | C. Weiser                 |  |             |
| 6M-3373    | C. Watt                   | Vist to General Mills Inc. Minneapolis, Minn.  | U           |
| 6M-3374    | J. Jacobs                 | Proposal for SAGE Experimental Subsector<br>Planning Approval Committee                              | U           |
| 6M-3376    | P. Bragar                 | SAGE System Meeting Feb. 14, 1955  | U           |
| 6M-3377    | J. Mazza                  | Notes on Systems Planning Meeting 14 February,<br>1955 at 0930E                                      | U           |
| 6M-3379    | L. Murrery                | Syllabus for the 1954 Cape Cod System Familiar-<br>ization Program 23 Feb. to 8 March 1955           | C           |
| 6M-3380    | T. Clough                 | Photo Multiplier and CRT Conference January 27,<br>1955 at Dumont Passaic, N.J.                      | U           |
| 6M-3381    | T. Clough                 | K-1303 Photo-Multiplier and K-1230 CRT Meeting<br>of January 18, 1955                                | U           |
| 6M-3383    | N. Taylor                 | Biweeklies   | U           |
| 6M-3384    | A. Smalley                | Mission Specifications (16-66) for Raydist<br>Orientation on 2 and 4 March 1955                      | U           |
| 6M-3386    | Automatic<br>Inputs Comm. | Long-Range Radar Input Specifications for the<br>Initial AN/FSQ-7 Machines                           | C           |
| 6M-3387    | S. Twicken                | Z-2177 Meeting of 10 January 55  | U           |
| 6M-3388    | P. Bagley                 | Preliminary Study of AN/FSQ-8  | C           |
|            | B. Housman                |  |             |
| 6M-3392    | P. Bragar                 | Sage System Meeting February 21, 1955  | U           |
| 6M-3398    | A. Smalley                | Group 61 Mission Specifications (19-55) for<br>an Accuracy Training Test on Tuesday, 1<br>March 1955 | U           |

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IBM Reports

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|------------|---------------|--|-------------|
| IBM-694    | ---           | Programmer's Reference Manual Punched Cards and Card<br>Machines | U           |
| IBM-695    | ---           | Weekly Summary of Prototype Development in Lexington             | U           |
| IBM-696    | ---           | AN/FSQ-7 Bi-Weekly Progress Report                               | C           |

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