

Memorandum M-2150

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Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: AIR DEFENSE BIWEEKLY REPORT, May 8, 1953

CAPE COD

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Auth: <u>DD 254</u>
By: <u>L. H. Everett</u>
Date: <u>2-1-60</u>

1.0 GENERAL

(C.R. Wieser)

The MEW radar is scheduled to be shut down May 15 and removed from Bedford. At present the flight test schedule is accelerated in order to work as much as possible with the MEW. In particular the program for 4 simultaneous interceptions is just being checked out. One trial with 2 simultaneous interceptions was successful, and one trial with 4 failed because of several different types of equipment trouble. Further trials with 4 interceptions are scheduled before May 15.

After May 15 there will be an increased demand for data from N. Truro for tests. The SDV link is still in the development stage under Group 24. Until it is turned over to Group 22 for routine operation, Paul Sebring (Group 24) should be notified of all periods when we want Truro data in order to avoid conflict with development work on the SDV link.

In order to get closer liaison between WWII development and the Cape Cod program, IBM has assigned Mr. Walker Thomas to work with Group 61. In the near future Mr. Rudolph Cypser of IBM will be assigned also.

2.0 EQUIPMENT ENGINEERING

(S.H. Dodd)

The Cape Cod installation work is progressing approximately on schedule. By May 15 a major portion of the wiring from the panels in the computer room to the remote station distribution box will be completed. Except for a couple of stations in the control center, which are not needed immediately, all wiring should be completed from the remote station distribution box to the control center consoles, and power wiring should also be completed to these consoles. The 16-inch scopes, 5-inch scopes, switch panels, and other associated equipment should be available to complete two consoles, and the signal and power interconnection wiring within these two consoles should be installed. Thus the equipment testing of these two consoles can begin during the week of May 18. The equipment and console interconnecting wires associated with the rest of the control center stations will be installed fast enough to keep ahead of the testing program. The goal of the test program is to obtain an operating system of good reliability by the first of July.

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2.0 EQUIPMENT ENGINEERING (CONTINUED)

(S.H. Dodd) (Continued)

The MEW radar located at Bedford will discontinue its operation about May 15. In an effort to use the remaining operating time of the MEW at maximum efficiency, we are scheduling installation days to start at twelve o'clock next week so that morning flight tests can be performed before each installation. During the week of May 18 most of the day-time hours will be assigned to the In-Out group for testing of the new equipment associated with control center consoles.

ERA expects to complete the testing of our buffer drum by May 22 and will then crate and ship the drum to us. Delivery can be expected early in June and manpower has been assigned to install and test this drum.

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

During the past biweekly period Pathfinder Unit #2 was received from Division 2. At present one of the Group 61 technicians is making our modifications to the first two Pathfinder units.

Delivery of the phototube mounts is slightly behind schedule as is the delivery of the Filter Amplifier and Pulse Generator Panel. However, we can expect delivery of one phototube mount on May 18 and if necessary, can build a breadboard amplifier for temporary installation of one unit for the N. Truro radar.

(H.J. Kirshner)

Attempts are being made to record SDV data from the CPS-6B radar at N. Truro on our Ampex twin-track recorder. To date we have been unable to record a really good tape due to the degradation of already poor phone line signals (relative to the signals of other SDV sites) by the recorder. Some changes will be made in the recorder circuitry in order to improve the fidelity of reproduction; however, even if the recorded signal exactly duplicates the phone line signal, a perfect SDV signal will not be attained. This condition will exist because the phone line signal from Truro is considerably noisier than that received from other sites. Group 24 is cognizant of this difficulty and is in the process of modifying transmitting and receiving equipment to cope with this problem.

A ten-position push-button switch has been received from John Newitt. The switch will be incorporated in a prototype radio control panel.

Now that our flight test activity necessitates the use of more than one radio channel, we are experiencing difficulty with our radio facilities because of cross talk between adjacent channels. We have been aware of the problem for some time, as has Group 22, but the remedy for the problem is dependent on the delivery of filters from Spencer-Kennedy Labs. As of this writing, delivery is more than three weeks late.

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2.0 EQUIPMENT ENGINEERING (CONTINUED)

(H.J. Kirshner) (Continued)

Difficulty was experienced with "light-guns" during a recent flight test. In order to prevent further trouble from this source, spares have been obtained.

The flight test section, commanded by Capt. Sullivan, will take over as much of morning Room 222 equipment check out as is possible. Abnormal operation of any equipment will be reported to me or Bill Karlsen for remedial action.

(B. Morriss, G. Young)

The MITE buffer storage for N. Truro radar data has been installed but at present is only giving marginal operation. An attempt is being made to set up a system for the use of the equipment at night and on weekends which will not require the presence of many persons to get the equipment into operation.

H.J. Kirshner is attempting to record N. Truro data for night and weekend operation of the N. Truro MITE equipment.

A computer program, 2607M1, has been written by B. Morriss for testing the N. Truro MITE and MITE buffer storage. This program may be, and perhaps should be, used to check out these units before or during the operation of a program using the units. The demodulators must be turned off or disconnected when this test program is used. The program will indicate whether or not the N. Truro MITE and MITE buffer are operating but does not give much aid in isolating a malfunction. A program is being written which will aid in trouble-shooting the equipment once a malfunction has been detected.

Block diagrams of the buffer drum have been completed and sent to the drafting room.

Memorandum M-2126 has been issued describing the effects of changes in displays on present programs.

The real time clock will be changed from its present position to an in-out position. An M-note describing these changes will be distributed next biweekly period.

Memorandum M-1985, Operation of Indicator Lights and Intervention Registers has been completed and will be distributed next biweekly period.

A note describing the operation of the GA unit (Ground-to-Air Link) is in the process of being written.

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2.0 EQUIPMENT ENGINEERING (CONTINUED)

(J. Newitt)

Installation of the equipment in the control room is underway. Station panels are being fabricated at present and special arrangements have been instituted to obtain sufficient variety by May 15 to produce one operating station.

Originally we had hoped to have five stations operating by May 15 but these will follow very shortly. There are now 13 scope consoles in the new control room and most of these have been hooked into the wireway system. Rather than cause too much disruption to the schedule for the total batches of panels now being fabricated, I believe it to our best overall interest to make only one initial station installation. We should have all panels (of the initial group) by the end of the month, and except for special considerations the bulk of the control room should be finished early in June. Five to ten stations should be operative (ready for de-bugging) by June 1.

Engineering is still underway on a group of special panels (for Walquist) and these will be expedited as rapidly as possible when finally released.

Drafting work for the two special visitor positions has been started.

Many other little odds and ends required in the final installation are now getting serious attention since we seem to be getting over the equipment hump.

If anyone can possibly think of any neglected item or items that might be helpful to the operation of the center, please contact me by phone (Ext. 3438) as soon as possible.

(F. Sandy)

The wireway from the remote station distribution box to the new control room wireway is complete. Holes have been drilled in the floor of the new control room for all positions that have been defined. Eleven scope consoles have been installed. Ten of these have all power connected to them except the 110V.A.C. for the convenience strips.

Two display gate panels and those panels in AX5 and AX7 requiring signal wire cables have been completely wired. One intervention register panel and the last display gates panel are being wired. These should be completed next week.

Fifty-six cables have been run from the RSDB to the new control room. Sixteen more will be run next Monday.

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3.0 BEDFORD EXPERIMENT

(D.R. Israel)

As noted in previous biweeklies, operations with the MEW will cease on May 15. It has previously been hoped that flight tests using data from the 6-B at N. Truro would get underway on May 18; however, this does not now appear to be a realistic situation. The MITE and the incoming data are not yet satisfactory, and the programs to use this data are wholly completed and checked. For these reasons, arrangements have been made with Steve Dodd so that the week of May 11-15 will be intensively devoted to flight tests with the MEW. In order to accomplish this and to hold tests each day, it was necessary to rearrange the normal computer schedule. The effect of these changes has been to eliminate all flight test time from the week of May 18 to May 22. It is hoped that flight tests with the 6-B will get underway on May 25.

During the past biweekly period, a successful collision course intercept involving a target maneuver was performed and recorded. Height finder operations in connection with the 6-B at N. Truro have not yet satisfactorily been held and it appears that this activity will be delayed until better arrangements are made for the use of an RHI console at N. Truro.

Two attempts at multiple intercepts were made during the past two weeks: one successfully used two interceptors and two targets; a second involving four interceptors and four targets was not successful. The reasons for the lack of success in the four-pair test were not due to the program, but were attributable to improper equipment operation and the inadequacy of certain preparations. From all appearances as soon as these relatively minor matters are corrected, a four-pair test should be successful. A number of these tests will be attempted before the 15th.

Following the four-pair test, those participating in the test conducted a critique. Notes on the items discussed have been prepared and distributed on an informal basis.

(A.W. Curby)

I have spent some time familiarizing myself with the new Four-Pair program and drawing a flow diagram of it. Copies will be printed up once the program has been run on the computer and any major changes necessary have been made.

(F.M. Garth)

When work was first begun on the rewrite of the Single-Pair Combined Interception Program, it was decided to make improvements wherever they could be done within reason of time and facility. For this reason progress has been slow. Completion should come sometime next week.

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3.0 BEDFORD EXPERIMENT (CONTINUED)

(F.M. Garth) (Continued)

Along with aiding in this rewriting, I have continued efforts to put Command Tracking in a form whereby it can be inserted into the above program to test its tracking reliability.

Meetings on the interception flow diagram for the September Cape Cod System have been fairly frequent. In conjunction with these meetings I have been assigned to aid L. Murray prepare a report on the function of the Radio Communicator.

(F. Heart)

The planned cessation in use of the Bedford MEW radar on May 15 has resulted in its increased use during the last two weeks. Several efforts have been made to successfully run and record a four-on-four intercept. Using the four-on-four program, a successful live test was run on April 28 which involved two simultaneous intercepts. An abortive attempt was made on May 6 to run 4 simultaneous intercepts. In both cases, however, program operation appeared to be correct.

The "Truro 6B" version of the four-on-four program was completed and a tape has been made. Initial testing of the tracking section has started. This testing was unavoidably delayed due to the complexity of the equipment problems associated with Truro radar data.

(W.Z. Lemnios)

The Combined Two-Aircraft Interception Program for Truro being written with C. Gaudette and F. Garth has been practically completed.

Two notes on three-dimensional interceptions have been written and distributed to interested people. The group which was constructing the flow diagram for three-dimensional interceptions has completed it.

On Tuesday, May 5, a conference was attended with Major Baldwin and Captain Hale from Bedford and C. Gaudette and F. Heart. Various problems regarding interception tactics were discussed. Major Baldwin has prepared graphs showing angles of bank and rates of turn as functions of time, air speed, and radius of turn. He also has graphs showing the effects of the attack angle and radius of turn upon the release point.

(C.A. Zraket)

A two aircraft interception with a maneuvering target was conducted on April 29. Results were good and are discussed under Flight Tests. An interception employing a beam attack was also attempted on this date. Results were excellent until a computer parity alarm which could not be repaired quickly nullified the test. During the next week two aircraft interceptions employing maneuvering targets and final-turn

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3.0 BEDFORD EXPERIMENT (CONTINUED)

(C.A. Zraket) (Continued)

interceptions employing beam attacks will be attempted. A test with the F-94 and the VHF data link will be attempted if the F-94 is available.

4.0 DATA SCREENING

(R.L. Walquist)

Detailed flow diagrams have been drawn up for all the various sections of the TWS program for the 1953 Cape Cod System. These flow diagrams have been discussed and criticized by the members of the Data Screening Group. Written descriptions are being prepared by the person responsible for each section. These descriptions plus the flow diagrams will be issued shortly in memorandum form.

The assignment of intervention switches for the TWS process has been completed. This includes all of the binary toggle switches used by the Tracking Officer for program and input data control. A supplement of M-1913 has been issued which indicates changes in the internal storage and computing time allocation for the fall demonstration. Changes are primarily a 12-second scan rate for the N. Truro CPS-6B and a reallocation of ES storage. A memo (M-2154) is being typed on the allocation of indicator lights for the TWS operation. This memo includes all of the necessary wiring interconnections between the TWS stations and the indicator light registers.

A memo is being prepared which discusses in general terms the various phases of the TWS program for the fall demonstration. This will include the order in which the sections of the program will be operated and what each section is supposed to accomplish.

(W.S. Attridge, Jr.)

With J. Ishihara, I have written M-2118, Test Storage Contents and Automatic Recycling Function in the 1953 Cape Cod System. The input of the real time clock has since been changed to operate through IOR, so this memo will soon be brought up-to-date. M-1984 will also be brought up-to-date.

I have written M-2143, Master Control Program Functions, which describes the subprogram control and the data transfer control. Related programming conventions are given which must be followed by programmers in the 1953 Cape Cod Program.

(H. Frachtman)

The data mapping program was tested but failed to operate successfully since no data was entering the computer.

The data collection, coordinate transformation, and data analysis program for the September system is almost complete.

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4.0 DATA SCREENING (CONTINUED)

(H. Frachtman)

Our quest for a suitable video mapping material received a set-back when the Eastman Kodak company refused to send us a sample of a substance which appeared quite promising.

(D. Goldenberg)

Two programs were written, using the Comprehensive System with (24,6) numbers, for the earth curvature problem. One program computes the distance between the two positions of a target as reported by one long- and one short-range radar in the Cape Cod System. The second program computes the true rectangular coordinates of a target relative to its center of coordinates and the rectangular coordinates of the target as reported by a long range radar, up to 200 miles in range, located at a great distance, up to 400 miles, from the center. These programs are in the tape room.

The equations which cross-tell the x,y coordinates in one system into the coordinates of a second system have been derived. The equations are:

$$X_2 = \frac{A_1 + A_2 X_1 + A_3 Y_1}{D_1 + D_2 X_1 + D_3 Y_1}$$

$$Y_2 = \frac{B_1 + B_2 X_1 + B_3 Y_1}{D_1 + D_2 X_1 + D_3 Y_1}$$

where A,B, and D are functions of the latitudes and longitudes of the two centers of coordinates of the systems and the radius of the earth. These constants can be derived for each combination of pairs of systems and stored for use in programming. The errors, which arise due to the rounding off in a 15-binary digit number system, have been estimated to have a maximum value of 0.06 miles.

(J. Ishihara)

All details of the correlation section for the Track-While-Scan 1953 Cape Cod Program have been decided. H. Seward and I are now coding and writing a description of the program.

A detailed description of the functions of the Tracking Control Register in TWS Programs has been written.

(J. Levenson)

All further work on the Track Monitor Program written earlier, and tested on the computer, has been abandoned because ideas on this subject have changed since the program was written, and recent changes in computer operation would necessitate considerable change in the program.

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4.0 DATA SCREENING (CONTINUED)

(J. Levenson) (Continued)

The two memos describing two sections of the Track-While-Scan program for September have been put in final form and should be appearing shortly. I am also preparing a short memo for TWS programmers describing the contents and uses of a Monitor Register to be associated with each track.

Final assignment of digits of the Intervention Registers used by the TWS program has been made, and all the necessary bookkeeping to fill out the forms for wiring has been completed.

(H. Peterson)

During the biweekly period I suggested a method for storing the subprograms of the 1953 Cape Cod Program and spent some time in conferences both with the Track-While-Scan group and with individuals.

(H.H. Seward)

The program for determining the repetition rate of data display still awaits operation with the MITE equipment. Work on descriptions and programs for track sorting and correlation continues.

(W.M. Wolf)

During this biweekly period preliminary programming for the data collection and display subroutines of the 1953 Track-While-Scan Master Control Program was begun.

Some time was spent with H.J. Kirshner in an attempt to record satisfactorily the N. Truro data. To date, these attempts have been unsuccessful.

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5.0 TRACKING AND CONTROL

(S. Best)

The subroutine for calculating $\frac{\sin 2\pi x}{2\pi x}$ has been checked and found to have a maximum error of .00013.

A program to facilitate the comparison of velocity heading smoothing with other types of smoothing by simulating a track and tracking simultaneously with up to 5 different smoothing methods is being checked out. Information may be printed out and/or the tracks may be displayed. The path is specified by means of a parameter tape and may include turns.

(M. Frazier)

A radar azimuth calibration program suggested by Arnow is being written. This program tracks an aircraft on two radars, and then tries changing the radar azimuths slightly to get a smoother track from the unfiltered data.

(W. Lone)

The program 2545M2 which converts standard tape and punches out in 5-56 form has been thoroughly checked and appears to be working in all respects with the exception of the conversion of the sb order which will be inserted into the program next week. A memorandum, M-2122, has been written which describes the procedures in tape preparation necessary in order to use this conversion program.

Some thought has been given to the type of training that should be given the Air Force personnel who will operate in the September system.

(A. Mathiasen)

A computer failure lengthened the string of failures in flight test designed to obtain information for Boeing.

Since it has been decided to extend the work on the accuracy of the predicted positions obtained with present smoothing routines and quantization, the present simulation programs will be combined to take some of the load off the Friden and place it on WWI. It has been found that this can be done in a simpler way than previously thought. This work will be done by W. Lone and myself.

(H.D. Neumann)

More time was spent investigating required information for the September tests Final Report, and effective means to obtain it. Also, a preliminary outline of the final report was prepared.

(B. Stahl)

The entire period has been spent with the Friden calculator

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5.0 TRACKING AND CONTROL (CONTINUED)

(B. Stahl) (Continued)

and A. Mathiasen's smoothed data. The end of this project is now in sight.

6.0 AIR DEFENSE CENTER OPERATIONS

(D.R. Israel)

Walker Thomas of IBM has been assigned to work with the Air Defense Center Operations Section. He is presently familiarizing himself with the Cape Cod plans and is actively working with the group formulating the intercept calculations and procedures. Wes Clark, Charles Grandy, Joshua Hayase, and George Rawling, who have previously been devoting their time to WWII studies, will now devote part of their time to Cape Cod planning and programming for ADCO Section.

The past biweekly period has seen a great deal of progress in the precise definition and the planning for various non-track-while-scan functions. Height Finding, Anti-Aircraft, Identification, and Weapon Assignment are in almost final shape, and the flow diagraming process is getting underway. Descriptive memos for each of these functions are in the process of preparation.

Considerable progress has been made during the past two weeks on the subject of track situation and digital information displays. M-1999, Display Categories and Assigned Scope Displays, (H. Benington) and M-2117, Track Symbol Displays, (D.R. Israel) have been issued. Benington is presently coordinating plans for the digital information displays. A memo on this subject is in the process of preparation.

Daily meetings have been held during the past two weeks to study and formulate the interception control equations and procedures for the Cape Cod System. This has turned out to be a more complicated and detailed subject than had originally been thought. This subject is receiving a maximum amount of effort and it is hoped that in another week or so the detailed flow diagrams for three-dimensional collision course interceptions will be available.

Decisions regarding the need for, and use of, certain external communication lines were made in the past week. Orin Conant is preparing a memo describing these lines as well as the actual connections for the Operations Room intercomm system. The telephone company is starting the intercomm installation.

After discussions with Walquist, a definite assignment of intervention registers and digits has been made. This is available as M-2115, Assignment of Intervention Registers and Digits, (D.R. Israel). Geraghty is presently proceeding to obtain detailed information specifying the connections of each push-button switch to the intervention register. This information will be issued as a memo in the very near future.

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6.0 AIR DEFENSE CENTER OPERATIONS (CONTINUED)

(D.R. Israel) (Continued)

M-1979, Frame and Panel Layouts, (Geraghty and Israel) has now been issued. This contains an up-to-date tabulation of the various panels for the Operations Rooms. Installation of the Operations Rooms is proceeding rapidly, with many of the consoles and frames already installed.

A decision has been made to provide temporary radar mapping facilities in Room 216, rather than in the part of Room 222 presently used for flight tests. This decision is discussed in M-2147, Temporary Radar Mapping Facilities, (Israel).

Room numbers have been assigned to the Group 61 area in Barta as follows (see SC-54407-1):

Room 216	remains	#216
Station Q	becomes	Rm. 225
"	P	" 223
"	W	" 228
Rest of	"	" 222
Group 61		
area		

Discussions have been held with H. Kirshner regarding the construction of an Availability and Scramble Indicator, which will, in effect, be an intercomm and tote board system used by the Senior Director, Weapons Director, and Squadron Operations Officers. This equipment will consist of a number of switches and lights by which the status of interceptors can be posted and changed.

Study is underway of actual personnel requirements for the 1953 Cape Cod System. This is particularly concerned with the requirements for manning each position, decisions as to the length of shifts, use of Air Force personnel, etc. Capt. Sullivan and Mr. Crow are assisting in this work. More definite results should be available by the next biweekly report.

In conjunction with Sullivan and Crow, a document outlining preparations and procedures for the September tests is being prepared. This document will contain the decisions reached with Major Woody of the 762 AC&W, as well as decisions which may be made in a future meeting with personnel at the Brunswick GCI. A rough draft is expected to be ready next week.

Radio channel requirements have been studied and recommendations for VHF and UHF channels have been given to Kirshner for forwarding to Fullerton of Group 22.

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6.0 AIR DEFENSE CENTER OPERATIONS (CONTINUED)

(H. Benington)

During the past biweekly period, the memo Display Categories and Scope Assignments (M-1999) was issued. This memo specifies the overall display in the Cape Cod System. Progress is now being made towards determining the exact nature of each display. First, this is being done for the Digital Information Displays (DID); this stage is almost completed. Next, the Situation Display will be specified; and finally, the Geography. Memos will be issued for each phase.

A program has been written which will simulate the character generator and its use in several of the DID's. This program is being run with different letter sizes, letter shapes, inter-letter spacing and group spacing. During the next period interested persons will be shown the displays for their comments. In this way the physical specification of displays will be made prior to the use of the character generator or the expanded display facilities.

Work is continuing on the program that will display the track situation in the September system. Work will start on a program which will test the external scope switching done by the three-legged gates. This program will be used by both equipment engineers and Group 61.

(M. Brand)

The simulated identification program (phase II) has been run on the computer several times. There are still several bugs in the program but it is hoped that they will be ironed out and that the program will operate satisfactorily during this biweekly period.

I have spent a good part of this biweekly period preparing a memo covering the entire identification function all the way from the input of data, processing, extrapolation, correlation displays, etc. When issued this memo presumably will provide a first attempt at the frozen picture of the ID (Identification) section for September. It will be complete with numerous diagrams.

In a meeting with D.R. Israel, J. Cahill, and M. Geraghty it was decided to look into the possibility of inserting altitude and number of aircraft reports received from the interceptor pilots by means of the Flight Plan Input Clerk-Cross Telling Input Clerk data insertion console. This action would be interpreted by use of one of the spare digit positions in the source action switch.

I have made suggestions relative to the modification of M-1979 with respect to the FPIC-CTIC data insertion panels, the IDO (Identification Officer) data insertion panels and the FTU (Flight Test Umpire) insertion panels.

I have continued attendance at various Cape Cod discussions.

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6.0 AIR DEFENSE CENTER OPERATIONS (CONTINUED)

(J. J. Cahill, Jr.)

The Eight-Aircraft AA-Guidance and Height-Finder Program has not been operated due to trouble with the data.

Meanwhile, attention is being given to organizational details of the September Program involved in the necessary exchange of information between the AAA & H-F sections and other sections (e.g., Weapons Direction & Squadron Operations). Conversations directed toward the solution of problems involved in this exchange, particularly as it affects displays, are continuing.

No flight-test activity in AAA or H-F occurred during this period.

(P. O. Cioffi)

The identification action section of the program to simulate the identification feature of the Cape Cod System was checked out on the computer at the start of this period. This section of the program which provides for various modes of track selection, expanded and digital display abilities is described more fully in a small paper available from the author. Final checking of this program will be completed as the various other sections become available for incorporation.

(O. T. Conant)

Conferences and discussions which have taken up a large proportion of this biweekly period have culminated in decisions of several subjects.

The general flow diagram for assignment assistance and interception computations has been completed and the use of W. Lemnios' 3-dimensional intercept equations for all computations agreed upon by the flow diagram group. Details are now being worked out and programming is being started.

Specification of the telephone intercommunication system has been completed and will appear in an M-note which is now being written. The use of a "scramble machine" to augment phone communication has also been decided upon. Installation of the telephone company's part of the intercomm system is under way and should be complete by July 1st. It is hoped that the equipment to be provided by Group 61 will also be ready by that time so that the system will be available for operational use in July.

The standard digital information display (DID) will present eight categories of information on any six desired tracks; it will be available on 5" scopes at 8 or 9 operating positions. Decisions on details should be made and programming started during the next period.

6.0 AIR DEFENSE CENTER OPERATIONS (CONTINUED)

(O. T. Conant) (Continued)

Interested individuals are now being contacted to determine the exact information to be included, symbology to be used, and frequency and priority of presentation for the 4 or 5 sections of the geography display. Decisions should be made in the near future.

(A. W. Curby)

The programs written for the identification section of the September system have been run and the results were encouraging, in view of the number of separate programs that had to be coordinated and our lack of previous experience with the magnetic drum. The processing and extrapolation programs were tried independently with simulated data and processed and extrapolated it satisfactorily, though it will take an extended run with more data before they can be completely checked out.

Some of the errors encountered in our last run have been corrected, and modifications making it possible to change programs stored on the drum have been made for ease in trouble shooting. A few errors have yet to be tracked down before the programs are run again.

Changes in the proposed information input box have already made the processing program obsolete, and it has been decided not to add the possibility of treating GOC, Cross-Tel, or Early-Warning reports until the present program has been checked out and is rewritten for the new input box.

(C. H. Gaudette)

Three interceptions (two aircraft) were performed during the past bi-weekly period. A maneuvering-target interception was satisfactorily completed on April 29. Also on April 29 a Final-Turn interception was attempted, but an ESC alarm when the interceptor was near the offset point prevented the completion of this interception. A successful straight-line interception was made on May 4 (Demonstration).

A group consisting of S. Knapp, C. Zraket, W. Lemnios, O. Conant, L. Murray, F. Heart, F. Garth, and myself have been constructing a flow diagram for the interception section of the September System. This flow diagram is now finished but must be expanded to include a description of how each box will be programmed. F. Heart, S. Knapp, W. Lemnios, and I will do this expansion.

Major Baldwin of the USAF has loaned us some charts which give the radii of turn for various true air speeds as a function of the rate of turn or the angle of bank. These charts will be reproduced before returning them to the Major.

6.0 AIR DEFENSE CENTER OPERATIONS (CONTINUED)

(C. H. Gaudette) (Continued)

The Two-Aircraft Combined Interception Program for the North Truro data should be ready for testing by Wednesday May 13.

(M. A. Geraghty)

Checking out of the 8 A/C Anti-Aircraft and Height-Finding guidance program has been awaiting the installation of MITE buffer storage for Truro data. This installation has been completed, and the program should be checked out in the next period.

Complete information on the assignment and wiring of data insertion registers has been accumulated and will be available in the next period. Certain uses are still tentative.

Considerable progress has been made with efforts to define the functioning of and programming for AA and HF in September.

(F. Heart)

1. With several members of the group, efforts have continued toward development of a logical flow diagram and satisfactory equations for the interception section of the Cape Cod program.

2. Time has been spent considering the summary scope display for Cape Cod, and other general display questions.

3. I have continued to participate in discussions directed toward Cape Cod planning.

4. Another discussion was arranged between several Group 61 members and Major Paul Baldwin of the 6520th Wing. Captain Hale accompanied Major Baldwin. Discussion subjects included final approach tactics and other "approach" considerations.

5. During the last few weeks the overall requirements of the flight test program have been increased. This has resulted in the following two items:

a. It became impossible to meet aircraft procurement requirements with Air Force aircraft from the 6520 Wing, even with the assistance of three or four aircraft already assigned to Group 61 from the Naval Air Torpedo Squadron at Quonset. Lt. Blad, the Naval Liaison Officer with whom we have been working, was asked if the Navy could help in this situation. The reply indicated that: 1. Naval Air Group Seven was temporarily based at Quonset for conversion from VHF equipment to UHF equipment; 2. several aircraft from this group, still equipped with VHF equipment, would temporarily be available for Group 61 use; 3. Naval Air Group Seven consists of about forty F9F jet fighters

6.0 AIR DEFENSE CENTER OPERATIONS (CONTINUED)

(F. Heart) (Continued)

and twenty jet attack bombers.

b. During flight tests involving several A/C, it has become imperative to use three radio channels. Present equipment does not permit simultaneous, completely isolated use of three frequency channels. This, according to H. Kirshner, is due to equipment difficulties at the remote transmitters at Bedford. This difficulty was partially responsible for the abortive results of the four-on-four flight test of May 6, involving ten aircraft.

In addition, since other groups in Division 2 require use of the available radio channels, our increased activity has partially hindered flight test planning by these groups.

(S. C. Knapp)

Some attempts have been made toward checking out the 8 a/c tracking program for North Truro data. A combination of program errors and difficulties with the MITE hampered the effort; however, sufficient computer time is being devoted to this program so that I think some progress will be made within the next biweekly period.

Work on the Weapons Director's duties and the interception flow diagram has continued.

(L. J. Murray)

During the past biweekly period progress has been made on the flow diagram for the "Interception Phase" of the September System. It is hoped that this will be completed during the next week.

The Four-Pair Intercept Program has been completed. The different sections are now being checked on the computer.

F. Garth and I are at present writing a memo concerning the Radio Communicator. This will contain a description of his duties, the display he will require and a flow diagram for this display.

(F. A. Webster)

Air Force Technical Report #6524 has been studied as an example of the classification of data that is handled by a control system during interceptions. The report shows that all transmissions used in the process of simulated GCI interceptions can be reduced to a reasonably limited code. There are three chief reasons why the derivation of an unambiguous and all-inclusive code might be useful:

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6.0 AIR DEFENSE CENTER OPERATIONS (CONTINUED)

(F. A. Webster) (Continued)

1. It permits a reduction of all transmissions to a standard, efficient form, thus reducing time of verbal transmissions and the probability of error or the need for repetition.

2. It suggests how supplementary or alternative presentations of transmitted data might increase the rapidity and reliability of transmission. (As an example, it suggests that the sender be visually represented at the receiver station, instead of requiring verbal identification.)

3. It indicates what would be involved in complete automatization of the pilot function, and the data that would be missing with partial automatization.

The report points out that under conditions of light message-loading and clear transmission facilities the need for such standardization and coding may not be apparent; but that under complex, heavily-loaded conditions it might be extremely important. It is an essential basis, moreover, of successive automatization of the intercept function.

Certain findings of this report may prove useful in expediting the flow of information in the September System. Such application is being studied.

Some time has been spent on the "filter-decision" problem of W. Wells. This will be discussed later.

(C. A. Zraket)

Work with members of the group on the weapons direction phase of the Cape Cod System is continuing. A flow diagram of the interception program is being drawn up.

M-1978, UHF Automatic Ground-To-Air Data Link, will be issued sometime during this week.

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7.0 ASSOCIATED STUDIES

(E.J. Craig)

The program for the Minimized Error N-step procedure has been written by Mr. Kenneth Ralston, and two examples have been tested to date.

1. A sixth order symmetric matrix with the ratio of characteristic numbers about 9:1. The answer was six ones (1) and the answer given by WWI (carrying about 24 bits) was off at most by 2 units in the sixth significant figure. Taking this answer as a new starting point, and running it through again gave a maximum error of 1 unit in the seventh place.

2. A third order ill-conditioned matrix (ratio of largest to smallest characteristic number 1400:1) was then attempted. After the first N-steps the answer was quite far off, but after running through again, accuracy was at least as good as the previous example, and running through a third time produced no change in the answer. Results are encouraging.

(B.G. Farley)

I have been spending the major part of my time with MTC, mostly on control, cabling, studying it, and drawing the Control Block Schematic.

8.0 COMPUTER OPERATIONS

(M. Brand)

The following is a summary of scheduled computer time used by Group 61 during the past biweekly period:

MEW Truro Tracking and Control	5 hrs 45 min
Data Screening	1 hr 35 min
Air Defense Center Operations	21 hrs 5 min
Library of Subroutines	10 min
Miscellaneous	1 hr 35 min
Equipment Characteristics	7 hrs 35 min
Demonstration	40 min
Flight Tests	<u>10 hrs 50 min</u>
 Total Time Used	 49 hrs 15 min
 Computer Breakdown (parities, etc.)	 7 hrs 20 min
 Time Given to Math Group	 4 hrs 30 min
Time Given to Magnetic Drum	<u>11 hrs 55 min</u>
 Total Time Lost	 23 hrs 45 min
Total Assigned Time	73 hrs 0 min

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8.0 COMPUTER OPERATIONS (CONTINUED)

(M. Brand) (Continued)

Percentage Assigned Time Used	67.4%
Percentage Available Time Used	100 %

9.0 FLIGHT TESTS

(F. Heart)

A Flight Test Schedule for May 1953 was issued as M-1991. A Flight Test Activity Report for April 1953 was issued as M-2130.

A considerable portion of time has been spent recently in planning for flight tests. This has been especially demanding in the last biweekly period due to the MEW removal date.

During the past biweekly period an effort has been made to include the services of members of Capt. Sullivan's section in all aspects of day-by-day flight test operation. This change has already resulted in improved operating efficiency; it is expected also to help provide a basis on which to judge future use of Air Force personnel in the Cape Cod System.

(F.Heart, M. Brand, Art Hill)

The following statistics apply to the last biweekly period:

- | | |
|--|----|
| 1) Computer hours scheduled for flight tests | 20 |
| 2) Computer hours used for flight tests | 11 |
| 3) Computer hours returned due to flight test cancellations | 9 |
| 4) Total Aircraft hours flown | 39 |
| 5) Aircraft hours flown by 6520th Wing at Bedford | 22 |
| 6) Aircraft hours flown by Navy (Quonset-based Squadron) | 17 |
| 7) Aircraft hours flown by M.I.T. Instrumentation Laboratory | 0 |

(P. Dolan, Art Hill)

April 28, 1000-1200 Tracking, Lone

Two T-11's used: 1. over Bedford, 2. over Ft. Devens
Used Londonderry radar site, with good tracking on both aircraft.

1400-1600 Two-Pair Intercepts, Knapp-Heart

As fighters, Navy F-9F & F-3D, both airborne holding Concord 8.5, IAS 300k; as targets two Air Force B-25's holding Rockport & Provincetown, 9.0, IAS 200k

- Run #1 - fighter #1: no intercept due to tracking
#2, passed 1 1/2 miles to port of target
Run #2 - fighter #1: one mile to starboard of target

9.0 FLIGHT TESTS (CONTINUED)

(P. Dolan, Art Hill)

This flight test was the first successful test using the four-on-four program.

April 29, 0900-1100 Single-Pair Intercepts, Gaudette

A.F. B-25 (fighter) Concord 8.0, IAS 225mph
Navy P-2V (target) Provincetown 8.5, IAS 170k
Run #1: fighter passed 500 yds. to left of target
#2: computer trouble (ESC) alarm - no intercept

1100-1200 AAA & HF, Cahill-Geraghty

F-3D 10 miles east of Portland, 16,000'
F-9F Isle of Shoals, 16,000'
Poor tracking Portland area, AAOC run too close to Boston for any results

May 4, 1300-1400 Single-Pair Intercepts, Zraket

F-3D holding Grenier 8.5, IAS 250k (fighter)
F-9F standby fighter (airborne at Bedford)
B-26 20 miles s.e. of Rockport 9.0, IAS 200k (target)
B-25 standby target (airborne)
Run #1: target passed 200 yds to rear of fighter, fighter then returned (vectored) to Grenier.

May 6, 1400-1600 Four-Pair Intercepts, Knapp-Heart

The four fighters used were: two Navy F-9F's, one Navy F-3D, and one AF F-51. The four targets furnished by the AF were: two B-29's, one C-82, and one B-25. The targets were positioned approximately 90 miles off the coast, starting with target #1 east of York, Me., with separation of 15 miles south with target #4 positioned east of Scituate. The fighters were positioned as follows: Fighter #1 over Concord, N.H., Fighter #2 over Manchester, Fighter #3 over Grenier, Fighter #4 over Haverhill. One run was attempted and aborted due to the following:

- a) Poor tracking targets at this range and altitude,
- b) Light guns were not functioning properly,
- c) Poor radio contact on targets made identification difficult,
- d) When final identification of targets was made, the Navy jet fighters were low on fuel and test had to be discontinued.

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9.0 FLIGHT TESTS (CONTINUED)

(P. Dolan, Art Hill) (Continued)

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DATE	TIME	SCHEDULED TEST A/C Description	TEST ACTUALLY RUN A/C Description	REASONS FOR CHANGES OR COMMENTS
4/24	1300-	2 Two A/C Intercepts	1	(16" scopes inoperative)
	1400			
4/28	1400-	1 Coverage	-	a) aircraft mechanical b) ground equipment
	1500			
	1000-	2 Two A/C Tracking	2	As Scheduled
	1200			
1400-	4 2 Pair Intercepts	4	As Scheduled	
1600				
4/29	0900-	2 2 A/C Intercepts	2	As Scheduled
	1100			
	1100-	2 AAA & H.F.	2	As Scheduled
	1200			
	1400-	1 Coverage	-	Computer inoperative
	1600			
5/1	1300-	8 4 Pair Intercepts	-	Weather
	1500			
	1500-	1 Coverage	-	Weather
	1600			
5/4	1300-	4 2 A/C Intercepts	4	As Scheduled
	1400			
5/5	0900-	2 2 A/C Intercepts	-	Change in computer schedule
	1200			
	1400-	10 4 Pair Intercepts	8	Used both standby a/c to fill in for scheduled a/c that aborted
	1600			

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* Added to schedule during week of test

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10.0 PUBLICATIONS

(M.R. Susskind)

The following material has been received in the Library, Whittemore Bldg., and is available to Laboratory personnel:

LABORATORY REPORTS

1. "Changes in Internal Storage and Computer Time Allocation Given in M-1913," M-1913-1, R.L. Walquist, May 7, 1953, pp. 1-5.
CONFIDENTIAL
2. "Standard Designations for Cape Cod Equipment and Operating Personnel," M-1962, O.T. Conant, April 17, 1953, pp. 1-4.
CONFIDENTIAL
3. "The Introduction of Data for the N. Truro CPS-6B and Small Gap Filler Radar Directly Into the Computer," M-1963, B. Morriss, G. Young, April 8, 1953, pp. 1-14.
CONFIDENTIAL
4. "Frame and Panel Layouts," M-1979, M. Geraghty, D. Israel, April 27, 1953, pp. 1-19.
CONFIDENTIAL
5. "Block Diagrams: Input and Output Interlocks," M-1981, R.P. Mayer, April 10, 1953.
CONFIDENTIAL
6. "Flight Test Schedule for May, 1953," M-1991, Art Hill, P. Dolan, F. Heart, April 27, 1953, pp. 1-2.
CONFIDENTIAL
7. "Minutes of Joint MIT-IBM Conference," M-1998, A.P. Kromer, April 23, 1953, pp. 1-6.
CONFIDENTIAL
8. "Display Categories and Assigned Scope Displays," M-1999, H.D. Benington, April 29, 1953, pp. 1-46.
CONFIDENTIAL
9. "Air Defense Biweekly Report, April 24, 1953," M-2113, pp. 1-28.
CONFIDENTIAL
10. "Assignment of Intervention Registers and Digits," M-2115, D. Israel, April 27, 1953, pp. 1-3.
CONFIDENTIAL
11. "Track Symbol Displays," M-2117, D. Israel, April 28, 1953, pp. 1-11.
CONFIDENTIAL

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10.0 PUBLICATIONS (CONTINUED)

(M.R. Susskind) (Continued)

12. "Test Storage Contents and Automatic Recycling Function in the 1953 Cape Cod System," M-2118, W.S. Attridge, Jr., J. Ishihara, April 27, 1953, pp. 1-3.
CONFIDENTIAL
13. "An Evaluation of the WWII Vacuum Tube Situation," M-2129, R. Fallows, April 17, 1953, pp. 1-11.
CONFIDENTIAL
14. "Flight Test Activity Report for April 1953," F. Heart, P. Dolan, Art Hill, M-2130, May 4, 1953, pp. 1-2.
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TECHNICAL REPORTS

1. "Performance Characteristics of Type SCA-2300 Servo Analysis and Synthesis Equipment," R.C. Shirley, U.S. Naval Air Development Center, Johnsville, Pennsylvania, February 5, 1953, Lib. No. 2337R.
2. "Temperature Recovery Factors on a Body of Revolution at Mach Numbers of 1.79 and 4.50," C. Gazley, P. Adams, August 1952, Guided Missiles Department, G.E., Schenectady, N.Y., Lib. No. 2338R.
3. "Wind Tunnel Tests to Determine the External Drag of the Hermes RV-A6 (B-1) Ramjet at M=3.30 and 3.89," O. Klima, W.F. Dankhoff, Guided Missiles Department, G.E., Schenectady, N.Y., December 1952, Lib. No. 2339R.
4. "Quarterly Progress Report, Div. 6-Digital Computer," Lincoln Laboratory, M.I.T., December 15, 1952, Lib. No. 2342C.
5. "Guided Missile Technical Information Distribution List," Committee on Guided Missiles, Research and Development Board, Department of Defense, February 16, 1953, Lib. No. 2348C.
6. "The Relation Between Frequency Response and Raster Characteristics in the Sinufly Computer," Control Systems Laboratory, Univ. of Illinois, February 27, 1953, Lib. No. 2358C.
7. "The Integrated Electronic and Control System, Project MX-1179," Monthly Progress Newsletter No. 29, Research & Development Laboratories, Hughes Aircraft, February 1, 1953, Lib. No. 318/S.
8. "Progress Report for February, 1953," "Progress Report for March, 1953," Control Systems Laboratory, Univ. of Illinois, Lib. Nos. 319/S., 320/S.
9. "Snorkel Detection Using Airborne Coherent Radar II, Control Systems Lab., Univ. of Ill., April 1953, Lib. No. 321/S.
10. "An Automatic Air Traffic Information and Control System," Control Systems Lab., Univ. of Ill., March 1, 1953, Lib. No. 322/S.

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WHIRLWIND II

(N. H. Taylor)

The following paragraphs give short summaries of current activity in Group 62.

1) MTC

All 17 planes of the MTC memory have been assembled and placed in their operating positions in the memory test computer. Preliminary tests using the computer to try out the memory have indicated trouble in the Z-plane drivers and read amplifier circuitry. This does not prevent operation but shows a need for better circuits at these points. It is anticipated that the computer will work within the next few days - in fact, very simple programs have already been in operation. All indications are that the next biweekly period will see full-scale operation of MTC.

Note: The air-conditioning unit has not yet arrived for MTC. Dangerously high panel temperatures are evident. Every effort must be made to acquire this air-conditioning immediately.

2) Arithmetic Element and Control

A fairly complete block diagram of the control and arithmetic elements is now in existence. We are about to release this to the IBM group for breadboard testing to establish the margins of operation on critical circuitry.

In order to deliver such a large section of the machine to IBM, it will be necessary to arrive at some formal arrangement for releasing specifications and still retain enough control to keep MIT abreast of developments in Poughkeepsie. The method of doing this is now under study.

3) Input-Output

A review of all the input and output problems associated with the WWII system has shown that we are weak in the areas of cross-telling, output to weapons, and display of slow-changing data to individual operators. We will intensify the activity in these three areas. Activity in the input from phone lines to buffer drum, radar mapping, and cathode ray output display systems seems to be moving along quite satisfactorily.

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WHIRLWIND II (CONTINUED)

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4) Mechanical Design

A meeting on mechanical design of the plug-in units has served to clear the air and establish a study group on this point. Within two weeks we expect a firm proposal from this group. A model or models of the proposed plug-in unit will be available for comment from all interested parties.

5) Time Schedules

A discussion on time schedules has resulted in the recognition of the need for a summary report which will acquaint all those concerned with the status of the project at any time. We are collecting a large amount of detailed information on basic circuits and minor subassemblies. We need more planning on the correlation of these schedules and a clearer picture as to when these parts of the machine will merge and become part of a major subassembly and later of a complete system. Such a summary report will henceforth be prepared by A. P. Kromer.

6) General Comments

The overall pattern of the WWII effort is taking much better form each week. A feeling of cooperation is beginning to be established between the individual engineers at MIT and IBM. The setting up of working committees with members from both organizations to solve specific problems seems to be working out very effectively as regards getting the individuals acquainted with each other and building confidence in each other's judgment. We finally seem to be breaking down the feeling that two organizations with two viewpoints are working on one job, and the organizational line seems to be less of a barrier as time goes by.

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(G. R. Briggs)

Development of the phone-line input system and buffer drum block diagrams continues. During the last period the IBM group under Raffensberger has taken over the radar mapper work almost completely, with the exception of experiments on methods of mapping using lucite sheets, which are being continued by Rising of this group.

The counter block diagram is basically complete. Besides working over the 701 flip-flop to improve it, several other special circuits will have to be developed, if the maximum possible saving in cathodes is to be realized. These desirable circuits for reading out

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WHIRLWIND II (CONTINUED)

of the counters have been discussed at length with R. Best and their desirability definitely confirmed. Work has not yet started, however.

The method of placing radar data on the input drum is the random one agreed upon in the joint IBM-MIT in-out meetings. The loss probability of storage of returns on the drum, attempting to store a return whenever it happens to occur, is only about 0.5%. It was decided that this method is undesirable, and either a sampled system or another system now under investigation, with less than 0.1% loss of returns but requiring more equipment, will be used.

(W. A. Clark)

Part of the past bi-weekly period was spent on vacation. The remainder of the period was spent in preparing to work half-time on the September Cape Cod demonstration.

(C. Grandy)

Programming work with the proposed WWII order code has been discontinued for the present in order to participate more actively in the Cape Cod work. A summary comparison was made between the displays listed in M-1999 for the Cape Cod system and the displays provided by a coincidence-scopeline system suitable for use with WWII. The comparison shows that such a coincidence-scopeline system can provide operationally equivalent displays. Approximately 50% of the categories considered for the coincidence-scopeline system are sufficient to duplicate the Cape Cod facilities. The remaining 50% provides displays having no equivalent in the Cape Cod system. The need for such additional displays, however, has not been established.

The first week of this period was spent on vacation.

(J. Hayase)

The automatic initiation scheme mentioned in the previous bi-weekly has been discarded and replaced by a scheme that initiates automatically only on uncorrelated returns that fall in a quadrant in which automatic initiation has not taken place during the past three or four scans.

Articles appearing in previous bi-weekly reports describing the identification phase of the Cape Cod system have been reread. During the next bi-weekly period the new corridor system and the identification programs written by M. I. Brand, P. O. Cioffi and A. W. Curby will be studied.

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WHIRLWIND II (CONTINUED)

(J. Jacobs, R. Jeffrey, R. Mayer)

The last two weeks were spent in a study of alternative In-Out interlocks and in going over the "First Draft of WWII Comprehensive Logical Diagram" (SD-54846-1) with MacDonald and Kurkjian of IBM.

(G. Rawling)

The investigation of weapon systems and their adaptability to the Transition Air Defense System has been completed.

I have commenced reviewing the Air Defense Biweeklies for the Height Finding and Anti-Aircraft Phase of the September Cape Cod, having joined the Cahill-Geroghty section as a part-time member.

I attended the Hartford In-Out meeting of May sixth.

(W. Ayer)

During the week of April 22nd through May 2nd, a trip was made by W. Ayer and J. Bassett of MIT and J. Montgomery and W. Hughes of IBM to inspect the packaging technique employed in a dozen computers located between Washington and New York. Logical physical design, size of pluggable units, signal and power distribution systems, cooling systems and types of mechanical construction were investigated. A summary of the various features will be written up as an E-note in the near future.

A meeting on May 7, 1953, was held at Hartford to help solidify thinking on the packaging of WWII. Some ten people attended from MIT and 15 or 20 from IBM. Several decisions were made that reduce the area of investigation necessary to form a final proposal for the packaging of WWII.

(J. Bassett)

Work has been progressing on the subject of setting up a set of engineering and component-parts standards for use with WWII. A joint MIT-IBM central-standards committee, augmented by several sub-committees, has been tentatively proposed. The sub-committee on component parts has been active and is making progress. The central committee at MIT includes Chan Watt and J. Bassett, but as yet has had no members assigned from IBM. Steps are being taken to accelerate this program in order to provide WWII design engineers with up-to-date standards at the earliest possible date.

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WHIRLWIND II (CONTINUED)

(R. Fallows)

Preliminary approaches to the logical and physical layout of the WWII central computer have led to some results. Current thinking on the logical operation of registers and control has been assembled in the form of preliminary block schematics (reference Jacobs & Co.). Some thinking on plug-in units has been done here and at IBM. Work to date has been only exploratory.

A committee consisting of Sarahan, Beeby, and Hughes of IBM and Aronson, Ayer, Callahan, Fallows and Pfaff of MIT has been given the responsibility of making an evaluation and submitting a proposal on the following: rack design, logical division, plug-in-unit design, and division of circuits into plug-in units. A preliminary proposal covering logical and circuit divisions is scheduled for May 15.

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