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Memorandum M-1638

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Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: GROUP 61 BI-WEEKLY REPORT, August 29, 1952

CLASSIFICATION CHANGED TO:
Auth: <i>DD 254</i>
By: <i>P. R. Everett</i>
Date: <i>2-1-60</i>

2.0 EQUIPMENT ENGINEERING

(N. Alperin)

This past bi-weekly period has been spent investigating the possibility of using a lens system to obtain better target resolution than is now possible with the old light gun. Very satisfactory results have been obtained. The problem now is to get a lens with a short enough focal length so the system will not be too bulky.

(H. J. Kirshner)

A major share of the installation work in Room 222 has been completed and those items of equipment which it is possible to check, without use of the computer, have been checked.

A VHF antenna has been installed at the Whittemore Building. Its use awaits the arrival of a transceiver from Group 22.

Perfect operation, with a minimum of effort, was obtained from the new S.D.V. receiver, during a recent demonstration.

(B. E. Morriss)

The conversion program written by Adams and Briscoe has been operated several times and initial failures were traced to IOS and not to the program. This program is a modification of the conversion program used in the past and the conventions which must be used are the same. The program interprets the new in-out orders as well as previously prepared master tapes and produces a tape on the old punch which can be read using the PETR and the new read-in program described in E-473. The program could be easily modified to operate with the new punch.

At present the mechanical reader operates by being selected by an si order which does not initiate the reading of a character, and each rd initiates the reading of one word or character and when it has been placed in IOR transfers the word into AC. Thus a sequence of orders written for PETR will operate the mechanical reader successfully if the address of the selecting si is changed to that of the mechanical reader. It is not possible to exchange the mechanical reader for the PETR with a switch although this facility should be provided in the near future.

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2.0 EQUIPMENT ENGINEERING (Continued)

(B. E. Morriss) (Continued)

One of the two punches will be omitted and a third printer will be substituted in its place. This printer will be placed in Room 222.

Several unforeseen or overlooked difficulties have been found with the magnetic tape units. When de-selected and stopped when recording the section of tape which the unit coasts over will not be erased with a signal of full strength. The signal has not been measured but is estimated to be from 1/4 to 1/2 full strength. Thus in the present system the space between blocks may not be adequately erased. It appears necessary to add another mode of operation to handle this situation. This would be an si (stop after recording) mode which would see that erasing continues until the unit has stopped and that a space as large as any which could be formed after reading will be formed.

Several programs have been written for operating external units with different modes of operation for testing purposes.

(J. H. Newitt)

During the past bi-weekly period lengthy discussions have been carried on between the air conditioning contractors (bidders) and myself. My specification, M-1572, purposely allowed a certain latitude with a view toward soliciting the best possible suggestions from the bidders regarding certain alternatives. The suggestions made in the various proposals (bids) have been quite enlightening. Now that I have a yardstick of costs against various technical features, I know how to properly define the details of the system to be installed.

After weighing the various arguments of the different contractors regarding the various alternatives of the specifications, I now have formed a definite opinion of exactly what is best suited to our application. A modifying specification addenda will therefore be issued in the near future to tie down specific practices and desirable features to be performed by the successful contractor. An outside consulting firm is being retained to help in the evaluation of the proposal-bids and to offer whatever other suggestions that they may have in regard to the final modification of the installation specification.

(A. V. Shortell, Jr.)

The installation of equipment in Room 222 has been completed except for the printer and remote constants panel.

A Teletalk 700 series Intercommunication Set has been ordered and should be received in about three weeks. This system will replace the present WWI intercommunication system. Room 222 will have six master stations, four for operations and two for visitor briefing. Other master stations will be located in 224, test control, and 156. Speaker stations will be located in the computer room, tape room, power supply room and at

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2.0 EQUIPMENT ENGINEERING (Continued)

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

the WW switchboard. All master stations will be equipped with handsets for confidential conversation and minimum noise level where stations are close together. All stations will be equipped with annunciator buttons for calling other stations and masters may be used in a conference circuit.

Curtains of 12 oz. black canvas, impervious to light and flameproof, have been ordered to provide for light traps inside the entrances to Room 222. These should be installed by the end of the next bi-weekly period.

(C. W. Watt)

Power Supply Control: Work has been progressing as fast as possible on the physical design of Power Supply Control panels for the MITE and Drum equipment. Panels have been laid out, and the shop is about to start work on them. Cabling layout has been started. A cabling diagram has been made, and details of cable runs are now being determined.

Power Supplies for Drums and MITE: The new 900A filament alternator will be shipped to M.I.T. Tuesday, September 2.

Racks for MITE: The rack installation will be complete in Room 156 on Oct. 10, according to Arlex, the fabricator.

(G. A. Young)

The past bi-weekly period has been spent considering methods of manually introducing information into the computer.

3.0 BEDFORD EXPERIMENT

(D. R. Israel)

The majority of scheduled flight tests were cancelled during this period since they interfered with the moving of equipment from Room 224 to Room 222.

M-1609, Tentative Flight Test Schedule For Month of September, by D. Israel and C. Zraket, outlines the flight tests for September. Our future flight test plans have been discussed with Captain T. Marx of the Flight Test Group at Bedford. An estimate of our needs during the next three months is 20 aircraft hours per week.

Discussions with Major P. Baldwin of the Flight Test Group have been helpful in understanding procedures involved in use of the APG-33 airborne radar. Major Baldwin will attempt to help us become more familiar with existing tactical procedures, particularly the final phase

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3.0 BEDFORD EXPERIMENT (Continued)

(D. R. Israel) (Continued)

of an intercept. He has already obtained some literature on the subject for us.

The section of the Lincoln Quarterly Report dealing with the tracking and control studies using the MEW radar was completed during this period.

(A. P. Hill)

A total of sixteen aircraft hours were scheduled for this period, with only three hours actually flown. The rest were cancelled due to shifting from Room 224 to 222.

Summary of tests held and results:

- Aug. 26 1730-1930 Ground Observer Test
Using a B-17 two runs were made from Newburyport to Portland, to Concord, N.H., to Newburyport. Reports from the Filter Center at Manchester, N.H., were forwarded by phone to the Barta Building
- Aug. 28 1330-1430 Jet (F-80) Coverage Cape Cod Area
Coverage Results:
Quonset Pt. to Otis at 10,000' - Good
Otis to Quonset Pt. at 12,000' - Good
Quonset Pt. to Provincetown at 12,000' descending to 7,000' - Coverage at 7-8-9,000' - Poor, at 10-11-12,000' - Good

Direct radio communication with the tower at Grenier A.F.B., New Hampshire, was attempted for future Take-off Initiation Tests. Results were unsatisfactory. The next alternative is a direct phone line from the Barta Building to the Grenier tower. This will be looked into and covered in the next report.

A new procedure in connection with Flight Test and Ampex Records has been set up, and is outlined in Memorandum M-1598.

(M. Brand)

Final Phase Guidance. C. Grandy and myself rewrote C. Zraket's Final Phase Guidance Program T-1073 incorporating the use of the new In-Out System. This is now T-2025.

One-Aircraft Printing Program. I modified this program so that it could be used for aided smoothing study analysis. This program now takes R, Θ and Ψ punched out from the guidance program and processes it through both NLS-2c and my new aided smoothing NLS-2c-CV (constant-velocity). This program prints the pertinent data from both smoothing programs on

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3.0 BEDFORD EXPERIMENT (Continued)

(M. Brand) (Continued)

different printers. The new In-Out System was also incorporated. This is program T-2023.

Data Tape Conversion. I have written a program which converts the punched tapes from the guidance program from the old 5-5-6 form to the new 556 form. This is program T-2049.

Beacon Response. I am still awaiting completion of the new Two A/c Interception Program for modification for Beacon.

I visited the MEW radar site at Bedford during this period.

(P. O. Cioffi)

Spent this period revising and rewriting operational programs for the new In-Out System with Gaudette and Zraket.

(J. Nolan)

The scope calibration program has been rewritten for use with the new In-Out System. I have written a new calibration program which displays two circles, 15 stations with letter displays, and the coast of New England.

Some time has been spent becoming familiar with the final-phase interception problem.

(C. Grandy)

Having been assigned to work with the Bedford Experiments group, most of this period was spent studying the work that has already been done by this group with particular attention to final phase guidance and final phase interception. Working with Milton Brand we revised and re-wrote the existing program for final phase guidance and will check it out as soon as the computer is available.

(F. M. Garth)

A question has arisen as to the best coordinate position to be used for the interceptor "scramble" point at Grenier Air Base. It was planned before to have the aircraft circle back over the control tower should the heading angle fall outside of a $\pm 60^\circ$ range centered by the runway. After sketching take-off tracks from a single runway, using all possible heading angles, I was able to determine that an aircraft would in several cases save time and in only a few cases lose a slight amount of time if the coordinate point were placed about a half mile beyond the take-off end of the runway.

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3.0 BEDFORD EXPERIMENT (Continued)

(S. Knapp)

MACT-16 has been rewritten for the new In-Out System and to incorporate some additions and refinements. Automatic Initiation is now part of the program, and provision has been made for addition of height-finder data, etc.

Arm Ward and I have worked together to rewrite the "Two on One" Interception Program.

Both of these are ready to run when the computer is back in operation.

(G. Rawling)

I have completed the indoctrination single aircraft-track-while-scan program. The multiple-aircraft track program and flow diagram are being studied.

Interception references are being collected.

(A. B. Ward)

The last bi-weekly period was spent studying Sue Knapp's Two-on-One Interception Program, and helping her revise it to use an azimuth counter and the new In-Out System.

(C. Zraket)

All operational programs have either been modified or rewritten to conform with the new In-Out System. An inter-office memo addressed to D. R. Israel has been written on this subject.

Work is continuing on the new basic 2 a/c Interception Program and the Final-Phase Interception Program.

A thesis proposal, Test Checking of a Magnetic Drum Buffer Storage System (M-1615), was written and submitted during the past bi-weekly period.

4.0 DATA SCREENING

(W. S. Attridge, Jr.)

MTP #1 has been rewritten for the new In-Out System. At the same time several minor coding changes resulted in a significant saving of computer storage. Work continues on the radar overlap display program.

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4.0 DATA SCREENING (Continued)

(W. A. Clark)

Re-writing of the program for the evaluation of area redundancy in systems of overlapping radars has continued. Some time also has been spent in proofreading and otherwise assisting in the preparation of the current order-code document.

The last three days of the subject period were spent on vacation.

(D. Goldenberg)

A memo is being prepared on a time analysis of sorting processes. The flow diagrams and programs will be presented for the various methods of sorting, along with graphs of the variations in the time of operation versus the number of pieces of data.

Work is continuing on the task of determining the best size and center of a search area for tracking.

(J. Ishihara)

A study of the problem of the track itself and the returns on the same track falling in different "boxes" in box-presort schemes has been undertaken in conjunction with further considerations of correlation and sorting programs. It is hoped that some measure of the frequency of this situation can be obtained for various box sizes and numbers. With automatic initiation-cessation it may be that changes will be unnecessary. One method of avoiding this problem would be to overlap boundaries of boxes, but methods studied thus far require too much time and storage.

(J. Levanson)

Most of my time has been spent acquainting myself with what has already been done on data screening. I have converted parts of the present Muldar Program for use with the new In-Out System.

(H. Peterson)

In the past two weeks I have rewritten two Radatan programs for the new In-Out System and have been making a study of the effect of using slant range for true range where more than one radar is involved.

(N. S. Potter)

T910-2, which automatically reads back and displays data from magnetic tape, block by block, has been rewritten for the new In-Out System, and now includes a grid display.

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5.0 TRACKING AND CONTROL

(M. Frazier)

Visits have been made to the Bedford MEW and Scituate SCR-584 sites.

A two-radar single-aircraft tracking program for MEW and SCR-584 is being written.

(W. Lone)

The parameter to A. Mathiasen's tracking program which saves all the data in a search area and compares it with the best fit to determine possible double ranges, double azimuths and other patterns has been written and awaits testing.

The TRASACT, times and positions averaged, program has been rewritten for the new In-Out System. This program tracked very well until the aircraft went out of range of one of the radars, and then the velocity dropped considerably. In rewriting, it was discovered that a position for the next scan had been predicted on the basis of a position and associated time which fell roughly in the middle of the smoothing interval rather than the predicted position at the average of the observed times. This required a minor change, and should remedy the defect.

(A. Mathiasen)

Time has been spent revising programs for the new In-Out System. RTPR (the SDV tracking program) has, in the process, been revised to better permit accommodation of W. Lone's pattern parameter. It can, at the operator's will, print the observed deviations. Small modifications, such as a change of data input register or change of radar rotation rate can be made on the spot by simply changing the start-over point. This is in addition to other parameter variation possibilities already incorporated.

Scituate and Bedford sites were visited.

(B. Stahl)

All non-obsolete programs have now been adapted for use with the new In-Out System. A few modifications also were added for the sake of neatness and versatility. The Rockport Radar Scan Timer (T-2015)

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5.0 TRACKING AND CONTROL (Continued)

(B. Lone) (Continued)

can now be employed to time the Scituate antenna by a simple two-register parameter (or manual intervention), and Bedford may be timed by using this program plus a parameter already prepared (T-2015, p1).

A trip was made to the radar site at Scituate.

6.0 AIR DEFENSE CENTER OPERATIONS

(D.R. Israel)

Work continues in connection with installation of equipment in Room 222. A Teletalk intercommunication system is planned.

Previously described memorandum dealing with future programs is still in preparation.

(M. Brand)

GOC Exercises - I manned the Barta end of the Manchester-Barta phone with Fred Webster during the August 26, GOC exercises. Run #1 of this exercise gave much worse results than any test before. Run #2 was fair.

I was one of a group of nine who visited the Manchester Filter Center during this period.

(J.J. Cahill, Jr.)

A rewrite of the AAA Guidance Program, based on the Interception Display Program, has been prepared. There are two versions available; the first provides a georef print-out of the position of any aircraft tracked as a target in addition to the other interception displays (T 2019 -- formerly T-1382), the second provides a display of the range in 1,000 yards and the azimuth with respect to the AAA station at Nahant, (T 2021 -- formerly T 1100, p2).

A rewrite has also been prepared of the Height-Finder Program, which is likewise based on the Interception Display Program. This program, (T 2024 -- formerly T 1100), will display the range in miles and azimuth from Rockport. The memo on the errors introduced by failure to use or compensate for lack of height information in two-radar problems has been prepared and is now under consideration by D.R. Israel.

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6.0 AIR DEFENSE CENTER OPERATIONS (Continued)

(F.A. Webster)

The main portion of the report on "manual tracking" under the Ground Observer system has been completed. The flow diagram needs revision; and certain theoretical issues raised by a system of this type warrant special discussion in supplementary notes. One concerns the problem of how best to handle data of high variability and low density that can be correlated only on the basis of multiplicity in the types of confirming information. Another concerns the problem of how to make such a system adaptable to a variable internal structure and a variable set of requirements. These, however, can best be treated as independent theoretical issues.

7.0 ASSOCIATED STUDIES

(P.R. Bagley)

This bi-weekly period has been spent in writing reference material for programmers. The Short Guide to Coding and the Whirlwind I Operation Code have been rewritten and brought up-to-date. A manual on Programming for In-Out Units has been completed. These will be issued soon.

(J.W. Craig)

During the past two weeks, discussions were held with Bob Sittler and Walter Wells concerning the possible application of Markov processes to the problem of noisy data, but no usable results are available as yet.

(I. Mann)

A short supplement to M-1591, a memorandum on the special input program, was written. If there is any doubt, this should be referred to for the registers used and the entering register of the program.

(R.W. Sittler & W.I. Wells)

The problem of correlation of radar data has proved to be similar to the analysis of Markov chains. During the past few weeks the properties of Markov chains have been studied. Some extensions of the simple theory have been made but with little practical advantage.

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7.0 ASSOCIATED STUDIES (Continued)

(R.W. Sittler & W.I. Wells) (Continued)

The correlation of radar data can be shown to be solved by successive multiplications of matrices which represent the transition probabilities of the Markov chain and the characteristics of the noise, including multiple returns, etc. The main difficulty is the size of the matrices required. These are too large to be handled in the required time. The reduction of the size is the problem now being considered.

8.0 COMPUTER OPERATIONS

(J.A. Arnow)

The computer was not used this period because of the shutdown necessitated by the installation of the new In-Out System. It is expected that time on the computer will be available early next week.

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9.0 PUBLICATIONS (Continued)

(M.R. Susskind) (Continued)

TECHNICAL REPORTS

1. "A Study of Project Scoop Linear Programming," R.W. Shephard, W.W. Baldwin, The Rand Corporation, Santa Monica, California March 1, 1951, Lib. No. 2035.

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2. "The Aerodynamic Characteristics of Fin-Stabilized Rocket Models With Oversized Heads," Luther, M.L., Drinkwater, W.D., Part 1, MACH Number 0.60, U.S. Naval Ordnance Test Station, Inyokern, China Lake, California, May 8, 1952, Lib. No. 2043.

RESTRICTED

3. "The Corporal Guided Missile XSSM-A-17," Corporal Bimonthly Summary Report No. 30A, for period covering May 1, 1952 to July 1, 1952, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, Lib. No. 265.

SECRET

4. "Progress Report No. 18, Projects RV-A-3 and RV-A-6," Redstone Arsenal, Huntsville, Alabama, January 1, 1952-June 30, 1952, Lib. No. 266.

SECRET

5. "Six-Component Wind-Tunnel Investigation of 1/15 and 1/18 Scale Models of the Caucasian (Secret) Missile (MX-1457), At High Subsonic Mach Numbers," Ondrejka, J., Stetson, K.F., Captain, USAF, Wright Air Development Center, Wright-Patterson Air Force Base, Dayton, Ohio, Lib. No. 267.

SECRET

6. "The Integrated Electronic and Control System," Project MX-1179, Monthly Progress Newsletter No. 20, May 1, 1952, Research and Development Laboratories, Hughes Aircraft Company, Lib. No. 268.

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9.0 PUBLICATIONS

(M.R. Susskind)

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

LABORATORY REPORTS

1. "Quarterly Status Report, Contract N56ri-06002, October through December, 1951," Linvill, W.K., M-1577, August 4, 1952, pp. 1.
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2. "Quarterly Status Report, Contract N56ri-06002, April through June, 1952," Linvill, W.K., M-1578, August 4, 1952, pp. 1.
CONFIDENTIAL
3. "Quarterly Status Report, Contract N56ri-06002, January through March, 1952," Linvill, W.K., M-1584, pp. 1-2.
CONFIDENTIAL
4. "Discussion of Group 61 GOC Test of July 15, 1952, and July 29, 1952," M. Brand, M-1597, August 13, 1952, pp. 1-3.
RESTRICTED
5. "Procedures in Connection with Flight Test and Ampex Tape Records," P. Dolan, A. Hill, D.R. Israel, M-1598, August 14, 1952, pp. 1-2.
RESTRICTED
6. "Programming for Stationary Clutter Rejection," P.R. Bagley, M-1600, August 19, 1952, pp. 1-6.
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7. "Group 61, Bi-Weekly Report, August 15, 1952," M-1603, pp. 1-15.
CONFIDENTIAL
8. "Reliability of Multiple Computers," R.R. Everett, E-471, August 13, 1952, pp. 1-17.
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