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SUBJECT: BI-WEEKLY REPORT, PROJECT 6673, MAY 11, 1951

1. GENERAL

(C. R. Wieser)

The second experiment in interception was successful, and no more flight tests have been made. For the time being, the computer is being used for analysis of data, testing new programs, and demonstrations for visitors.

Our technique of running flight tests is still unsatisfactory, and must be improved. Three changes are underway: (1) construction of a local intercommunication system, (2) direct connection between the man reading heading instructions and the radio transmitter, and (3) earlier access to the computer to get the system functioning before take-off. Also, all equipment additions or modifications are to be tested carefully before the day a flight-test is to be held.

Preliminary planning for the application of WWI to a multiple radar system has been started. It is evident that experiments with such a system will require the addition of magnetic drums and more electrostatic storage as well as terminal equipment. As a result, the existing Bedford system will be kept intact for a long period (probably at least a year) to study the operation of a radar and computer system.

2. ENGINEERING

(D. A. Buck)

The problem of noise pickup in the vertical and horizontal deflection cables has not yet been solved. Various grounds are being bonded in an attempt to remove stray 60-cycle and 180-cycle currents from the coaxial cable outer conductor. Because the magnitude of the noise pickup which has a blurring effect on the display is down in the neighborhood of six millivolts, amplification of the two deflection voltages at the decoder end of the line is being considered.

Multichannel magnetic tape recorders are available from Ampex and Brush. Ampex puts 14 channels on a one-inch tape. Brush supplies heads up to 15 channels but with no tape handling equipment. The 21-channel Raytheon units are not available.

2. ENGINEERING (continued)

(D. A. Buck) (continued)

Headsets have arrived for the intercommunication system, and the phone-line amplification equipment is nearing completion at AFCRL.

Parts have been received for a modification of one P-5 synchroscope for 12 KV operation with a 5XP2 which will allow maintenance personnel to see asynchronous low frequency WWI standard pulses.

(H. J. Kirahner)

Wiring diagrams for the revised communication system for room 224 are near completion, and construction of required equipment and cabling should commence during the week of 14 May 1951.

Terminal equipment in room 224 has been re-located to permit the construction of a door between 224 and Test Control. In the process of moving, an attempt is being made to arrange inter-connecting cabling in a fashion more orderly than that which existed previously.

Circuit schematics for the Light Gun have been completed by the drafting department. These drawings were delayed due to the press of higher priority work in the drafting department.

(R. L. Best)

The 16-inch display scope has been assembled in the mock-up rack and appears to operate satisfactorily. A more thorough evaluation will be made when computer time becomes available.

3. ANALYSIS FOR BEDFORD EXPERIMENTS

(D. R. Israel)

Another successful flight test has been held, and additional reels of Magnecord Tape have been accumulated. As soon as the previously discussed (last Bi-Weekly Report) data processing programs have been completely checked out, we shall proceed with an intensive analysis of the data.

In anticipation of the successful operation of the data processing programs, more effort has been put back into consideration of smoothing. A serious attempt will now be made to program and use a scheme involving the decrease of α and during successive sweeps after initiation, as well as varying these parameters in accordance with the deviation between observed and predicted positions. Under serious consideration and apparently with some merit is a scheme involving the averaging of successive pieces of data before using the data in the smoothing equations. J. Rossbach is now working on a program which selects as the best piece of data, a position at the weighted means

3. ANALYSIS FOR BELFORD EXPERIMENTS (continued)

(D. R. Israel)

of all reports inside the search area; this is to be compared to the present scheme of selecting the piece of data closest to the predicted position as the best.

(J. Arnow)

A program for printing the r.θ co-ordinates of multiple returns of a tracked aircraft falling within a specified search area has been written.

(R. Walquist)

Completed the writing of the range gate and target identification program. Am in process of checking program and preparing copy for typist.

(W. S. Attridge, Jr.)

The major portion of the past bi-weekly period has been devoted to writing the program for punching data while running an interception. The tape has been run on WWI and timing seems to be the main cause of difficulties. J. Rossbach and I both wrote programs to investigate the timing involved in the punching program.

A new simulated combat program has been run on WWI with a few things yet to be investigated.

I have started to rewrite the tracking program so that time counters will be practically eliminated and each azimuth will be inspected to see if it is time to look for an a/c, of the search sector has been covered, etc. This may be a better way of tracking particularly in view of the new type of radar data being received.

(F. E. Heart)

Spent the major portion of time in the past two weeks in revising, testing, and trouble-shooting a program to print from input tapes containing R,θ, and heading.

Further time was spent taking data with the Criteria Smoothing program, and a modification of this program is under construction. This modification will provide for a constant time of simulated flight rather than a constant distance, and will allow separate study of the best $\underline{a}$, Δ values for both the transient and steady state response.

3. ANALYSIS FOR BEDFORD EXPERIMENTS (continued)

(D. A. Kemper)

The two-aircraft velocity vector program now works; it originally contained a tape preparation error. The program gives a very pretty display and makes it almost impossible not to see at a glance just where the two aircraft are. If the scale factors of the length of the vectors are adjusted correctly, their tips will intersect at the place where the interception will occur when the program is used to track two planes one of which is intercepting the other. A possible refinement would be to have the vectors displayed whether or not the particular aircraft is picked up on a given sweep; at present the vectors are displayed only when the aircraft is actually picked up.

The PWTWS - two aircraft program contained an additional error that was not discovered until last week - it did not seem to track aircraft that were too close to the sector where printing takes place. The trouble was corrected by changing two td orders to ts.

The memorandum describing the Trigonometric and Square-Root Checking Programs has been rewritten and is being issued as M-2097.

A program has been written for transcribing Magnecorder data to punched tape, within a certain (specified) sector, but has not yet been tried.

(J. Rossbach)

I have been working on a two-aircraft tracking program which uses as the observed position the average of all pieces of data which fall inside the search area.

The program to determine how many azimuths (or ranges and azimuths) are lost while printing n characters a carriage return was run successfully and significant results were obtained. Two display programs were run on the computer but failed to work properly because of programming errors.

4. THEORETICAL ANALYSIS

4.1. General Studies

(C. Gaudette)

The "One Coordinate Prediction Testing Program" has been revised and operated successfully on the computer. The program now displays the input (cosine) function accompanied by either the predicted path or the error between the predicted

4.1. General Studies

(C. Gaudette)

path and the input.

A parameter tape, consisting of ten sets of parameters, has been prepared. This tape may be used with either the "Locus Display Program" or the "One Coordinate Prediction Testing Program."

Photographs of the displays for each set of parameters and for both programs mentioned above will be taken as soon as possible.

A "One Coordinate Prediction Comparison Program," which will compare the method of prediction in current use with the methods prescribed by the ten sets of parameters, is being written. A similar program limited to one particular set of parameters has had a trial run and appears to be error-free.

4.3. Correlation Studies

(F. Van Wyk)

I am engaged in the problem of correlating the information received from "n" stations operating a radar net used to track a/c. The specific method to be followed will depend on the relative efficiencies of systems of storing and processing the information received.

At present I am concentrating on two methods of reducing the field to be surveyed. One consists of dividing the area concerned into a large grid and referring only to those grids which contain spotted a/c. The other method (which seems at present the more promising) comprises the division of the area into sectors of a large circle and referring as before only to those which contain spotted a/c.

6. RECORD OF COMPUTER UTILIZATION

(J. A. Arnow)

5-1-51

1400 - 1600 A flight test was held. Successful interceptions were recorded. Operation was initially delayed due to computer and other equipment difficulties.

1600 - 1645 The synthetic combat program was used to try to determine the cause for program errors.

6. RECORD OF COMPUTER UTILIZATION (Continued)

5-2-51

1500 - 1505 A number of velocity magnitudes were computed from components on punched paper tape.

5-3-51

1200 - 1310 The Locus Display Program operated satisfactorily.

1310 - 1325 Synthetic combat was used to investigate program errors.

1325 - 1335 The Simulated Combat program contained program errors.

1335 - 1400 A program to determine printing time in terms of radar data lost was run unsuccessfully due to programming errors.

1400 - 1600 Data was obtained using the Criteria for Smoothing Program.

1300 - 1330 A program for determination of printing time contained programming errors.

1330 - 1600 Preparation was made for an expected group of visitors.

1600 - 1700 More data was obtained using the Criteria for Smoothing Program.

5-7-51

1100 - 1130 A program to print various quantities from an r, θ punched paper tape did not operate satisfactorily.

1130 - 1145 A program to count azimuths operated satisfactorily.

1200 - 1250 A one co-ordinate prediction program was run.

1250 - 1310 A Linear Smoothing Display ran into trouble due to faulty tape preparation.

1315 - 1530 A number of programs were used for demonstration purposes.

1530 - 1600 The 2 a/c PWTWS Program was used to determine the cause for an error previously noted.

6. RECORD OF COMPUTER UTILIZATION (Continued)

5-7-51 (Continued)

1600 - 1680 A program for determination of printing time operated satisfactorily.

1630 - 1645 A scope calibration program contained programming errors.

1655 - 1700 A program for the display of a heading angle contained programming errors.

5-9-51

1300 - 1345 The Simulated Combat Program was run.

1345 - 1415 A 2 a/c interception program that records r, θ data on punched paper tape operated satisfactorily.

1415 - 1500 The program for determination of printing time operated satisfactorily.

1500 - 1600 An unsuccessful attempt was made to take pictures of the Locus Display slots due to difficulties with the display equipment.

1600 - 1700 The program to print from punched paper tape did not work.

5-10-51

1320 - 1430 An attempt was made to photograph various display programs. It was later found that the film in the camera was not indexing.

1430 - 1530 The 2 a/c interception with punched paper tape was run with other parameters, but still had trouble with timing

1580 - 1700 A program to print from r, θ tape did not operate.

5-11-51

1315 - 1615 The Simulated Combat was run.

1615 - 1700 A Smoothing program gave no results due to computer difficulties.

5-12-51

1300 - 1431 The Simulated Combat Program gave inconclusive results.