Tabulating Book

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1. ANALYSIS

(W. G. Welchman)

Two informal conferences were held to discuss the work being done by Walquist and Arnow. Walquist had been preparing codes suitable for early experiments and Arnow had begun to consider the probabilities associated with the size of the tracking box.

Some time was spent in reading literature on the effect of radar errors. It should perhaps be mentioned that the use of manual intervention referred to below is primarily intended for experimental work.

(D. R. Israel)

The proofs of Summary Report 5 arrived last week, rather overdue. Some assistance was given Welchman in proofreading and correcting the text and figures.

The memo on radar quantization which was described in the last Bi-Weekly report has been completed and thoroughly discussed with Welchman. It will be prepared for publication as an E-note.

A good deal of work has been done with Arnow and Walquist in conjunction with their current work. Walquist's first coding of the tracking program exceeded the available storage capacity by some 20 registers. Careful examination of the program revealed places where economies could be made, and further work by Walquist resulted in a saving of about 50 orders. This latter version has been read and examined both for errors and correctness - it now appears to be in fine shape.

The probability aspects of tracking, briefly mentioned in the past Bi-Weekly report, are now being investigated by Arnow. The results are very encouraging, indicating that a box of 3 units in range enables an 85% chance of a second contact following an initial contact. This is to be compared to a theoretical 100% probability of contact with a box of 5 units in length. The 100% probability is not possible of course, in as much as the antenna might miss some return signals (echoes).

The lack of storage space mentioned in connection with tracking a single aircraft is likely to impede progress towards multiple tracking. Of the 256 electrostatic storage registers it had been

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(D. R. Israel) - continued

planned to use 48 for Manual Intervention (MIV) leaving 208 registers for program use. Inasmuch as the tracking of a single aircraft requires 181 registers, it is apparent that consideration must be made of possible economies. A saving of 48 registers could be made if MIV were not used, however, a shorter and less flexible form of MIV would be a better solution. The only other source of saving appears to be in the Main Display Program where some 30 orders are used to convert from (r, θ) to (x, y) coordinates in order to display with x, y decoders. Serious consideration has been given to the use of these decoders for the display of (r, θ) data directly--the θ being plotted horizontally, r vertically. The mental transformation to normal r, θ coordinates is easily made and as such the display should give an understandable picture. Such a display would be less of an inconvenience when used for tracking programs where the primary interest is in relative positions rather than the absolute.

Further consideration has been given to the automatic rather than manual (by joy stick) initiation of tracking. The first case to be programmed will be the tracking of aircraft entering an annular ring.

(R. L. Walquist)

The past Bi-Weekly period has been spent, almost entirely, in writing and checking a program which will be, combined with the Main Display Program for tracking, a single selected target.

The over-all program may be broken down into the following parts:

1. Main Display Program
2. Spot Movement (joy stick) Program
3. Tracking Initiation Program
4. Tracking Program

The general features of the program are as follows:

1. All incoming radar data is displayed on the main display scope in x, y coordinates.
2. Selection of a target is done manually by means of the Spot Movement Program.
3. The Tracking Initiation Program searches the area chosen by the Spot Movement Program, this search being done in x, y coordinates.
4. The Tracking Program tracks only one target, this target being picked up by the Tracking Initiation Program; tracking is done by searching a target box in r, θ coordinates.

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(R. L. Walquist) - continued

5. Each time the antenna makes one revolution and the target is not picked up by the Tracking Program the size of the tracking box is increased and an indication is given (by means of FF-3) of the number of misses.
6. If the target is missed "N" times, where "N" can be adjusted by the operator, the Tracking Program is stopped, and an indication is given (by means of FF-3) that the tracked target has been lost.

Registers used for this and the MIV program are as follows:

1.	Main Display Program (slightly revised)	57
2.	Spot Movement Program	16
3.	Tracking and Tracking Initiation Programs	71
4.	Manual Intervention Check	2
5.	Storage registers for constants and variable parameters	35
6.	Manual Intervention Program	48
	Total	229

A flow diagram and final draft of this program are being prepared, and should be completed shortly.

(E. J. Samario)

A tentative stationary-target-indicator program, which will select and store those targets which appear on at least 7 out of 8 radar sweeps, has been written. A maximum of 16 distinct targets can be stored at any one azimuth, that is, the first 16 distinct signals to arrive are stored and subsequent signals are compared with these. It is expected that this restriction will not greatly reduce the effectiveness of the program.

The program will examine all azimuths, two at a time, The region to be examined can be limited to a sector bounded by the 255th azimuth by MIV. More flexibility can be obtained by a slight modification of the program. Scanning time can be reduced by a simultaneous examination of more azimuths but this would greatly increase the number of registers required.

(J. A. Arnow)

For the purposes of tracking, it is desirable to minimize the

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(J. A. Arnow) - continued

size of the tracking box and yet be reasonably certain that contact will be made with the aircraft. Upon first contact, nothing is known as to the direction of velocity of the target, consequently an investigation has been carried out to obtain a probability density function for the projection upon a line of the flight. The question of how large a box is necessary if the aircraft was missed due to either the failure of the radar set to make contact or the possibility that the aircraft is outside the tracking box was also considered.

The distribution obtained is based upon the following assumptions:

1. The aircraft is flying in a straight path. (If the radius of curvature is not too small, the effects of this are negligible.)

2. It is equally likely that the velocity of the target lies anywhere between 180 and 480 mph.

3. It is equally likely that the target T is moving in any direction.

4. The sectors between range and azimuth readings may be approximated by rectangles.

5. If a quantized target reading is obtained at r_1, it is equally likely that the target could be anywhere between $(r_1 \pm 1/2)$ miles.

In extending this work to obtain a distribution for azimuth, two points must be taken into consideration. The first is that the distance between successive azimuth readings varies directly with range and secondly an assumption concerning the distribution of actual location of the target in azimuth for a given quantized reading must be obtained.

2. ENGINEERING

(D. A. Buck)

Intensification Gate Generator completed.

Two DuMont 304H oscilloscopes modified for D. and F. Scopes as follows:

BNC connectors mounted for X, Y, and Z axis inputs.

Z axis input routed through blanking amplifier to CRT grid.

Cathode resistor for 6Y6 driver placed on Z axis input within scope as line termination.

Intensification control in scope moved down on the high voltage divider so that the high-intensity continuous input pulses can be adjusted to proper brilliance.

These two scopes, a synchroscope, the intensification gate chassis, and a FF register were mounted in a rack and placed behind the decoders on WW1.

The vertical decoder was modified so as to hold for about 80 microseconds instead of sixteen by changing the ten R-10's to one megohm and the ten C-4's to 390 mmf.

(L. S. Bensky)

A microphone available in the stockroom was plugged into the "Bridge In" input of the Magnecorder; voice recording, satisfactory for identifying recorded tapes, was found possible.

Test procedures for servicing the System and making initial adjustments on the many gain controls have been written up. These, various schematics of switch panel and ACRL equipment, and other data concerning interconnection of equipment will be available from C. R. Wieser.

Most of the remainder of the period covered by this report was spent helping D. Buck test and install D, F, and M display scope intensifiers.