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Digital Computer Laboratory  
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## MITRE ACCOUNTABILITY

SUBJECT: CHANGES IN INTERNAL STORAGE AND COMPUTING TIME ALLOCATION  
GIVEN IN M-1913  
 (Supplement to M-1815: 1953 Cape Cod System)

To: C. R. Wieser  
 From: R. L. Walquist  
 Date: 7 May 1953

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 Auth: D.D. 254  
 By: R.R. Everett  
 Date: 2-1-60

Abstract: The North Truro CPS-6B is to operate with a scan time of 12 seconds in the 1953 Cape Cod System. The major computing frame for the data processing program will also be set at 12 seconds. A redistribution of ES has been made in order to simplify some of the track-while-scan (TWS) operations and in certain cases to allow a larger number of registers for excessively long sub-programs. The values of stored velocity for the tracks have been changed to correspond to a scan time of 12 seconds.

SUBJECT INDEX: 5.0 CONVENTIONS FOR PROGRAMMING

The decision has been made that the North Truro CPS-6B will operate with a scan time of about 12 seconds. Correspondingly, it has been decided that the major computing frame for the 1953 Cape Cod System will be 12 seconds in length. The decision made in M-1913 to break this major computing frame into four sub-frames will still hold. Each of these sub-frames will thus be 3 seconds in length. With the four sub-frames as a basis, it is possible to obtain a display every three, six or twelve seconds, depending upon whether the display is made every sub-frame, every other sub-frame, or once per major computing frame. M-1913 also indicated that track-while-scan (TWS) operations will be carried out in each of the four sub-frames. Since the sub-frames are now only 3 seconds in length, it may be desirable to restrict the TWS operations to two of these sub-frames and reserve the other two sub-frames for non-TWS operations. A possible reason for this is that displays for the non-TWS programs may require a considerable fraction of 3 seconds each time the displays are made. The TWS programs are being considered as utilizing time in all four sub-frames, but it will be possible to arrange the programs so that they occupy only two sub-frames if this appears desirable to others.

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It has been pointed out by some of the people programming for the 1953 Cape Cod System that the 736 ES registers set aside for temporary program and data storage may not be sufficient for some of the more complex programs. A review of the storage allocation that was made for the 1953 Cape Cod System indicated that by reorganizing this storage, it would be possible, in some cases, to allow more than the original 736 registers for program and temporary data storage. Since it is planned to transfer the permanent contents of ES to the auxiliary storage drum once per scan (for purposes of recycling following a parity alarm), it is possible for other programs to use the ES registers which store track data and certain other quantities. In order to do this, the program requiring use of these registers would immediately follow the above transfer to the auxiliary drum. The only additional operation necessary would be to read back from the drum the original ES data after this long program has been carried out.

Figure 1 shows the new internal storage allocation for the 1953 Cape Cod System. The original 736 registers for temporary program and data storage remain the same; however, an additional 768 registers are available if the ES registers occupied by the correlation box address table, the track data storage, and the table of changeable constants are used. In other words, all of ES storage could be available up to the registers occupied by the sine-cosine and master control program. The sine-cosine program must remain in ES since radar data is converted to X-Y coordinates and displayed as the data arrives. The time required for the block transfer of the original ES data back into the computer would have to be charged against a program which required the use of any of these additional 768 registers since this transfer is not needed otherwise.

Figure 2 shows the internal storage of track data for the 1953 Cape Cod System. The arrangement of the blocks of track information has been interchanged to simplify some of the TWS operations and also to allow excessively long non-TWS programs to use temporarily some of the registers set aside for track data. Non-TWS programs which require the X and Y positions and velocity components of the track may temporarily use 444 additional registers of ES, besides the 736 set aside, and still leave the pertinent track information they need in ES. The restrictions on this type of operation are identical to those mentioned above for the situation where all of the registers containing track data are used by the program.

The change of the scan rate from 15 seconds to 12 seconds has resulted in a change of how the X and Y velocity components of the track will be stored. Each of these will still be of 8-digit accuracy as mentioned in M-1913. X will still be stored in the left-hand 8 digits and Y in the right-hand 8 digits of the register as was indicated in M-1913. The first digit of each 8 will still indicate whether X or Y is positive or negative. However, the next digit will indicate a velocity of 300 knots. In the tracking programs, this digit corresponds to one-half nautical mile; the number

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stored is thus the distance an aircraft will move in 6 seconds. The X and Y positions of the tracks will still be stored as nautical miles times  $2^{-9}$  with all track positions being positive. The coordinates of the North Truro CPS-6B will be taken as: + 256, + 256 nautical miles times  $2^{-9}$ .

Signed Robert L. Walquist  
R. L. Walquist

Approved C. R. Wieser  
C. R. Wieser

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Figure 1

INTERNAL STORAGE ALLOCATION FOR 1953 CAPE COD SYSTEM

Register Addresses		Number of Registers	Use
<u>Decimal</u>	<u>Octal</u>		
0 - 31 (TS)	0 - 37	32	Part of read-in program; automatic start-over after parity; part of correlation program.
32 - 767	40 - 1377	736	Temporary program and data storage.
768 - 895	1400 - 1577	128	Correlation box address table.
896 - 1407	1600 - 2577	512	Track data storage for 64 tracks.
1408 - 1535	2600 - 2777	128	Table of changeable constants for all programs requiring such changes. (No constants will be changed on the drum within the program itself.)
1536 - 1663	3000 - 3177	128	Sine-cosine sub-routine, including sine-cosine table.
1664 - 2047	3200 - 3777	384	Master control program; data collection and temporary storage; controls sequence and block transfers of programs carried out by computer.

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Figure 2

INTERNAL STORAGE OF TRACK DATA FOR 1953 CAPE COD SYSTEM

<u>Block Number</u>	<u>Register Addresses</u>		<u>Contents</u>
	<u>Decimal</u>	<u>Octal</u>	
1	896 - 959	1600 - 1677	Track address table for correlation
2	960 - 1023	1700 - 1777	$\sum D_x$ (x position deviation for smoothing)
3	1024 - 1087	2000 - 2077	$\sum D_y$ (y position deviation for smoothing)
4	1088 - 1151	2100 - 2177	Track monitoring control
5	1152 - 1215	2200 - 2277	Tracking control register
6	1216 - 1279	2300 - 2377	x position of track
7	1280 - 1343	2400 - 2477	y position of track
8	1344 - 1407	2500 - 2577	$\dot{x}$ and $\dot{y}$ (velocity components of track)

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