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age table one target at a time, as found. The corresponding AIPR register is set ØN to indicate that the MET data was obtained from tape for this target. GMGPHT converts altitude from geopotential feet to geometric feet. This is stored in duplexed registers AIHT according to altitude band and target. The north wind and west wind components were taken from the tape in feet per second and are stored in duplexed registers AIWN and AIWE, respectively, according to altitude band and target. Density deviation is stored in duplexed registers AIDN according to altitude band and target. For SIM mode only one target is processed and the subprogram continues at step 39. Otherwise, each altitude band is processed similarly until all ten bands are processed. The target count is increased by one. If all the targets have been processed, control is transferred to step 26; otherwise the subprogram continues at the next step.

(6) Steps 39-40. Tape B4 is rewound and the contents of the index registers are restored. The subprogram exits to the user subprogram.

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2-132. SUBPROGRAM P25 (MISDIS). MISDIS computes the X, Y, and Z components and the magnitude of the miss distance. Miss distance is the separation vector between the desired detonation point and the point on the trajectory of a simulated flight which is at the desired detonation altitude. The FORTRAN II reference statement is CALL MISDIS (XYZ,DI).

a. Inputs. The inputs are as follows:

COMMON TAG	DIMENSION	ITEM	SYMBOLS	UNITS
TWDRV	2	Current target distance to center of earth		feet
TWCLT	2	Current target geocentric latitude		degrees
TWIN	2	Current target longitude west of Greenwich		degrees
GDPSM (1,7)	2	Time of flight		seconds
GDPSM (1,1)	2	X-coordinate of final detonation point	X_d	feet
GDPSM (1,2)	2	Y-coordinate of final detonation point	Y_d	feet
GDPSM (1,3)	2	Z-coordinate of final detonation point	Z_d	feet

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b. Outputs. XYZ and DI define the output registers. XYZ defines a 6 dimensional array containing the duplexed X, Y, and Z coordinates of the miss distance separation vector. DI defines the duplexed magnitude of the miss distance. Outputs are in feet.

c. Program Logic. FD P25. GEØXYZ converts the spherical

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coordinates of the target position to inertial coordinates. Expressions (1)-(3) evaluate the X, Y, and Z components of the miss distance. VECMAG computes the magnitude of the miss distance using expression (4). CUTIE is stepped by one and control is returned to the user subprogram.

d. Expressions.

$$\Delta X = X_d - X_t \tag{1}$$

$$\Delta Y = Y_d - Y_t \tag{2}$$

$$\Delta Z = Z_d - Z_t \tag{3}$$

$$DI = \sqrt{X^2 + Y^2 + Z^2} \tag{4}$$

where

X_d, Y_d, Z_d are inertial coordinates of the final detonation point

X_t, Y_t, Z_t are inertial coordinates of the current target

ΔX, ΔY, ΔZ are inertial coordinates of the miss distance

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2-133. SUBPROGRAM P78 (MSSNT). MSSNT is the control subprogram for the Missile Simulation System. It controls the processing of the simulation and decimal correction functions. The FORTRAN II reference statement is CALL MSSNT.

a. Inputs. The inputs are the following switches indicating the phase of simulation requested:

COMMON TAG	ITEM (switch in ØN state)
SW(86)	Closed loop simulation requested
SW(87)	Ballistic phase simulation requested
SW(88)	Re-entry phase simulation requested
SW(89)	Ideal-earth simulation requested
SW(90)	Series simulation requested
SW(135)	Open loop option in CLØØP

b. Outputs. The output is the following statement printed and written:

SW(I) = 1

SETS SW(I) = ØN

SW(I) = 2

SETS SW(I) = ØFF

c. Program Logic. FD P78

(1) Steps 1-3. The subprogram return path is saved by SAVE4. IGENE registers (1), (2), (5), and (7) are ini-

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tialized to zero for use by SIMNT. ISLØT is set to one, and the output statement is written.

(2) Steps 4-14. The switches indicating that the DEC subprograms (SW(137)) and the SIM subprograms (SW(156)) are in core are set ØFF. INTRØG sequentially interrogates the switches indicating the phase of simulation requested (SW(86)-SW(90) and SW(135)). If a switch is ØFF, the next switch is examined. After the last switch has been examined, RTRN4 returns the subprogram to the user subprogram. If a switch is ØN, the SIM card indicator SW(79) is set ØFF, and the DEC card indicator SW(80) is set ØN. BAREA verifies that the B subprograms are in core. Core is set up for the DEC mode of operation by BENTRY which transfers control to DECNT. SW(79) is set ØN, SW(80) is set ØFF, and BAREA again verifies that the B subprograms are in core. Core is set up for the SIM mode of operation by BENTRY which transfers control to SIMNT. The subprogram continues at step 4.

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2-134. SUBPROGRAM S01 (SPRINT). SPRINT controls the executable FORTRAN II input-output statements, which compile as linkage to subprograms that carry out the desired operation such as conversion and transmission of data. Input and output, with FORTRAN II source programs, is accomplished using the following statements:

READ n, List

READ INPUT TAPE i, n, List

PRINT n, List

WRITE OUTPUT TAPE i, n, List

PUNCH n, List

FORMAT (Specification)

READ TAPE i, List

WRITE TAPE i, List

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a. Storage To Tape Hollerith (STH), To Tape Monitor (STHM). The linkage is compiled by the input-output (I/O) translator. BCD records prepared by subprogram (IØH) are written on the specified tape when SENSE switch 6 is up, the normal case. If SENSE switch 6 is down, then the record is also printed on-line.

(1) Use. The program is a system I/O tape subprogram with entry points at (STH) for output/storage to tape Hollerith, and (STHM) for output/tape monitor.

With FORTRAN:

WRITE OUTPUT TAPE i, n, List

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where i is the tape

n is the format statement

List is the array to be written

With FAP:

A	CAL N	Tape in AC
	TSX (STH), 4	Storage to tape Hollerith
	PZE 8)K, 0,0	8)K is the format designation
A1	...	Indexing, if any
B	LDQ Symbol, Tag	Place datum in MQ for conversion
	STR	Trap to control program
B1	...	Indexing, if any
C	TSX (FIL), 4	Fill out line and return

b. Storage To Printer Hollerith (SPH). The linkage is compiled by the input-output translator. BCD information prepared by subprogram (IØH) is written on SYSPØT, the system output tape, for peripheral printing if SENSE switch 6 is up, the normal case. When SENSE switch 6 is down, the same information is also printed on-line.

(1) Use. The program is a system I/O tape subprogram with entry at (SPH).

With FORTRAN:

PRINT n, List

where n is the format statement

List is the array.

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With FAP:

A	TSX (SPH), 4	Storage to printer Hollerith
	PZE 8)K	Format designation
A1	...	Indexing, if any
B	LDQ Symbol, Tag	Place datum in MQ for conversion
	STR	Trap to control
	... ..	Indexing, if any
C	TSX (FIL), 4	Fill out line and return

c. Input And Output Of Hollerith Data (IØH). This routine controls input and output with conversion of Hollerith data. It is called by subprogram (TSH), (CSH), (STH), (SPH), and (SCH). It uses the FORMAT statement to determine the type of conversion to be performed. The end of format is signaled when the scan encounters an illegal character or when zero level reduction, with respect to parenthesis, is attained. The entry point is at (IØH) with secondary entry point at (RTN) and (FIL) which permit recovery from the list when input or output is to be terminated, respectively.

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d. Cards To Storage Hollerith (CSH). Hollerith coded cards are read into storage from the on-line card reader and their contents are converted to BCD if SENSE switch 5 is down. With SENSE switch 5 up, the normal case, subprogram (CSH) is equivalent to subprogram (TSH), the implied tape, the system input tape SYSPIT. In either case, conversion from BCD to binary is handled by (IØH).

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(1) Use. The program is a system I/O tape subprogram with entry at (CSH).

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With FORTRAN:

READ n, List

where n is the format statement

List is the array to be read

With FAP:

A	TSX (CSH), 4	Cards to storage Hollerith
	PZE 8)K, 0,0	Format designation
A1	... ..	Indexing, if any
	STR	Trap to control program
B	STQ Symbol, Tag	Store result of conversion
	... ..	Indexing, if any
C	TSX (RTN), 4	Return

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The chief advantage of (CSH) over (TSH) is the flexibility imparted to the system. Thus, by depressing SENSE switch 5, the system primary input source is changed from SYSPIT to the card reader. This permits running problems on-line in the event of peripheral equipment failure or when the nature of the problem requires an on-line run.

e. Tape To Storage Hollerith (TSH), At Object Time (TSHM). BCD tape record(s) are read from the specified tape into storage for conversion by subprogram (IØH).

(1) Use. The program is a system I/O tape subprogram set by the FORTRAN compiler or by the monitor at object time.

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With FORTRAN:

READ INPUT TAPE i, n, List

where i is the tape

n is the format statement

List is the array to be read from tape

With FAP:

A	CAL N	Tape in AC
	TSX (TSH), 4	Tape to storage Hollerith
	PZE 8)K, 0,0	Format designation
A1	... ..	Indexing, if any
	STR	Trap to control program
B	STQ Symbol, Tag	Store result of conversion
B1	...	Indexing, if any
C	TSX (RTN), 4	Return

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f. Storage To Cards Hollerith (SCH). If SENSE switch 4 is up, the normal position, then Hollerith card images prepared in conjunction with subprogram (IØH) are written in binary on the system punch tape SYSPPT for peripheral punching. If SENSE switch 4 is down, the punching is done on-line.

(1) Use. The program is a system I/O tape subprogram with entry point at (SCH).

With FORTRAN:

PUNCH n, List

where n is the format statement

List is the array

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With FAP:

A	TSX (SCH), 4	Storage to punch Hollerith
	PZE 8)K	Format designation
A1	...	Indexing, if any
B	LDQ Storage, Tag	Place datum in MQ for conversion
	STR	Trap to control program
B1	...	Indexing, if any
C	TSX (FIL), 4	Fill out card and return

g. Input And Output Of Binary Data (IØB). This routine controls the transmission of binary data. This transmission always involves tapes and it is buffered for greater efficiency. (IØB) is used with subprogram (TSB) and (STB).

(1) Use. The program is a system I/O tape subprogram with entry point at (IØB). A re-entry point at (EXB) is used when the list from the user subprogram is satisfied.

h. Tape To Storage Binary (TSB). Binary record(s) are read from the specified tape into storage under the control of subprogram (IØB).

With FORTRAN:

READ TAPE i, List

where i is the tape

List is the array

With FAP:

A	CAL I	Place tape designation in AC

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	TSX (TSB), 4	Tape to storage binary
A1	...	Indexing, if any
	STR	Trap to control program
B	STQ Storage,Tape	Store datum
B1	...	Indexing, if any
	TSX (RLR), 4	Read last record and return

(RLR) is a secondary entry point to (TSB) and causes the last physical record of the current logical record to be searched for and passed, if necessary; thus the tape is positioned to read the next logical record.

i. Storage To Tape Binary (STB). Binary tape record(s) are written on the specified tape from storage under the control of subprogram (IØB).

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(1) Use. The program is a system I/O tape subprogram with entry point at (STB).

With FORTRAN:

WRITE TAPE i, List

where i is the tape

List is the array to be written

With FAP:

A	CAL I	Place tape designation in AC
	TSX (STB), 4	Storage to tape binary
A1	...	Indexing, if any
B	LDQ Storage, Tag	Place datum in MQ

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	STR	Trap to control program
B1	...	Indexing, if any
C	TSX (WLR), 4	Write last record and return

(WLR) is a secondary entry point to subprogram (STB) and causes the last physical record of the current logical record to be written on tape.

j. Short List Output (SLØ). When the name of an array appears in the list FORTRAN compiles linkage to short list output (SLØ). (SLØ) controls that part of the list dealing with the output of arrays.

(1) Use. The program is a system I/O tape subprogram with the following calling sequence:

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TSX (SLØ), 4	For output of an array
PZE Symbol + 1	Location of the array + 1
PZE N	Number of elements

k. Short List Input (SLI). When the name of an array appears in the list FORTRAN compiles linkage to short list input (SLI). (SLI) controls that part of the list dealing with the input arrays.

(1) Use. The program is a system I/O tape subprogram with the following calling sequence:

TSX (SLI), 4	For input of an array
PZE Symbol + 1	Location of the array + 1
PZE N	Number of elements

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l. Read Tape Error (RER), (RDC). This subprogram checks the binary tape record(s) read into storage, subprogram (TSB) and the BCD tape record(s) read into storage, subprogram (TSH). An error occurs when the input/output trigger is ØN, when an end of file is reached, or when failure occurs in ten attempts at reading.

m. Write Tape Error (WER), (WTC). This subprogram checks the binary tape record(s) written from storage, subprogram (STB), and the BCD tape record(s) written from storage, subprogram (STH). Errors occur if the input/output trigger is ØN, if failure occurs in five attempts at writing, and if a redundancy check occurs while erasing.

n. Non-Monitor Error Routine (EXE). This subprogram is used to set the transfer address on an error return. (EXE) may be modified to take different action depending on the error code contained in the sense indicators.

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2-135. SUBPROGRAM P49 (TRAIL). TRAIL determines the trail T and the focusing height D as a function of the re-entry velocity, re-entry angle, and burst altitude, using empirical formulae. The FORTRAN II reference statement is CALL TRAIL (X).

a. Inputs. The inputs are as follows:

COMMON TAG	DIMENSION	ITEM	SYMBOL	UNITS
TWAL	2	Current target altitude above geoid	h_G	feet
TWDA	2	Current target desired detonation altitude	h_{DD}	feet
GRESM	2,9	Re-entry vehicle summary data table		
FRTØD	2	Conversion factor		deg/rad

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b. Outputs. The outputs are the values of trail in GTRAL, and focusing height as the argument X.

c. Program Logic. FD P49.

(1) Steps 1-11. The matrix S_{ij}, expression (6), is stored for use in computation of the empirical formula for trail. The absolute value of the re-entry angle γ in radians is computed. TANGNT computes tangent γ. The re-entry velocity is divided by 1000 (V) and the burst altitude is divided by 1000 (H). The linear equations A, B, and C of expressions (1), (2), and (3) are computed and used to compute

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the trail using expression (4). The focusing height, expression (5), is computed. CUTIE is stepped by one and the subprogram returns to the user subprogram.

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d. Expressions.

$$A = S_{1,1} + S_{2,1}V + S_{3,1}V + S_{4,1}VH + S_{5,1}V^2 + S_{6,1}H^2 + S_{7,1}V^2H + S_{8,1}VH^2 + S_{9,1}V^2H^2 \quad (1)$$

$$B = S_{1,2} + S_{2,2}V + S_{3,2}H + S_{4,2}VH + S_{5,2}V^2 + S_{6,2}H^2 + S_{7,2}V^2H + S_{8,2}VH^2 + S_{9,2}V^2H^2 \quad (2)$$

$$C = S_{1,3} + S_{2,3}V + S_{3,3}H + S_{4,3}VH + S_{5,3}V^2 + S_{6,3}H^2 + S_{7,3}V^2H + S_{8,3}VH^2 + S_{9,3}V^2H^2 \quad (3)$$

$$T = \text{Trail} = e^{AZ^2} + BZ + C \quad (4)$$

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$$D = \text{Focusing height} = TZ^2\ (2AZ + B) \quad (5)$$

where

$$\begin{matrix} S_{1,1} & S_{2,1} & S_{3,1} & S_{4,1} & S_{5,1} & S_{6,1} & S_{7,1} & S_{8,1} & S_{9,1} \\ S_{1,2} & S_{2,2} & S_{3,2} & S_{4,2} & S_{5,2} & S_{6,2} & S_{7,2} & S_{8,2} & S_{9,2} \\ S_{1,3} & S_{2,3} & S_{3,3} & S_{4,3} & S_{5,3} & S_{6,3} & S_{7,3} & S_{8,3} & S_{9,3} \end{matrix} \quad (6)$$

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2-136. SUBPROGRAM D16 (TRGTRB). TRGTRB computes the inertial range angle and bearing of a target from the launch pad based on an estimation of total time of flight. **Inertial range angle ϕ' is the angle at the center of the** earth formed by the earth radius to the launch pad at time of missile launch and the earth radius to the target at the time of missile impact. Inertial bearing B_T is the angle on the surface of the earth between the great circle arc connecting the launch pad at time of missile launch with the north pole and the great circle arc connecting the launch pad at time of missile launch with the target at time of missile impact. The FORTRAN II reference statement is CALL TRGTRB.

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a. Inputs. The inputs are as follows:

COMMON TAG	DIMENSION	ITEM	SYMBOL	UNITS
GTMFL	2	Total time of flight	t_f	seconds
PLLØN	2	Geographic longitude of this launch pad	λ_L'	degrees
PLCLT	2	Geocentric latitude of launch pad	L_{CL}	degrees
PLSCL	2	Sine of geocentric latitude of this launch pad	L_{CL}	pure no.
PLDR7	2	Distance from center of earth to launch pad	r_e	feet
TWLN	2	Longitude λ_t of the target west of Greenwich		degrees
TWCLT	2	Geocentric latitude	L_{CT}	degrees

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COMMON TAG	DIMENSION	ITEM	SYMBOL	UNITS
TWDRV	2	Distance from center of earth to target	r_T	feet
GØMGA	2	Rate of rotation of earth		
TWCCL	2		cos L_{CT}	
TWSCL	2	Current target sine of geocentric latitude	sin L_{CT}	pure no.
PLCCL	2	Launch pad cosine of geocentric latitude	cos L_{CL}	pure no.
FRTØD	2	Conversion constant		deg/rad

b. Outputs. The outputs are as follows:

COMMON TAG	DIMENSION	ITEM	SYMBOL	UNITS
GTRNG	2	Inertial range angle	$\emptyset'$	degrees
GSRNG	2		sin $\emptyset'$	
GCRNG	2		cos $\emptyset'$	
GTBRG	2	Target bearing angle	B_T	degrees
GSBRG	2		sin B_T	
GCBRG	2		cos B_T	

c. Program Logic. FD D16

(1) Steps 1-6. In determining inertial range, the position vectors of the launch pad at time of missile launch and of the target at time of missile impact are determined in inertial earth-centered rectangular coordinate system. GEØXYZ performs the necessary conversions successively from the geocentric latitude, longitude, and altitude parameters

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given, first for the launch pad location and then the target position. VCDØTP computes the cosine of the angle between the launch pad and target position vectors as defined in the inertial earth-centered rectangular coordinate system. The inertial range angle is converted from radians to degrees. SINE computes the sine of the inertial range angle. RØUND rounds the double-precision sine value to single precision.

(2) Steps 7-26. Expressions (1), (2), and (3) evaluate the target bearing. SINE computes the sine function in expression (1). The values of K1 and K2 in expression (3) are obtained from a series of tests on the geocentric latitude and the value Q obtained in expression (1). ARCCØS computes the inverse sine function in expression (3). CØSINE computes the cosine of the target bearing angle. RØUND rounds the double-precision cosine value to single precision. CUTIE is stepped by one and control is returned to the user subprogram.

(3) Steps 27-28. If the sine of the inertial range angle in step 9 is not zero, IFLAG is set to identification integer 416 and the subprogram exits to RLLBCK for return to previous check point.

d. Expressions.

$$Q = \sin\,(\lambda_L' - \lambda_T + \Omega t_f) \quad (1)$$

$$S = \left[\sin L_{CT} - (\sin L_{CL} \cos \phi')\right] \Big/ \left[\cos L_{CL} \sin \phi'\right] \quad (2)$$

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$$B_T = K_1 \arccos |S| + K_2 \qquad (3)$$

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where

K1 = + 1 if L_{CT} is + and Q is +

or if L_{CT} is - and Q is -

K1 = - 1 if L_{CT} is + and Q is -

or if L_{CT} is - and Q is +

K2 = 0 if L_{CT} is + and Q is +

K2 = 180° if L_{CT} is - and Q is -

or if L_{CT} is - and Q is +

K2 = 360° if L_{CT} is + and Q is -

A positive value of L_{CT} indicates north latitude.

A positive value of Q indicates shooting east.

All other terms are defined in the Inputs or Outputs paragraphs.

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2-137. SUBPROGRAM P01 (TRJPAR). TRJPAR obtains values for six trajectory parameters: kick angle δ, radar coordinate system parameters A_o and E_o, total time of flight t_f, reentry angle and launch azimuth A_T. These parameters are functions of inertial target azimuth (bearing from launch site at time of launch to target at time of impact) and inertial target range. The FORTRAN II reference statement is CALL TRJPAR.

a. Inputs. The inputs are as follows:

COMMON TAG	DIMENSION	ITEM	SYMBOL	UNITS
GZMTH	2	Current estimate of earth-fixed target bearing	A_T	degrees
INAZM	1	Number of azimuth entries in delta matrix		integer
TLZTH	13	Launch azimuth table, delta matrix		degrees
INRNG	1	Number of range entries in delta matrix		integer
GEFXR	2	Current value of earth-fixed range		degrees
RANGE	13,4	Earth-fixed range tables		degrees
GICK	13,4	Kick angle delta vs earth-fixed range and launch azimuth table, delta matrix		degrees
TMFLT	13,4	Total time of flight vs earth-fixed range and launch azimuth table, delta matrix		seconds

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COMMON TAG	DIMENSION	ITEM	SYMBOL	UNITS
AZERØ	13,4	A_o vs earth-fixed range and launch azimuth table, delta matrix		degrees
EZERØ	13,4	E_o vs earth-fixed range and launch azimuth table, delta matrix		degrees
RNGLE	13,4	Delta-matrix re-entry angle		

b. Outputs. The outputs are as follows:

COMMON TAG	DIMENSION	ITEM	UNITS
GZMTH	2	Current estimate of earth-fixed target bearing	degrees
GKICK	2	Current value of kick angle δ	degrees
GAZRØ	2	Current value of A_o	degrees
GEZRØ	2	Current value of E_o	degrees
GTIME	2	Current estimate of total time of flight	seconds
GNGLE	1	Re-entry angle	

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c. Program Logic. FD P1

(1) Steps 1-9. The input is a table of values of launch azimuth and range vs kick angle δ, radar coordinates A_o and E_o, time of flight t_f and re-entry angle. For each launch azimuth value $A_{T1} \ldots A_{TM}$, there is corresponding set of four range values. For each range value R_{ML} there is a corresponding set of parameters δ_{ML}, A_{oML}, E_{oML}, t_{fML} and re-entry

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angle $_{ML}$. The table would appear visually as follows:

A_{T1}	$R_{1,1}$	$R_{1,2}$	$R_{1,3}$	$R_{1,4}$
A_{T2}	$R_{2,1}$	$R_{2,2}$	$R_{2,3}$	$R_{2,4}$
.	.	.	.	.
.	.	.	.	.
A_{TM}	$R_{M,1}$	$R_{M,2}$	$R_{M,3}$	$R_{M,4}$

If the launch azimuth is less than A_{T1} or greater than A_{TM}, IFLAG is set to identification integer 1601 and RLLBCK determines the subprogram in which an error has occurred and establishes a re-entry point if possible. If the launch azimuth equals one of the tabular values, the row of range values corresponding to that azimuth is extracted. If the launch azimuth is between two tabular values, expressions (1) and(2), evaluate the corresponding values of range and parameters. The table has now been reduced to four values of range and four sets of parameters. If the current range is less than the first value, the first set of parameters is used. If the current range is greater than the fourth value, the fourth set of parameters is used. If the current range equals one of the values, then the corresponding set of parameters is used. Otherwise, expressions (1) and (2) interpolate for the correct parameters.

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d. Expressions.

$$a = (X - X_{k-1})/(X_k - X_{k-1}) \quad (1)$$

$$Y = Y_{k-1} + a(Y_k - Y_{k-1}) \quad (2)$$

where

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X = current value of azimuth or range

$X_{k-1} < X < X_k$

Y = interpolated value of δ, A_o, E_o, or t_f

$Y_{k-1} < Y < Y_k$

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2-138. SUBPROGRAM U09 (U09). U09, in conjunction with U08, prints and writes on the card columns or print wheels that have been found to be in error. The FORTRAN II reference statement is CALL U09. The FAP reference instruction is TSX U09, 4.

a. Inputs. The inputs are the contents of ITYER, CLEL and CLER, or UEKØL and UEKØR.

b. Outputs. The output is the following statement printed and written for each column that is in error: ERROR IN COLUMN____

c. Program Logic. FD U09

(1) Step 1. The contents of index registers 1, 2, and 4 are saved.

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(2) Steps 2-4. ITYER, which contains the error code, is examined. A 7 indicates a print error and the print wheel error registers UEKØL (representing columns 1-36) and UEKØR (representing columns 37-72) are initialized for checking. For all other error codes, the card column registers CLEL (representing columns 1-36) and CLER (representing columns 37-72) are initialized for checking.

(3) Step 5. All zeros in the first register indicate no errors have occurred in columns 1-36 and the subprogram continues at step 10. If columns 1-36 have errors, the subprogram continues at the next step.

(4) Step 6. Each bit in the 36 bit register is examined

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consecutively. If the bit is a zero, the subprogram continues at the next step. If the bit is a one, indicating that the column is in error, the subprogram continues at step 8.

(5) Step 7. If all 36 bits of the first register have been examined (determined by index register 1 which is used as a counter), the subprogram continues at step 12. Otherwise the subprogram continues at step 6.

(6) Steps 8-9. The number of the column in error is determined and stored in BCD form in the error statement. U08 prints and writes the output error statement. The subprogram continues at step 7.

(7) Step 10. If the second register contains all zeros, indicating no errors have occurred in columns 37-72, the subprogram continues at the next step. Otherwise the subprogram continues at step 12.

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(8) Step 11. The contents of the index registers are restored and the subprogram exits to the user subprogram.

(9) Step 12. If all 72 bits have been examined (determined by index register 1 which is used as a counter), the subprogram continues at step 11. Otherwise, the subprogram continues at step 6.

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2-139. SUBPROGRAM U20 (U20). U20 reads a card from the card reader or a record from magnetic tape and stores it in BCD format in the card image area CDIO-CDI12. The FORTRAN II reference statement is CALL U20. The FAP reference instruction is TSX U20, 4.

a. Inputs. The input may be a Hollerith coded IBM card or a BCD tape record on tape B10. SENSE switch 5 is ON if the input is from the card reader, or OFF is the input is from the tape.

b. Outputs. The output is a record in the card image area CDIO-CDI12 in BCD format.

c. Program Logic. FD U20

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(1) Steps 1-7. The contents of index registers 1, 2, and 4 are saved. IFLAG is set to identification integer 2120. SW(70) is set ØFF. SENSE switch 5 is interrogated to determine if the input is on tape or cards. If the input is on tape (SENSE switch 5 OFF), the subprogram continues at step 16. If the input is on cards (SENSE switch 5 ON), the card image area CDIO-CDI12 is set to zero and a card is read in. If no end-of-file is sensed, the subprogram continues at step 11. If an end-of-file is sensed, the subprogram continues at the next step.

(2) Step 8. A nine is stored in ITYER.

(3) Step 9. Switch SW(70) is set ØN.

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(4) Step 10. The contents of the index registers are restored and the subprogram exits to the user subprogram.

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(5) Steps 11-15. The Hollerith coded card is converted to BCD format and stored in CDIO-CDI12. The card is checked for illegal punches. If there are no illegal punches, CLEL and CLER are set to zero and the subprogram continues at step 10. If there are illegal punches, the columns on the card that are in error are indicated by setting to one the corresponding proper bits in CLEL and/or CLER. A four is stored in ITYER and the subprogram continues at step 9.

(6) Steps 16-18. A record is read into CDIO-CDI12 from tape B10. If an end-of-file is sensed, the subprogram continues at step 8. If no tape redundancy occurs, the subprogram continues at step 10.

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(7) Steps 19-21. If tape redundancy occurs, index register 1, which is used as a counter, is interrogated to determine if three attempts have been made to read the tape. Until three attempts have been made the tape is backspaced and the subprogram continues at step 16. If the redundancy error still occurs after the third attempt, the tape redundancy error indicator ITYER is set to eight and the subprogram continues at step 9.

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2-140. SUBPROGRAM U40 (U40). U40 converts latitude and longitude data obtained from ground guidance complex and target cards from BCD to floating point binary. The FORTRAN II reference statement is CALL U40. The FAP reference instruction is TSX U40,4.

a. Inputs. The input is a card containing a latitude or longitude, in BCD form, stored in CDI0-CDI4. Figures 2-2 and 2-5 illustrate the format of the TGT cards and GGC cards containing LAT or LON information. The bit configuration of columns 13-28 in the card image area in CDI2-CDI4 is as follows:

	S 5	6 11	12 17	18 23	24 29	30 35
CDI2	13	14	15	16	17	18
CDI3	19	20	21	22	23	24
CDI4	25	26	27	28		

SW(72) is ØN if it is a LAT card, SW(73) is ØN if it is a LON card, SW(71) is ØN if it is a GGC card, and SW(199) is ØN, if the limits angle is less than 360 degrees.

b. Outputs. The output is the converted data stored in UDGCN. If an error occurs, SW(70) is turned ØN and the columns in error are indicated in CLEL.

c. Program Logic. FD U40

(1) Steps 1-2. The contents of index registers 1, 2, and 4 are saved. UDGCN, GRASE, GRASE-4, and GRASE-6 are

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initialized to zero.

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(2) Steps 3-10. Column 13 is examined to determine the direction. If this column contains and S, E, or -, the sign of UDGCN is set negative. If column 13 does not contain an N, S, E, W, + or -, the column is in error and is stored in GRASE-6.

(3) Steps 11-26. Seconds are stored in GRASE-1. If this is a GGC card, these seconds are in card image area, columns 23-27. If it is a TGT card, the seconds are in columns 23-26. Column 25 is checked to determine if a decimal point is present. If no decimal point is present, column 25 is stored in the error work area. Columns 27 (for a GGC card), 26, 24, and 23 are examined for overpunches. If there are any overpunches, the column(s) are stored in GRASE-6. The decimal point from column 25 is removed, and columns 20, 19, 16, and 15 are checked for overpunches. Any columns with overpunches are stored in GRASE-6.

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(4) Steps 27-28. If SW(199) is ØFF, the subprogram continues at step 29. If ØN, and if column 14 is greater than three, the subprogram continues at step 32, otherwise subprogram continues at step 33.

(5) Steps 29-31. SW(72) is interrogated to determine if the input is a LAT card. If the input is other than a LAT card, the subprogram continues at step 37. Column 14 is examined and, if not zero, subprogram continues at step 33.

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