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THE CCTC QUICK-REACTING GENERAL WAR GAMING SYSTEM. (QUICK). USE--ETC(U)
MAY 79

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SUBJECT: Change 1 to Users Manual CSM UM 9-77, Volume IV, Sortie Generation Subsystem

1. Insert the enclosed change pages and destroy the replaced pages according to applicable security regulations.

2. A list of Effective Pages to verify the accuracy of this manual is enclosed. This list should be inserted before the title page.

3. When this change has been posted, make an entry in the Record of Changes.

FOR THE DIRECTOR:

J. DOUGLAS POTTER
Assistant to the Director
for Administration

44 Enclosures
Change 1 pages

(11) May 79

(6) The CCTC Quick-Reacting General War Gaming System (QUICK). Users Manual. Volume IV. Sortie Generation Subsystem. Change 1.

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EFFECTIVE PAGES - MAY 1979

This list is used to verify the accuracy of CSM UM 9-77 Volume IV after change 1 pages have been inserted. Original pages are indicated by the letter O and change 1 pages by the numeral 1.

Page No.	Change No.
Title Page	0
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iii-viii	0
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82-111	0
112-114	1
114.1-114.2	1
115-117	0
118	1
119-128	0

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SECTION 1. GENERAL

1.1 Purpose

This volume of the QUICK Users Manual is intended to inform the user/analyst on how to prepare control cards; structure execution (run) decks; prepare computer job requests; and understand the associated computer output, to include the recognition of error messages for the Sortie Generation subsystem of QUICK. It complements information contained in the Maintenance Manuals on the QUICK System.

1.2 General Description

The Sortie Generation Subsystem operates using the integrated data base as developed by the Weapon Allocation subsystem and produces detailed bomber and missile (delivery vehicle and weapon) sortie specifications. Thus, it accepts a near-optimal weapon allocation, and from this as well as consideration of delivery vehicle characteristics and other factors, generates a detailed plan of attack for one opposing side in a hypothetical general war.

The subsystem consists of modules FOOTPRNT, POSTALOC, PLANOUT and PLOTIT as shown in figure 1. Figure 2 shows the relationship of the Sortie Generation subsystem to other QUICK subsystems in terms of procedural information flow.

In addition to the plan generation requirements, per se, the output of this subsystem is utilized alternatively by:

a. Damage Assessment systems external to QUICK which utilize weapon/target strike data (DGZ tapes) as required.

b. General War simulation models external to QUICK (e.g., NEMO and ESP) which utilize relevant strike data as required (DGZ and A/B tapes).

If any missile delivery vehicles exist within the data base, module FOOTPRNT must be executed. For single shot missile delivery system individual sorties are simply formatted; no other action is required. For MIRV weapon groups detailed reentry vehicle target point assignments which satisfy the various constraints are created.

POSTALOC processes bomber weapon groups and develops specific bomber sorties.

All weapon groups are processed only if the attack posture indicator (attribute ATTPOS) equals zero. Otherwise only those weapon groups are processed where attack increment (attribute ATTING) equals ATTPOS.

The sortie plans at this point are neither fully detailed nor in the format required for input to simulator external to the QUICK system. Module PLANOUT therefore adds the required data, e.g., timing information and bomber serial constraints, and creates tapes for external simulators.

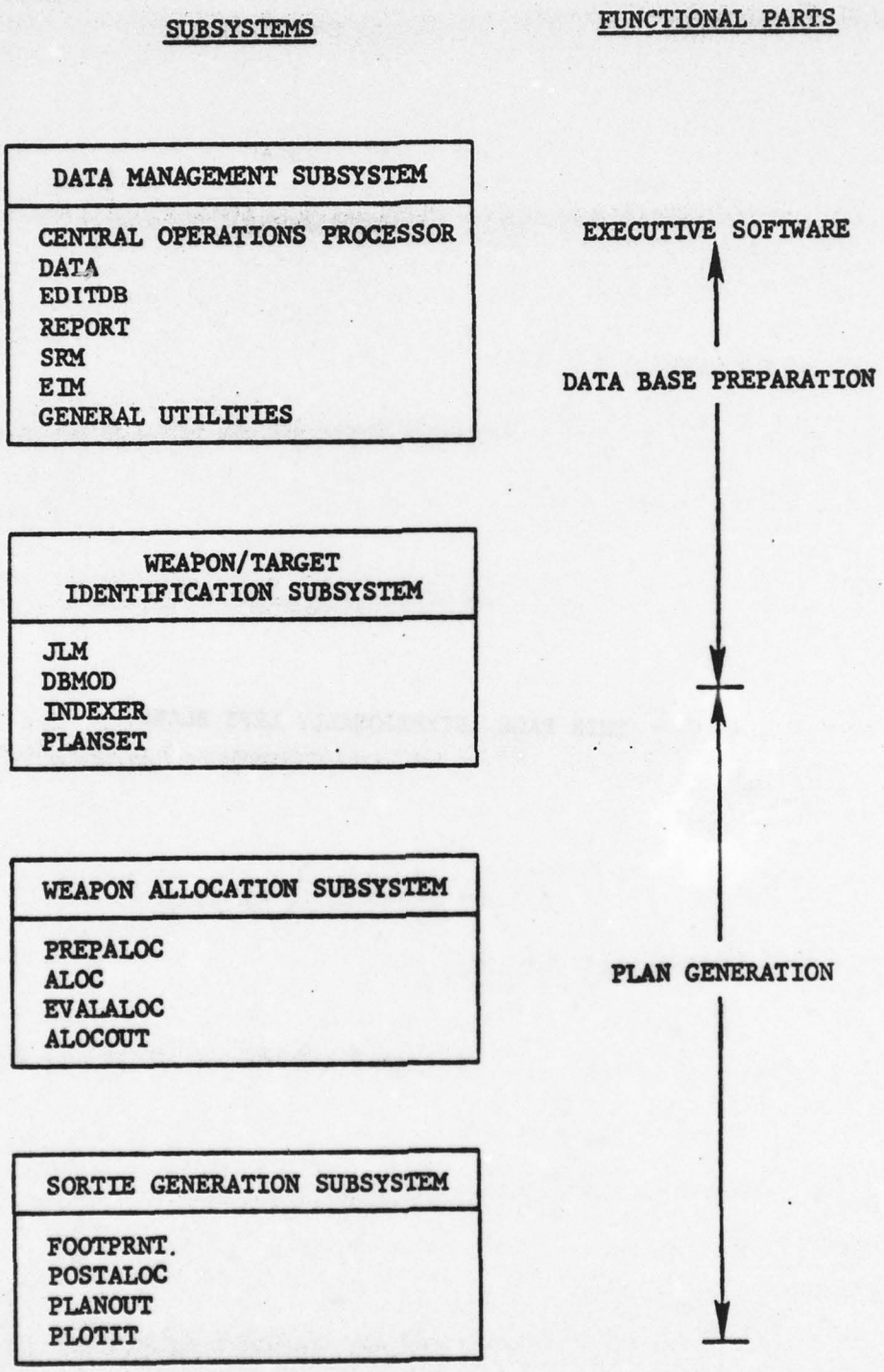


Figure 1. Major Subsystems of the QUICK System

SECTION 2. FOOTPRNT MODULE

2.1 General Purpose

Individual missile sortie records are created for missile weapon systems where weapon groups attack increment (ATTINC) equals attack posture (ATTPOS) or for all systems if ATTPOS equals zero. In addition FOOTPRNT generates individual reentry vehicle assignments for MIRV weapons. This is done by dividing the set of targets assigned to a MIRV group into subsets, each of which is assigned to one booster in the group. This division is constrained by the limitations of the MIRV systems so that the acceptable booster assignments lie within a geographic pattern known as a footprint.

2.2 Input

2.2.1 QUICK's MIRV Platform Representation. Excluding print requests, all inputs to FOOTPRNT define the shape of each MIRV platform to be modeled. Capability exists whereby the user may directly input equations necessary to represent each MIRV system. This generalization permits ease in introducing new platforms as they become operational in the future.

The form of the input equations are relatively unrestricted. However, their definitions must conform to QUICK's representation of a feasible footprint. Accordingly, QUICK views each MIRV platform as an initial energy source and, associated with that source, a rate of energy consumption. The energy source may be given in terms of pounds (lbs), as a fuel supply; velocity, as a momentum measure, or any other measure. By selecting targets as being lead targets (that is, the initial target assignment for a given footprint) QUICK constructs feasible footprints by collecting a subset of targets such that there is sufficient energy on the MIRV platform to traverse the targets. A feasible footprint, then is any collection of targets that may be hit within the energy constraints; no other limitations apply within the QUICK model.

The model requires four sets of equations which define footprint feasibility. (For purposes of discussion, assume fuel as being the energy source.) These sets are equations for:

a. Determining fuel load available for footprinting

b. Determining maximum booster range and range extension

c. Determining fuel consumption per mile of equivalent downrange distance (explained below)

d. Determining factors for converting crossrange and uprange distances to equivalent downrange distances.

Explanations of each set of equations follows.

2.2.1.1 Fuel Load. This represents the initial source level. It may, and usually is, simply set to a constant; say 1,000 lbs. Or, as in some cases, it equals a second order power series equation dependent on the range to the first target within the footprint being developed.

2.2.1.2 Maximum Booster Range. This equation limits the distance from the launch base to the first target within a potential footprint. If the first target is beyond the range of the booster an attempt will be made to use some of the "maneuvering fuel" to reach it. If Range Extension equations exist they will be used, otherwise the Fuel Consumption equations for a fully loaded platform will be used.

2.2.1.3 Fuel Consumptions. This set of equations relates the rate of fuel usage on an (equivalent) downrange distance basis. Downrange distances are measured along an axis which is parallel to the shorter of the two great circle routes from the launch point to the first target point to be hit; crossrange distances are measured along on axis which is perpendicular to this route. The uprange direction is defined to be parallel but oppositely directed to the downrange direction. All MIRV systems, to date, give fuel expenditures based on the number of reentry vehicles currently onboard. In terms of footprint construction, this implies one set of equations for reentry vehicle deployment at the first target; another set of equations for the second reentry vehicle deployment at the second target and so on.

2.2.1.4 Crossrange and Uprange Factors. The fuel consumption rates, given above, assume expenditures over a downrange distance. To compensate for target spacing other than downrange, use is made of the equivalent downrange distance (EDD) of a target. The major premise of this method is that all downrange, crossrange, and uprange distances can be converted into an equivalent downrange distance, EDD. The EDD is equal to the downrange distance that could be traversed by the payload if the same amount of energy were expended as would be required to traverse the distance under consideration. In practice, the EDD from point i to point j, may be expressed by the following relationship:

$$(EDD_{ij})^2 = \begin{cases} DOWN_{ij}^{\,2} + \left(\frac{DR}{CR}\right)^2 \left(CR_{ij}\right)^2 & \text{if j is downrange of i} \\ \left(\frac{DR}{UR}\right)^2 UR_{ij}^{\,2} + \left(\frac{DR}{CR}\right)^2 \left(CR_{ij}\right)^2 & \text{if j is uprange of i} \end{cases}$$

where:

$\frac{DR}{CR}$ = downrange-crossrange ratio as user supplied

$\frac{DR}{UR}$ = downrange-uprange ratio as user supplied

$DOWN_{ij}$ = downrange distance from i to j

CR_{ij} = crossrange distance from i to j

UR_{ij} = uprange distance from i to j

The next subsection explains how these sets of equations may be entered into the FOOTPRNT module.

2.2.2 Generalized FOOTPRNT Text English Command. The FOOTPRNT module is executed via verb FOOTPRNT followed by optional adverbs EQUATE, IF, REEQUATE, and ONPRINTS. Adverb EQUATE is used to define the sets of equations necessary for footprinting; IF states conditions when an equation is to be executed; adverb REEQUATE alters existing equations defined under previous executions of FOOTPRNT; ONPRINTS selects print requests.

2.2.2.1 The EQUATE and IF Adverbs. The EQUATE clause is used to create a new equation from scratch. The clause provides capability for naming equations to be developed and the linkage with the payload system associated with the MIRV. As explained above, the mathematical MIRV model requires representation of fuel (called FUELLOAD) up-to-down range ratio (called UPTODOWN) and the crossrange ratio (called CROSSTODOWN) as well as measures of fuel expenditures (called FUELRATE) and the maximum range the first reentry vehicle may be deployed (called MAXRANGE). The cost of extending the range of the booster can also be defined as RANGEXTEND, if desired.

EQUATE equation-label AS { UPTODOWN / CROSSTODOWN / FUELRATE / RANGEXTEND / FUELLOAD / MAXRANGE }

OF payload-table-name TO footprint formula

[IF if clause]

The "equation-label" is a user defined label for the equation to be developed. If the label equals any existing labels, the existing equation will be replaced. Following the label name is the name of the factor that the formulas will define and, next, is the name of the MIRV payload system. Finally the formula for the equation is input. This formula may contain any logical combination of QUICK attributes, constraints and operators plus the functions listed in table 1. The optional IF clause follows the formula in order to state certain conditions as to when the equation may be exercised. In particular, the form of equations differs according to azimuth. The IF clause informs the

Table 1. Footprint Formula Functions

MNEMOWIC	USE
ACOS	Arc-cosine: used as a function, i.e., ACOS (quantity)
ACOT	Arc-cotangent: used as a function
ASIN	Arc-sine: used as a function
ATAN	Arc-tangent: used as a function
AZIMUTH	Azimuth of the flight path of the involved weapon group and target; used as a constant
COS	Cosine: used as a function
COT	Cotangent: used as a function
EXP	Exponential: i.e., EXP(X) = e^X: used as a function
NUMRVS	Number of reentry vehicles remaining on the MIRV platform
RANGE	Great circle distance from weapon group to lead target: used as a constant
SIN	Sine: used as a function
TAN	Tangent: used as a function

module when the equations are to be calculated. An example of an EQUATE clause of a complex nature is:

```
EQUATE MMZCA AS CROSSTODOWN OF 'MM-II' TO

(5.3 + 1.2 * AZIMUTH) * EXP(2.1(3124 + SIN(AZIMUTH) -RANGE)/

3200)  IF AZIMUTH GREATER THAN 0 AND NUMRVS = 1
```

This equation (called MMZCA) defines CROSSTODOWN for situations when azimuth is greater than 0 and the number of onboard reentry vehicles = 1. Information concerning the number of reentry vehicles is obtained within the 'MM-II' payload table.

Table 2 presents a complete set of equations necessary to model a given MIRV system. All equations are power series expansions no greater than the second order. These forms of equations historically have been adequate for most of QUICK's MIRV representations. The example of table 2 shows a MIRV system that contains four reentry vehicles. Explanations of parameters have been cited above with the exception of the constants (BETA, PO, NO, A1O, UO, and so on) associated with each power series. Obviously, at execution time, the user must supply values for these constants rather than specifying their generic spellings. Since these forms of equations have been frequently used in the past a standard methodology of defining these constants from raw intelligence data has been formulated and is presented within appendix A of this manual.

The initial onboard fuel load is set to a constant (BETA). The range extension equations are given as straight lines dependent on the range from the weapon group to the target and the launch azimuth. The IF clause defines the azimuth dependency. The fuel consumption equations are of the second order dependent on range and the number of reentry vehicles remaining onboard at the time of deployment. Note that the same equation is used when either three or four reentry vehicles are onboard. Both of the ratios use straight line equations.

2.2.2.2 The REEQUATE Clause.

2.2.2.2.1 Equation Print. A print of each equation will be produced for each EQUATE (or REEQUATE) clause. An integral part of this print will be the enumeration of the "item-numbers" which are the discrete items (or steps) used by FOOTPRNT in computing each equation. By performing each "item-number" in the given sequential order, the final result is determined. Figure 3 gives the sequential number of equation determination and immediately below that number is the item to be executed. The series of executions are the exact steps required for solving the user input equations. The print is of importance if the user desires to change an existing equation. The subsection below details the method of altering equations in conjunction with the figure 3 print.

Table 2. Examplar Footprint Equations

```
(Initial fuel load)
        EQUATE FUELS17 AS FUELLOAD OF 'SS-17' TO BETA

        EQUATE MAXRPS17 AS RANGEXTEND OF 'SS-17' TO P0 + P1 * RANGE IF AZIMUTH > 0

        EQUATE MAXRWS17 AS RANGEXTEND OF 'SS-17' TO N0 + N1 * RANGE IF AZIMUTH < 0

(Fuel consumption)
        EQUATE RATE1S17 AS FUELRATE OF 'SS-17' TO A10 + (A11 + A12 * RANGE) * RANGE IF NUMRVS = 1

        EQUATE RATE2S17 AS FUELRATE OF 'SS-17' TO A20 + (A21 + A22 * RANGE) * RANGE IF NUMRVS = 2

        EQUATE RATE3S17 AS FUELRATE OF 'SS-17' TO A30 + (A31 + A32 * RANGE) * RANGE IF NUMRVS
                BETWEEN 3 AND 4

(Uprange ratio)
        EQUATE UPS17 AS UPTODOWN OF 'SS-17' TO U0 + U1 * RANGE

(Crossrange ratio)
        EQUATE CRS17 AS CROSSTODOWN OF 'SS-17' TO C0 + C1 * RANGE

(Maximum booster range)
        EQUATE MAXRGEP AS MAXRANGE IF 'SS-17' TO R0 + R1 * SIN (AZIMUTH) IF AZIMUTH > 0

        EQUATE MAXGEN AS MAXRANGE OF 'SS-17' TO RN0 + RN1 * SIN (AZIMUTH) IF AZIMUTH < 0
```

LABEL: MM3CA
FACTOR: CROSSTODOWN
WEAPON: MM-III

FORMULA

Number:	1	2	3	4	5	6	7	8	9	10
Item:	(	5.3	+	1.2	*	AZIMUTH	)			
Number:	11	12	13	14	15	16	17	18	19	20
Item:	2.1	*	(	3124	+	(	123	*	SIN	(
Number:	21	22	23	24	25	26	27	28	29	30
Item:	AZIMUTH	)	-	RANGE	)	/	3200	)		

IF CLAUSE

AZIMUTH GREATER 0 AND NUMRVS EQUAL 1

Figure 3. Example of Equation Print

2.2.2.2.2 The REEQUATE Adverb. This optional clause creates a new equation (label-1) from an old equation (label-2). The general form is:

REEQUATE equation-label-1 AS { MAXRANGE / FUELLOAD / UPTODOWN / CROSSTODOWN / FUELRATE / RANGEXTEND } OF

payload-table-name LIKE equation-label-2

TO { AFTER / REPLACE / REMOVE } item-number [inserted items]

{ AFTER / REPLACE / REMOVE } . . . . [IF if clause]

If the two labels are the same, the new equation replaces the old. The clause consists largely of phrases begun by one of the special words AFTER, REPLACE or, REMOVE. Each of these words is followed by the "item-number" involved which is found in the equation print. The AFTER special word implies that all items following the item-number up to the next special word are to be inserted after the named item. The REPLACE special word implies that all items following the item-number up to the next special word are to be inserted in place of the named item. The REMOVE special word implies that the named item should be removed. Any IF clause which follows will replace the old IF clause. An example of a REEQUATE clause is:

```
REEQUATE MM3CB LIKE MM3CA REPLACE 15 MINUS IF AZIMUTH LESS
THAN 0 AND NUMRVS = 1
```

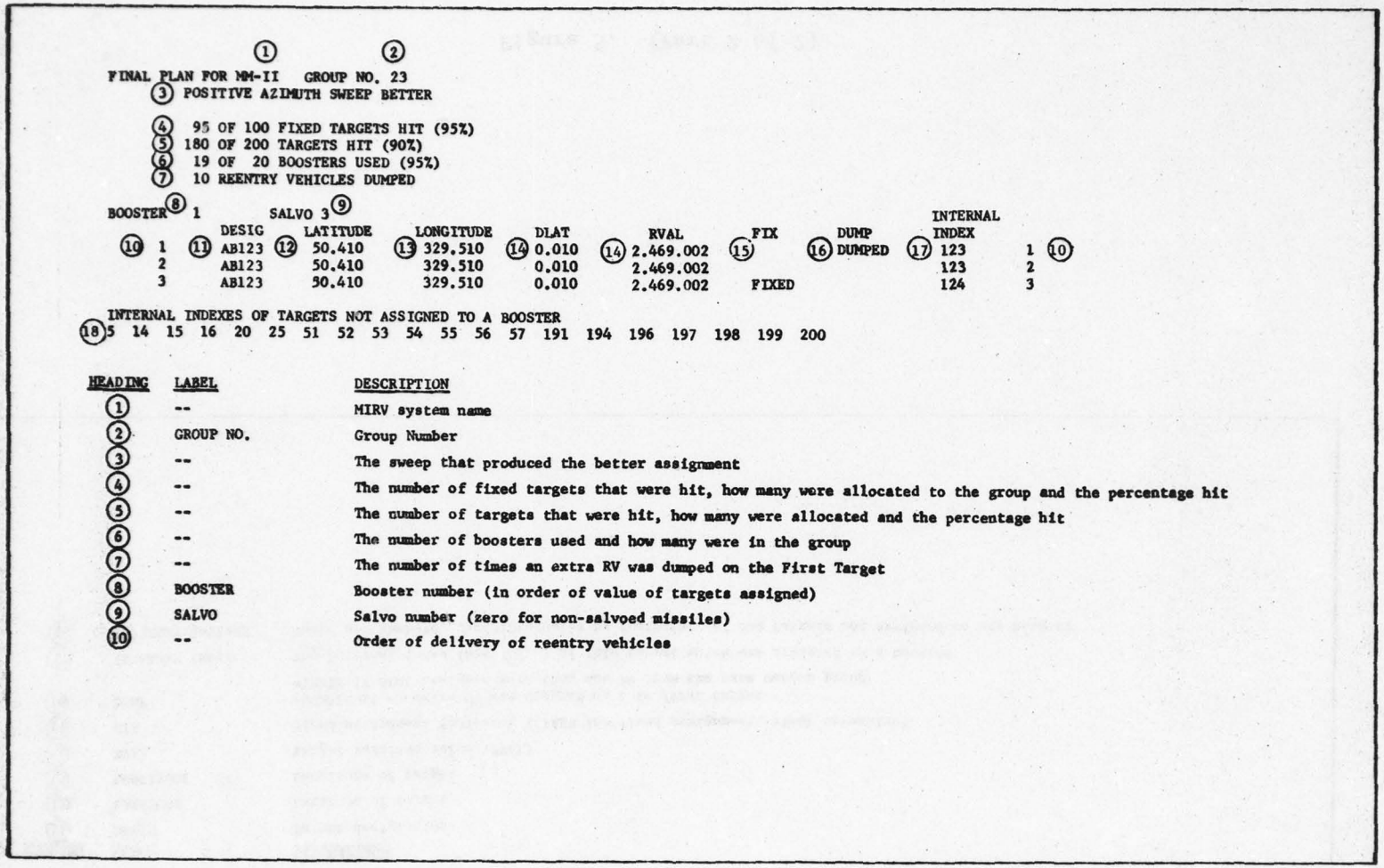
2.2.2.3 The ONPRINTS Adverb. This optional clause controls debug prints and has the form:

ONPRINTS group-number [* pass] [/ internal-pass]

[(lower internal index - high internal index)]

[group-number . . .]

Print options may be selected by weapon group number and further controlled by pass (preceded by an asterisk), internal pass (preceded by a slash), and a range of internal indexes (enclosed in parenthesis). If any of the operators are missing, no print control exists for that operator. Definitions of controlling parameters are:



HEADING	LABEL	DESCRIPTION
(1)	--	MIRV system name
(2)	GROUP NO.	Group Number
(3)	--	The sweep that produced the better assignment
(4)	--	The number of fixed targets that were hit, how many were allocated to the group and the percentage hit
(5)	--	The number of targets that were hit, how many were allocated and the percentage hit
(6)	--	The number of boosters used and how many were in the group
(7)	--	The number of times an extra RV was dumped on the First Target
(8)	BOOSTER	Booster number (in order of value of targets assigned)
(9)	SALVO	Salvo number (zero for non-salvoed missiles)
(10)	--	Order of delivery of reentry vehicles

Figure 5. Final Plan Print (Part 1 of 2)

HEADING	LABEL	DESCRIPTION
(11)	DESIG	Target designation
(12)	LATITUDE	Latitude of target
(13)	LONGITUDE	Longitude of target
(14)	RVAL	Target relative value (RVAL)
(15)	FIX	Fixed assignment indicator (FIXED for fixed assignment; blank otherwise)
(16)	DUMP	=DUMPED if an extra RV was dropped on this first target =INDEX if ALOC assigned more than one RV from the same weapon group
(17)	INTERNAL INDEX	The internal index (see (18)) of this target which was assigned to a booster
(18)	INTERNAL INDEXES	These are numbers, used internally by footprint, of the targets not assigned to any booster

Figure 5. (Part 2 of 2)

```
INTERNAL INDEX  125 (1)
 ELLIPSE (2) 1  (3) OPTIMAL SOLUTION FAILED
 ELLIPSE   2      TOO MANY PASSES/BRANCHES
 ELLIPSE   3      CHOSEN
```

HEADING	LABEL	DESCRIPTION
(1)	INTERNAL INDEX	The internal index number for the first target whose ellipses are being described
(2)	ELLIPSE	The Ellipse number
(3)	--	What happened with the ellipse after being passed to PATHFIND OPTIMAL 'OPTIMAL SOLUTION FAILED' - The best sequence could not meet fuel constraints 'TOO MANY PASSES/BRANCHES' - Due to the relative positions of the targets an inordinate amount of time and care being used to find a solution 'CHOSEN' - This ellipse was feasible

Figure 8. Results of Individual Target Processing

ONPRINTS CLAUSE ERROR IN FOOTPRINT
UNABLE TO FIND (A6) NUMBER
ATTEMPTING TO RECOVER

Could not find the Group, Sweep, Pass, Low Target or High Target in the print request. Missing *, /, (, or -.

MISSING (A10) AT (I4)

TOAS found a missing operator, variable or parenthesis at that location in the equation.

TOO MANY (A6) PARENTHESIS

Unbalanced left or right parenthesis

UNKNOWN EQUATION TYPE (A12)

Equation type does not describe a footprint constraint (UPTODOWN, CROSSTODOWN, FUELLOAD, FUELRATE, MAXRANGE, or RANGEXTEND).

(013) IS ILLEGAL OR MISPLACED ADVERB

Check spelling of input adverbs to FOOTPRNT

REEQUATE ERROR -- EQUATION NAMED (A,12) DOES NOT EXIST THE FOLLOWING EQUATIONS ARE IN THE DATA BASE ((10A12)

Attempting to reequate using a nonexistent equation. Only the equations in the list exist and can be used.

EQUATION NAMED (A12) ALREADY EXIST UNDER PAYTBLNM (A6)

There already is an equation with this name under another payload.

LIKE PHRASE MISSING

Check syntax reequate needs an equation to reequate.

ITEM (10I12)
ERROR (10I12)

These items are listed with the equation print and will pinpoint where the error occurred in the equation.

Figure 9. FOOTPRNT Error Messages

SECTION 3. POSTALOC MODULE

3.1 General Purpose

The purpose of module POSTALOC is the generation of detailed sortie specifications for bomber vehicles, and their weapons, based on the near-optimal weapon allocation received from the Weapon Allocation subsystem and consistent with user input weapon systems specifications and operational constraints. Module FOOTPRNT generates sorties for missiles systems in either single or multi-loads.

The main operation performed in module POSTALOC is the expanding of the allocation that was developed in module ALOC into a plan of sufficient detail to serve as input for module PLANOUT. The first step in the development of a flight plan is the combining of several strikes into a single feasible sortie. In addition, with each sortie are associated a launch base and a recovery base. Also a flight profile is selected which specifies where in the flight plan low attitude capability is to be utilized.

3.2 Input

The general form of the text English command for POSTALOC execution is:

POSTALOC SETTING { TARFAC / MUSTREC / VUNLOAD } = value [GRP, RATIO] =

(value , value) ,[(value , value) . . .]

[ONPRINTS print-option [(first-sortie] [- last-sortie]]

[* pass] [/ corridor] [, weapon group]

[print-option . . .] . . .

3.2.1 The SETTING Adverb. This adverb introduces a clause whereby parameters necessary for POSTALOC's execution may be defined. Definition of the processing parameters are:

TARFAC - A fraction by which the local attrition parameter will be multiplied

MUSTREC -- Used to specify the required recovery of the bombers. A value of zero implies the possibility of ditching aircraft; a value of one means all aircraft must be recovered

VUNLOAD - Significance parameter for final alterations in sortie. The significance parameter is the fractional change in

sortie value which must occur before the module will either have the bomber attack previously omitted targets with ASMs or will remove unprofitable bombs from the sortie plan. Recommended settings are values from .002 - .005.

GRP, RATIO - RATIO of recovery value to total sortie for bombers in GRP. An entry for RATIO with GROUP set to 251 causes the indicated ratio to pertain to all unspecified weapon groups. Up to 250 sets of data (each separated by a blank) may be entered.

3.2.2 The ONPRINTS Adverb. This clause controls the user print requests and the frequency each report is to print. For any given execution of POSTALOC, up to 60 individual print requests may be honored. Each print request number indicates both the print required and the point during processing at which that print is to be output. For example, print 1 displays the contents of common /SORTYTGT/. If that print is to be output by subroutine SORTOPT, the user specifies print request number 31. If it is to be output by subroutine EVALB, it is effected by print request numbers 103, 104, 105, 106, 107, or 108; the one to be chosen depends on at what point within EVALB the print is to be issued. A list of print request numbers is given in table 3.

A print request number that stands by itself will produce output for all occurrences of the request. Provision is included to control the frequency of the prints by specifying sortie numbers, pass number, corridor index, and/or weapon group. A special operator (see example above of text input) introduces separate controls. If an operator is missing, default conditions occurs. Consider, an example:

ONPRINTS 75 11 (2-9) * 1/4, 10 18 (-5) 10,5

Print request 75 occurs with no restriction. Print request 11 is printed for weapon group 10, corridor 4, pass 1 and sortie between 2 and 9. Print 18 prints the first 5 sorties for all weapon groups and corridors. Print 10 will occur only for weapon group 5. Note that individual requests are separated by at least one space.

3.3 Output

3.3.1 Standard. The only standard output gives the number of sorties generated; the message is:

TOTAL NUMBER OF SORTIES = (I)

where I is the number of sorties.

All remaining prints must be user requested.

```
PRINT NO.  7 FROM  PRERAID  (1)
PRINT REQUESTED FROM
   POSTALT   POSTALOC    PRERAID
```

HEADING	LABEL	DESCRIPTION
(1)	---	The rightmost name is the subroutine from which the print was requested. Each subroutine in the list was called by the preceding subroutine printed.

Figure 26. Print Option 18: The Contents of Common /DEBUG/

PRINT NO. 76 FROM OUTSRT

OUTSRT

(1) IOUTSRT = 4 MYGROUP = 1 MYCORR = 7 INDVEH = 2 JREF = 5 JDPEN = 6 KPAYLOAD = 8 LNCHBASE = 2136

(2) ITYP = 4 BASELAT = 40.5 BASELONG = 91.5 NMAP = 6 DSTLOW = 0.0 105.4 515.3

(3) SPDLO = 480.0 SPDHI = 510.0 RANGE = 4800.0 RANGREF = 6300.0 DELAY = 0.00 IREG = 1 IALERT = 1

	(4) MAPTYPE	(5) OBLAT	(6) OBLONG	(7) DLAT	(8) DLONG	(9) IOBJECT	DESIG	TSK	CL	(13) F	(14) ATTROUT	(15) SURVOUT
1	DOGLEG	73.0	275.0	0.000	0.000	7	(10) 00000	(11) 00	(12) 00	00	0.0006	1.0000
2	DROPBOMB	49.7	286.7	0.000	0.000	2802	AD672	AD	UR	00	0.4000	0.8284
3	DROPBOMB	45.1	294.0	0.000	0.000	2595	PF111	PF	UR	00	0.0000	0.7892
4	DROPBOMB	41.2	290.7	0.000	0.000	2171	AB157	AB	UR	00	0.0000	0.7069
5	DROPBOMB	38.5	293.2	0.000	0.000	2414	AD446	AD	UR	00	0.0000	0.6271
6	DEPEN	0.0	0.0	0.000	0.000	6	00000	00	00	00	0.0000	0.5359

HEADING	LABEL	DESCRIPTION
	IOUTSRT	Sortie index number
	MYGROUP	Group index
	MYCORR	Corridor index
	INDVEH	Index of vehicle on base
(1)	JREF	Refuel index
	JDPEN	Depenetration index
	KPAYLOAD	Sortie sequence number
	LNCHBASE	Base index

Figure 27. Print Option 20: The Contents of Common /OUTSRT/ (Part 1 of 3)

4.2.2.1 The CCARD Clause. This clause is used to change strikes within existing sorties. The general form is (see table 5):

CCARD sortie number, desig1, desig2, [, hob, dec, rac, tchange, asm] [* caloff, dlatoff, dlongoff]

The first three parameters specify the action to be performed and must be entered for each adverb. The "sortie number" indicates which sortie is to be changed. Various modes of entries for the target DESIG's are:

- o "desig1" will be dropped when "desig2" is blank (that is, a comma appears in lieu of a target DESIG)
- o Strikes are replaced when both "desig1" and "desig2" are non-blank and not equal. "desig 1" will be replaced by "desig2" (and if a complex, it must be the representative target)
- o When "desig1" equals "desig2", elements of the strike are changed. This allows a change in down time, height of burst, offset characteristics or depenetration corridor.

The user also has the option to substitute a numeric value for "desig1." This value is the sequential count of the strike to be changed. Thus if the strike is third in the order of the original sortie, the user may enter the value 3 in lieu of a target DESIG. This option allows the user to select among multiple occurrences of the same DESIG.

Following "desig2" parameters that may be changed are optional. These options come in two collections. In each collection the individual parameters may be omitted but their preceding commas must still appear. The first collection contains the options of changing the height-of-burst, specifying a new depenetration corridor, suppressing recalculation of attrition, and altering the flight time. The second collection permits the definition of target offset. This collection must be introduced by the asterisk (*) operator. Also, if no options are used from the first collection default commas are not required. Similar logic applies if the fourth, or third and fourth, or second, third or fourth options are not employed.

If any of the change fields (tchange, hob, etc.) are omitted and the target is not changed, the current sortie values are used. When they are omitted for a new target, default values will be assigned. The defaults will use normal times derived from distances, hob as specified in module PREPALOC and zero offsets.

For time change requests, the time of the bomb or ASM hit will be changed by the amount specified. In the case of missiles the downtime will be changed but there will be no change to launch times. If the target is new, then time change specifies the change to be applied to the calculated time.

The "tchange", "dlatoff" and "dlongoff" are assigned quantities. Direction is positive (+) north or west and negative (-) south and east. Offsets are always computed from the data base locations of target "desig2".

Table 5. CCARD Clause

LABEL	RANGE	DESCRIPTION
sortie number	N/A	Sortie sequential number*
desig1	(DESIG** or comma)	DESIG1 reference*
desig2	(DESIG** or comma)	DESIG2 reference*
hob	(A, G or comma)	Height of burst option
dec	(1-30 or comma)	Depenetration corridor change
rac	(N or comma)	Attrition recalculation
tchange	(Numeric or comma)	Time of flight change (minutes)
asm	ASM	ASM indicator. If absent, strike is non-ASM
caloff***	(C or comma)	If "C" follows the asterisk operator, dlatoff and dlongoff represents the actual ground zero. Otherwise, dlatoff and dlongoff represents offsets from the target
dlatoff	(0-180 or comma)	Dependent on 'caloff'. In either case units are decimal degrees
dlongoff	(0-360 or comma)	Same as 'dlatoff', but for longitude

* Items mandatory.

** Any data base target DESIG. If blank (see text) insert a comma.

*** 'caloff' must be introduced by the asterisk operator.

There are two methods of defining offsets: (1) direct offset entry if "caloff" does not equal "C"; and entry of actual ground zero if "caloff" equals "C". Note that an entry of 0 sets offsets to zero.

New attritions will always be calculated unless parameter "rac" equals "N".

Some examples of the CCARD are:

```
CCARD 14,BB123
CCARD 15,AA432,AA432,G,,,275
CCARD 16,AA777,AA666,,2*,-.01,.003
```

The first example shows that for sortie number 14 the strike on BB123 is eliminated. In the second example, sortie number 15's strike on AA432 has its height of burst changed to ground and its time of flight changed to 275 minutes.

The third example shows the AA777 for sortie number 16 replaced by a strike on AA666, depenetration using corridor 2 and appropriate offsets.

4.2.2.2 The ICARD Clause. This clause is used to insert a new strike in a sortie. The general form of the clause is:

ICARD sortie number , [desig1] , desig2 [, hob , dec , rac , tchange, asm] [* caloff , dlatoff , dlongoff]

"desig2" will be inserted after "desig1." If "desig1" is omitted (two commas after the sortie number), "desig2" will become the first target of the sortie. The discussion of optional information for the CCARD clause on new targets applies to "desig2."

The user may substitute a strike number for "desig1." If a value of zero (0) is entered, the new strike is inserted prior to the current first strike.

This option is used for air delivered ordnance and MIRV capable missiles. In the case of bombers it may be used in conjunction with CCARD clauses to change the order of strikes on a given sortie. However, if the program determines a switch in the order of strikes is not mathematically optimal, the changes will not be made.

An example is:

```
ICARD  15,AA432,BB123,,2
```

A strike on BB123 will occur after the strike AA432 and the depenetration corridor is changed to 2.

4.2.2.3 The ACARD Clause. This clause is used to add non-MIRV missile sorties. This clause has the general form:

ACARD desig, hob, group, siteind, [, isal, tlaun]
[* caloff, dlatoff, dlongoff]

Generally, all comments concerning the CCARD clause applies to the ACARD clause. Note, that no sequence number is supplied; PLANOUT will supply the correct value. "group" is the weapon group number containing the launch base. "siteind" is the INDEXNO of the site from the weapon group. If no launch time (tlaun) is given, the program sets this time according to salvo number and launch interval. If simultaneous launches are desired, salvo numbers ("isal") must be repeated for each round which is to be salvoed; i.e., if SIMLAUNCH is i, the missile salvo number j would be repeated i times in order to have i weapons launch at (j-i)*(launch interval). In the case of non-salvoed missiles and bombers, launch will occur at the earliest feasible time as determined by alert status, CORMSL, etc. If a launch time is specified, that value is added to the delay times discussed above.

An example of an ACARD clause:

```
ACARD  BB123,G,7,1374,,14*,-.01,.12
```

This would cause a sortie to be added allocating group 7 from 1374 to target with DESIG BB123. A ground burst is desired offset by -.01 degrees latitude and .12 degrees longitude. The launch is to take place 14 minutes after h-hour.

4.2.2.4 General Sortie Change Comments. Some changes will necessitate the recalculation of the survival probability, attrition, and available low altitude range of a mission. Such changes are the addition or deletion of targets from the original sortie. Other changes, such as changing the time between targets should, strictly speaking, affect the available low altitude range and survival probability also; however, if the adjustments are small enough the user may not want the whole sortie disrupted by these calculations. Thus, on time changes the user will be able to select whether recalculation is desired. The default will be to recalculate the basic parameters. Of course, if the user opts for recalculation at any change on a sortie, all events will be affected.

If a decrease in time has been input between strikes, the effect is to actually increase the speed of an aircraft. The actual speed will be calculated by dividing the distance by time between the two points and if this increase is greater than a data set percentage of the aircraft speed it will be considered to be an error. The time will be set to the maximum allowed time differential and an error message printed. The time error messages round down to the whole minute.

FIELD	CARD COLUMNS	LABEL	RANGE	DESCRIPTION
1	1		S	STRIKE Card indicator
2	2		1-9	Command/function code
3	3-7	SSSN	1-99999	Sortie Sequence Number
4	8-10	STSK	3 Numeric	SIOP Table Number
5	11-12	SDTM	01-31	Day (Of weapon detonation)
	13-14		00-23	Hour (Of weapon detonation)
	15-16		00-59	Minute (Of weapon detonation)
	17-18		00-59	Second (Of weapon detonation)
6	19-24	SLAT	DDMMSS	DD=degrees, MM=minutes, SS=seconds (Latitude of desired ground zero (DGZ))
7	25		N or S	North or South
8	26-32	SLON	DDDMMSS	DDD=degrees, MM=minutes, SS=seconds (Longitude of DGZ)
9	33		E or W	East or West
10	34-38	SDES	2 Alpha, 3 Numeric	Target designator code
11	39-40	SPLS	-1-99	PLS-Probability* of pre-launch survival
12	41-42	SPTP	-1-99	PTP-Penetration probability*
13	43-44	SWSR	-1-99	WSR-Weapon system reliability*
14	45	SREG	1-9	Region cod
14	45	SREG	1-9	Regiod code

*A printed probability of -1 implies a value of 100.

Figure 42. STRIKE Tape Format (Part 1 of 3)

FIELD	CARD COLUMNS	LABEL	RANGE	DESCRIPTION
15	46-48	SFYR	000-999	Fission/yield ratio
16	49-53	SYLD	00001-99999	Yield (kilotons)
17	54-57	SHOB	0000-9999	Height of burst (tens of feet)
18	58-61	SCEP	0000-9999	CEP in time of feet
19	62	SATT	0-9	Attack increment
20	63-64	SCLO	2 Alpha	Country code for target locations
21	65-66	SCOW	2 Alpha	Country code for target owner
22	67-68	SPAT	-1-99	Attritions probability* (i.e., percent change of attrition)
23	69	SSEQ	0-9	Sequential Washed Number when operation code is 7, 10, or 11. Otherwise, blank.
24	70-71	SPTC	01-99	Plane type code
25	72-73	SWTC	01-99	Weapon type code
26	74-77	SUNT	0001-9999	Unit number (INDEXNO of launch base)
27	78-79		00-99	Sortie number
28	80			Blank
29	81-83	SGNM	001-999	Group number
30	84-89	SWNM	6 Alpha	Weapon type name
31	90-95	SLNM	6 Alpha	Launch site name

*A printed probability of -1 implies a value of 100.

Figure 42. (Part 2 of 3)

FIELD	CARD COLUMNS	LABEL	RANGE	DESCRIPTION
32	96-101	SLLT	DDMMSS	DD=degrees, MM=minutes, SS=seconds — Latitude of launch base
33	102		N or S	North or South
34	103-109	SLLN	DDDMMSS	DDD=degrees, MM=minutes, SS=seconds — Longitude of launch base
35	110		E or W	East or West
36	111-112	SLTM	00-23	Hours — Time of Launch
	113-114		00-59	Minutes — Time of Launch
	115-116		00-59	Seconds — Time of Launch
37	117-119	SAZM	000-999	Back Azimuth

Figure 42. (Part 3 of 3)

SORTIE SPECIFICATION: "A" CARD FORMAT

FIELD	CARD COLUMNS	LABEL	RANGE	DESCRIPTION
1	1		A	A-card indicator
2	2-4	ANNUM	001-999	A-card number
3	5-8	AUNT	0001-9999	Unit number
4	9-10	ASNO	01-99	Sortie number
5	11			Blank
6	12-14	APTC	001-999	Plane type code
7	15-17			Blank
8	18		0	
9	19-22	AREF		Reference time (launch time in hours and minutes)
10	23		1	Time reference (1= launch)
11	24-30		0000000	
12	31-35			Blank
13	36-37	ALCC	2 Alpha	Country code of launch base
14	39-40	AFUN	1-9	SAGA Vehicle Function Code 1=ICBM 2=IRBM 3=MRBM 5=SSB/SSBN 6=SSGN 7=LRA 0, 4, 8, 9 not used
16	41		0-9	Non-Executed Force Code

Figure 43. STRIKE Format (A and B Cards) (Part 1 of 4)

FIELD	CARD COLUMNS	LABEL	RANGE	DESCRIPTION
17	42			Blank
18	43-48	ATNN	6 Alpha	Weapon type name
19	49			Blank
20	50-55	ABNO	6 Alpha	Launch base BE Number
21	56-80			Blank

SORTIE SPECIFICATION: "B" CARD FORMAT

FIELD	CARD COLUMNS	LABEL	RANGE	DESCRIPTION
1	1		B	B-card indicator
2	2-4	BNUM	001-999	B-card number
3	5-8	BUNT	0001-9999	Unit number
4	9-10	BSNO	01-99	Sortie number
5	11-12	BFLN	01-99	Flight leg number
6	13-14	BEUT	01-14	Event or operation type indicator
			1	Takeoff
			2	Aerial refueling
			3-4	Dogleg
			6	ASM launch
			7	ASM on target
			8	Decoy release
			9	Decoy impact
			10	Missile or bomb on target
			11	MIRV on target
			13	Recovery if bomber; splash if air breathing missile
			14	Slash (ballistic missile)

Figure 43. (Part 2 of 4)

FIELD	CARD COLUMNS	LABEL	RANGE	DESCRIPTION
7	15-19	BLOC		Location identifier for given operation
				1=Base index 2=Area number 6="1" 7=Target DESIG code 8 or 9="1" 10 or 11=Target DESIG code 13=Recovery base INDEXNO if bomber
8	20-25	BLAT	DDMMSS	Latitude at end of leg is degrees, minutes and seconds
9	26-33	BLON	DDDMMSSX	Longitude at end of leg is degrees, minutes, seconds, East or West
10	34	BMOD		Mode of operation
			1	High altitude
			4	Low altitude
11	35		0	
12	36-41	BTIM	HHMMSS	Time of event in hours, minutes and seconds
13	42		S	Southern latitude indicator (if latitude is North-blank)
14	43-44	BSEQ	01-99	Sequential index within unit number
15	45-46			Blank
16	47-49	BAZI	000-360	Launch/Back azimuth in degrees
17	50	BECM		ECM status
			0	Off
			1	On

Figure 43. (Part 3 of 4)

FIELD	CARD COLUMNS	LABEL	RANGE	DESCRIPTION
18	51		0	
19	52-53	BWAR	01-99	Warhead type
20	54	BCRA		Height of burst 0=ground 1=air
21	55		0	
22	56-58	BPTC	001-999	Plane type code
23	59-60	BTCC	2 Alpha	Country code of target location
24	61	BRFC	1-9	Region code
25	62-64	BTSK	000-999	SIOP Table Number
26	65-68	BHOB	0000-9999	Height of burst (tens of feet)
27	69-73	BYLD	00001-99999	Yield (kilotons)
28	74-77	BCEP	0000-9999	CEP (tens of feet)
29	78-79	BCOW	2 Alpha	Country code for target owners
30	80	BATT	0-9	Attack increment

Figure 43. (Part 4 of 4)

4.3 Output

The output of PLANOUT can also be divided into three subsets relating to the three functions.

4.3.1 Sortie Completion Output. The output of the sortie completion function consists of additions to the integrated data base, in the form of additional sortie events and tanker sorties, and printed output. The printed output may be divided into four categories:

- o Standard output, which is printed regardless of the print option selected
- o Frequently used optional print -- 3, 10, 11 and 12 -- which are detailed bomber, missile and tanker plans, and the tanker allocation table
- o Debug print options
- o Error messages

4.3.1.1 Standard Output. First a list appears of the print options selected titling the list SNAP REQUESTS and putting appropriate headings on each column. Next, the input information on missile timing lines and CORMSLs is printed (see figure 44). A list of tanker bases is printed giving, for each base, the corresponding latitude (TKRLAT), longitude (TKRLONG), and tanker range (TRANGE), as shown in figure 45.

There are three printouts which give information used by PLNTPLAN's subroutine VAM. VAM applies Vogel's Approximation Method to the transportation problem of assigning available tankers to refuel areas where automatic tanker allocation is to be performed. These prints are output mainly for use by QUICK system programmers. The prints are:

a. The COST matrix, giving the contents of the FORTRAN array by the same name. Row i refers to tanker base i; column j to refuel area j. The entry in COST (i, j) is the distance between tanker base i and refuel area j. The matrix is printed up to 20 columns to a page.

b. The SOURCE/SINK table, printing for each integer i:

SOURCE(I) = N, where N is the number of tankers available for automatic allocation at tanker base I
SINK(I) = M, where M is the number of bombers which have been assigned to refuel at refuel area I

c. The VAM solution, showing the elements of the X(i, j) matrix which constitute the final feasible solution to the transportation problems. Again, i = the tanker base number, and j = the refuel area number. The value for X(i, j) = the number

HEADING	LABEL	DESCRIPTION
⑧	I, REL(I)	I = weapon type REL(I) = reliability of weapon type I
⑨	I, IHWTYPE(I)	I = weapon type IHWTYPE = type name for weapon type I
⑩	I,PGTYPE(I)	I = weapon group number PGTYPE(I) = type index for weapon group I
⑪	I, SBL(I)	I = weapon group number SBL(I) = survival-before-launch probability for weapon group I

Figure 60. (Part 3 of 3)

1 NO ADVERBS FOR PLANOUT
The PLANOUT verb must have at least one clause

2 ERROR IN ONPRINTS CLAUSE
Check syntax and print option limits

3 ERROR IN MISTME CLAUSE
Check clause for errors in data input order

4 ERROR IN MSLCOR CLAUSE
Check clause for errors in order of data input and validity of type names

5 ***** INSUFFICIENT TANKER RANGE **********
NEW REFUEL POINT CALCULATED
BASE AT (2F6.1) ENTRY AT (2F6.1) BUDDY REFUEL AT (2F6.1)
CLOSEST TANKER BASE AT (2F6.1) NEW REFUEL POINT AT (2F6.1)
The buddy refuel point calculated for a bomber is not within range of any tanker base. A new refuel point is calculated by interpolation such that it will be within range of the nearest tanker base. This does not indicate an error. Values are latitude/longitude pairs.

6 NO.ASMS FOR PAYLOAD (I4)
An ASM launch is assigned to a bomber which has none.
Value is index number of appropriate payload table

7 NEGATIVE GOLOW2 EXTENDS TO END OF SORTIE
Input go-low information is wrong. Further processing of the plan is halted and the next plan is read. Examine plan from POSTALOC.

8 NO EVENTS AFTER CORRIDOR ORIGIN
Degenerate input plan. Further processing of the bomber plan is halted and the next plan is read. Examine plan from POSTALOC.

9 NUMBER OF DECOY LAUNCHES EXCEEDS CAPACITY OF DECOY ALLOCATION
Sufficient decoys are available to launch more than six at each possible launch point. No further decoys are allocated. This does not indicate an error.

10 ***** PLAN TOO LARGE *****
There are too many lines in the plan for print request 3 to handle. Processing continues.

Figure 61. Sortie Completion Error Messages (Part 1 of 2)

11 PRINT DELETED--EXCEEDS 20 LINES
A print 7 has been requested (precorridor legs), but the print 7 coding cannot handle more than 20 lines. Processing continues.

Figure 61. (Part 2 of 2)

1 ERROR. RANGE LIMITS EXCEEDED. MAX RANGE = (F7.1) CALCULATE RANGE = (F7.1) SORTIE SEQUENCE = (I5)

For the given sortie sequence number, a missile or bomber is asked to exceed its range. May occur on an ACARD or due to a target change (CCARD) or addition (ICARD).

2 TIME CHANGE TOO LARGE. TIME CHANGED TO MAX OF (I5) MINUTES SORTIE SEQUENCE = (I5)

A target time change request is too large; time is reset to maximum.

3 THE FOLLOWING (A5) CLAUSE HAS (A30) (I3) (A5) (A80)

Error in a sortie change clause

Field 1 contains either ACARD, CCARD or ICARD
Field 2 contains one of the following codes

a.	NO SORTIE NUMBER	- Sortie identifier missing
b.	NO DESIG	- ACARD has no target DESIG
c.	AN INVALID DESIG	- ACARD has non-existant DESIG
d.	AN INAPPROPRIATE DESIG	- ACARD has a non-lead or non-target list DESIG
e.	A MISSING COMMA	- Syntax error
f.	THE WRONG SYNTAX	- Syntax error
g.	NO GROUP NUMBER	- ACARD has no group number
h.	AN INVALID GROUP NUMBER	- Group number does not exist or is inappropriate
i.	NO BASE INDEX NUMBER	- ACARD base identifier missing
j.	AN IMPROPER OFFSET SYNTAX	- Syntax error
k.	AN INVALID MISSILE RANGE	- Target out of range or within missing range
l.	AN INVALID SORTIE NUMBER	- Sortie number does not exist
m.	AN INVALID FIRST DESIG	- Value for "desig1" invalid, sortie count wrong or DESIG does not exist
n.	AN INVALID SECOND DESIG	- Value for "desig2" does not exist
o.	AN IMPROPER OPTION SYNTAX	- Syntax error
p.	AN INVALID HOB	- Value entered for "hob" not A or G

Figure 62. Sortie Change Error Messages (Part 1 of 2)

q.	AN INVALID CORRIDOR NUMBER	- Value entered for "dec" out of range
r.	AN INVALID OPTION CODE	- Value entered for "rac" not valid
s.	AN INVALID TIME CHANGE	- Value for change not numeric
t.	AN INAPPROPRIATE FIRST DESIG	- Value given for "desig1" not lead target or not in target list
u.	AN INVALID OLD ASSIGNMENT	- Value given for "desig1" not a target in sortie
v.	AN INAPPROPRIATE SECOND DESIG	- Value for "desig2" not lead target or not in target list
w.	AN INVALID ASM CODE	- Value for "asm" not ASM

Field 3 contains the sequential count of the clause containing the error. This count includes all clauses not just sortie change clauses.

Field 4 and 5 contain a reconstruction of the clause

Figure 62. (Part 2 of 2)

OFFENSIVE SYSTEM TABLE

① PLAN GEN TYPE NO.	② TYPE NAME	③ PLANE TYPE	④ PAYLOAD CONFIGURATION NOBOMB1	⑤ IWHD1	⑥ NOBOMB2	⑦ IWHD2	⑧ NASM	⑨ IASM	⑩ NUMBER
2	B-58	17	1	3	3	1	0	0	64
1	MM-IA	1	1	1	0	0	0	0	150
0		23	0	0	0	0	0	0	720

LABEL	HEADING	DESCRIPTION
①	PLAN GEN TYPE NO.	Plan generator type number
②	TYPENAME	Weapon type name
③	PLANETYPE	Plane type number
④	NOBOMB1	Number of type 1 bombs
⑤	IWHD1	Type 1 warhead index
⑥	NOBOMB2	Number of type 2 bombs
⑦	IWHD2	Type 2 warhead index
⑧	NASM	Number of ASMs
⑨	IASM	ASM index
⑩	NUMBER	Number of offensive systems

Figure 65. The Offensive System Table

1	MULTIPLE STRIKE OR ABTAPE ADVERBS NOT ALLOWED Only one instance each of either STRIKE or ABTAPE clause is permitted in a single run of PLANOUT.
2	SETTING/IF ORDER WRONG SETTING/IF clauses must appear in pairs and in that order.
3	ERROR IN SETTING/IF PAIR (I3) Error has occurred in clause pair indicated. Most likely the spelling of a field name is wrong.
4	INTERFACE REQUIRES GAMETIME AND FUNCOM CLAUSES Both GAMETIME and FUNCOM clauses must appear in any valid run of the External interface function.
5	ERROR IN GAMETIME CLAUSE Check order and spelling of input flags.
6	ERROR IN FUNCOM CLAUSE Check clause syntax.

Figure 66. External Interface Error Messages