S (displacement). These corrections are necessary because of the rounding of E to the nearest 0.1°.

(3) The procedure outlined below is used for both A and B.

(*a*) Step 1—Using the argument t_a, enter the A and B sections of the firing tables and extract data for A(1), A(2), B(1), and B(2). The a values of A(1), A(2), B(1), and B(2) are recorded in column (1).

(*b*) Step 2—Extract from worksheet 2, the appropriate data and record in column (2).

(*c*) Step 3—Cumulatively multiply column (1) by column (2) and record the total product in appropriate blocks in column (3).

(*d*) Step 5—Round off to two decimal places and transfer the A value to worksheet 11 and the B value to worksheet 12.

e. *Worksheet 8* (fig. 29).

(1) This worksheet facilitates the solution of the formulas $\overline{TT}=TT(1)+TT(2)\ \text{Cos}\ 2\phi_L+TT(3)\ \text{Cos}\ \phi_L\ \text{Sin}\ K_T.$

$$TT=\frac{\overline{TT}+C(1)\ h_L+C(2)\ h_T}{1+C(3)\ h_L+C(4)\ h_T}$$

$$TC=\frac{(t_b-t_a)\ IF+t_a}{4}+\overline{TC}$$

The value TT is the total time of flight of the missile from firing to impact. The standard launch time for a missile fired from a zero firing altitude to zero impact altitude is computed then corrected for firing position, and impact altitude effects. The value TT is used in worksheet 10 for computing displacement presetting variations. The value TC is the cutoff signal time. This value is used in computing the minimum required alcohol temperature.

(2) The following procedure is used for worksheet 8:

(*a*) Step 1—Complete chart I.

1. Using t_a and t_b as arguments, enter the firing tables in the TT section. Extract data for TT(1), TT(2), and TT(3). Record those values in column 1.

2. From worksheet 2, extract the appropriate values and record in column (2).

3. Cumulatively multiply column (1) by column (2) and record the total product in the appropriate a and b column. Complete the indicated computations.

4. Apply interpolation factor. Complete computations to determine $\overline{\text{TT}}$.

(*b*) Step 2—Complete chart II.

1. Enter $\overline{\text{TT}}$ from chart I in line (1).

CHART I

		(1) From Firing T.	(2) WS 2	(3) (a)	(4) (b)
TT(1)	a	370.20249		370.20249	
	b	371.62940			371.62940
TT(2)	a	1.33479	-0.4978818	-369.53792	
	b	1.34138	(14)		-370.96155
TT(3)	a	5.97800	0.4999364	+372.52654	
	b	6.05118	(15)		+373.98676
			Total	372.52654	373.98676
				$TT_b - TT_a = dTT$	1.46022

dTT x IF (WS 2)	0.43748
dTT x IF + TT_a = TT	372.96402

CHART II

1	TT	372.96402
2	h_L WS 2 (3)	1235
3	h_T WS 2 (4)	730
4	C(1) From Firing Table Section C	0.00007631
5	C(2) From Firing Table Section C	-0.00491659
6	C(3) From Firing Table Section C	-0.00000145
7	C(4) From Firing Table Section C	-0.00000965
8	(4) (2)	0.09424
9	(5) (3)	-3.58911
10	(6) (2)	-0.00179
11	(7) (3)	-0.00704
12	(1) + (8) + (9)	369.46915
13	(10) + (11) + 1.0	0.99117
14	(12) ÷ (13) = TT	372.76063

CHART III

1	t_a (From WS 4)		103
2	t_b (From WS 4)		104
3	IF (From WS 4)		0.2996
4	(3) + (1)		103.2996
5	$\overline{TC}$	If R < 1,643°, $\overline{TC}$ = 95.75	91
		If R ≥ 1,643°, $\overline{TC}$ = 91.00	
6	TC = (5) + 0.25(4)		116.82490

Figure 29. (CMHA) Example of worksheet 8.

2. From worksheet 2, extract the appropriate values and record.

3. Enter the firing tables in the C section and extract data for C(1), C(2), C(3), and C(4). Record those values in lines (4) through (7).

4. Perform the indicated computations in lines (8) through (14) to determine total time of flight (TT).

(*c*) Step 3—Complete chart III.

1. From worksheet 4, extract the appropriate values and record in lines (1) through (3).

2. Perform the indicated computations in line (4).

3. Enter the value $\overline{TC}$ for the appropriate range in line (5).

4. Perform the indicated computations to obtain the cutoff signal time (TC).

f. *Worksheet 9* (fig. 30).

(1) This worksheet facilitates the computation of the required minimum alcohol temperature to which the alcohol must be heated in order to obtain the required burning time.

(2) The following procedure is used for worksheet 9:

(*a*) Step 1—From the FDC basic data record, extract the appropriate values and record in chart I lines 1 through 5. For computation of planned missions when alcohol temperature is not available, a standard alcohol temperature of 40° F. will be used.

(*b*) Step 2—Complete the indicated computations for lines 6 through 17. When using tapes 1–11, it is only necessary to compute through step 10, and TA is −25°.

(*c*) Step 3—If the value of line 17 is greater than the value in line 11, complete chart II. If line 17 is equal to or less than line 11, complete chart III.

g. *Worksheet 10* (fig. 31).

(1) Chart I of this worksheet facilitates the solution of the equation $dQ1 = -[W(1) + W(2)R + W(3)h_L] \quad dWL + [F(1) + F(2)R + F(3)h_L]\,dFS - [SI(1) + SI(2)R + SI(3)h_L]\,dSI$. This value is the first velocity presetting change (dQ1) which will be applied to the value Q to compensate for variations in standard missile lift-off weight, thrust, and specific impulse.

(2) The following procedure is used for chart I:

(*a*) Step 1—Extract from worksheet 9 the appropriate data and enter in lines 1 through 4. For line 3 when using tapes 1–11 use the value of line 7, worksheet 9.

(*b*) Step 2—Complete the indicated computations for line 4.

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TA

Worksheet 9

CHART I

1	TAO (From Log Sheet)	-25	
2	SIO (From Log Sheet)	216.7	
3	WL (From Log Sheet)	61884	
4	FS (From Log Sheet)	98000	
5	h_L (From WS 2 (3))	1235	
6	dTA = (1) - 75	- 100	1
7	SIP = (2) + 0.04312 (6)	212.388	3
8	dSIO = (7) - 215.6	-3.212	3
9	dWL = (3) - 61185	699	0
10	dFS = (4) - 78000	0	0
11	TBM = -2.9984 + 0.5625678 (7)	116.48425	5
12	- 0.00090171 (5)	-1.11361	5
13	9.0021188 (9)	1.48104	5
14	-0.000813 (10)	0	5
15	0.2682 (8)	-0.86146	5
16	TC (From WS 8)	116.82490	5
17	TB = (16) + (15) + (14) + (13) + (12) + 0.3	116.63087	5

CHART II

If TB > TBM			
18	3.39711 (17)	396.208	3
19	-0.911105 (7)	-193.508	3
20	SI = 10.1859 + (18) + (19)	212.89	2
21	(20) - 2	-3.81	1
22	TA = 75 + 23.1911 (21)	-13.4	

CHART III

If TB ≤ TBM			
18	SI = (7)		2
19	(17) - (11)		9
20	TA = (1) + 78.78 (19)		1*

* If < -25°F the minimum alcohol temperature is -25°F.
If >110°F the missile should not be fired.

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Figure 30. (CMHA) *Example of worksheet 9.*

(*c*) Step 3—Extract from worksheet 1 the value R and enter in line 6.

(*d*) Step 4—Enter the firing tables in the W section and extract data for W(1), W(2), and W(3). Record in the appropriate blocks lines 7 through 9.

(*e*) Step 5—Enter the firing tables in the F section and extract data for F(1), F(2), and F(3). Record in the appropriate blocks lines 10 through 12.

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Worksheet 10
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CHART I

1	dWL (From WS 9)	699	0
2	dFS (From WS 9)	0	0
3	(From WS 9, Chart II, line 20 or Chart III, SI line 18, whichever is completed.)	212.89	2
4	dSI = (3) - 215.6	- 2.71	2
5	h_L (From WS 9)	1235	
6	R (From WS 1)	2° 76694	
7	W(1) } From W Section in Firing T.	0.00515	
8	W(2) } From W Section in Firing T.	0.001832	
9	W(3) } From W Section in Firing T.	-0.000000372	
10	F(1) } From F Section in Firing T.	0.00362	
11	F(2) } From F Section in Firing T.	0.000751	
12	F(3) } From F Section in Firing T.	-0.000000224	
13	SI (1) } From SI Section in Firing T.	0.24706	
14	SI (2) } From SI Section in Firing T.	0.2427	
15	SI (3) } From SI Section in Firing T.	-0.000035603	
16	(9) (5)	- 0.00046	5
17	(8) (6)	0.00507	5
18	(7) + (16) + (17)	0.00976	5
19	(12) (5)	-0.00028	5
20	(11) (6)	0.00208	5
21	(10) + (19) + (20)	0.00542	5
22	(15) (5)	-0.04397	5
23	(14) (6)	0.67154	5
24	(13) + (22) + (23)	0.87463	5
25	(18) (1)	6.82224	5
26	(21) (2)	0	5
27	(24) (4)	-2.37025	5
28	dQ1 = (26) - (25) - (27)	-4.45199	5

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Figure 31.* (CMHA) *Example of worksheet 10.

(*f*) Step 6—Enter the firing tables in the SI section and extract data for SI(1), SI(2), and SI(3). Record in the appropriate blocks lines 13 through 15.

CHART II

1	R (From Chart I)	2° 76694	
2	h_L (From Chart I)	1235	
3	ST (1)	-13.422	
4	ST (2) From ST Section in Firing T.	- 0.0018877	
5	ST (3)	5.2129	
6	ST (4)	0.0016236	
7	(6) (2)	2.00515	5
8	(5) + (7)	7.21805	5
9	(8) (1)	19.97191	5
10	(4) (2)	-2.33131	5
11	dQ2 = (3) + (10) + (9)	4.21860	5

CHART III

1	dWL (From Chart I)	699	0
2	dFS (From Chart I)	0	0
3	dSI (From Chart I)	-2.71	2
4	R (From Chart I)	2° 76694	
5	TT (From WS 8)	372.7606	4
6	-0.009544 (1)	- 6.6713	4
7	-0.026045 (1)	-18.2055	4
8	-1.9636 (3)	5.3214	4
9	0.016651 (2)	0	4
10	(7) + (8) + (9)	-12.8841	4
11	(4) (10)	-35.6495	4
12	(11) + (6)	-42.3208	4
13	dQ1 (From Chart I)	-4.4520	4
14	dQ2 (From Chart II)	4.2186	4
15	dQ = (13) + (14)	-0.2334	4
16	(5) (15)	-87.0023	4
17	dS = (12) - (16)	44.6815	4

dQ *	-0.233	3
dS **	45	0

* Enter on WS 11

** Enter on WS 12

Figure 31. (CMHA)—Continued

(*g*) Step 7—Complete the indicated computations for lines 16 through 28 to obtain the first velocity presetting change (dQ1).

(3) Chart II of this worksheet facilitates the solution of the equation $dQ2=ST(1)+ST(2)h_L+[ST(3)+ST(4)h_L]R$. This value is the second velocity presetting change (dQ2) which will be applied to the value Q to compensate for variations in standard missile lift-off weight, thrust, and specific impulse.

(4) The following procedure is used for chart II:

(*a*) Step 1—Extract from chart I the values R and h_L and enter in the appropriate block lines 1 and 2.

(*b*) Step 2—Enter the firing tables in the ST section and extract data for ST(1), ST(2), ST(3), and ST(4). Record in the appropriate blocks lines 3 through 6.

(*c*) Step 3—Complete the indicated computations for lines 7 through 11 to obtain the second velocity presetting change (dQ2).

(5) Chart VI of this worksheet facilitates the solution of the equation $dS=-(dQ1+dO2)\ TT-0.009544\ dWL+R\ [-0.026045\ dWL-1.9636\ dSI+0.016651\ dFS]$. The solution of this equation will provide dQ the total velocity presetting change and dS the total displacement presetting changes due to variations in standard missile lift-off weight, thrust, and specific impulse.

(6) The following procedure is used for Chart III:

(*a*) Step 1—Extract from chart I the values dWL, dFS, dSI, and R, and enter in the appropriate blocks lines 1 through 4.

(*b*) Step 2—Extract from worksheet 8 the value TT and enter in line 5.

(*c*) Step 3—Compute the indicated computations for lines 6 through 15 to obtain dQ. Enter dQ in the box at the end of chart III.

(*d*) Step 4—Compute the indicated computations for lines 16 and 17 to obtain dS. Enter dS in the box at the end of chart III.

(*e*) Step 5—Enter the value dQ into worksheet 11. Enter the value dS into worksheet 12.

h. Worksheet 11 (fig. 32).

(1) Worksheet 11 facilitates the solution of the formula $Q=Q(1)+Q(2)\ \text{Cos}\ \phi_L\ \text{Sin}\ K_T+Q(3)\ \text{Cos}\ 2\phi_L+Q(4)\ \text{Cos}\ 2K_T+Q(5)\ \text{Cos}\ 2\phi_L\ \text{Cos}\ 2K_T+Q(6)\ \text{Sin}\ 2\phi_L\ \text{Cos}\ K_T+C_1h_L+dQ$. (For $t_a \geqq 57$, $C_1=0.0134$. For $t_a<57$, $C_1=0.0126$.) The value Q is the missile velocity presetting. Three corrections have been applied—one to compensate for altitudes other

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Worksheet 11

Q

		(1) From Firing T.	(2) From WS 2	(3) a	(4) b
Q(1)	a	-2236.898		-2236.898	
	b	-2249.740			-2249.740
Q(2)	a	26.082	0.49994	-2223.8586	
	b	26.099	(15)		-2236.6921
Q(3)	a	-0.819	-0.49788	-2223.4508	
	b	-0.814	(14)		-2236.2868
Q(4)	a	-0.113	-0.99106	-2223.3388	
	b	-0.116	(13)		-2236.1718
Q(5)	a	-0.114	0.49343	+2223.3951	
	b		(18)		+2236.2296
Q(6)	a		0.05799	+2223.4159	
	b		(24)		+2236.2505
$t_a \geq 57$		.0134	1235 (3)	-2206.867	-2219.701
$t_a < 57$		.0126			
			TOTAL	-2206.867	-2219.701
				$(Q_b - Q_a) = \Delta Q$	-12.834

$\Delta Q \times IF$ (WS 2) = (ΔQ) (IF)	-3.845
(ΔQ) (IF) + Q_a = Q_h	2210.712
$(E - E_h)$ [FROM WS 6] × A [FROM WS 7]	0.106
$Q_h + (E - E_h)(A) = \bar{Q}$	-2210.606
dQ = (From WS 10)	-0.233
$Q = \bar{Q} + dQ$	-2210.839

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Figure 32. (CMHA) *Example of worksheet 11.*

than sea level, one to compensate for the rounding of E to the nearest 0.1° and one to compensate for variations in standard missile lift-off weight, thrust, and specific impulse. The value Q is used in worksheet 14 to compute a time in seconds.

(2) The following procedure is used for worksheet 11:

(*a*) Step 1—Using t_a and t_b as arguments, enter the firing tables in the Q section. Extract data for Q(1), Q(2), Q(3), Q(4), Q(5), and Q(6). Record values for Q(1), Q(2), Q(3), Q(4), Q(5), and Q(6) in the appropriate blocks under column (1).

(*b*) Step 2—From worksheet 2, extract the appropriate values and record in column (2).

(*c*) Step 3—Cumulatively multiply column (1) by column (2) and record the total product in the appropriate a and b columns. Complete the indicated computations.

(*d*) Step 4—Apply the interpolation factor and determine a value for $\overline{Q}_s$.

(*e*) Step 5—Apply the correction factor necessitated by the rounding of E to the nearest 0.1°. Use values $(E-E_s)$ from worksheet 6 and A from worksheet 7. Determine a value for $\overline{Q}$.

(*f*) Step 6—Enter dQ from worksheet 10 and add to $\overline{Q}$ to obtain Q. This value is transferred to worksheet 14.

i. Worksheet 12 (fig. 33).

(1) This worksheet facilitates the solution of the formula $S = S(1) + S(2) \text{ Cos } \phi_L \text{ Sin } K_T + S(3) \text{ Cos } 2\phi_L + S(4) \text{ Cos } 2K_T + S(5) \text{ Cos } 2\phi_L \text{ Cos } 2K_T + S(6) \text{ Sin } 2\phi_L \text{ Cos } K_T + C_2 h_L + dS$. (For $t_a \geq 57$, $C_2 = -2.25$. For $t_a < 57$, $C_2 = -1.67$.)

(2) The value S is the missile displacement presetting. Three corrections have been applied; one to compensate for altitudes other than sea level, one to compensate for the rounding of E to the nearest 0.1° and one to compensate for variations in standard missile weight, thrust, and specific impulse. The value S is used in worksheet 14 to compute a time in seconds. This time is used to preset S in the missile.

(3) The following procedure is used for worksheet 12:

(*a*) Step 1—Using t_a and t_b as arguments, enter the firing tables in the S section. Extract data for S(1), S(2), S(3), S(4), S(5), and S(6). Record values for S(1), S(2), S(3), S(4), S(5), and S(6) in the appropriate boxes under column (1).

(*b*) Step 2—From worksheet 2, extract the appropriate values and record in column (2).

(*c*) Step 3—Cumulatively multiply column (1) by column (2) and record total product in the appropriate a and b columns. Complete the indicated computations.

(*d*) Step 4—Apply the interpolation factor and determine a value for $\overline{S}_s$.

(*e*) Step 5—Apply the correction factor necessitated by the rounding of E to the nearest 0.1°. Use the values $(E-E_s)$ from worksheet 6 and B from worksheet 7. Determine a value for $\overline{S}$.

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Worksheet 12

S

		(1) From Firing T.	(2) From WS 2	(3) a	(4) b
S(1)	a	169631 (0)		169631 (0)	
	b	171035 (0)			171035 (0)
S(2)	a	-1174 (0)	0.49994 (5)	- 169044.1 (1)	
	b	-1173 (0)	(15)		- 170448.6 (1)
S(3)	a	82 (0)	-0.49788 (5)	- 169003.2 (1)	
	b	81 (0)	(14)		- 170408.2 (1)
S(4)	a	12 (0)	-0.99106 (5)	- 168991.4 (1)	
	b	12 (0)	(13)		- 170396.3 (1)
S(5)	a	12 (0)	0.49343 (5)	+ 168997.3 (1)	
	b	12 (0)	(18)		+ 170402.3 (1)
S(6)	a	18 (0)	0.05799 (5)	+ 168998.3 (1)	
	b	18 (0)	(24)		+ 170403.3 (1)
$t_a \geq 57$		-2.25	1235 (0)	- 166219.6 (1)	- 167624.6 (1)
$t_a < 57$		-1.67	(3)		
			Total	166219.6 (1)	167624.6 (1)
				$(S_b - S_a) = \Delta S$	1405.0 (1)

$\Delta S \times IF$ (WS 2) = $(\Delta S)(IF)$	420.9 (1)
$(\Delta S)(IF) + S_a = S_h$	166640.5 (1)
$(E-E_h)$ (WS 6) x (B) (WS 7)	-6.0 (1)
$S_h + (E-E_h)(B) = \bar{S}$	166634 (0)
dS (From WS 10)	45 (0)
$S = \bar{S} + dS$	166679 (0)

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Figure 33. (CMHA) *Example of worksheet 12.*

(*f*) Step 6—Enter dS from worksheet 10 and add to S to obtain S. This value is transferred to worksheet 14.

j. Worksheet 13 (fig. 34).

(1) Chart I of this worksheet facilitates the solution of the equation $T = T(1) + T(2)\ \mathrm{Cos}\ \phi_L\ \mathrm{Sin}\ K_T + T(3)\ \mathrm{Cos}\ 2\phi_L + C_3 h_L$. (For $t_a \geqq 57$, $C_3 = 0.00285$. For $t_a < 57$, $C_3 = 0.00275$). This value is the first of two cutoff equation constants which are preset into the missile. The value T must be converted

into another numerical value for dial setting. This is done by applying the formula $L=\left[2.75-\frac{481.25}{T}\right]10^3$ to the value T. This value is called L. It represents T as a dial setting to the value T. This value is called L. It represents T as a dial setting in seconds.

(2) The following procedure is used for chart I:

(*a*) Step 1—Using arguments t_a and t_b, enter the firing tables in the T section and extract data for T(1), T(2), and T(3). The values of T(1), T(2), and T(3) are recorded in the appropriate blocks in column (1).

(*b*) Step 2—Extract from worksheet 2 the appropriate data and record in column (2).

(*c*) Step 3—Cumulatively multiply column (1) by column (2) and record the total products in the appropriate blocks in columns a and b.

(*d*) Step 4—Apply interpolation factor and determine value for T.

(*e*) Step 5—Apply calibration factor to determine L, the dial setting. Round off to nearest whole number.

(3) Chart II of this worksheet facilitates the solution of the equation $N=N(1)+N(2)\ \text{Cos}\ \phi_L\ \text{Sin}\ K_T+N(3)\ \text{Cos}\ 2\phi_L+C_4h_L$. (For $t_a\geqq 57$, $C_4=0.0004000$. For $t_a<57$, $C_4=0.000458$). This value is the second of two cutoff equation constants which are preset into the missile. The value N in meters per second must be converted into a numerical value for dial setting. This is accomplished by multiplying N by 33.333. This product is called M and it represents N as a dial setting.

(4) The following procedure is used for chart II:

(*a*) Step 1—Using arguments t_a and t_b, enter the firing tables in the N section and extract data for N(1), N(2), and N(3). The values of N(1), N(2), and N(3) are recorded in the appropriate blocks in column (1).

(*b*) Step 2—Extract from worksheet 2 the appropriate data and record in column (2).

(*c*) Step 3—Cumulatively multiply column (1) by column (2) and record the total products in the appropriate blocks in columns a and b.

(*d*) Step 4—Apply interpolation factor. Determine value for N.

(*e*) Step 5—Multiply N by 33.333 to determine M, the missile dial setting. Round off to the nearest whole number.

T

Chart I

		(1) From Firing T.	(2) From WS 2	(3) a	(4) b
T(1)	a	228.74 [2]		228.74 [2]	
	b	230.07 [2]			230.07 [2]
T(2)	a	6.09 [2]	0.49994 [5]	+ 231.785 [3]	
	b	6.16 [2]	(15)		+ 233.150 [3]
T(3)	a	1.38 [2]	− 0.49788 [5]	− 231.098 [3]	
	b	1.39 [2]	(14)		− 232.458 [3]
$t_a \geq 57$		.00285	1235 [0] (3)	+ 234.617 [3]	+ 235.977 [3]
$t_a < 57$		.00275			
			Total	234.62 = T_a [2]	235.98 = T_b [2]
				$(T_b - T_a) = \Delta T$	1.36 [2]

(1)	$\Delta T \times IF$ (WS 2) = $\Delta T \times IF$	0.407 [3]
(2)	(1) + T_a = T	235.027 [3]
(3)	481.25 ÷ (2)	2.048 [3]
(4)	[2.750 − (3)] × 10^3 = L	702 [0]

N

Chart II

		(1) From Firing T.	(2) From WS 2	(3) a	(4) b
N(1)	a	16.71 [2]		16.71 [2]	
	b	16.85 [2]			16.85 [2]
N(2)	a	0.10 [2]	0.49994 [5]	+ 16.760 [3]	
	b	0.10 [2]	(15)		+ 16.900 [3]
N(3)	a	0.05 [2]	− 0.49788 [5]	− 16.735 [3]	
	b	0.05 [2]	(14)		− 16.875 [3]
$t_a \geq 57$		.000400	1235 [0] (3)	+ 17.229 [3]	+ 17.369 [3]
$t_a < 57$		.000458			
			Total	17.23 = N_a [2]	17.37 = N_b [2]
				$(N_b - N_a) = \Delta N$	14 [2]

(1)	$\Delta N \times IF$ (WS 2) = $\Delta N \times IF$	0.04 [2]
(2)	(1) + N_a = N	17.27 [2]
(3)	33,333 × (2) = M	576 [0]

Figure 84. (CMHA) Examples of worksheet 13.

k. Worksheet 14 (fig. 35).

(1) The purpose of worksheet 14 is to facilitate the solution of the formulas $F=\frac{720}{Ag+Ar}$, $I=\frac{-Q}{Ag+A_r}$, and $J=\sqrt{\frac{25}{Ag+A_r}}$ where F is the value for calibrating the range accelerometer, I is the time required for presetting the velocity presetting Q, and J is the time required for presetting the displacement presetting S. $A_g=g_L$ Sin E and g_L is the value of gravity at the launcher. $A_r=-0.00834$ (Cos K Cos E Cos ϕ_L+ Sin ϕ_L Sin E). This is the magnitude of the apparent acceleration in the range measuring direction due to the rotation of the earth.

(2) The following procedure is used for worksheet 14:

(*a*) Step 1—From worksheets 2, 6, 11, and 12 extract the appropriate values and record on worksheet 14, lines 1 through 6.

Worksheet 14

F, I, J

(1)	(8)	WS 2	0.8654137	7
(2)	(29)	WS 2	9.81537	5
(3)	(9)	Chart 1 WS 6	0.04489	5
(4)	E	Chart 2 WS 6	38.2	1
(5)	Q	WS 11	-.2210837	3
(6)	S	WS 12	166679	0
(7)	(4) + .01		38.21	2
(8)	(4) -.01		38.19	2
(9)	Sin (4)		0.6184084	7
(10)	Sin (7)		0.6185455	7
(11)	Sin (8)		0.6182712	7
(12)	Cos (4)		0.7858569	7
(13)	Cos (7)		0.7857489	7
(14)	Cos (8)		0.7859648	7
(15)	(1) (9)		0.5351791	7
(16)	(1) (10)		0.5352977	7
(17)	(1) (11)		0.5350604	7
(18)	(3) (12)		0.0352771	7

(19)	(3) (13)		0.0352723	7
(20)	(3) (14)		0.0352820	7
(21)	(2) (9)		6.06991	5
(22)	(2) (10)		6.07125	5
(23)	(2) (11)		6.06856	5
(24)	-.00834 [(18) + (15)]		-0.00476	5
(25)	-.00834 [(19) + (16)]		-0.00476	5
(26)	-.00834 [(20) + (17)]		-0.00476	5
(27)	(21) + (24)		6.06515	5
(28)	(22) + (25)		6.06649	5
(29)	(23) + (26)		6.06380	5
(30)	720 ÷ (27)	F	118.711	3
(31)	720 ÷ (28)	F + .01 Sec	118.685	3
(32)	720 ÷ (29)	F - .01 Sec	118.737	3
(33)	-(5) ÷ (27)	I	364.515	3
(34)	2 × (6) ÷ (27)		54963	0
(35)	$\sqrt{(34)}$	J	234.442	3

Figure 35. (CMHA) *Example of worksheet 14.*

(b) Step 2—Complete the indicated computations for lines 7 through 29.

(c) Step 3—Determine values for F; F+0.01 sec; F−0.01 sec; I; and J. Round off to three decimals.

l. *Worksheet 15* (fig. 36).

(1) The purpose of worksheet 15 is to facilitate the solution of the formula $H=100\ (L_g+L_r)$, where H is the velocity output of the lateral accelerometer at the end of 100 seconds due to the rotation of the earth at the launcher location.

$L_g=g_L \text{ Sin } d$

$L_r=0.00834\ (\text{Cos } \phi_L \text{ Sin } K \text{ Cos } d-\text{Sin } \phi_L \text{ Sin } d)$. This is the magnitude of the apparent acceleration in the lateral direction.

(2) The following procedure is used for worksheet 15:

(a) Step 1—Extract from worksheets 2 and 6 the appropriate values and record on worksheet 15, lines 1 through 3.

(b) Step 2—Complete the indicated computation for lines 4 through 13.

(c) Step 3—Determine values for H: H+0.01; and H−0.01, lines 14 through 16. Round off to three decimals.

101. (CMHA) Azimuth of Orienting Line

a. The aiming azimuth (K) as determined in worksheet 5 (fig. 26) is a geodetic azimuth adjusted for rotation of the earth. To orient properly the lateral accelerometer, the azimuth of the orienting line must be expressed as a geodetic azimuth.

b. Geodetic azimuth is obtained from grid azimuth by applying the convergence factor C to the grid azimuth. The missile programming data computer will compute the geodetic azimuth of the orienting line (par. 94).

c. The hand computation for determining the geodetic azimuth of the orienting line is performed on the FDC basic data record (fig. 18) in the following manner:

(1) Survey personnel report the grid azimuth of the orienting line. This value is entered on the FDC basic data record.

(2) After completion of worksheet 1 (fig. 22), the value of convergence from line 34, worksheet 1, is entered on the FDC basic data record. Note 4 on worksheet 1 provides for converting this value to degrees, minutes, and seconds for recording on the FDC basic data record.

(3) Using the proper sign, the value of C is applied to the grid azimuth of the orienting line, converting it to a geodetic azimuth (this is not actually a true geodetic azimuth, since it includes the value of convergence for the firing position

H

(1)	Sin ϕ_L (8) WS 2	0.86541	5	
(2)	g_L (29) WS 2	9.81537	5	
(3)	(8) Chart I WS 6	0.49905	5	
(4)	.0001745 (1)	0.00015	5	
(5)	-.0001745 (1)	- 0.00015	5	
(6)	.0001745 (2)	0.00171	5	
(7)	-.0001745 (2)	- 0.00171	5	
(8)	(3) - (4)	0.49890	5	
(9)	(3) - (5)	0.49920	5	
(10)	.00834 (8)	0.00416	5	
(11)	.00834 (9)	0.00416	5	
(12)	(6) + (10)	0.00587	5	
(13)	(7) + (11)	0.00245	5	
(14)	100 (12)	0.587	3	H + .01
(15)	100 (13)	0.245	3	H - .01
(16)	.834 (3)	0.416	3	H

Figure 36. (CMHA) *Example of worksheet 15.*

rather than the orienting line). The geodetic azimuth of the orienting line is then recorded on the fire command sheet (fig. 19).

(4) If a zone to zone transformation is necessary, the coordinates of the launcher used for convergence computation must be the ones referenced on the central meridian in the zone of the launcher.

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