METEOROLOGICAL OFFICE,

AIR MINISTRY.

SUPPLEMENT TO M.O.317.

"The supply of Meteor Reports to Artillery Units".

This supplement contains instructions for the issue of Meteor reports for Anti-Aircraft fire. Paras. 7 and 9 of M.O. 317 are cancelled.

Table VI removed and destroyed. Replaced by Ammendment No. 1.

Sept.1938.

FOR OFFICIAL USE ONLY

AMENDMENT No. 1
TO
M.O. 317 SUPPLEMENT
MAY, 1940

AIR MINISTRY
METEOROLOGICAL OFFICE

THE SUPPLY OF METEOR REPORTS
TO ARTILLERY UNITS

Remove and destroy the existing Table VI and replace by the revised table attached which has been arranged so that the separate sheets can be pasted on cards to facilitate easy reference.

29016-1

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TABLE VI
(Sheet 1)

WEIGHTING FACTORS AND PRODUCTS FOR COMPUTING BALLISTIC TEMPERATURES FOR ANTI-AIRCRAFT TRAJECTORIES

M.O. 317
(Amendment No. 1)

Difference From Standard °F	1,000' LAYER								3,000' LAYER								Difference From Standard °F
	THOUSANDS OF FEET																
	4	6	8	10	12	14	16	20	4	6	8	10	12	14	16	20	
1	.7	.5	.4	.3	.2	.2	.1	.1	.3	.3	.3	.2	.2	.2	.1	.1	1
2	1.4	1.1	.8	.6	.5	.4	.3	.2	.5	.6	.6	.5	.4	.4	.3	.2	2
3	2.2	1.6	1.1	.8	.7	.6	.4	.3	.8	1.0	.9	.7	.6	.5	.4	.3	3
4	2.9	2.2	1.5	1.1	1.0	.8	.6	.4	1.0	1.3	1.2	1.0	.8	.7	.6	.4	4
5	3.6	2.7	1.9	1.4	1.2	1.0	.7	.5	1.3	1.6	1.5	1.2	1.1	.9	.7	.5	5
6	4.3	3.2	2.3	1.7	1.4	1.2	.8	.6	1.6	1.9	1.8	1.4	1.3	1.1	.8	.6	6
7	5.0	3.8	2.7	2.0	1.7	1.4	1.0	.7	1.8	2.2	2.1	1.7	1.5	1.3	1.0	.7	7
8	5.8	4.3	3.0	2.2	1.9	1.6	1.1	.8	2.1	2.6	2.4	1.9	1.7	1.4	1.1	.8	8
9	6.5	4.9	3.4	2.5	2.2	1.8	1.3	.9	2.3	2.9	2.7	2.2	1.9	1.6	1.3	.9	9
10	7.2	5.4	3.8	2.8	2.4	2.0	1.4	1.0	2.6	3.2	3.0	2.4	2.1	1.8	1.4	1.0	10
11	7.9	5.9	4.2	3.1	2.6	2.2	1.5	1.1	2.9	3.5	3.3	2.6	2.3	2.0	1.5	1.1	11
12	8.6	6.5	4.6	3.4	2.9	2.4	1.7	1.2	3.1	3.8	3.6	2.9	2.5	2.2	1.7	1.2	12
13	9.4	7.0	4.9	3.6	3.1	2.6	1.8	1.3	3.4	4.2	3.9	3.1	2.7	2.3	1.8	1.3	13
14	10.1	7.6	5.3	3.9	3.4	2.8	2.0	1.4	3.6	4.5	4.2	3.4	2.9	2.5	2.0	1.4	14
15	10.8	8.1	5.7	4.2	3.6	3.0	2.1	1.5	3.9	4.8	4.5	3.6	3.1	2.7	2.1	1.5	15
16	11.5	8.6	6.1	4.5	3.8	3.2	2.2	1.6	4.2	5.1	4.8	3.8	3.4	2.9	2.2	1.6	16
17	12.2	9.2	6.5	4.8	4.1	3.4	2.4	1.7	4.4	5.4	5.1	4.1	3.6	3.1	2.4	1.7	17
18	13.0	9.7	6.8	5.0	4.3	3.6	2.5	1.8	4.7	5.8	5.4	4.3	3.8	3.2	2.5	1.8	18
19	13.7	10.3	7.2	5.3	4.6	3.8	2.7	1.9	4.9	6.1	5.7	4.6	4.0	3.4	2.7	1.9	19
20	14.4	10.8	7.6	5.6	4.8	4.0	2.8	2.0	5.2	6.4	6.0	4.8	4.2	3.6	2.8	2.0	20
22	15.8	11.9	8.4	6.2	5.3	4.4	3.1	2.2	5.7	7.0	6.6	5.3	4.6	4.0	3.1	2.2	22
24	17.3	13.0	9.1	6.7	5.8	4.8	3.4	2.4	6.2	7.7	7.2	5.8	5.0	4.3	3.4	2.4	24
26	18.7	14.0	9.9	7.3	6.2	5.2	3.6	2.6	6.8	8.3	7.8	6.2	5.5	4.7	3.6	2.6	26
28	20.2	15.1	10.6	7.8	6.7	5.6	3.9	2.8	7.3	9.0	8.4	6.7	5.9	5.0	3.9	2.8	28
30	21.6	16.2	11.4	8.4	7.2	6.0	4.2	3.0	7.8	9.6	9.0	7.2	6.3	5.4	4.2	3.0	30

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TABLE VI (contd.)
(Sheet 2)

M.O. 317
(Amendment No. 1)

Difference From Standard °F	5,000' LAYER							7,000' LAYER						9,000' LAYER					Difference From Standard °F
	THOUSANDS OF FEET																		
	6	8	10	12	14	16	20	8	10	12	14	16	20	10	12	14	16	20	
1	·1	·2	·2	·2	·2	·1	·1	·1	·1	·1	·1	·1	·1	·1	·1	·1	·1	·1	1
2	·2	·4	·4	·3	·3	·3	·2	·1	·3	·2	·2	·2	·2	·1	·2	·2	·2	·2	2
3	·3	·6	·6	·5	·5	·4	·3	·1	·4	·4	·4	·3	·3	·2	·2	·3	·3	·2	3
4	·4	·8	·8	·7	·6	·5	·4	·2	·5	·5	·5	·4	·4	·2	·3	·4	·4	·3	4
5	·5	1·0	·9	·9	·8	·7	·5	·3	·7	·6	·6	·5	·5	·3	·4	·5	·5	·4	5
6	·6	1·2	1·1	1·0	1·0	·8	·6	·3	·8	·7	·7	·7	·5	·4	·5	·5	·5	·5	6
7	·7	1·4	1·3	1·2	1·1	·9	·7	·3	·9	·8	·8	·8	·6	·4	·6	·6	·6	·6	7
8	·8	1·6	1·5	1·4	1·3	1·0	·8	·4	1·0	1·0	1·0	·9	·7	·5	·6	·7	·7	·6	8
9	·9	1·8	1·7	1·5	1·4	1·2	·9	·5	1·2	1·1	1·1	1·0	·8	·5	·7	·8	·8	·7	9
10	1·0	2·0	1·9	1·7	1·6	1·3	1·0	·5	1·3	1·2	1·2	1·1	·9	·6	·8	·9	·9	·8	10
11	1·1	2·2	2·1	1·9	1·8	1·4	1·1	·5	1·4	1·3	1·3	1·2	1·0	·7	·9	1·0	1·0	·9	11
12	1·2	2·4	2·3	2·0	1·9	1·6	1·2	·6	1·6	1·4	1·4	1·3	1·1	·7	1·0	1·1	1·1	1·0	12
13	1·3	2·6	2·5	2·2	2·1	1·7	1·3	·7	1·7	1·6	1·6	1·4	1·2	·8	1·0	1·2	1·2	1·0	13
14	1·4	2·8	2·7	2·4	2·2	1·8	1·4	·7	1·8	1·7,	1·7	1·5	1·3	·8	1·1	1·3	1·3	1·1	14
15	1·5	3·0	2·9	2·5	2·4	1·9	1·5	·7	1·9	1·8	1·8	1·7	1·3	·9	1·2	1·3	1·3	1·2	15
16	1·6	3·2	3·0	2·7	2·6	2·1	1·6	·8	2·1	1·9	1·9	1·8	1·4	1·0	1·3	1·4	1·4	1·3	16
17	1·7	3·4	3·2	2·9	2·7	2·2	1·7	·9	2·2	2·0	2·0	1·9	1·5	1·0	1·4	1·5	1·5	1·4	17
18	1·8	3·6	3·4	3·1	2·9	2·3	1·8	·9	2·3	2·2	2·2	2·0	1·6	1·1	1·4	1·6	1·6	1·4	18
19	1·9	3·8	3·6	3·2	3·0	2·5	1·9	·9	2·5	2·3	2·3	2·1	1·7	1·1	1·5	1·7	1·7	1·5	19
20	2·0	4·0	3·8	3·4	3·2	2·6	2·0	1·0	2·6	2·4	2·4	2·2	1·8	1·2	1·6	1·8	1·8	1·6	20
22	2·2	4·4	4·2	3·7	3·5	2·9	2·2	1·1	2·9	2·6	2·6	2·4	2·0	1·3	1·8	2·0	2·0	1·8	22
24	2·4	4·8	4·6	4·1	3·8	3·1	2·4	1·2	3·1	2·9	2·9	2·6	2·2	1·4	1·9	2·2	2·2	1·9	24
26	2·6	5·2	4·9	4·4	4·2	3·4	2·6	1·3	3·4	3·1	3·1	2·9	2·3	1·6	2·1	2·3	2·3	2·1	26
28	2·8	5·6	5·3	4·8	4·5	3·6	2·8	1·4	3·6	3·4	3·4	3·1	2·5	1·7	2·2	2·5	2·5	2·2	28
30	3·0	6·0	5·7	5·1	4·8	3·9	3·0	1·5	3·9	3·6	3·6	3·3	2·7	1·8	2·4	2·7	2·7	2·4	30

TABLE VI (contd.)
(Sheet 3)

Difference From Standard °F	11,000' LAYER				13,000' LAYER			15,000' LAYER		17,000' LAYER	19,000' LAYER	Difference From Standard °F
	THOUSANDS OF FEET											
	12	14	16	20	14	16	20	16	20	20	20	
1	0	·1	·1	·1	0	0	·1	0	0	0	0	1
2	·1	·1	·1	·1	0	·1	·1	0	·1	·1	0	2
3	·1	·1	·2	·2	0	·1	·1	0	·1	·1	0	3
4	·1	·2	·2	·3	0	·2	·2	0	·2	·1	0	4
5	·1	·3	·3	·3	·1	·2	·3	·1	·2	·1	·1	5
6	·2	·3	·4	·4	·1	·2	·3	·1	·2	·2	·1	6
7	·2	·3	·4	·5	·1	·3	·3	·1	·3	·2	·1	7
8	·2	·4	·5	·6	·1	·3	·4	·1	·3	·2	·1	8
9	·3	·5	·5	·6	·1	·4	·5	·1	·4	·3	·1	9
10	·3	·5	·6	·7	·1	·4	·5	·1	·4	·3	·1	10
11	·3	·5	·7	·8	·1	·4	·5	·1	·4	·3	·1	11
12	·4	·6	·7	·8	·1	·5	·6	·1	·5	·4	·1	12
13	·4	·7	·8	·9	·1	·5	·7	·1	·5	·4	·1	13
14	·4	·7	·8	1·0	·1	·6	·7	·1	·6	·4	·1	14
15	·5	·7	·9	1·1	·1	·6	·7	·1	·6	·5	·1	15
16	·5	·8	1·0	1·1	·2	·6	·8	·2	·6	·5	·2	16
17	·5	·9	1·0	1·2	·2	·7	·9	·2	·7	·5	·2	17
18	·5	·9	1·1	1·3	·2	·7	·9	·2	·7	·5	·2	18
19	·6	·9	1·1	1·3	·2	·8	·9	·2	·8	·6	·2	19
20	·6	1·0	1·2	1·4	·2	·8	1·0	·2	·8	·6	·2	20
22	·7	1·1	1·3	1·5	·2	·9	1·1	·2	·9	·7	·2	22
24	·7	1·2	1·4	1·7	·2	1·0	1·2	·2	1·0	·7	·2	24
26	·8	1·3	1·6	1·8	·3	1·0	1·3	·3	1·0	·8	·3	26
28	·8	1·4	1·7	2·0	·3	1·1	1·4	·3	1·1	·8	·3	28
30	·9	1·5	1·8	2·1	·3	1·2	1·5	·3	1·2	·9	·3	30

D 29016-1 500 D/d 6051 5/40 P.R.P

ANTI - AIRCRAFT FIRE

(a) Introductory

Anti-aircraft fire is distinguished by the fact that the target is to be reached before the projectile has returned to the ground. Meteorological variations are more complicated in these cases by reason of the fact that the position of the burst is altered in height by meteorological factors as well as in range and deviation. Calculation shews that the weighting factors, both as regards wind and density, are not the same for the horizontal and the vertical displacements, and these differences are sometimes considerable in the case of winds in the plane of the trajectory. When working under experimental conditions it is of course possible to make proper corrections for all the displacements due to meteorological changes but, in the field, such a complete treatment of the problem is quite out of the question.

The problem as regards field work was rendered more tractable by making two assumptions:

(1) that all targets will be engaged on the ascending branch of the trajectory or, at any rate, not far beyond the vertex

(2) That meteorological disturbances as regards the height of the burst can be left out of account and only the effect on range and deviation be considered.

When the problem had been thus simplified it was found possible to compile a table of factors and products for computing ballistic winds and temperatures for anti-aircraft fire along somewhat similar lines to the methods adopted already for flat-fire work. We can no longer, however, classify trajectories according to their time of flight. For anti-aircraft purposes we adopt a classification according to the height of burst. The standard practice is to consider trajectories which terminate at the heights 2000, 4000, 6000, etc. feet, in steps of 2000 feet, and to prepare ballistic winds and temperatures for these trajectories, combining the results in a meteor telegram in a manner now to be explained.

(b) Winds

Table V gives the factors and products for use in the calculation of ballistic winds and the method can best be followed by considering the specimen calculations given on pages 2 and 3. On the reproduction of Form 98 which follows, the results of a pilot balloon ascent by the tail method are shown and on the opposite page the computation of the ballistic winds is set out in detail on the form prepared for this purpose. We first select from the pilot balloon results layers approximating to the standard 2000-ft. intervals, and from these results the mean components in the layers are written down in the appropriate spaces at the left hand side of the computation form. (In practice the values of D_E and D_N need not be calculated except for the particular layers which are needed).

They are derived as follows:

Minute	Height (ft)	D_E	D_N	Mean Components: Layer	E	N
4	1,990	- 10.4	+ 49.7	0 - 2,000	- 2.6	+ 12.4
8	3,840	- 13.0	+ 123.2	2,000 - 4,000	- 0.7	+ 18.4
13	6,20C	- 1.0	+ 213.	4,000 - 6,000	+ 2.4	+ 18.0
17	8,200	+ 53.	+ 309.	6,000 - 8,000	+ 13.5	+ 24.0
21	10,200	+ 123.	+ 380.	8,000 - 10,000	+ 17.5	+ 17.8
25	12,200	+ 193.	+ 470.	10,000 - 12,000	+ 17.5	+ 22.5
29	14,200	+ 276.	+ 597.	12,000 - 14,000	+ 20.8	+ 31.8
33	16,200	+ 351.	+ 716.	14,000 - 16,000	+ 18.8	+ 29.8

The method so far is similar to that described in paragraph 3. We now proceed to the weighting process.

The column headed 2000 feet presents no difficulty. A trajectory to this height represents only a single layer and therefore all that is necessary is to copy the two components into the column and then combine them by means of Table II. The ballistic wind for the 2000-ft. trajectory is at once obtained.

The remaining columns are completed by means of Table V. For the 4000-ft. trajectory we have two layers. For the layer 0 - 2000 feet the Table shews that the ballistic wind corresponding to a component of 2.6 is 1.8, and to a component of 12.4 it is 8.8. These figures are therefore inserted in the appropriate spaces. Similary, for the next layer, 2000 - 4000 feet, the Table gives a ballistic wind of 0.2 for a component of 0.7. For a component of 18.4 the corresponding ballistic wind is 5.3. Inserting these figures in the form, always with due regard to sign, and summing the entries in the two columns, we can combine the two sums so obtained and the result is the ballistic wind for a 4000-ft. trajectory. This process is repeated for all the heights for which a ballistic wind is required. This has been done in the specimen calculation up to 16,000 feet. The figures at the bottom of a column give the ballistic wind for a trajectory terminating at the height printed at the top of that column.

It is clear that the quickest way to carry out the work is to complete each <u>line</u> of the calculation instead of working down the columns. By completing the work line by line the use of Table V is much facilitated as entries needed in each part of the Table always occur together.

(c) Ballistic Temperature

The lower half of the computation form is devoted to the calculation of the Ballistic Temperature. We again use 2000-ft. layers and the appropriate Table for this part of the work is Table VI. The values 1000, 3000, 5000, etc. feet already printed in the form are the mid-heights of the standard 2000-ft. layers and the standard temperatures at these mid-heights are already printed in the adjoining column. We now insert in the next column the observed temperatures at the same heights. If available, the results of an actual upper air sounding should be used here, but in the absence of such data the values will have to be estimated from a consideration of the relevant synoptic chart or such other information as may be available. The differences of the observed temperatures from the standard can now be written down in the adjacent column with due regard to sign. The convention used is the same as in flat-fire work, standard temperature being subtracted from observed temperature. This column of temperature differences is the material which is operated upon by the factors of Table VI.

The 4000-ft. trajectory consists of two layers. In the first layer, 0 - 2000 feet, Table VI shews that a difference of temperature of 7° corresponds to a weighted temperature of 4.9. This is entered in the first space of the column headed 4000 ft. Similarly for the second layer, 2000 - 4000 feet, we find from Table VI that a weighted temperature of 0.6 oorresponds to a temperature difference of 2°. Inserting this value and adding the column we find a total of + 5.5°.F. The ballistic temperature for the 4000-ft. trajectory is therefore 60 plus 5.5 = 65.5° F. which is rounded off to 66°. The other columns are completed in a similar way. No column is necessary for the 2000-ft. trajectory as this consists of a single layer only. Since the observed temperature 65° differs from the standard temperature 58° by +7°, the ballistic temperature is 60 + 7° = 67° F.

Here again working is facilitated by working along a line rather than down the columns.

(d) Meteor Telegram

The code at present in use consists mainly of alternate four and five figure groups. The scheme is as follows:

Bar PPPP 02TT VVDDD 04TT VVDDD 06TT VVDDD ....

.... Time tttt.

PPPP is the barometric pressure at MSL in inches and hundredths.

TT is the ballistic temperature in whole degrees Fahr. for the height indicated in 1000's feet by the preceding two figures.

VV is the ballistic wind in feet per second.

DDD is the true direction of the ballistic wind in degrees.

Each five figure group refers to the trajectory noted in the preceding four figure group.

tttt Time of observation in hours and minutes.

In the specimen calculation the Meteor telegram shewn is built up on this code and the construction will be immediately clear. Thus the groups 0864 28183 indicate that for an 8000-ft. trajectory the ballistic temperature is 64° F, and the ballistic wind is 28 f/s. from 183° true bearing.

(e) General Remarks

It will be noted in Tables V and VI that the weight allotted to winds and temperatures at the greater heights is much less than that apportioned to the lower heights. This is of some practical importance as there is often a lack of meteorological data at the greater heights and the necessary figures have to be estimated. Errors in the ballistic winds and temperatures are minimised on this account because errors in the data at the greater heights are of less relative importance.

X.P. FORM 98

PILOT BALLOON ASCENT, Number 1

Date 17th July, 1936

Time of start 0915 G.M.T.

How lost Distance

Weather b

Station Shoeburyness

Size of balloon 70"

Dry bulb 69.5°F

Filler No. 3 + 2 Rings

Surface wind (15 ft. above ground)

Barometer (as read) 1012.5 mb.

Tail length(s 30 Feet

9 fps from 128°

Barometer (corrected) 1012.1 mb.

t	m	A	E	h	DE	DN	V w to E	V s to N	V	∅
1	28.2	324.0	31.0	470	- 4.6	+ 6.3	- 4.6	+ 6.3	13	144
2	13.2	333.4	27.7	940	8.0	16.0	3.4	9.7	17	161
3	7.8	342.6	24.4	1,440	9.5	30.3	1.5	14.3	24	174
4	5.1	348.2	21.4	1,990	10.4	49.7	0.9	19.4	32	177
5	4.0	350.0	19.8	2,390	11.5	65.2	1.1	15.5	26	176
6	3.1	351.5	18.4	2,900	12.9	86.0	- 1.4	20.8	35	176
7	2.6	353.0	17.5	3,300	12.8	104.0	+ 0.1	18.0	30	180
8	2.2	354.0	17.2	3,840	13.0	123.2	- 0.2	19.2	32	179
9	2.0	354.0	17.2	4,230	14.3	135.7	1.3	12.5	21	174
10	1.8	354.3	17.0	4,650	15.1	151.0	- 0.8	15.3	25	177
11	1.6	356.0	17.0	5,230	11.9	170.4	+ 3.2	19.4	33	189
12	1.45	357.9	16.7	5,700	7.0	189.7	4.9	19.3	33	194
13		359.9	16.2	6,200	1	213	6	23	39	195
14		2.3	15.5	6,700	+ 10	240	11	27	49	202
15		4.5	14.9	7,200	21	270	11	30	53	200
16		6.8	14.7	7,700	35	292	14	22	43	212
17		9.7	14.6	8,200	53	309	18	17	41	227
18		12.3	14.5	8,700	72	328	19	19	45	225
19		14.4	14.5	9,200	88	344	16	16	38	225
20		16.3	14.4	9,700	106	363	18	19	44	223
21		18.0	14.3	10,200	123	380	17	17	40	225
22		19.7	14.1	10,700	143	400	20	20	47	225
23		20.7	14.0	11,200	159	421	16	21	44	217
24		21.5	13.9	11,700	173	441	14	20	41	215
25		22.4	13.5	12,200	193	470	20	29	59	215
26		23.3	13.2	12,700	214	498	21	28	58	217
27		24.0	12.9	13,200	235	529	21	31	62	214
28		24.5	12.5	13,700	256	562	21	33	65	213
29		24.9	12.2	14,200	276	597	20	35	67	210
30		25.2	12.0	14,700	295	627	19	30	59	212
31		25.5	11.8	15,200	312	655	17	28	54	211
32		25.8	11.6	15,700	332	688	20	33	64	211
33		26.1	11.5	16,200	351	716	19	28	56	214
34										
35										
36										
37										
38										
39										
40										

COMPUTATION OF BALLISTIC WINDS AND TEMPERATURES FOR ANTI-AIRCRAFT FIRE

Date 17th July 1936 | Time 0915 G.M.T. | Ascent No. 1

Layer	Mean compts.		2,000 ft.		4,000 ft.		6,000 ft.		8,000 ft.		10,000 ft.		12,000 ft.		14,000 ft.		16,000 ft.		20,000 ft.	
	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N
0-2	- 2.6	+12.4	- 2.6	+12.4	- 1.8	+ 8.8	- 1.2	+ 5.8	- 0.9	+ 4.1	- 0.7	+ 3.2	- 0.6	+ 3.1	- 0.6	+ 2.8	- 0.5	+ 2.2		
2-4	- 0.7	+18.4	21	168	- 0.2	+ 5.3	- 0.3	+ 7.2	- 0.2	+ 5.9	- 0.2	+ 4.6	- 0.2	+ 4.4	- 0.2	+ 4.0	- 0.1	+ 3.5		
4-6	+ 2.4	+18.0			- 2.0	+14.1	+ 0.3	+ 2.5	+ 0.6	+ 4.7	+ 0.6	+ 4.1	+ 0.5	+ 4.0	+ 0.5	+ 3.8	+ 0.4	+ 3.2		
6-8	+13.5	+24.0			24	172	- 1.2	+15.5	+ 1.3	+ 2.2	+ 2.6	+ 4.6	+ 2.2	+ 3.8	+ 2.2	+ 3.8	+ 2.3	+ 4.1		
8-10	+17.5	+17.8					26	176	+ 0.8	+16.9	+ 1.3	+ 1.3	+ 1.8	+ 1.8	+ 2.0	+ 2.0	+ 2.3	+ 2.3		
10-12	+17.5	+22.5							28	183	+ 3.6	+17.8	+ 0.5	+ 0.7	+ 1.1	+ 1.3	+ 1.4	+ 1.8		
12-14	+20.8	+31.8									30	191	+ 4.2	+17.8	+ 0.4	+ 0.7	+ 1.0	+ 1.6		
14-16	+18.8	+29.8											31	193	+ 5.4	+18.4	+ 0.4	+ 0.6		
16-18															32	196	+ 7.2	+19.3		
18-20																	34	200		

Station
Shoeburyness

Height	Standard temp.	Observed temp.	Diff.	4,000′	6,000′	8,000′	10,000′	12,000′	14,000′	16,000′	20,000′
feet 1,000	58	65	+ 7	+ 4.9	+ 3.5	+ 2.8	+ 2.1	+ 1.4	+ 1.4	+ 0.7	
3,000	54	56	+ 2	+ 0.6	+ 0.6	+ 0.6	+ 0.4	+ 0.4	+ 0.4	+ 0.2	
5,000	50	51	+ 1		+ 0.1	+ 0.2	+ 0.2	+ 0.2	+ 0.2	+ 0.1	
7,000	46	48	+ 2			+ 0.1	+ 0.3	+ 0.2	+ 0.2	+ 0.2	
9,000	42	41	- 1				- 0.1	- 0.1	- 0.1	- 0.1	
11,000	37	34	- 3					0.0	- 0.2	- 0.2	
13,000	32	29	- 3						0.0	- 0.2	
15,000	26	22	- 4							0.0	
17,000	20										
19,000	13										
		Sum		+ 5 5	+ 4.2	+ 3.7	+ 2.9	+ 2.1	+ 1.9	+ 0.7	
		Ballistic temperature		66	64	64	63	62	62	61	

Standard surface temperature 60°F.

Meteor telegram

Sent at.................. By

Bar	29.89
02 67	21168
04 66	24172
06 64	26176
08 64	28183
10 63	30191
12 62	31193
14 62	32196
16 61	34200
20	
Time:-	0915

37689-1

TABLE V

FACTORS AND PRODUCTS FOR COMPUTING BALLISTIC WINDS FOR ANTI-AIRCRAFT TRAJECTORIES

MEAN COMPT.	0–2,000'							
	4,000	6,000	8,000	10,000	12,000	14,000	16,000	20,000
1	.71	.47	.33	.26	.25	.22	.18	.16
2	1.4	.9	.7	.5	.5	.5	.4	.3
3	2.1	1.4	1.0	.8	.7	.7	.5	.5
4	2.8	1.9	1.3	1.0	1.0	.9	.7	.7
5	3.6	2.4	1.6	1.3	1.2	1.1	.9	.8
6	4.3	2.8	2.0	1.6	1.5	1.3	1.1	1.0
7	5.0	3.3	2.3	1.8	1.8	1.5	1.3	1.1
8	5.7	3.8	2.6	2.1	2.0	1.7	1.5	1.3
9	6.4	4.2	3.0	2.3	2.2	2.0	1.6	1.4
10	7.1	4.7	3.3	2.6	2.5	2.2	1.8	1.6
11	7.8	5.2	3.6	2.9	2.8	2.4	2.0	1.8
12	8.5	5.6	4.0	3.1	3.0	2.7	2.2	1.9
13	9.2	6.1	4.3	3.4	3.3	2.9	2.3	2.1
14	9.9	6.6	4.6	3.6	3.5	3.1	2.5	2.3
15	10.7	7.0	5.0	3.9	3.7	3.3	2.7	2.4
16	11.4	7.5	5.3	4.2	4.0	3.5	2.9	2.6
17	12.1	8.0	5.6	4.4	4.3	3.8	3.1	2.7
18	12.8	8.5	5.9	4.7	4.5	3.9	3.3	2.9
19	13.5	8.9	6.3	4.9	4.7	4.2	3.4	3.0
20	14.2	9.4	6.6	5.2	5.0	4.4	3.6	3.2
22	15.6	10.3	7.3	5.7	5.5	4.9	4.0	3.5
24	17.0	11.3	7.9	6.2	6.0	5.3	4.3	3.9
26	18.5	12.2	8.6	6.8	6.5	5.7	4.7	4.2
28	19.9	13.2	9.3	7.3	7.0	6.1	5.1	4.5
30	21.3	14.1	9.9	7.8	7.5	6.6	5.4	4.8
32	22.7	15.0	10.6	8.3	8.0	7.1	5.8	5.1
34	24.1	16.0	11.2	8.8	8.5	7.5	6.1	5.4
36	25.6	16.9	11.9	9.4	9.0	7.9	6.5	5.7
38	27.0	17.9	12.6	9.9	9.5	8.4	6.9	6.1
40	28.4	18.8	13.2	10.4	10.0	8.8	7.2	6.4

MEAN COMPT.	2,000'–4,000'							
	4,000	6,000	8,000	10,000	12,000	14,000	16,000	20,000
1	.29	.39	.32	.25	.24	.22	.19	.16
2	.6	.8	.6	.5	.5	.4	.4	.3
3	.9	1.2	.9	.7	.7	.6	.6	.5
4	1.2	1.6	1.3	1.0	1.0	.9	.8	.6
5	1.4	1.9	1.6	1.2	1.2	1.1	1.0	.8
6	1.7	2.4	1.9	1.5	1.4	1.3	1.1	.9
7	2.0	2.7	2.2	1.8	1.7	1.5	1.3	1.1
8	2.3	3.1	2.6	2.0	1.9	1.7	1.5	1.3
9	2.6	3.5	2.8	2.3	2.2	2.0	1.7	1.4
10	2.9	3.9	3.2	2.5	2.4	2.2	1.9	1.6
11	3.2	4.3	3.5	2.7	2.6	2.4	2.1	1.8
12	3.5	4.7	3.8	3.0	2.9	2.6	2.3	1.9
13	3.8	5.1	4.1	3.2	3.1	2.8	2.5	2.1
14	4.1	5.5	4.5	3.5	3.4	3.1	2.7	2.2
15	4.3	5.9	4.8	3.7	3.6	3.3	2.8	2.4
16	4.6	6.3	5.1	4.0	3.8	3.5	3.0	2.5
17	4.9	6.6	5.5	4.3	4.1	3.7	3.2	2.7
18	5.2	7.0	5.8	4.5	4.3	3.9	3.4	2.9
19	5.5	7.4	6.1	4.8	4.6	4.2	3.6	3.0
20	5.8	7.8	6.4	5.0	4.8	4.4	3.8	3.2
22	6.4	8.6	7.0	5.5	5.3	4.9	4.2	3.5
24	7.0	9.4	7.7	6.0	5.8	5.3	4.6	3.8
26	7.5	10.1	8.3	6.5	6.2	5.7	4.9	4.2
28	8.1	10.9	8.9	7.0	6.7	6.1	5.3	4.5
30	8.7	11.7	9.6	7.5	7.2	6.6	5.7	4.8
32	9.3	12.5	10.2	8.0	7.7	7.0	6.1	5.1
34	9.9	13.3	10.9	8.5	8.2	7.5	6.5	5.4
36	10.4	14.1	11.5	9.0	8.6	7.9	6.8	5.7
38	11.0	14.8	12.1	9.5	9.1	8.3	7.2	6.1
40	11.6	15.6	12.8	10.0	9.6	8.8	7.6	6.4

MEAN COMPT.	4,000'–6,000'						
	6,000	8,000	10,000	12,000	14,000	16,000	20,000
1	.14	.26	.23	.22	.21	.18	.15
2	.3	.5	.5	.4	.4	.3	.3
3	.4	.8	.7	.7	.6	.5	.4
4	.5	1.0	.9	.9	.8	.7	.6
5	.7	1.3	1.2	1.1	1.0	.9	.8
6	.8	1.6	1.4	1.3	1.2	1.1	.9
7	1.0	1.9	1.6	1.5	1.5	1.3	1.1
8	1.1	2.1	1.8	1.8	1.7	1.4	1.2
9	1.3	2.4	2.1	2.0	1.9	1.6	1.4
10	1.4	2.6	2.3	2.2	2.1	1.8	1.5
11	1.5	2.9	2.5	2.4	2.3	2.0	1.6
12	1.7	3.1	2.8	2.6	2.5	2.2	1.8
13	1.8	3.4	3.0	2.8	2.7	2.3	1.9
14	1.9	3.6	3.2	3.1	2.9	2.5	2.1
15	2.1	3.9	3.5	3.3	3.1	2.7	2.3
16	2.2	4.2	3.7	3.5	3.3	2.9	2.4
17	2.4	4.4	3.9	3.7	3.6	3.1	2.6
18	2.5	4.7	4.1	4.0	3.8	3.2	2.7
19	2.7	4.9	4.4	4.2	4.0	3.4	2.9
20	2.8	5.2	4.6	4.4	4.2	3.6	3.0
22	3.1	5.7	5.1	4.8	4.6	3.9	3.3
24	3.3	6.2	5.5	5.3	5.0	4.3	3.6
26	3.7	6.8	6.0	5.7	5.4	4.7	3.9
28	3.9	7.3	6.4	6.2	5.9	5.0	4.2
30	4.2	7.8	6.9	6.6	6.3	5.4	4.5
32	4.5	8.3	7.4	7.0	6.7	5.8	4.8
34	4.7	8.8	7.8	7.5	7.2	6.1	5.1
36	5.0	9.4	8.3	7.9	7.6	6.5	5.4
38	5.3	9.9	8.7	8.4	8.0	6.8	5.7
40	5.6	10.4	9.2	8.8	8.4	7.2	6.0

MEAN COMPT	6,000'–8,000'					
	8,000	10,000	12,000	14,000	16,000	20,000
1	.09	.19	.16	.16	.17	.14
2	.2	.4	.3	.3	.3	.3
3	.3	.6	.5	.5	.5	.4
4	.4	.8	.6	.7	.7	.6
5	.5	.9	.8	.8	.8	.7
6	.5	1.1	1.0	1.0	1.0	.8
7	.6	1.3	1.1	1.1	1.2	1.0
8	.7	1.5	1.3	1.3	1.3	1.1
9	.8	1.7	1.4	1.4	1.5	1.3
10	.9	1.9	1.6	1.6	1.7	1.4
11	1.0	2.1	1.8	1.8	1.9	1.5
12	1.1	2.3	1.9	1.9	2.0	1.7
13	1.2	2.5	2.1	2.1	2.2	1.8
14	1.3	2.7	2.2	2.2	2.4	2.0
15	1.3	2.9	2.4	2.4	2.6	2.1
16	1.4	3.0	2.6	2.6	2.7	2.2
17	1.5	3.2	2.7	2.7	2.9	2.4
18	1.6	3.4	2.9	2.9	3.1	2.5
19	1.7	3.6	3.0	3.0	3.2	2.7
20	1.8	3.8	3.2	3.2	3.4	2.8
22	2.0	4.2	3.5	3.5	3.7	3.1
24	2.2	4.6	3.8	3.8	4.1	3.4
26	2.3	4.9	4.2	4.2	4.4	3.6
28	2.5	5.3	4.5	4.5	4.8	3.9
30	2.7	5.7	4.8	4.8	5.1	4.2
32	2.9	6.1	5.1	5.1	5.4	4.5
34	3.1	6.5	5.4	5.4	5.8	4.8
36	3.2	6.8	5.8	5.7	6.1	5.1
38	3.4	7.2	6.1	6.1	6.5	5.3
40	3.6	7.6	6.4	6.4	6.8	5.6

MEAN COMPT.	8,	
	10,000	12,000
1	.07	.10
2	.1	.2
3	.2	.3
4	.3	.4
5	.4	.5
6	.4	.6
7	.5	.7
8	.6	.8
9	.6	.9
10	.7	1.0
11	.8	1.1
12	.8	1.2
13	.9	1.3
14	1.0	1.4
15	1.0	1.5
16	1.1	1.6
17	1.2	1.7
18	1.3	1.8
19	1.3	1.9
20	1.4	2.0
22	1.5	2.2
24	1.7	2.4
26	1.8	2.6
28	2.0	2.8
30	2.1	3.0
32	2.2	3.2
34	2.4	3.4
36	2.5	3.6
38	2.7	3.8
40	2.8	4.0

9–1 200 D/d 5347 9/38

FACTORS AND PRODUCTS FOR COMPUTING BALLISTIC WINDS FOR ANTI-AIRCRAFT TRAJECTORIES

MEAN COMPT.	2,000'-4,000' 6,000	8,000	10,000	12,000	14,000	16,000	20,000	4,000'-6,000' 6,000	8,000	10,000	12,000	14,000	16,000	20,000
1	.39	.32	.25	.24	.22	.19	.16	.14	.26	.23	.22	.21	.18	.15
2	.8	.6	.5	.5	.4	.4	.3	.3	.5	.5	.4	.4	.3	.3
3	1.2	.9	.7	.7	.6	.6	.5	.4	.8	.7	.7	.6	.5	.4
4	1.6	1.3	1.0	1.0	.9	.8	.6	.5	1.0	.9	.9	.8	.7	.6
5	1.9	1.6	1.2	1.2	1.1	1.0	.8	.7	1.3	1.2	1.1	1.0	.9	.8
6	2.4	1.9	1.5	1.4	1.3	1.1	.9	.8	1.6	1.4	1.3	1.2	1.1	.9
7	2.7	2.2	1.8	1.7	1.5	1.3	1.1	1.0	1.9	1.6	1.5	1.5	1.3	1.1
8	3.1	2.6	2.0	1.9	1.7	1.5	1.3	1.1	2.1	1.8	1.8	1.7	1.4	1.2
9	3.5	2.8	2.3	2.2	2.0	1.7	1.4	1.3	2.4	2.1	2.0	1.9	1.6	1.4
10	3.9	3.2	2.5	2.4	2.2	1.9	1.6	1.4	2.6	2.3	2.2	2.1	1.8	1.5
11	4.3	3.5	2.7	2.6	2.4	2.1	1.8	1.5	2.9	2.5	2.4	2.3	2.0	1.6
12	4.7	3.8	3.0	2.9	2.6	2.3	1.9	1.7	3.1	2.8	2.6	2.5	2.2	1.8
13	5.1	4.1	3.2	3.1	2.8	2.5	2.1	1.8	3.4	3.0	2.8	2.7	2.3	1.9
14	5.5	4.5	3.5	3.4	3.1	2.7	2.2	1.9	3.6	3.2	3.1	2.9	2.5	2.1
15	5.9	4.8	3.7	3.6	3.3	2.8	2.4	2.1	3.9	3.5	3.3	3.1	2.7	2.3
16	6.3	5.1	4.0	3.8	3.5	3.0	2.5	2.2	4.2	3.7	3.5	3.3	2.9	2.4
17	6.6	5.5	4.3	4.1	3.7	3.2	2.7	2.4	4.4	3.9	3.7	3.6	3.1	2.6
18	7.0	5.8	4.5	4.3	3.9	3.4	2.9	2.5	4.7	4.1	4.0	3.8	3.2	2.7
19	7.4	6.1	4.8	4.6	4.2	3.6	3.0	2.7	4.9	4.4	4.2	4.0	3.4	2.9
20	7.8	6.4	5.0	4.8	4.4	3.8	3.2	2.8	5.2	4.6	4.4	4.2	3.6	3.0
22	8.6	7.0	5.5	5.3	4.9	4.2	3.5	3.1	5.7	5.1	4.8	4.6	3.9	3.3
24	9.4	7.7	6.0	5.8	5.3	4.6	3.8	3.3	6.2	5.5	5.3	5.0	4.3	3.6
26	10.1	8.3	6.5	6.2	5.7	4.9	4.2	3.7	6.8	6.0	5.7	5.4	4.7	3.9
28	10.9	8.9	7.0	6.7	6.1	5.3	4.5	3.9	7.3	6.4	6.2	5.9	5.0	4.2
30	11.7	9.6	7.5	7.2	6.6	5.7	4.8	4.2	7.8	6.9	6.6	6.3	5.4	4.5
32	12.5	10.2	8.0	7.7	7.0	6.1	5.1	4.5	8.3	7.4	7.0	6.7	5.8	4.8
34	13.3	10.9	8.5	8.2	7.5	6.5	5.4	4.7	8.8	7.8	7.5	7.2	6.1	5.1
36	14.1	11.5	9.0	8.6	7.9	6.8	5.7	5.0	9.4	8.3	7.9	7.6	6.5	5.4
38	14.8	12.1	9.5	9.1	8.3	7.2	6.1	5.3	9.9	8.7	8.4	8.0	6.8	5.7
40	15.6	12.8	10.0	9.6	8.8	7.6	6.4	5.6	10.4	9.2	8.8	8.4	7.2	6.0

MEAN COMPT.	6,000'-8,000' 8,000	10,000	12,000	14,000	16,000	20,000
1	.09	.19	.16	.16	.17	.14
2	.2	.4	.3	.3	.3	.3
3	.3	.6	.5	.5	.5	.4
4	.4	.8	.6	.7	.7	.6
5	.5	.9	.8	.8	.8	.7
6	.5	1.1	1.0	1.0	1.0	.8
7	.6	1.3	1.1	1.1	1.2	1.0
8	.7	1.5	1.3	1.3	1.3	1.1
9	.8	1.7	1.4	1.4	1.5	1.3
10	.9	1.9	1.6	1.6	1.7	1.4
11	1.0	2.1	1.8	1.8	1.9	1.5
12	1.1	2.3	1.9	1.9	2.0	1.7
13	1.2	2.5	2.1	2.1	2.2	1.8
14	1.3	2.7	2.2	2.2	2.4	2.0
15	1.3	2.9	2.4	2.4	2.6	2.1
16	1.4	3.0	2.6	2.6	2.7	2.2
17	1.5	3.2	2.7	2.7	2.9	2.4
18	1.6	3.4	2.9	2.9	3.1	2.5
19	1.7	3.6	3.0	3.0	3.2	2.7
20	1.8	3.8	3.2	3.2	3.4	2.8
22	2.0	4.2	3.5	3.5	3.7	3.1
24	2.2	4.6	3.8	3.8	4.1	3.4
26	2.3	4.9	4.2	4.2	4.4	3.6
28	2.5	5.3	4.5	4.5	4.8	3.9
30	2.7	5.7	4.8	4.8	5.1	4.2
32	2.9	6.1	5.1	5.1	5.4	4.5
34	3.1	6.5	5.4	5.4	5.8	4.8
36	3.2	6.8	5.8	5.7	6.1	5.1
38	3.4	7.2	6.1	6.1	6.5	5.3
40	3.6	7.6	6.4	6.4	6.8	5.6

MEAN COMPT.	8,000'-10,000' 10,000	12,000	14,000	16,000	20,000	10,000'-12,000' 12,000	14,000	16,000	20,000
1	.07	.10	.11	.13	.12	.03	.06	.08	.10
2	.1	.2	.2	.3	.2	.1	.1	.2	.2
3	.2	.3	.3	.4	.4	.1	.2	.2	.3
4	.3	.4	.4	.5	.5	.1	.2	.3	.4
5	.4	.5	.6	.6	.6	.2	.3	.4	.5
6	.4	.6	.7	.8	.7	.2	.4	.5	.6
7	.5	.7	.8	.9	.8	.2	.4	.6	.7
8	.6	.8	.9	1.0	.9	.2	.5	.7	.8
9	.6	.9	1.0	1.2	1.1	.3	.5	.7	.9
10	.7	1.0	1.1	1.3	1.2	.3	.6	.8	1.0
11	.8	1.1	1.2	1.4	1.3	.3	.7	.9	1.1
12	.8	1.2	1.3	1.5	1.5	.4	.7	1.0	1.2
13	.9	1.3	1.4	1.7	1.6	.4	.8	1.1	1.3
14	1.0	1.4	1.5	1.8	1.7	.4	.9	1.1	1.4
15	1.0	1.5	1.7	2.0	1.8	.5	.9	1.2	1.5
16	1.1	1.6	1.8	2.1	1.9	.5	1.0	1.3	1.6
17	1.2	1.7	1.9	2.2	2.0	.5	1.0	1.4	1.7
18	1.3	1.8	2.0	2.3	2.2	.5	1.1	1.4	1.8
19	1.3	1.9	2.1	2.5	2.3	.6	1.1	1.5	1.9
20	1.4	2.0	2.2	2.6	2.4	.6	1.2	1.6	2.0
22	1.5	2.2	2.4	2.9	2.6	.7	1.3	1.8	2.2
24	1.7	2.4	2.7	3.1	2.9	.7	1.4	1.9	2.4
26	1.8	2.6	2.9	3.4	3.1	.8	1.6	2.1	2.6
28	2.0	2.8	3.1	3.6	3.3	.8	1.7	2.2	2.8
30	2.1	3.0	3.3	3.9	3.6	.9	1.8	2.4	3.0
32	2.2	3.2	3.5	4.2	3.9	1.0	1.9	2.5	3.2
34	2.4	3.4	3.7	4.4	4.1	1.0	2.0	2.7	3.4
36	2.5	3.6	4.0	4.7	4.3	1.1	2.2	2.9	3.6
38	2.7	3.8	4.2	4.9	4.5	1.1	2.3	3.0	3.8
40	2.8	4.0	4.4	5.2	4.8	1.2	2.4	3.2	4.0

MEAN COMPT.	12,000'-14,000' 14,000	16,000	20,000	14,000'-16,000' 16,000	20,000	16,000'-18,000' 20,000	18,000'-20,000' 20,000
1	.02	.05	.07	.02	.06	.03	.01
2	.1	.1	.2	.0	.1	.1	.0
3	.1	.2	.2	.1	.2	.1	.0
4	.1	.2	.3	.1	.2	.1	.0
5	.1	.3	.3	.1	.3	.2	.0
6	.1	.3	.4	.1	.4	.2	.1
7	.2	.3	.5	.1	.4	.2	.1
8	.2	.4	.6	.2	.5	.2	.1
9	.2	.5	.6	.2	.5	.3	.1
10	.2	.5	.7	.2	.6	.3	.1
11	.2	.5	.8	.2	.7	.3	.1
12	.3	.6	.8	.2	.7	.4	.1
13	.3	.6	.9	.3	.8	.4	.1
14	.3	.7	1.0	.3	.8	.4	.1
15	.3	.7	1.1	.3	.9	.4	.1
16	.3	.8	1.1	.3	1.0	.5	.2
17	.3	.8	1.2	.3	1.0	.5	.2
18	.4	.9	1.2	.4	1.1	.5	.2
19	.4	1.0	1.3	.4	1.1	.6	.2
20	.4	1.0	1.4	.4	1.2	.6	.2
22	.4	1.1	1.6	.4	1.3	.7	.2
24	.5	1.2	1.7	.5	1.4	.7	.2
26	.5	1.3	1.8	.5	1.5	.8	.3
28	.6	1.4	2.0	.6	1.7	.8	.3
30	.6	1.5	2.1	.6	1.8	.9	.3
32	.7	1.6	2.2	.6	1.9	1.0	.3
34	.7	1.7	2.4	.7	2.1	1.0	.3
36	.7	1.8	2.5	.7	2.2	1.1	.4
38	.7	1.9	2.7	.8	2.3	1.1	.4
40	.8	2.0	2.8	.8	2.4	1.2	.4

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METEOROLOGICAL OFFICE,

AIR MINISTRY.

SUPPLEMENT TO M.O.317

(incorporating Amendment No. 1)

"The supply of Meteor Reports to Artillery Units"

This supplement contains instructions for the issue of Meteor reports for Anti-Aircraft fire.

Paras. 7 and 9 of M.O. 317 are cancelled.

ANTI - AIRCRAFT FIRE

(a) Introductory

Anti-aircraft fire is distinguished by the fact that the target is to be reached before the projectile has returned to the ground. Meteorological variations are more complicated in these cases by reason of the fact that the position of the burst is altered in height by meteorological factors as well as in range and deviation. Calculation shews that the weighting factors, both as regards wind and density, are not the same for the horizontal and the vertical displacements, and these differences are sometimes considerable in the case of winds in the plane of the trajectory. When working under experimental conditions it is of course possible to make proper corrections for all the displacements due to meteorological changes but, in the field, such a complete treatment of the problem is quite out of the question.

The problem as regards field work was rendered more tractable by making two assumptions:

(1) that all targets will be engaged on the ascending branch of the trajectory or, at any rate, not far beyond the vertex

(2) That meteorological disturbances as regards the height of the burst can be left out of account and only the effect on range and deviation be considered.

When the problem had been thus simplified it was found possible to compile a table of factors and products for computing ballistic winds and temperatures for anti-aircraft fire along somewhat similar lines to the methods adopted already for flat-fire work. We can no longer, however, classify trajectories according to their time of flight. For anti-aircraft purposes we adopt a classification according to the height of burst. The standard practice is to consider trajectories which terminate at the heights 2000, 4000, 6000, etc. feet, in steps of 2000 feet, and to prepare ballistic winds and temperatures for these trajectories, combining the results in a meteor telegram in a manner now to be explained.

(b) Winds

Table V gives the factors and products for use in the calculation of ballistic winds and the method can best be followed by considering the specimen calculations given on pages 2 and 3. On the reproduction of Form 2079 which follows, the results of a pilot balloon ascent by the tail method are shown and on the opposite page the computation of the ballistic winds is set out in detail on the form prepared for this purpose. We first select from the pilot balloon results layers approximating to the standard 2000-ft. intervals, and from these results the mean components in the layers are written down in the appropriate spaces at the left hand side of the computation form. (In practice the values of DE and DN need not be calculated except for the particulars layers which are needed).

They are derived as follows:

Minute	Height (ft.)	D_E	D_N	Mean Components: Layer	E	N
4	1,990	- 10.4	+ 49.7	0 - 2,000	- 2.6	+ 12.4
8	3,840	- 13.0	+ 123.2	2,000 - 4,000	- 0.7	+ 18.4
13	6,200	- 1.0	+ 213.	4,000 - 6,000	+ 2.4	+ 18.0
17	8,200	+ 53.	+ 309.	6,000 - 8,000	+ 13.5	+ 24.0
21	10,200	+ 123.	+ 380.	8,000 - 10,000	+ 17.5	+ 17.8
25	12,200	+ 193.	+ 470.	10,000 - 12,000	+ 17.5	+ 22.5
29	14,200	+ 276.	+ 597.	12,000 - 14,000	+ 20.8	+ 31.8
33	16,200	+ 351.	+ 716.	14,000 - 16,000	+ 18.8	+ 29.8

The method so far is similar to that described in paragraph 3. We now proceed to the weighting process.

The column headed 2000 feet presents no difficulty. A trajectory to this height represents only a single layer and therefore all that is necessary is to copy the two components into the column and then combine them by means of Table II. The ballistic wind for the 2000-ft. trajectory is at once obtained.

The remaining columns are completed by means of Table V. For the 4000-ft. trajectory we have two layers. For the layer 0 - 2000 feet the Table shews that the ballistic wind corresponding to a component of 2.6 is 1.8, and to a component of 12.4 it is 8.8. These figures are therefore inserted in the appropriate spaces. Similarly, for the next layer, 2000 - 4000 feet, the Table gives a ballistic wind of 0.2 for a component of 0.7. For a component of 18.4 the corresponding ballistic wind is 5.3 Inserting these figures in the form, always with due regard to sign, and summing the entries in the two columns, we can combine the two sums so obtained and the result is the ballistic wind for a 4000-ft. trajectory. This process is repeated for all the heights for which a ballistic wind is required. This has been done in the specimen calculation up to 16,000 feet. The figures at the bottom of a column give the ballistic wind for a trajectory terminating at the height printed at the top of that column.

It is clear that the quickest way to carry out the work is to complete each line of the calculation instead of working down the columns. By completing the work line by line the use of Table V is much facilitated as entries needed in each part of the Table always occur together.

(c) Ballistic Temperature

The lower half of the computation form is devoted to the calculation of the Ballistic Temperature. We again use 2000-ft. layers and the appropriate Table for this part of the work is Table VI. The values 1000, 3000, 5000, etc. feet already printed in the form are the mid-heights of the standard 2000-ft. layers and the standard temperatures at these mid-heights are already printed in the adjoining column. We now insert in the next column the observed temperatures at the same heights. If available, the results of an actual upper air sounding should be used here, but in the absence of such data the values will have to be estimated from a consideration of the relevant synoptic chart or such other information as may be available. The differences of the observed temperatures from the standard can now be written down in the adjacent column with due regard to sign. The convention used is the same as in flat-fire work, standard temperature being subtracted from observed temperature. This column of temperature differences is the material which is operated upon by the factors of Table VI.

The 4000-ft. trajectory consists of two layers. In the first layer, 0 - 2000 feet, Table VI shews that a difference of temperature of 7° corresponds to a weighted temperature of 4.9. This is entered in the first space of the column headed 4000 ft. Similarly for the second layer, 2000 - 4000 feet, we find from Table VI that a weighted temperature of 0.6 corresponds to a temperature difference of 2°. Inserting this value and adding the column we find a total of + 5.5°.F. The ballistic temperature for the 4000-ft. trajectory is therefore 60 plus 5.5 = 65.5°F. which is rounded off to 66°. The other columns are completed in a similar way. No column is necessary for the 2000-ft. trajectory as this consists of a single layer only. Since the observed temperature 65° differs from the standard temperature 58° by +7°, the ballistic temperature is 60 + 7° = 67° F.

Here again working is facilitated by working along a line rather than down the columns.

(d) Meteor Telegram

The code at present in use consists mainly of alternate four and five figure groups. The scheme is as follows:

Bar PPPP 02TT VVDDD 04TT VVDDD 06TT VVDDD ...

.... Time tttt.

PPPP is the barometric pressure at MSL in inches and hundredths.

TT is the ballistic temperature in whole degrees Fahr. for the height indicated in 1000's feet by the preceding two figures.

VV is the ballistic wind in feet per second.

DDD is the true direction of the ballistic wind in degrees.

Each five figure group refers to the trajectory noted in the preceding four figure group.

tttt Time of observation in hours and minutes.

In the specimen calculation the Meteor telegram shewn is built up on this code and the construction will be immediately clear. Thus the groups 0864 28183 indicate that for an 8000-ft. trajectory the ballistic temperature is 64° F, and the ballistic wind is 28 f/s. from 183° true bearing.

(e) General Remarks

It will be noted in Tables V and VI that the weight allotted to winds and temperatures at the greater heights is much less than that apportioned to the lower heights. This is of some practical importance as there is often a lack of meteorological data at the greater heights and the necessary figures have to be estimated. Errors in the ballistic winds and temperatures are minimised on this account because errors in the data at the greater heights are of less relative importance.

FORM 2079

PILOT BALLOON ASCENT, Number 1

Date 17th July, 1936

Time of start 0915 G.M.T. How lost Distance Weather b Station Shoeburyness

Size of balloon 70" Dry bulb 69.5°F

Filler No. 3 + 2 Rings Surface wind (15 ft. above ground) Barometer (as read) 1012.5 mb.

Tail length 30 Feet 9 fps from 128° Barometer (corrected) 1012.1 mb.

t	m	A	E	h	DE	DN	V w to E	V s to N	V	ø
1	28.2	324.0	31.0	470	- 4.6	+ 6.3	- 4.6	+ 6.3	13	144
2	13.2	333.4	27.7	940	8.0	16.0	3.4	9.7	17	161
3	7.8	342.6	24.4	1,440	9.5	30.3	1.5	14.3	24	174
4	5.1	348.2	21.4	1,990	10.4	49.7	0.9	19.4	32	177
5	4.0	350.0	19.8	2,390	11.5	65.2	1.1	15.5	26	176
6	3.1	351.5	18.4	2,900	12.9	86.0	- 1.4	20.8	35	176
7	2.6	353.0	17.5	3,300	12.8	104.0	+ 0.1	18.0	30	180
8	2.2	354.0	17.2	3,840	13.0	123.2	- 0.2	19.2	32	179
9	2.0	354.0	17.2	4,230	14.3	135.7	1.3	12.5	21	174
10	1.8	354.3	17.0	4,650	15.1	151.0	- 0.8	15.3	25	177
11	1.6	356.0	17.0	5,230	11.9	170.4	+ 3.2	19.4	33	189
12	1.45	357.9	16.7	5,700	7.0	189.7	4.9	19.3	33	194
13		359.9	16.2	6,200	1	213	6	23	39	195
14		2.3	15.5	6,700	+ 10	240	11	27	49	202
15		4.5	14.9	7,200	21	270	11	30	53	200
16		6.8	14.7	7,700	35	292	14	22	43	212
17		9.7	14.6	8,200	53	309	18	17	41	227
18		12.3	14.5	8,700	72	328	19	19	45	225
19		14.4	14.5	9,200	88	344	16	16	38	225
20		16.3	14.4	9,700	106	363	18	19	44	223
21		18.0	14.3	10,200	123	380	17	17	40	225
22		19.7	14.1	10,700	143	400	20	20	47	225
23		20.7	14.0	11,200	159	421	16	21	44	217
24		21.5	13.9	11,700	173	441	14	20	41	215
25		22.4	13.5	12,200	193	470	20	29	59	215
26		23.3	13.2	12,700	214	498	21	26	58	217
27		24.0	12.9	13,200	235	529	21	31	62	214
28		24.5	12.5	13,700	256	562	21	33	65	213
29		24.9	12.2	14,200	276	597	20	35	67	210
30		25.2	12.0	14,700	295	627	19	30	59	212
31		25.5	11.8	15,200	312	655	17	28	54	211
32		25.8	11.6	15,700	332	688	20	33	64	211
33		26.1	11.5	16,200	351	716	19	28	56	214
34										
35										
36										
37										
38										
39										
40										

COMPUTATION OF BALLISTIC WINDS AND TEMPERATURES FOR ANTI-AIRCRAFT FIRE

Date 17th July 1936 | Time 0915 G.M.T. | Ascent No. 1

Layer	Mean compts.		2,000 ft.		4,000 ft.		6,000 ft.		8,000 ft.		10,000 ft.		12,000 ft.		14,000 ft.		16,000 ft.		20,000 ft.	
	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N
0-2	- 2.6	+ 12.4	- 2.6	+12.4	- 1.8	+ 8.8	- 1.2	+ 5.8	- 0.9	+ 4.1	- 0.7	+ 3.2	- 0.6	+ 3.1	- 0.6	+ 2.8	- 0.5	+ 2.2		
2-4	- 0.7	+ 18.4	21	168	- 0.2	+ 5.3	- 0.3	+ 7.2	- 0.2	+ 5.9	- 0.2	+ 4.6	- 0.2	+ 4.4	- 0.2	+ 4.0	- 0.1	+ 3.5		
4-6	+ 2.4	+ 18.0			- 2.0	+14.1	+ 0.3	+ 2.5	+ 0.6	+ 4.7	+ 0.6	+ 4.1	+ 0.5	+ 4.0	+ 0.5	+ 3.8	+ 0.4	+ 3.2		
6-8	+13.5	+ 24.0			24	172	- 1.2	+15.5	+ 1.3	+ 2.2	+ 2.6	+ 4.6	+ 2.2	+ 3.8	+ 2.2	+ 3.8	+ 2.3	+ 4.1		
8-10	+17.5	+ 17.8					26	176	+ 0.8	+16.9	+ 1.3	+ 1.3	+ 1.8	+ 1.8	+ 2.0	+ 2.0	+ 2.3	+ 2.3		
10-12	+17.5	+ 22.5							28	183	+ 3.6	+17.8	+ 0.5	+ 0.7	+ 1.1	+ 1.3	+ 1.4	+ 1.8		
12-14	+20.8	+ 31.8									30	191	+ 4.2	+17.8	+ 0.4	+ 0.7	+ 1.0	+ 1.6		
14-16	+18.8	+ 29.8											31	193	+ 5.4	+18.4	+ 0.4	+ 0.6		
16-18															32	196	+ 7.2	+19.3		
18-20																	34	200		

Station
Shoeburyness

Height	Standard temp.	Observed temp.	Diff.	4,000′	6,000′	8,000′	10,000′	12,000′	14,000′	16,000′	20,000′
feet 1,000	58	65	+ 7	+ 4.9	+ 3.5	+ 2.8	+ 2.1	+ 1.4	+ 1.4	+ 0.7	
3,000	54	56	+ 2	+ 0.6	+ 0.6	+ 0.6	+ 04	+ 0.4	+ 0.4	+ 0.2	
5,000	50	51	+ 1		+ 0.1	+ 0.2	+ 0.2	+ 0.2	+ 0.2	+ 0.1	
7,000	46	48	+ 2			+ 0.1	+ 0.3	+ 0.2	+ 0.2	+ 0.2	
9,000	42	41	- 1				- 0.1	- 0.1	- 0.1	- 0.1	
11,000	37	34	- 3					0.0	- 0.2	- 0.2	
13,000	32	29	- 3						0.0	- 0.2	
15,000	26	22	- 4							0.0	
17,000	20										
19,000	13										
		Sum		+ 5.5	+ 4.2	+ 3.7	+ 2.9	+ 2.1	+ 1.9	+ 0.7	
		Ballistic-temperature		66	64	64	63	62	62	61	

Standard surface temperature 60°F.

Meteor telegram

Sent at .... By ....

Bar	29.89
02 67	21168
04 66	24172
06 64	26176
08 64	28183
10 63	30191
12 62	31193
14 62	32196
16 61	34200
20	
Time:-	0915

86976-1

TABLE V
(Sheet 1)

FACTORS AND PRODUCTS

FOR COMPUTING BALLISTIC WINDS FOR ANTI-AIRCRAFT

TRAJECTORIES

MEAN COMPT.	0-2,000'								2,000'-4,000'								4,000'-6,000'							MEAN COMPT.
	4,000	6,000	8,000	10,000	12,000	14,000	16,000	20,000	4,000	6,000	8,000	10,000	12,000	14,000	16,000	20,000	6,000	8,000	10,000	12,000	14,000	16,000	20,000	
1	.71	.47	.33	.26	.25	.22	.18	.16	.29	.39	.32	.25	.24	.22	.19	.16	.14	.26	.23	.22	.21	.18	.15	1
2	1.4	.9	.7	.5	.5	.5	.4	.3	.6	.8	.6	.5	.5	.4	.4	.3	.3	.5	.5	.4	.4	.3	.3	2
3	2.1	1.4	1.0	.8	.7	.7	.5	.5	.9	1.2	.9	.7	.7	.6	.6	.5	.4	.8	.7	.7	.6	.5	.4	3
4	2.8	1.9	1.3	1.0	1.0	.9	.7	.7	1.2	1.6	1.3	1.0	1.0	.9	.8	.6	.5	1.0	.9	.9	.8	.7	.6	4
5	3.6	2.4	1.6	1.3	1.2	1.1	.9	.8	1.4	1.9	1.6	1.2	1.2	1.1	1.0	.8	.7	1.3	1.2	1.1	1.0	.9	.8	5
6	4.3	2.8	2.0	1.6	1.5	1.3	1.1	1.0	1.7	2.4	1.9	1.5	1.4	1.3	1.1	.9	.8	1.6	1.4	1.3	1.2	1.1	.9	6
7	5.0	3.3	2.3	1.8	1.8	1.5	1.3	1.1	2.0	2.7	2.2	1.8	1.7	1.5	1.3	1.1	1.0	1.9	1.6	1.5	1.5	1.3	1.1	7
8	5.7	3.8	2.6	2.1	2.0	1.7	1.5	1.3	2.3	3.1	2.6	2.0	1.9	1.7	1.5	1.3	1.1	2.1	1.8	1.8	1.7	1.4	1.2	8
9	6.4	4.2	3.0	2.3	2.2	2.0	1.6	1.4	2.6	3.5	2.8	2.3	2.2	2.0	1.7	1.4	1.3	2.4	2.1	2.0	1.9	1.6	1.4	9
10	7.1	4.7	3.3	2.6	2.5	2.2	1.8	1.6	2.9	3.9	3.2	2.5	2.4	2.2	1.9	1.6	1.4	2.6	2.3	2.2	2.1	1.8	1.5	10
11	7.8	5.2	3.6	2.9	2.8	2.4	2.0	1.8	3.2	4.3	3.5	2.7	2.6	2.4	2.1	1.8	1.5	2.9	2.5	2.4	2.3	2.0	1.6	11
12	8.5	5.6	4.0	3.1	3.0	2.7	2.2	1.9	3.5	4.7	3.8	3.0	2.9	2.6	2.3	1.9	1.7	3.1	2.8	2.6	2.5	2.2	1.8	12
13	9.2	6.1	4.3	3.4	3.3	2.9	2.3	2.1	3.8	5.1	4.1	3.2	3.1	2.8	2.5	2.1	1.8	3.4	3.0	2.8	2.7	2.3	1.9	13
14	9.9	6.6	4.6	3.6	3.5	3.1	2.5	2.3	4.1	5.5	4.5	3.5	3.4	3.1	2.7	2.2	1.9	3.6	3.2	3.1	2.9	2.5	2.1	14
15	10.7	7.0	5.0	3.9	3.7	3.3	2.7	2.4	4.3	5.9	4.8	3.7	3.6	3.3	2.8	2.4	2.1	3.9	3.5	3.3	3.1	2.7	2.3	15
16	11.4	7.5	5.3	4.2	4.0	3.5	2.9	2.6	4.6	6.3	5.1	4.0	3.8	3.5	3.0	2.5	2.2	4.2	3.7	3.5	3.3	2.9	2.4	16
17	12.1	8.0	5.6	4.4	4.3	3.8	3.1	2.7	4.9	6.6	5.5	4.3	4.1	3.7	3.2	2.7	2.4	4.4	3.9	3.7	3.6	3.1	2.6	17
18	12.8	8.5	5.9	4.7	4.5	3.9	3.3	2.9	5.2	7.0	5.8	4.5	4.3	3.9	3.4	2.9	2.5	4.7	4.1	4.0	3.8	3.2	2.7	18
19	13.5	8.9	6.3	4.9	4.7	4.2	3.4	3.0	5.5	7.4	6.1	4.8	4.6	4.2	3.6	3.0	2.7	4.9	4.4	4.2	4.0	3.4	2.9	19
20	14.2	9.4	6.6	5.2	5.0	4.4	3.6	3.2	5.8	7.8	6.4	5.0	4.8	4.4	3.8	3.2	2.8	5.2	4.6	4.4	4.2	3.6	3.0	20
22	15.6	10.3	7.3	5.7	5.5	4.9	4.0	3.5	6.4	8.6	7.0	5.5	5.3	4.9	4.2	3.5	3.1	5.7	5.1	4.8	4.6	3.9	3.3	22
24	17.0	11.3	7.9	6.2	6.0	5.3	4.3	3.9	7.0	9.4	7.7	6.0	5.8	5.3	4.6	3.8	3.3	6.2	5.5	5.3	5.0	4.3	3.6	24
26	18.5	12.2	8.6	6.8	6.5	5.7	4.7	4.2	7.5	10.1	8.3	6.5	6.2	5.7	4.9	4.2	3.7	6.8	6.0	5.7	5.4	4.7	3.9	26
28	19.9	13.2	9.3	7.3	7.0	6.1	5.1	4.5	8.1	10.9	8.9	7.0	6.7	6.1	5.3	4.5	3.9	7.3	6.4	6.2	5.9	5.0	4.2	28
30	21.3	14.1	9.9	7.8	7.5	6.6	5.4	4.8	8.7	11.7	9.6	7.5	7.2	6.6	5.7	4.8	4.2	7.8	6.9	6.6	6.3	5.4	4.5	30
32	22.7	15.0	10.6	8.3	8.0	7.1	5.8	5.1	9.3	12.5	10.2	8.0	7.7	7.0	6.1	5.1	4.5	8.3	7.4	7.0	6.7	5.8	4.8	32
34	24.1	16.0	11.2	8.8	8.5	7.5	6.1	5.4	9.9	13.3	10.9	8.5	8.2	7.5	6.5	5.4	4.7	8.8	7.8	7.5	7.2	6.1	5.1	34
36	25.6	16.9	11.9	9.4	9.0	7.9	6.5	5.7	10.4	14.1	11.5	9.0	8.6	7.9	6.8	5.7	5.0	9.4	8.3	7.9	7.6	6.5	5.4	36
38	27.0	17.9	12.6	9.9	9.5	8.4	6.9	6.1	11.0	14.8	12.1	9.5	9.1	8.3	7.2	6.1	5.3	9.9	8.7	8.4	8.0	6.8	5.7	38
40	28.4	18.8	13.2	10.4	10.0	8.8	7.2	6.4	11.6	15.6	12.8	10.0	9.6	8.8	7.6	6.4	5.6	10.4	9.2	8.8	8.4	7.2	6.0	40

MEAN COMPT.	6,000'-8,000'						8,000'-10,000'				
	8,000	10,000	12,000	14,000	16,000	20,000	10,000	12,000	14,000	16,000	20,000
1	.09	.19	.16	.16	.17	.14	.07	.10	.11	.13	.12
2	.2	.4	.3	.3	.3	.3	.1	.2	.2	.3	.2
3	.3	.6	.5	.5	.5	.4	.2	.3	.3	.4	.4
4	.4	.8	.6	.7	.7	.6	.3	.4	.4	.5	.5
5	.5	.9	.8	.8	.8	.7	.4	.5	.6	.6	.6
6	.5	1.1	1.0	1.0	1.0	.8	.4	.6	.7	.8	.7
7	.6	1.3	1.1	1.1	1.2	1.0	.5	.7	.8	.9	.8
8	.7	1.5	1.3	1.3	1.3	1.1	.6	.8	.9	1.0	.9
9	.8	1.7	1.4	1.4	1.5	1.3	.6	.9	1.0	1.2	1.1
10	.9	1.9	1.6	1.6	1.7	1.4	.7	1.0	1.1	1.3	1.2
11	1.0	2.1	1.8	1.8	1.9	1.5	.8	1.1	1.2	1.4	1.3
12	1.1	2.3	1.9	1.9	2.0	1.7	.8	1.2	1.3	1.5	1.5
13	1.2	2.5	2.1	2.1	2.2	1.8	.9	1.3	1.4	1.7	1.6
14	1.3	2.7	2.2	2.2	2.4	2.0	1.0	1.4	1.5	1.8	1.7
15	1.3	2.9	2.4	2.4	2.6	2.1	1.0	1.5	1.7	2.0	1.8
16	1.4	3.0	2.6	2.6	2.7	2.2	1.1	1.6	1.8	2.1	1.9
17	1.5	3.2	2.7	2.7	2.9	2.4	1.2	1.7	1.9	2.2	2.0
18	1.6	3.4	2.9	2.9	3.1	2.5	1.3	1.8	2.0	2.3	2.2
19	1.7	3.6	3.0	3.0	3.2	2.7	1.3	1.9	2.1	2.5	2.3
20	1.8	3.8	3.2	3.2	3.4	2.8	1.4	2.0	2.2	2.6	2.4
22	2.0	4.2	3.5	3.5	3.7	3.1	1.5	2.2	2.4	2.9	2.6
24	2.2	4.6	3.8	3.8	4.1	3.4	1.7	2.4	2.7	3.1	2.9
26	2.3	4.9	4.2	4.2	4.4	3.6	1.8	2.6	2.9	3.4	3.1
28	2.5	5.3	4.5	4.5	4.8	3.9	2.0	2.8	3.1	3.6	3.3
30	2.7	5.7	4.8	4.8	5.1	4.2	2.1	3.0	3.3	3.9	3.6
32	2.9	6.1	5.1	5.1	5.4	4.5	2.2	3.2	3.5	4.2	3.9
34	3.1	6.5	5.4	5.4	5.8	4.8	2.4	3.4	3.7	4.4	4.1
36	3.2	6.8	5.8	5.7	6.1	5.1	2.5	3.6	4.0	4.7	4.3
38	3.4	7.2	6.1	6.1	6.5	5.3	2.7	3.8	4.2	4.9	4.5
40	3.6	7.6	6.4	6.4	6.8	5.6	2.8	4.0	4.4	5.2	4.8

MEAN COMPT.	10,000'-12,000'				12,000'-14,000'			14,000'-16,000'		16,000'-18,000'	18,000'-20,000'	MEAN COMPT
	12,000	14,000	16,000	20,000	14,000	16,000	20,000	16,000	20,000	20,000	20,000	
1	.03	.06	.08	.10	.02	.05	.07	.02	.06	.03	.01	1
2	.1	.1	.2	.2	.1	.1	.2	.0	.1	.1	.0	2
3	.1	.2	.2	.3	.1	.2	.2	.1	.2	.1	.0	3
4	.1	.2	.3	.4	.1	.2	.3	.1	.2	.1	.0	4
5	.2	.3	.4	.5	.1	.3	.3	.1	.3	.2	.0	5
6	.2	.4	.5	.6	.1	.3	.4	.1	.4	.2	.1	6
7	.2	.4	.6	.7	.2	.3	.5	.1	.4	.2	.1	7
8	.2	.5	.7	.8	.2	.4	.6	.2	.5	.2	.1	8
9	.3	.5	.7	.9	.2	.5	.6	.2	.5	.3	.1	9
10	.3	.6	.8	1.0	.2	.5	.7	.2	.6	.3	.1	10
11	.3	.7	.9	1.1	.2	.5	.8	.2	.7	.3	.1	11
12	.4	.7	1.0	1.2	.3	.6	.8	.2	.7	.4	.1	12
13	.4	.8	1.1	1.3	.3	.6	.9	.3	.8	.4	.1	13
14	.4	.9	1.1	1.4	.3	.7	1.0	.3	.8	.4	.1	14
15	.5	.9	1.2	1.5	.3	.7	1.1	.3	.9	.4	.1	15
16	.5	1.0	1.3	1.6	.3	.8	1.1	.3	1.0	.5	.2	16
17	.5	1.0	1.4	1.7	.3	.8	1.2	.3	1.0	.5	.2	17
18	.5	1.1	1.4	1.8	.4	.9	1.2	.4	1.1	.5	.2	18
19	.6	1.1	1.5	1.9	.4	1.0	1.3	.4	1.1	.6	.2	19
20	.6	1.2	1.6	2.0	.4	1.0	1.4	.4	1.2	.6	.2	20
22	.7	1.3	1.8	2.2	.4	1.1	1.6	.4	1.3	.7	.2	22
24	.7	1.4	1.9	2.4	.5	1.2	1.7	.5	1.4	.7	.2	24
26	.8	1.6	2.1	2.6	.5	1.3	1.8	.5	1.5	.8	.3	26
28	.8	1.7	2.2	2.8	.6	1.4	2.0	.6	1.7	.8	.3	28
30	.9	1.8	2.4	3.0	.6	1.5	2.1	.6	1.8	.9	.3	30
32	1.0	1.9	2.5	3.2	.7	1.6	2.2	.6	1.9	1.0	.3	32
34	1.0	2.0	2.7	3.4	.7	1.7	2.4	.7	2.1	1.0	.3	34
36	1.1	2.2	2.9	3.6	.7	1.8	2.5	.7	2.2	1.1	.4	36
38	1.1	2.3	3.0	3.8	.7	1.9	2.7	.8	2.3	1.1	.4	38
40	1.2	2.4	3.2	4.0	.8	2.0	2.8	.8	2.4	1.2	.4	40

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M.O. 317
(Amendment No. 1)

TABLE VI
(Sheet 1)

WEIGHTING FACTORS AND PRODUCTS
FOR COMPUTING BALLISTIC TEMPERATURES FOR ANTI-AIRCRAFT
TRAJECTORIES

Difference From Standard °F	1,000' LAYER								3,000' LAYER								Difference From Standard °F
	THOUSANDS OF FEET																
	4	6	8	10	12	14	16	20	4	6	8	10	12	14	16	20	
1	·7	·5	·4	·3	·2	·2	·1	·1	·3	·3	·3	·2	·2	·2	·1	·1	1
2	1·4	1·1	·8	·6	·5	·4	·3	·2	·5	·6	·6	·5	·4	·4	·3	·2	2
3	2·2	1·6	1·1	·8	·7	·6	·4	·3	·8	1·0	·9	·7	·6	·5	·4	·3	3
4	2·9	2·2	1·5	1·1	1·0	·8	·6	·4	1·0	1·3	1·2	1·0	·8	·7	·6	·4	4
5	3·6	2·7	1·9	1·4	1·2	1·0	·7	·5	1·3	1·6	1·5	1·2	1·1	·9	·7	·5	5
6	4·3	3·2	2·3	1·7	1·4	1·2	·8	·6	1·6	1·9	1·8	1·4	1·3	1·1	·8	·6	6
7	5·0	3·8	2·7	2·0	1·7	1·4	1·0	·7	1·8	2·2	2·1	1·7	1·5	1·3	1·0	·7	7
8	5·8	4·3	3·0	2·2	1·9	1·6	1·1	·8	2·1	2·6	2·4	1·9	1·7	1·4	1·1	·8	8
9	6·5	4·9	3·4	2·5	2·2	1·8	1·3	·9	2·3	2·9	2·7	2·2	1·9	1·6	1·3	·9	9
10	7·2	5·4	3·8	2·8	2·4	2·0	1·4	1·0	2·6	3·2	3·0	2·4	2·1	1·8	1·4	1·0	10
11	7·9	5·9	4·2	3·1	2·6	2·2	1·5	1·1	2·9	3·5	3·3	2·6	2·3	2·0	1·5	1·1	11
12	8·6	6·5	4·6	3·4	2·9	2·4	1·7	1·2	3·1	3·8	3·6	2·9	2·5	2·2	1·7	1·2	12
13	9·4	7·0	4·9	3·6	3·1	2·6	1·8	1·3	3·4	4·2	3·9	3·1	2·7	2·3	1·8	1·3	13
14	10·1	7·6	5·3	3·9	3·4	2·8	2·0	1·4	3·6	4·5	4·2	3·4	2·9	2·5	2·0	1·4	14
15	10·8	8·1	5·7	4·2	3·6	3·0	2·1	1·5	3·9	4·8	4·5	3·6	3·1	2·7	2·1	1·5	15
16	11·5	8·6	6·1	4·5	3·8	3·2	2·2	1·6	4·2	5·1	4·8	3·8	3·4	2·9	2·2	1·6	16
17	12·2	9·2	6·5	4·8	4·1	3·4	2·4	1·7	4·4	5·4	5·1	4·1	3·6	3·1	2·4	1·7	17
18	13·0	9·7	6·8	5·0	4·3	3·6	2·5	1·8	4·7	5·8	5·4	4·3	3·8	3·2	2·5	1·8	18
19	13·7	10·3	7·2	5·3	4·6	3·8	2·7	1·9	4·9	6·1	5·7	4·6	4·0	3·4	2·7	1·9	19
20	14·4	10·8	7·6	5·6	4·8	4·0	2·8	2·0	5·2	6·4	6·0	4·8	4·2	3·6	2·8	2·0	20
22	15·8	11·9	8·4	6·2	5·3	4·4	3·1	2·2	5·7	7·0	6·6	5·3	4·6	4·0	3·1	2·2	22
24	17·3	13·0	9·1	6·7	5·8	4·8	3·4	2·4	6·2	7·7	7·2	5·8	5·0	4·3	3·4	2·4	24
26	18·7	14·0	9·9	7·3	6·2	5·2	3·6	2·6	6·8	8·3	7·8	6·2	5·5	4·7	3·6	2·6	26
28	20·2	15·1	10·6	7·8	6·7	5·6	3·9	2·8	7·3	9·0	8·4	6·7	5·9	5·0	3·9	2·8	28
30	21·6	16·2	11·4	8·4	7·2	6·0	4·2	3·0	7·8	9·6	9·0	7·2	6·3	5·4	4·2	3·0	30

TABLE VI (contd.)
(Sheet 2)

Difference From Standard °F	5,000' LAYER							7,000' LAYER						9,000' LAYER					Difference From Standard °F
	THOUSANDS							OF					FEET						
	6	8	10	12	14	16	20	8	10	12	14	16	20	10	12	14	16	20	
1	·1	·2	·2	·2	·2	·1	·1	·1	·1	·1	·1	·1	·1	·1	·1	·1	·1	·1	1
2	·2	·4	·4	·3	·3	·3	·2	·1	·3	·2	·2	·2	·2	·1	·2	·2	·2	·2	2
3	·3	·6	·6	·5	·5	·4	·3	·1	·4	·4	·4	·3	·3	·2	·2	·3	·3	·2	3
4	·4	·8	·8	·7	·6	·5	·4	·2	·5	·5	·5	·4	·4	·2	·3	·4	·4	·3	4
5	·5	1·0	·9	·9	·8	·7	·5	·3	·7	·6	·6	·5	·5	·3	·4	·5	·5	·4	5
6	·6	1·2	1·1	1·0	1·0	·8	·6	·3	·8	·7	·7	·7	·5	·4	·5	·5	·5	·5	6
7	·7	1·4	1·3	1·2	1·1	·9	·7	·3	·9	·8	·8	·8	·6	·4	·6	·6	·6	·6	7
8	·8	1·6	1·5	1·4	1·3	1·0	·8	·4	1·0	1·0	1·0	·9	·7	·5	·6	·7	·7	·6	8
9	·9	1·8	1·7	1·5	1·4	1·2	·9	·5	1·2	1·1	1·1	1·0	·8	·5	·7	·8	·8	·7	9
10	1·0	2·0	1·9	1·7	1·6	1·3	1·0	·5	1·3	1·2	1·2	1·1	·9	·6	·8	·9	·9	·8	10
11	1·1	2·2	2·1	1·9	1·8	1·4	1·1	·5	1·4	1·3	1·3	1·2	1·0	·7	·9	1·0	1·0	·9	11
12	1·2	2·4	2·3	2·0	1·9	1·6	1·2	·6	1·6	1·4	1·4	1·3	1·1	·7	1·0	1·1	1·1	1·0	12
13	1·3	2·6	2·5	2·2	2·1	1·7	1·3	·7	1·7	1·6	1·6	1·4	1·2	·8	1·0	1·2	1·2	1·0	13
14	1·4	2·8	2·7	2·4	2·2	1·8	1·4	·7	1·8	1·7,	1·7	1·5	1·3	·8	1·1	1·3	1·3	1·1	14
15	1·5	3·0	2·9	2·5	2·4	1·9	1·5	·7	1·9	1·8	1·8	1·7	1·3	·9	1·2	1·3	1·3	1·2	15
16	1·6	3·2	3·0	2·7	2·6	2·1	1·6	·8	2·1	1·9	1·9	1·8	1·4	1·0	1·3	1·4	1·4	1·3	16
17	1·7	3·4	3·2	2·9	2·7	2·2	1·7	·9	2·2	2·0	2·0	1·9	1·5	1·0	1·4	1·5	1·5	1·4	17
18	1·8	3·6	3·4	3·1	2·9	2·3	1·8	·9	2·3	2·2	2·2	2·0	1·6	1·1	1·4	1·6	1·6	1·4	18
19	1·9	3·8	3·6	3·2	3·0	2·5	1·9	·9	2·5	2·3	2·3	2·1	1·7	1·1	1·5	1·7	1·7	1·5	19
20	2·0	4·0	3·8	3·4	3·2	2·6	2·0	1·0	2·6	2·4	2·4	2·2	1·8	1·2	1·6	1·8	1·8	1·6	20
22	2·2	4·4	4·2	3·7	3·5	2·9	2·2,	1·1	2·9	2·6	2·6	2·4	2·0	1·3	1·8	2·0	2·0	1·8	23
24	2·4	4·8	4·6	4·1	3·8	3·1	2·4	1·2	3·1	2·9	2·9	2·6	2·2	1·4	1·9	2·2	2·2	1·9	24
26	2·6	5·2	4·9	4·4	4·2	3·4	2·6	1·3	3·4	3·1	3·1	2·9	2·3	1·6	2·1	2·3	2·3	2·1	26
28	2·8	5·6	5·3	4·8	4·5	3·6	2·8	1·4	3·6	3·4	3·4	3·1	2·5	1·7	2·2	2·5	2·5	2·2	28
30	3·0	6·0	5·7	5·1	4·8	3·9	3·0	1·5	3·9	3·6	3·6	3·3	2·7	1·8	2·4	2·7	2·7	2·4	30

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TABLE VI (contd.)
(Sheet 3)

Difference From Standard °F	11,000' LAYER				13,000' LAYER			15,000' LAYER		17,000' LAYER	19,000' LAYER	Difference From Standard °F
	THOUSANDS OF FEET											
	12	14	16	20	14	16	20	16	20	20	20	
1	0	·1	·1	·1	0	0	·1	0	0	0	0	1
2	·1	·1	·1	·1	0	·1	·1	0	·1	·1	0	2
3	·1	·1	·2	·2	0	·1	·1	0	·1	·1	0	3
4	·1	·2	·2	·3	0	·2	·2	0	·2	·1	0	4
5	·1	·3	·3	·3	·1	·2	·3	·1	·2	·1	·1	5
6	·2	·3	·4	·4	·1	·2	·3	·1	·2	·2	·1	6
7	·2	·3	·4	·5	·1	·3	·3	·1	·3	·2	·1	7
8	·2	·4	·5	·6	·1	·3	·4	·1	·3	·2	·1	8
9	·3	·5	·5	·6	·1	·4	·5	·1	·4	·3	·1	9
10	·3	·5	·6	·7	·1	·4	·5	·1	·4	·3	·1	10
11	·3	·5	·7	·8	·1	·4	·5	·1	·4	·3	·1	11
12	·4	·6	·7	·8	·1	·5	·6	·1	·5	·4	·1	12
13	·4	·7	·8	·9	·1	·5	·7	·1	·5	·4	·1	13
14	·4	·7	·8	1·0	·1	·6	·7	·1	·6	·4	·1	14
15	·5	·7	·9	1·1	·1	·6	·7	·1	·6	·5	·1	15
16	·5	·8	1·0	1·1	·2	·6	·8	·2	·6	·5	·2	16
17	·5	·9	1·0	1·2	·2	·7	·9	·2	·7	·5	·2	17
18	·5	·9	1·1	1·3	·2	·7	·9	·2	·7	·5	·2	18
19	·6	·9	1·1	1·3	·2	·8	·9	·2	·8	·6	·2	19
20	·6	1·0	1·2	1·4	·2	·8	1·0	·2	·8	·6	·2	20
22	·7	1·1	1·3	1·5	·2	·9	1·1	·2	·9	·7	·2	22
24	·7	1·2	1·4	1·7	·2	1·0	1·2	·2	1·0	·7	·2	24
26	·8	1·3	1·6	1·8	·3	1·0	1·3	·3	1·0	·8	·3	26
28	·8	1·4	1·7	2·0	·3	1·1	1·4	·3	1·1	·8	·3	28
30	·9	1·5	1·8	2·1	·3	1·2	1·5	·3	1·2	·9	·3	30

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