PART VI

OPERATING DATA

117. Loading and C.G. data

(a) *C.G. limitations*

(i) The C.G. limits, undercarriage down, are as follows:

Forward limit	0 ins. aft of datum.
Aft limit	14.5 ins. aft of datum.

(ii) Ballast must be carried if any of the following items are not carried:—
Radar ranging, I.F.F., D.M.E.

(b) *Effects of consumption of expendable stores*

(i) *Ammunition*
Firing the gun causes the C.G. to move aft.

(ii) *Fuel*

Consumption from	C.G. Movement
Outboard drop tanks	Forward
Inboard drop tanks	Negligible
Wing tanks	Slight aft
Rear tanks	Slight forward
Front tanks	Aft

(iii) Inboard drop tank jettison has a negligible effect on C.G.

(iv) R.P. firing or outboard drop tank jettison causes a forward C.G. movement.

(c) *Typical service loads*
The figures given below are approximate and are intended only as a guide. Reference should always be made to R.A.F. Form 4801 or to A.P.4347G—Vol. 1, Sect. 2, Chap. 3.

Configuration	Approx. AUW. (lb.)
(1) Clean, full internal fuel and ammunition	17,250
(2) As (1) plus 24×25 lb. RP's	18,900
(3) As (2) plus 2×100 gall. (full) drop tanks	21,000
(4) As (1) plus 2×100 gall. (full) drop tanks	19,250
(5) As (1) plus 4×100 gall. (full) drop tanks	21,150

118. **Pressure error corrections**

(a) The A.S.I. sea level pressure error corrections are as follows:—

I.A.S.—Knots	200	300	400	500	600
Clean or with any stores combination *excluding* a port outboard drop tank	+1	+3	+4	+3	0
With any stores combination *including* a port outboard drop tank	0	+4	+6	+9	+12

(b) The machmeter pressure error corrections are as follows:—

Configuration	Height	Level Flight—I.M.N.				Diving—I.M.N.				
		0.7	0.8	0.85	0.9	0.93	0.94	0.985	1.0	1.1
Clean, or with any stores combination *excluding* a port outboard drop tank	All	← Negligible →						+0.015	+0.03	+0.13
With any stores combination *including* a port outboard drop tank	S.L.	+0.02	+0.03	+0.03	+0.05					
	40,000	Negligible		+0.02	+0.04					

(c) (i) The altimeter pressure error corrections at approach speeds, clean or with drop tanks are negligible.

(ii) The following are the p.e.c's, in feet, at the higher speeds.

With a Port Outboard Drop Tank

	Sea Level	5,000 ft.	10,000 ft.	15,000 ft.	20,000 ft.	25,000 ft.	30,000 ft.	35,000 ft.	40,000 ft.
0.7	+400	+370	+320	+260	+200	+120	+40	−80	−200
0.8	+670	+610	+540	+460	+390	+300	+200	+80	−40
0.85	+1000	+920	+820	+720	+620	+520	+400	+270	+140
0.87	+1200	+1120	+1020	+910	+800	+690	+560	+430	+300
0.88	+1320	+1240	+1160	+1060	+960	+860	+760	+640	+520

Without a Port Outboard Drop Tank

0.7	+190	+170	+150	+120	+90	+60	+20	−20	−60
0.8	+200	+170	+130	+90	+60	+10	−20	−50	−90
0.85	+180	+140	+100	+50	0	−30	−60	−100	−140
0.9	+40	+50	+50	−40	−50	−80	−110	−160	−200

119. **Fuel consumptions**

The approximate fuel consumptions in lb./hr. for various r.p.m. and altitudes are given below:—

Height	6,800 r.p.m.	7,000 r.p.m.	7,200 r.p.m.	7,400 r.p.m.	7,700 r.p.m.	8,100 r.p.m.
Sea Level	3,040	3,560	4,170	5,290	7,150	9,600
10,000 ft.	2,350	2,880	3,550	4,360	6,080	7,550
20,000 ft.	—	2,260	2,880	3,640	4,460	5,470
30,000 ft.	—	1,780	2,250	2,770	3,250	4,080
40,000 ft.	—	—	1,330	1,780	2,250	2,790

120. **Take-off distances**

The following are the approximate sea level take-off distances, in yards, for various configurations, wind and temperature conditions.

(a) *Clean aircraft* (A.U.W. 17,250 lb.)

Temperature (°C.)		−15	0	15	30	45
Zero wind	Ground Run	590	680	780	910	1,060
	Distance to 50 ft.	970	1,080	1,210	1,390	1,560
30 K. wind	Ground Run	350	400	470	550	640
	Distance to 50 ft.	660	730	820	930	1,040

(b) *With 2×100 gallon drop tanks* (A.U.W. 19,250 lb.)

Temperature (°C.)		−15	0	15	30	45
Zero wind	Ground Run	720	830	950	1,120	1,290
	Distance to 50 ft.	1,160	1,300	1,450	1,660	1,870
30 K. wind	Ground Run	440	510	590	690	800
	Distance to 50 ft.	800	900	990	1,140	1,260

(c) *With 4×100 gallon drop tanks* (A.U.W. 21,150 lb.)

Temperature (°C.)		−15	0	15	30	45
Zero wind	Ground Run	900	1,040	1,200	1,410	1,630
	Distance to 50 ft.	1,400	1,570	1,750	2,000	2,250
30 K. wind	Ground Run	580	660	770	900	1,050
	Distance to 50 ft.	990	1,090	1,220	1,380	1,550

Altitude Correction:

For every 1,000 ft. increase in airfield altitude:

increase Ground Run by 10%.
increase 50 ft. Distance by 9%.

121. **Flight planning data**

(a) The tables on the following pages show the flight planning data for:—

(i) *Climbing*

The climb table gives the data for climbs in I.S.A. conditions using the speed recommended in para. 77.

(ii) *Cruising*

Each separate altitude block in the cruise table shows:—

1. The speed for maximum range, the approximate A.N.M./100 lb. and the approximate fuel consumption for the particular height. In addition a 95% range speed is given, use of any speed between it and the best range speed should not cause more than a 5% reduction in range.
2. The range obtainable for various amounts of available fuel when flying at the best range speed for the height. The range given is to the point of let-down, allowance being made for the descent fuel required.
3. The range obtainable for various amounts of available fuel including the distance covered on the climb, if a climb is made to another altitude. In this case the climb must be made at the speed given in para. 77 and the flight continued at the new altitude at the best range speed for that height.

NOTE.—The range at any altitude is independent of temperature, but dependent on the weight of fuel carried.

(iii) *Descent*

The descent table gives the data for descending from one height to another.

(b) *Use of the tables*

NOTE.—The ANM/100 lb. values in both the tables and curves are achieved figures, arbitrarily reduced by 5% to allow for variations between individual aircraft.

(i) *Pre-flight planning*

Enter the cruise data table in the sea-level block at the fuel state applying immediately after take-off. Select the height at which maximum range is available at that fuel state. The distance available includes distance covered on the climb, but not on the descent. (Absolute maximum range is obtained by adding on the descent distance provided that the let-down is commenced at that distance from the destination.) For short-range flights inspect the sea-level block and select the height at which the distance to be covered requires the least amount of fuel. This is the best altitude for the flight.

(ii) *In-flight planning*

At any stage of a flight the available range may be ascertained by applying the fuel state to the level flight range in the particular altitude block. If increase in range is required, or if a climb has to be made, the new available range may be obtained by entering the existing-altitude block at the particular fuel state and moving vertically downwards within the block until the new altitude is reached. Figures underlined indicate the best altitude for the maximum increase in range. Above these heights no further range increase is possible. If a descent is necessitated the new range is shown by moving direct from the existing-altitude level-flight range for the particular fuel state to the new altitude level-flight range.

CLEAN AIRCRAFT

FUEL CONTENTS: 3,188 lb. AVTAG (7.7 lb./gall.)

ALLOWANCES:

START-UP AND TAXY	100 lb.
TAKE-OFF TO CLIMB SPEED	180 lb.
LANDING (excluding descent fuel)	620 lb.

CLIMB DATA

From	To	Fuel (lb.)	Dist. (N.M.)	Time (Mins.)
Sea Level	10,000 ft.	350	11	3
	20,000 ft.	520	29	4½
	30,000 ft.	700	46	6¾
	40,000 ft.	900	72	10
	45,000 ft.	1,050	99	14
10,000 ft.	20,000 ft.	170	18	1½
	30,000 ft.	350	35	3¾
	40,000 ft.	550	61	7
	45,000 ft.	700	88	11
20,000 ft.	30,000 ft.	180	17	2¼
	40,000 ft.	380	43	5½
	45,000 ft.	530	70	9½
30,000 ft.	40,000 ft.	200	26	3¼
	45,000 ft.	350	53	7¼
40,000 ft.	45,000 ft.	150	27	4

Fuel *and* time are given from wheels rolling; allowance for take-off and acceleration to climb speed, 1½ mins.

DESCENT DATA

See page 122.

CRUISE DATA—CLEAN AIRCRAFT

FUEL AVAILABLE — POUNDS		GAUGED FUEL (Actual fuel state)				
		2,908*	2,500	2,000	1,500	1,000
Sea Level ANM/100 lb.—9.6 Lb./min.—57 Best Range Speed—330 K. 95% Range Speed—430 K.	Range	220	180	135	85	35
	10,000 ft.	290	235	170	100	**35**
	20,000 ft.	345	275	190	**110**	—
	30,000 ft.	385	305	200	100	—
	40,000 ft.	430	**330**	**205**	80	—
	45,000 ft.	**430**	325	195	—	—
10,000 ft. ANM/100 lb.—13.4 Lb./min.—47.8 Best Range Speed—310 K. 95% Range Speed—370 K.	Range	—	245	180	115	**45**
	20,000 ft.	—	295	210	**125**	40
	30,000 ft.	—	330	225	120	—
	40,000 ft.	—	360	**235**	110	—
	45,000 ft.	—	**365**	230	95	—
20,000 ft. ANM/100 lb.—16.8 Lb./min.—37.8 Best Range Speed—290 K. 95% Range Speed—0.75 M.	**Range**	—	**305**	**220**	**135**	**50**
	30,000 ft.	—	**345**	**245**	**140**	**35**
	40,000 ft.	—	**385**	**260**	**135**	—
	45,000 ft.	—	**390**	**260**	**125**	—
30,000 ft. ANM/100 lb.—20.7 Lb./min.—34.5 Best Range Speed—0.7 M. 95% Range Speed—0.82 M.	Range	—	370	265	160	**60**
	40,000 ft.	—	415	**290**	**165**	40
	45,000 ft.	—	**420**	285	155	—
40,000 ft. ANM/100 lb.—25.1 Lb./min.—30.8 Best Range Speed—0.81 M. 95% Range Speed—0.87 M.	Range	—	440	**315**	**190**	**65**
	45,000 ft.	—	**445**	310	180	50
45,000 ft. ANM/100 lb.—26.4 Lb./min.—29.6 Best Range Speed—0.82 M. 95% Range Speed—0.87 M.	Range	—	**455**	**325**	**195**	**60**
FUEL AVAILABLE — POUNDS		2,908*	2,500	2,000	1,500	1,000

Page 117 A.L.3

*Excludes start-up, taxy and take-off allowances.

WITH 2×100 GALLON DROP TANKS

FUEL CONTENTS: 4,738 lb. AVTAG (7.7 lb./gall.)

ALLOWANCES:

START-UP AND TAXY	100 lb.
TAKE-OFF TO CLIMB SPEED	200 lb.
LANDING (excluding descent fuel)	620 lb.

CLIMB DATA

From	To	Fuel (lb.)	Dist. (N.M.)	Time (Mins.)
Sea Level	10,000 ft.	400	14	3¼
	20,000 ft.	600	32	5½
	30,000 ft.	800	51	8
	40,000 ft.	1,000	80	12½
10,000 ft.	20,000 ft.	200	18	2¼
	30,000 ft.	400	37	4¾
	40,000 ft.	600	66	9¼
20,000 ft.	30,000 ft.	200	19	2½
	40,000 ft.	400	48	7
30,000 ft.	40,000 ft.	200	29	4½

Fuel and time are given from wheels rolling; allowance for take-off and acceleration to climb speed, 1¾ mins.

DESCENT DATA

See page 122.

CRUISE DATA—2×100 GALLON DROP TANKS

FUEL AVAILABLE—POUNDS		Full fuel	GAUGED FUEL (Actual fuel state)				
		4,428*	3,188	2,500	2,000	1,500	1,000
Sea Level ANM/100 lb.—9.4 Lb./min.—52 Best Range Speed—295 K. 95% Range Speed—380 K.	**Range**	**370**	**245**	**175**	**130**	**85**	**35**
	10,000 ft.	**450**	**295**	**210**	**150**	**90**	**30**
	20,000 ft.	**570**	**370**	**260**	**180**	**100**	—
	30,000 ft.	**665**	**420**	**285**	**185**	85	—
	40,000 ft.	**780**	**480**	**310**	**190**	—	—
10,000 ft. ANM/100 lb. —12.2 Lb./min.—46.8 Best Range Speed—300 K. 95% Range Speed—380 K.	Range	—	305	225	165	105	40
	20,000 ft.	—	390	280	200	**120**	**40**
	30,000 ft.	—	440	310	215	115	—
	40,000 ft.	—	**515**	**350**	**225**	105	—
20,000 ft. ANM/100 lb.—16.1 Lb./min.—37.6 Best Range Speed—275 K. 95% Range Speed—0.7 M.	Range	—	400	290	210	130	**50**
	30,000 ft.	—	465	330	230	130	35
	40,000 ft.	—	**550**	**375**	**250**	**130**	—
30,000 ft. ANM/100 lb.—19.7 Lb./min.—35 Best Range Speed—0.7 M. 95% Range Speed—0.8 M.	Range	—	490	355	255	160	**60**
	40,000 ft.	—	**580**	**410**	**290**	**165**	45
40,000 ft. ANM/100 lb.—24.3 Lb./min.—31 Best Range Speed—0.79 M. 95% Range Speed—0.85 M.	Range	—	**600**	**430**	**310**	**185**	**65**
FUEL AVAILABLE—POUNDS		4,428*	3,188	2,500	2,000	1,500	1,000

*Excludes start-up, taxy and take-off allowances.

WITH 4×100 GALLON DROP TANKS

FUEL CONTENTS: 6,268 lb. AVTAG (7.7 lb./gall.)

ALLOWANCES:

START-UP AND TAXY	100 lb.
TAKE-OFF TO CLIMB SPEED	230 lb.
LANDING (excluding descent fuel)	620 lb.

CLIMB DATA

From	To	Fuel (lb.)	Dist. (N.M.)	Time (Mins.)
Sea Level	10,000 ft.	470	18	4
	20,000 ft.	700	37	6½
	30,000 ft.	930	59	9¾
	35,000 ft.	1,050	74	12
10,000 ft.	20,000 ft.	230	19	2½
	30,000 ft.	460	41	5¾
	35,000 ft.	580	56	8
20,000 ft.	30,000 ft.	230	22	3¼
	35,000 ft.	350	37	5½
30,000 ft.	35,000 ft.	120	15	2¼

Fuel and time are given from wheels rolling; allowance for take-off and acceleration to climb speed, 2 mins.

DESCENT DATA

See page 122.

CRUISE DATA—WITH 4×100 GALLON DROP TANKS

FUEL AVAILABLE—Pounds		Full fuel	Out-boards empty	GAUGED FUEL (Actual fuel state)				
		5,938*	4,728	3,188	2,500	2,000	1,500	1,000
Sea Level ANM/100 lb.—8.65 Lb./min.—58.4 Best Range Speed—295 K. 95% Range Speed—365 K.	Range	400	355	225	165	120	75	**35**
	10,000 ft.	660	460	280	202	145	85	30
	20,000 ft.	710	545	325	225	155	**85**	—
	30,000 ft.	835	630	360	245	160	75	—
	35,000 ft.	1,010	**680**	**385**	**255**	**160**	—	—
10,000 ft. ANM/100 lb.—11.6 Lb./min.—45 Best Range Speed—280 K. 95% Range Speed—325 K.	Range	—	470	290	215	155	100	**40**
	20,000 ft.	—	555	340	240	170	**100**	30
	30,000 ft.	—	650	385	265	180	95	—
	35,000 ft.	—	**705**	**410**	**280**	**185**	90	—
20,000 ft. ANM/100 lb.—14.1 Lb./min.—40.7 Best Range Speed—260 K. 95% Range Speed—320 K.	Range	—	570	355	255	185	115	**45**
	30,000 ft.	—	670	405	290	205	**115**	30
	35,000 ft.	—	**730**	**440**	**310**	**215**	120	—
30,000 ft. ANM/100 lb.—17.2 Lb./min.—38.7 Best Range Speed—260 K. 95% Range Speed—0.8 M.	Range	—	685	425	305	220	135	**50**
	35,000 ft.	—	**745**	**455**	**325**	**230**	**135**	40
35,000 ft. ANM/100 lb.—18.9 Lb./min.—36.5 Best Range Speed—0.72 M. 95% Range Speed—0.83 M.	Range	—	**755**	**465**	**335**	**240**	**145**	**50**
FUEL AVAILABLE—Pounds		5,938*	4,728	3,188	2,500	2,000	1,500	1,000

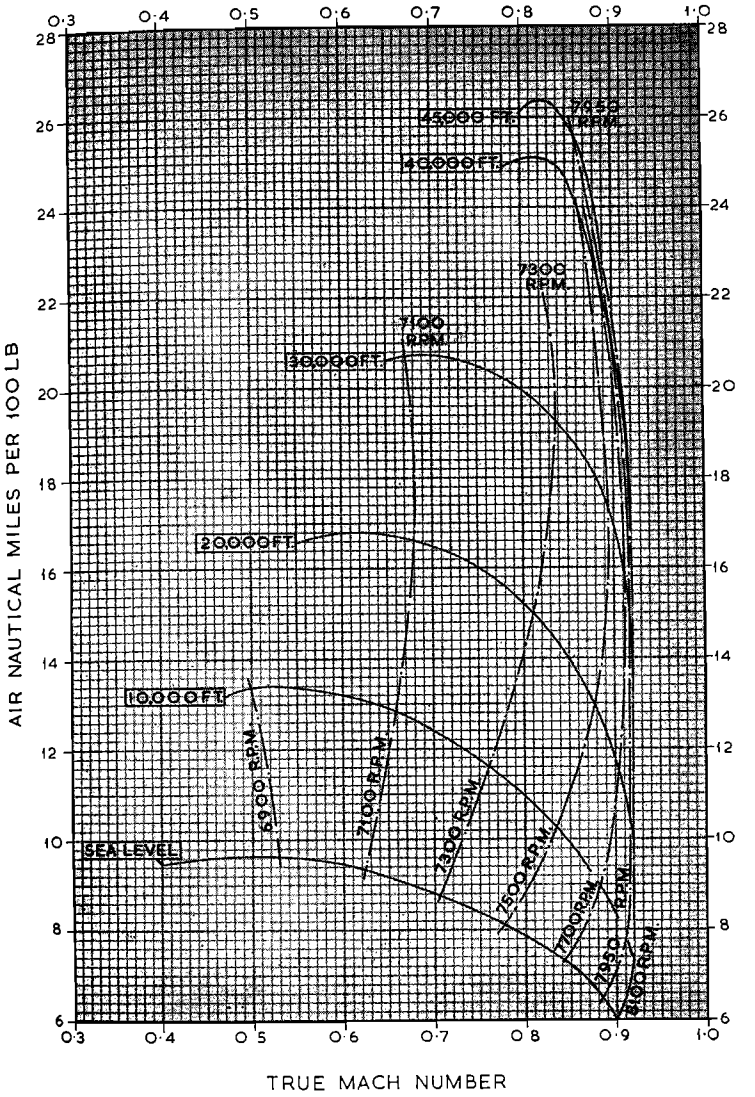
*Excludes start-up, taxy and take-off allowances.

ALL CONFIGURATIONS

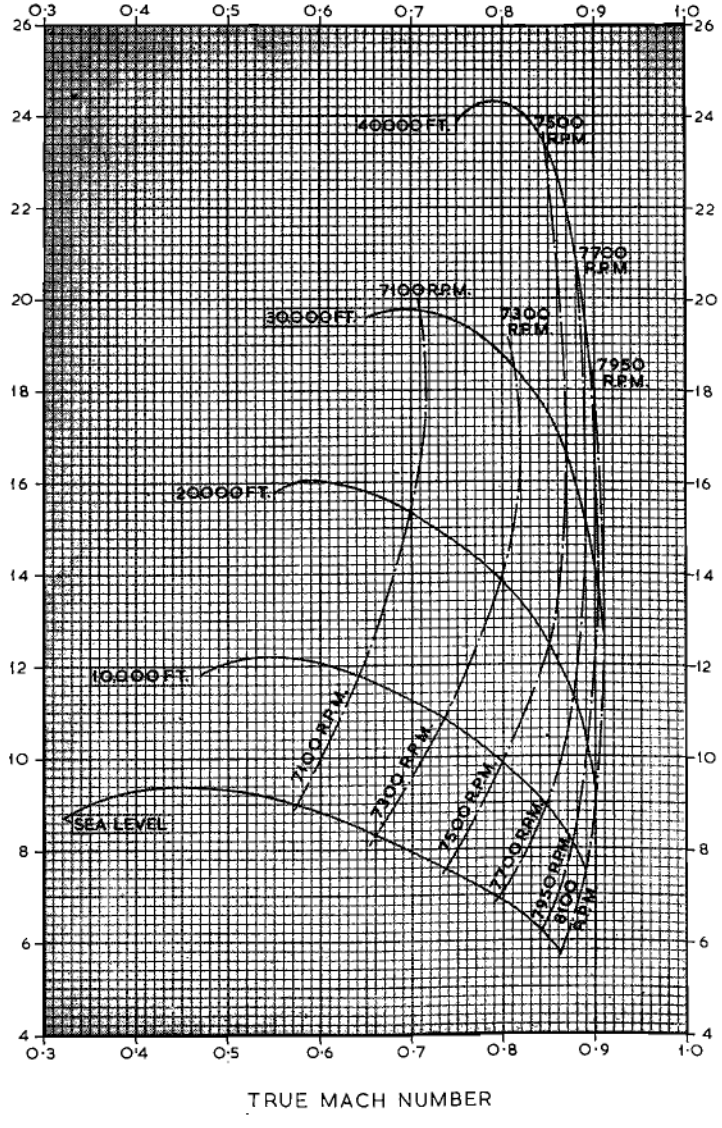
DESCENT DATA (Q. G.H.)

From	To	Fuel (lb.)	Dist. (N.M.)	Time (Mins.)
45,000 ft.	30,000 ft.	50	12	2
	20,000 ft.	80	19	3
	10,000 ft.	110	27	4½
	Sea Level	150	35	7¼
30,000 ft.	20,000 ft.	30	7	1
	10,000 ft.	60	15	2½
	Sea Level	100	23	5¼
20,000 ft.	10,000 ft.	30	8	1½
	Sea Level	70	16	4¼
10,000 ft.	Sea Level	40	8	2¾
AIRBRAKE OUT, FLAPS DOWN 23° R.P.M. 6,600 SPEED 280 K				

CLEAN AIRCRAFT



WITH 2×100 GALLON DROP TANKS



WITH 4×100 GALLON DROP TANKS