PART VII

OPERATING DATA

96. Loading and C.G. data

NOTE.—1. When making C.G. calculations, reference should always be made to A.P.4335D, Vol. 1, Sect. 2, Chap. 3.

2. All data below assumes the use of AVTUR fuel (8 lb./gall.).

(a) *Weight and C.G. limitations*
These are given in Part II (Limitations) para. 45 (f) (g).

(b) *Clean aircraft, no ammunition*
The C.G. will move aft after take-off, reaching the aftmost position when approximately 328 lb. (41 gallons) of fuel have been used. The C.G. then moves progressively forward, reaching its most forward position when about 552 lb. (69 gallons) of fuel remain, after which the C.G. again moves slightly aft.

(c) *Empty tip tanks, no ammunition*
The C.G. movement is as in (b) above, with the initial C.G. further aft.

(d) *Full tip tanks, no ammunition, with or without full pylon tanks*

(i) *Without pylon tanks*
The C.G. will be on the aft limit on take-off; as fuel is used, the C.G. moves rapidly forward until transfer is complete, after which C.G. movement is as in (b) above.

(ii) *With pylon tanks*
The C.G. is slightly further forward than in (i) above.

(e) *Effect of carriage of ammunition and R.P.s*

(i) Carriage of ammunition moves the C.G. forward considerably.

(ii) At the most forward C.G. position quoted in (b) above, the C.G. is on the forward limit when full ammunition and 8 R.P.s are carried.

97. Pressure error corrections

The pressure error corrections at sea level are:—

From	150	200	250	300	350	400	450 knots
To	200	250	300	350	400	450	500 knots
	0	+3	+5	+6	+7	+8	+9 knots

98. Take-off distances

The approximate take-off distances, in yards, are given below.

(a) *With tip tanks (13,320 lb.)*

Temperature		−15° C.	0° C.	+15° C.	+30° C.	+45° C.
No Wind	Ground run	700	800	900	1,050	1,150
	To clear 50 ft.	1,250	1,420	1,620	1,830	2,000
40 kt. Wind	Ground run	380	440	500	580	630
	To clear 50 ft.	770	830	950	1,070	1,170

(b) *With tip tanks and R.P.s (14,132 lb.)*

Temperature		−15° C.	0° C.	+15° C.	+30° C.	+45° C.
No Wind	Ground run	800	900	1,050	1,180	1,300
	To clear 50 ft.	1,430	1,600	1,830	2,060	2,270
30 kt. Wind	Ground run	430	500	570	650	710
	To clear 50 ft.	910	1,020	1,160	1,300	1,440

The ground run and distance to clear 50 feet should be increased by approximately 10% for every 1,000 feet the aerodrome is above sea level.

99. **Fuel consumptions**

The approximate fuel consumptions in lb./hour for varying r.p.m. at different altitudes are given below. If it is required to know the consumptions in gall./min. divide the figures by the fuel density.

AVTUR=8.0 lb./gall.
AVTAG=7.7 lb./gall.

Height (feet)	At 10,250 r.p.m.	At 9,750 r.p.m.	At best range speed		
			Clean	Tip tanks and R.P.s	Tip tanks
Sea level	7,200	5,400	2,220	2,340	2,340
10,000	5,400	4,200	1,620	1,860	1,740
20,000	4,200	3,300	1,260	1,620	1,380
30,000	3,000	2,400	1,080	1,320	1,140
40,000	2,100	1,500	960	1,320	1,020

100. **Flight planning data**

(a) The tables on the following pages show the climb, cruise and descent data in tabular form for various configurations. Heights are given at 10,000 feet intervals but interpolation is possible for intermediate heights.

(b) The climb and descent data tables give the necessary information for climbing or descending from any one height to another. Climb distances are included where necessary in the cruise data table but not descent distances, since in some cases the descent may be made from overhead and in others some distance from the destination. Allowance is made for fuel used on the descent.

(c) Each cruise data table consists of five separate altitude blocks. Each block shows:—

(i) The level flight range to the let-down point in nautical miles, at the particular height for various fuel states.

(ii) The best range speed at the particular height together with approximate A.N.M. per 100 lb. fuel used and the approximate fuel consumption in lb./min.

(iii) The range, *including* the distance covered on the climb if a climb is made to any other altitude during flight.

(d) *Use of the tables*

(i) *Pre-flight planning*

Enter the appropriate 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 started 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) *Inflight 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 an 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 in heavy type 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.

(e) *Effect of temperature change on performance*

(i) Climb performance is dependent on temperature. The following table lists the correction factors per 10° C. *rise* in temperature from I.S.A. conditions. All figures should be *added* to the appropriate climb data figures in the tables on the following pages.

From sea level to	Clean			With tip tanks			With tip tanks and RP			With tip and pylon tanks		
	lb.	Dist.	Min.	lb.	Dist.	Min.	lb.	Dist.	Min.	lb.	Dist.	Min.
10,000 ft.	30	3	½	33	3	½	35	5	½	38	5	½
20,000 ft.	60	7	1	63	8	1	70	10	1½	70	11	1½
30,000 ft.	90	12	1¾	100	14	2	125	16	2½	130	18	2½
40,000 ft.	135	23	3	163	32	4	190	35	5	220	40	6

(ii) The range at any altitude is independent of temperature but dependent on the weight of fuel carried.

CLEAN AIRCRAFT

FUEL CONTENTS:—342 GALLONS
2,736 lb. AVTUR (8 lb./gall.)
2,630 lb. AVTAG (7.7 lb./gall.)
TAXY AND TAKE-OFF ALLOWANCE=336 lb. (42 gall.)
LANDING ALLOWANCE .. .. =480 lb. (60 gall.)
(excluding descent fuel)

CLIMB DATA

From	To	Lb.	Dist.	Mins.
Sea Level	10,000 ft.	160	10	1½
	20,000 ft.	280	20	3
	30,000 ft.	400	35	5
	40,000 ft.	520	60	8½
10,000 ft.	20,000 ft.	120	10	1½
	30,000 ft.	240	25	3½
	40,000 ft.	360	50	7
20,000 ft.	30,000 ft.	120	15	2
	40,000 ft.	240	40	5½
30,000 ft.	40,000 ft.	120	25	3½
Climb at: 10,250 r.p.m. below 25,000 ft. 10,100 r.p.m. above 25,000 ft.				

DESCENT DATA

From	To	Lb.	Dist.	Mins.
40,000 ft.	30,000 ft.	15	75	4
	20,000 ft.	40	45	7
	10,000 ft.	65	60	10
	Sea Level	115	80	14
30,000 ft.	20,000 ft.	25	20	3
	10,000 ft.	50	35	6
	Sea Level	100	55	10
20,000 ft.	10,000 ft.	25	15	3
	Sea Level	75	35	7
10,000 ft.	Sea Level	50	20	4
AIRBRAKES—IN R.P.M. —6,500 SPEED —0.67M above 25,000 ft. —270K below 25,000 ft.				

CRUISE DATA—CLEAN AIRCRAFT

FUEL STATE—LB.		2,400	2,000	1,600	1,200	800
	Range	220	175	130	85	**40**
Sea Level	10,000 ft.	280	215	150	90	30
	20,000 ft.	365	275	185	**95**	—
ANM/100 lb.—11.4	30,000 ft.	460	335	210	85	—
Lb./min.—37	40,000 ft.	**525**	**370**	**220**	70	—
I.A.S.—250 Kts.						
	Range	—	235	170	105	**40**
10,000 ft.	20,000 ft.	—	305	215	125	30
	30,000 ft.	—	380	255	**130**	—
ANM/100 lb.—16	40,000 ft.	—	**420**	**270**	120	—
Lb./min.—27						
I.A.S.—230 Kts.						
	Range	—	320	230	140	**50**
20,000 ft.	30,000 ft.	—	410	285	**160**	35
	40,000 ft.	—	**455**	**305**	155	—
ANM/100 lb.—22.7						
Lb./min.—21						
I.A.S.—210 Kts.						
	Range	—	430	305	180	**55**
30,000 ft.	40,000 ft.	—	**485**	**335**	**185**	35
ANM/100 lb.—31.0						
Lb./min.—17						
I.A.S.—200 Kts.						
	Range	—	—	**355**	**205**	**55**
40,000 ft.						
ANM/100 lb.—37.4						
Lb./min.—16						
I.A.S.—185 Kts.						
Fuel State—Gals. AVTUR		300	250	200	150	100

NOTE: With rocket rails fitted, the above ranges are reduced by approximately 2%.

WITH TIP TANKS

FUEL CONTENTS:—498 GALLONS
3,984 lb. AVTUR (8 lb./gall.)
3,840 lb. AVTAG (7.7 lb./gall.)

TAXY AND TAKE-OFF ALLOWANCE=360 lb. (45 gall.)

LANDING ALLOWANCE .. .. =480 lb. (60 gall.)
(excluding descent fuel)

CLIMB DATA

From	To	Lb.	Dist.	Min.
Sea Level	10,000 ft.	200	10	2
	20,000 ft.	360	20	4
	30,000 ft.	520	45	6½
	40,000 ft.	680	70	12
10,000 ft.	20,000 ft.	160	10	2
	30,000 ft.	320	35	4½
	40,000 ft.	480	60	10
20,000 ft.	30,000 ft.	160	25	2½
	40,000 ft.	320	50	8
30,000 ft.	40,000 ft.	160	25	5½
Climb at: 10,250 r.p.m. below 25,000 ft. 10,100 r.p.m. above 25,000 ft.				

DESCENT DATA

From	To	Lb.	Dist.	Min.
40,000 ft.	30,000 ft.	15	10	3
	20,000 ft.	35	30	5½
	10,000 ft.	60	45	8½
	Sea Level	105	65	12½
30,000 ft.	20,000 ft.	20	20	2½
	10,000 ft.	45	35	5½
	Sea Level	90	55	9½
20,000 ft.	10,000 ft.	25	15	3
	Sea Level	70	35	7
10,000 ft.	Sea Level	45	20	4
AIRBRAKES—IN R.P.M. —6,500 SPEED —0.67M above 25,000 ft. —270 K below 25,000 ft.				

CRUISE DATA—WITH TIP TANKS

FUEL STATE—LB.		3,600	3,200	2,400	1,600	800
	Range	340	295	210	125	**35**
Sea Level	10,000 ft.	450	390	265	140	15
	20,000 ft.	595	505	335	160	—
ANM/100 lb.—10.9	30,000 ft.	725	615	395	**170**	—
Lb./min.—39	40,000 ft.	**880**	**740**	**455**	**170**	—
I.A.S.—255 Kts.						
	Range	—	415	290	165	**40**
10,000 ft.	20,000 ft.	—	560	385	215	**40**
	30,000 ft.	—	660	440	220	—
ANM/100 lb.—15.6	40,000 ft.	—	**800**	**515**	**230**	—
Lb./min.—29						
I.A.S.—235 Kts.						
	Range	—	565	390	220	**45**
20,000 ft.	30,000 ft.	—	700	475	250	30
	40,000 ft.	—	**845**	**580**	**295**	—
ANM/100 lb.—21.6						
Lb./min.—23						
I.A.S.—220 Kts.						
	Range	—	720	500	280	**50**
30,000 ft.	40,000 ft.	—	**880**	**600**	**310**	20
ANM/100 lb.—27.7						
Lb./min.—19						
I.A.S.—205 Kts.						
	Range	—	—	**625**	**340**	**55**
40,000 ft.						
ANM/100 lb.—35.6						
Lb./min.—17						
I.A.S.—195 Kts.						
Fuel State—Galls. AVTUR		450	400	300	200	100

NOTE: With rocket rails fitted, the above ranges are reduced by approximately 4%.

WITH TIP TANKS AND 8 R.P.s

FUEL CONTENTS:—498 GALLONS
3,984 lb. AVTUR (8 lb./gall.)
3,840 lb. AVTAG (7.7 lb./gall.)

TAXY AND TAKE-OFF ALLOWANCE=360 lb. (45 gall.)

LANDING ALLOWANCE .. .. =480 lb. (60 gall.)
(excluding descent fuel)

CLIMB DATA

From	To	Lb.	Dist.	Min.
Sea Level	10,000 ft.	200	10	2
	20,000 ft.	400	25	4½
	30,000 ft.	600	45	8½
	40,000 ft.	840	85	15
10,000 ft.	20,000 ft.	200	15	2½
	30,000 ft.	400	35	6½
	40,000 ft.	640	75	13
20,000 ft.	30,000 ft.	200	20	4
	40,000 ft.	440	60	10½
30,000 ft.	40,000 ft.	240	40	6½
Climb at: 10,250 r.p.m. below 25,000 ft. 10,100 r.p.m. above 25,000 ft.				

DESCENT DATA

From	To	Lb.	Dist.	Min.
40,000 ft.	30,000 ft.	20	15	2½
	20,000 ft.	40	25	4¼
	10,000 ft.	80	40	6½
	Sea Level	160	55	10
30,000 ft.	20,000 ft.	20	10	1¾
	10,000 ft.	60	25	4
	Sea Level	140	40	7½
20,000 ft.	10,000 ft.	40	15	2¼
	Sea Level	120	30	5¾
10,000 ft.	Sea Level	80	15	3½
AIRBRAKES—IN R.P.M. —6,500 SPEED —0.67M above 25,000 ft. —270 Kts. below 25,000 ft.				

CRUISE DATA—
WITH TIP TANKS AND 8 R.P.s

FUEL STATE—LB.		3,600	3,200	2,400	1,600	800
	Range	310	270	190	110	**30**
Sea Level	10,000 ft.	400	345	235	125	15
	20,000 ft.	490	420	270	135	—
ANM/100 lb.—10	30,000 ft.	620	525	335	**145**	—
Lb./min.—39	40,000 ft.	**675**	**565**	**340**	120	—
I.A.S.—235 Kts.						
	Range	—	365	255	145	**35**
10,000 ft.	20,000 ft.	—	445	300	160	15
	30,000 ft.	—	555	365	**175**	—
ANM/100 lb.—13.8	40,000 ft.	—	**610**	**385**	165	—
Lb./min.—31						
I.A.S.—220 Kts.						
	Range	—	465	325	180	**35**
20,000 ft.	30,000 ft.	—	585	395	**205**	—
	40,000 ft.	—	**650**	**430**	**205**	—
ANM/100 lb.—17.9						
Lb./min.—27						
I.A.S.—210 Kts.						
	Range	—	615	425	235	**45**
30,000 ft.	40,000 ft.	—	**685**	**460**	**240**	—
ANM/100 lb.—23.7						
Lb./min.—22						
I.A.S.—200 Kts.						
	Range	—	—	**490**	**270**	**45**
40,000 ft.						
ANM/100 lb.—27.7						
Lb./min.—22						
I.A.S.—165 Kts.						
Fuel State—Galls. AVTUR		450	400	300	200	100

WITH TIP AND PYLON TANKS

FUEL CONTENTS:—658 GALLONS
5,264 lb. AVTUR (8 lb./gall.)
5,070 lb. AVTAG (7.7 lb./gall.)

TAXY AND TAKE-OFF ALLOWANCE=360 lb. (45 gall.)

LANDING ALLOWANCE .. .. =480 lb. (60 gall.)
(excluding descent fuel)

CLIMB DATA

From	To	Lb.	Dist.	Min.
Sea Level	10,000 ft.	225	10	2¼
	20,000 ft.	450	30	5¼
	30,000 ft.	690	60	9¾
	40,000 ft.	995	115	18
10,000 ft.	20,000 ft.	225	20	3
	30,000 ft.	465	50	7½
	40,000 ft.	770	105	15¾
20,000 ft.	30,000 ft.	240	30	4½
	40,000 ft.	545	85	12¾
30,000 ft.	40,000 ft.	305	55	8¼
Climb at: 10,250 r.p.m. below 25,000 ft. 10,100 r.p.m. above 25,000 ft.				

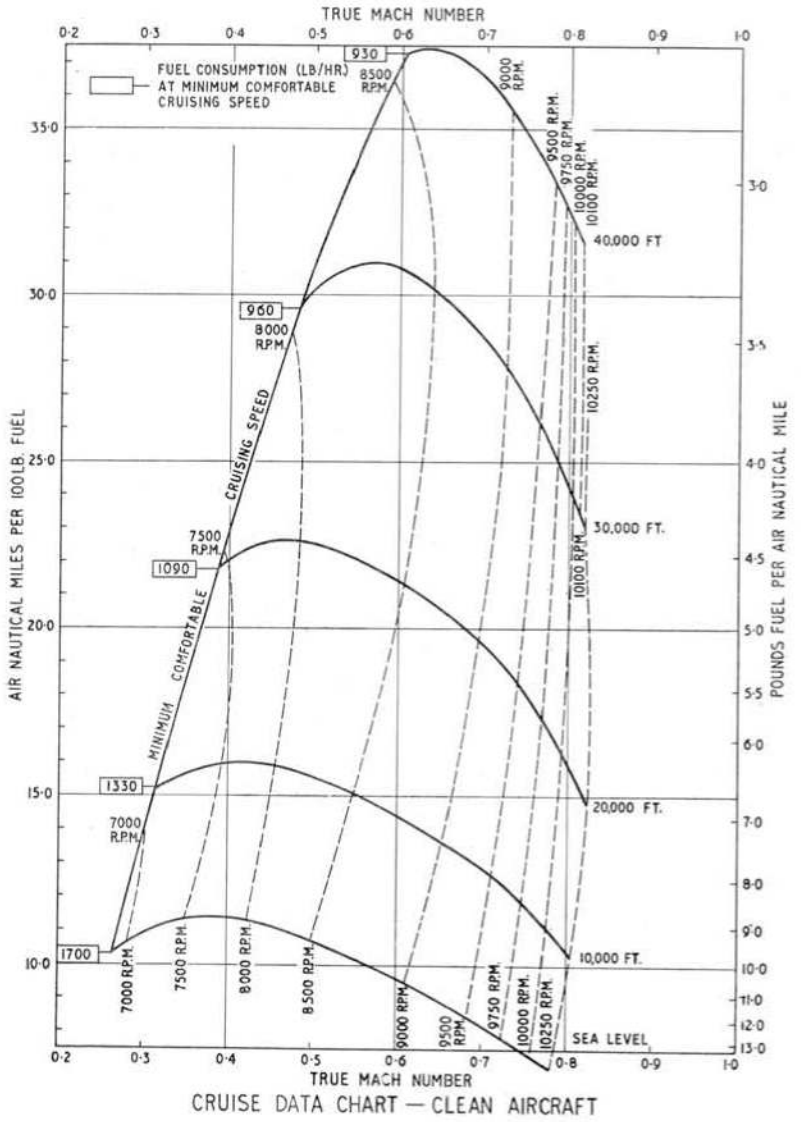
DESCENT DATA

From	To	Lb.	Dist.	Min.
40,000 ft.	30,000 ft.	20	15	2¾
	20,000 ft.	40	30	4¾
	10,000 ft.	80	45	7½
	Sea Level	155	65	11¼
30,000 ft.	20,000 ft.	20	15	2
	10,000 ft.	60	30	4¾
	Sea Level	135	50	8½
20,000 ft.	10,000 ft.	40	15	2¾
	Sea Level	115	35	6½
10,000 ft.	Sea Level	75	20	3¾

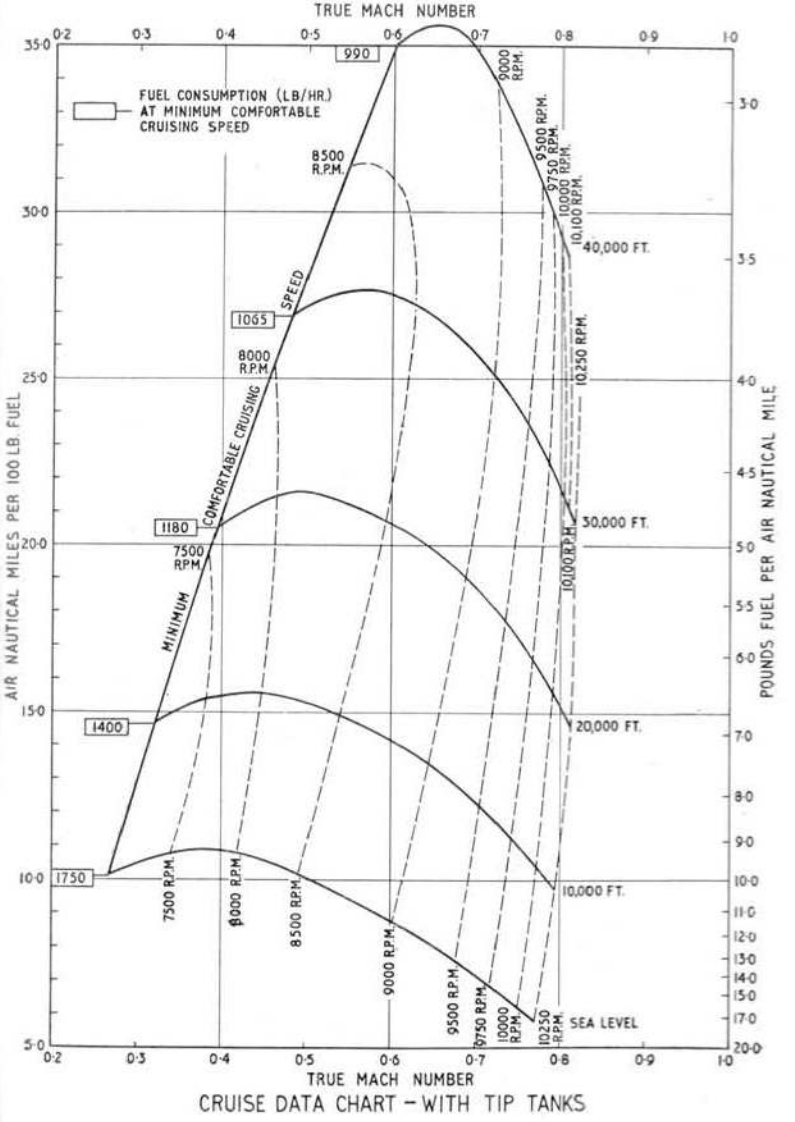
AIRBRAKES —IN
R.P.M. —6,500
SPEED —0.67M above 25,000 ft.
—270 Kts. below 25,000 ft.

CRUISE DATA—
WITH TIP AND PYLON TANKS

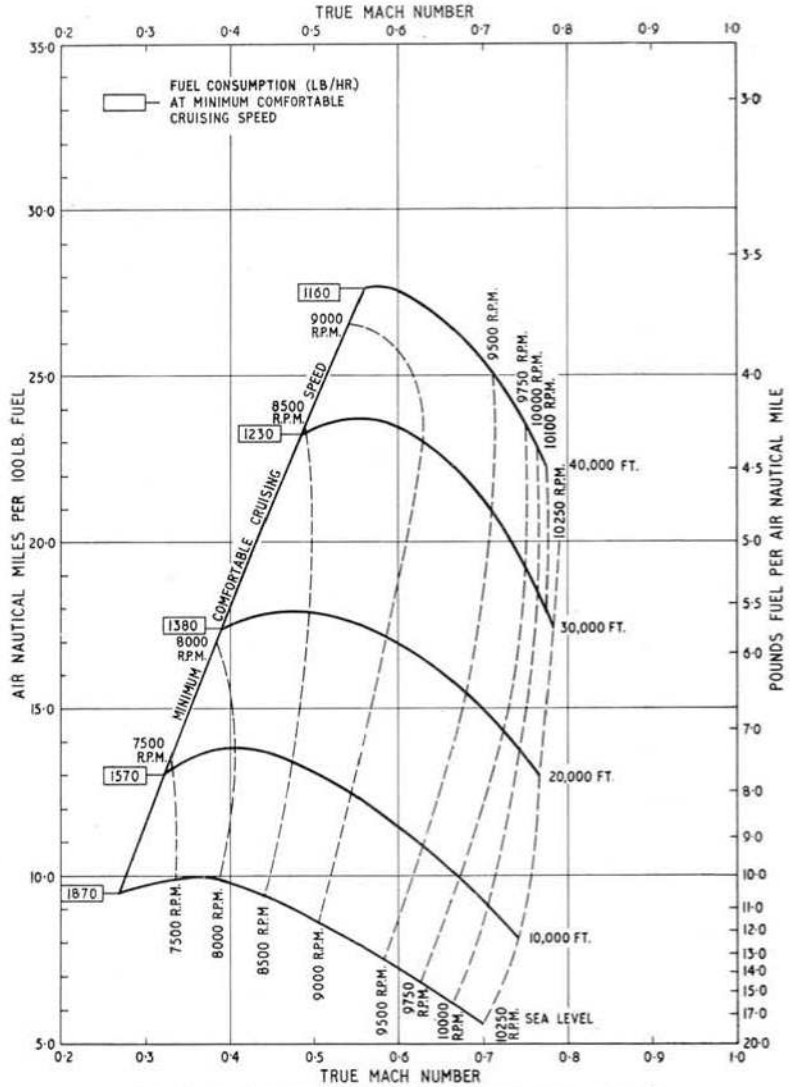
FUEL STATE—LB.		4,700	4,000	3,000	2,500	2,000	1,500	1,000
	Range	455	380	275	230	165	115	**60**
Sea Level	10,000 ft.	600	500	355	280	205	**130**	50
	20,000 ft.	760	630	435	335	235	**130**	—
ANM/100 lb.—10.65	30,000 ft.	945	775	520	390	**255**	120	—
Lb./min.—42	40,000 ft.	**1,120**	**910**	**595**	**425**	250	—	—
I.A.S.—260 Kts.								
	Range	—	520	375	300	225	150	**70**
10,000 ft.	20,000 ft.	—	660	465	365	265	165	60
	30,000 ft.	—	820	565	435	305	**170**	—
ANM/100 lb.—14.7	40,000 ft.	—	**960**	**650**	**485**	**320**	140	—
Lb./min.—32								
I.A.S.—240 Kts.								
	Range	—	680	490	390	290	190	**90**
20,000 ft.	30,000 ft.	—	850	600	475	340	**210**	75
	40,000 ft.	—	**1,010**	**700**	**545**	**375**	205	—
ANM/100 lb.—19.6								
Lb. min.—26								
I.A.S.—225 Kts.								
	Range	—	880	640	510	380	245	**110**
30,000 ft.	40,000 ft.	—	**1,050**	**750**	**590**	**425**	**255**	80
ANM/100 lb.—25.5								
Lb./min.—22								
I.A.S.—210 Kts.								
	Range	—	—	**790**	**635**	**475**	**305**	**135**
40,000 ft.								
ANM/100 lb.—31.6								
Lb./min.—21								
I.A.S.—200 Kts.								
Fuel State—Galls. AVTUR		585	500	375	312	250	187	125



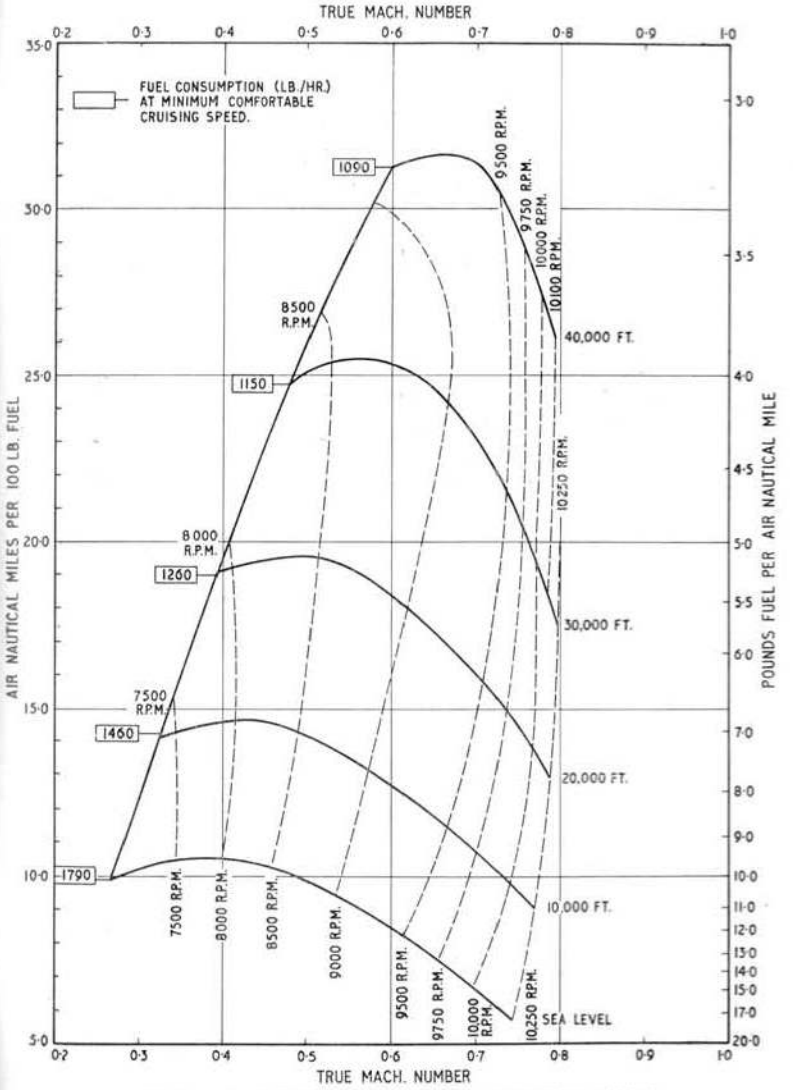
CRUISE DATA CHART — CLEAN AIRCRAFT



CRUISE DATA CHART – WITH TIP TANKS



CRUISE DATA CHART — TIP TANKS AND 8 X 60 LB. R.P.'S.



CRUISE DATA CHART — TIP TANKS AND PYLON TANKS