N613ES

2005 Cessna T182T

Performance Data

MSN: T18208424

Prepared by the worldwide aviation specialists at RidgeAire, Inc.

PERFORMANCE
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INTRODUCTION

Performance data charts on the following pages are presented so that you may know what to expect from the airplane under various conditions, and also, to facilitate the planning of flights in detail and with reasonable accuracy. The data in the charts has been computed from actual flight tests with the airplane and engine in good condition and using average piloting techniques.

It should be noted that performance information presented in the range and endurance profile charts allows for 45 minutes reserve fuel at the specified cruise power. Fuel flow data for cruise is based on the recommended lean mixture setting at all altitudes. Some indeterminate variables such as mixture leaning technique, fuel metering characteristics, engine and propeller condition, and air turbulence may account for variations of 10% or more in range and endurance. Therefore, it is important to utilize all available information to estimate the fuel required for the particular flight and to flight plan in a conservative manner.

USE OF PERFORMANCE CHARTS

Performance data is presented in tabular or graphical form to illustrate the effect of different variables. Sufficiently detailed information is provided in the tables so that conservative values can be selected and used to determine the particular performance figure with reasonable accuracy.

SAMPLE PROBLEM

The following sample flight problem utilizes information from the various charts to determine the predicted performance data for a typical flight. Assume the following information has already been determined:

AIRPLANE CONFIGURATION:	
Takeoff weight	3100 Pounds
Usable fuel	87.0 Gallons
TAKEOFF CONDITIONS	
Field pressure altitude	3500 Feet
Temperature	24°C (16°C Above Standard)

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SAMPLE PROBLEM (Continued)

Wind component along runway	12 Knot Headwind
Field length	3500 Feet

CRUISE CONDITIONS:

Total distance	450 Nautical Miles
Pressure altitude	11,500 Feet
Temperature	8°C
Expected wind enroute	10 Knot Headwind

LANDING CONDITIONS:

Field pressure altitude	3000 Feet
Temperature	25°C
Field length	3000 Feet

TAKEOFF

The takeoff distance chart, Figure 5-6, should be consulted, keeping in mind that distances shown are based on the short field technique. Conservative distances can be established by reading the chart at the next higher value of weight, altitude and temperature. For example, in this particular sample problem, the takeoff distance information presented for a weight of 3100 pounds, pressure altitude of 4000 feet and a temperature of 30°C should be used and results in the following:

Ground roll	1095 Feet
Total distance to clear a 50-foot obstacle	1880 Feet

These distances are well within the available takeoff field length. However, a correction for the effect of wind may be made based on Note 3 of the takeoff chart. The correction for a 12 knot headwind is:

$$\frac{12 \text{ Knots}}{9 \text{ Knots}} \times 10\% = 13\% \text{ Decrease}$$

This results in the following distances, corrected for wind:

Ground roll, zero wind	1095
Decrease in ground roll (1095 feet X 13%)	-142
Corrected ground roll	953 Feet

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SAMPLE PROBLEM (Continued)

Total distance to clear a 50-foot obstacle, zero wind	1880
Decrease in total distance (1880 feet X 13%)	-244
Corrected total distance to clear 50-foot obstacle	1636 Feet

CRUISE

The cruising altitude should be selected based on a consideration of trip length, winds aloft, and the airplane's performance. A typical cruising altitude and the expected wind enroute have been given for this sample problem. However, the power setting selection for cruise must be determined based on several considerations. These include the cruise performance characteristics presented in Figure 5-9, the range profile chart presented in Figure 5-10, and the endurance profile chart presented in Figure 5-11.

The relationship between power and range is illustrated by the range profile chart. Considerable fuel savings and longer range result when lower power settings are used. For this sample problem, a cruise power of approximately 70% will be used.

The cruise performance chart, Figure 5-9, is entered at 12,000 feet pressure altitude and 20°C above standard temperature. These values most nearly correspond to the planned altitude and expected temperature conditions. The engine speed chosen is 2400 RPM and 24 inches of manifold pressure, which results in the following:

Power	70%
True airspeed	146 Knots
Cruise fuel flow	13.5 GPH

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SAMPLE PROBLEM (Continued)

FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in Figure 5-8 and Figure 5-9. For this sample problem, the time, fuel, and distance to climb may be determined from Figure 5-8 for normal climb. The difference between the values shown in the table for 4,000 feet and 12,000 feet result in the following: Time: 17 minutes; Fuel: 4.3 gallons; and Distance: 30 NM. These values are for a standard temperature and are sufficiently accurate for most flight planning purposes. However, a further correction for the effect of temperature may be made as noted on the climb chart. The approximate effect of a non-standard temperature is to increase the time, fuel, and distance by 10% for each 8°C above standard temperature, due to the lower rate of climb. In this case, assuming a temperature 16°C above standard the correction would be:

$$\frac{16^\circ}{8^\circ C} \times 10\% = 20\% \text{ Increase}$$

With this factor included, the fuel estimate would be calculated as follows:

Fuel to climb, standard temperature	4.3
Increase due to non-standard temperature (4.3 X 20%)	0.9
Corrected fuel to climb	5.2 Gallons

Using a similar procedure for the distance to climb results in 36 nautical miles.

The resultant cruise distance is:

Total distance	450
Climb distance	-36
Cruise distance	414 NM

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SAMPLE PROBLEM (Continued)

With an expected 10 knot headwind, the ground speed for cruise is predicted to be:

$$\begin{array}{r} 146 \\ -10 \\ \hline 136 \text{ Knots} \end{array}$$

Therefore, the time required for the cruise portion of the trip is:

$$\frac{414 \text{ Nautical Miles}}{136 \text{ Knots}} = 3.1 \text{ Hours}$$

The fuel required for cruise is:

3.1 hours X 13.5 gallons/hour = 41.9 Gallons

A 45-minute reserve requires:

$$\frac{45}{60} \text{ X } 10.7 \text{ gallons / hour} = 8.0 \text{ Gallons}$$

The total estimated fuel required is as follows:

Engine start, taxi, and takeoff	2.0
Climb	5.2
Cruise	41.9
Reserve	10.2
Total fuel required	59.3 Gallons

Once the flight is underway, ground speed checks will provide a more accurate basis for estimating the time enroute and the corresponding fuel required to complete the trip with ample reserve.

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SAMPLE PROBLEM (Continued)

LANDING

A procedure similar to takeoff should be used for estimating the landing distance at the destination airport. Figure 5-12 presents landing distance information for the short field technique. The distances corresponding to 3000 feet and 30°C are as follows:

Ground roll	695 Feet
Total distance to clear a 50-foot obstacle	1525 Feet

A correction for the effect of wind may be made based on Note 2 of the landing chart, using the same procedure as outlined for takeoff.

DEMONSTRATED OPERATING TEMPERATURE

Satisfactory engine cooling has been demonstrated for this airplane with an outside air temperature 23°C above standard. This is not to be considered as an operating limitation. Reference should be made to Section 2 for engine operating limitations.

AIRSPEED CALIBRATION

NORMAL STATIC SOURCE

CONDITIONS:

Power required for level flight or maximum power descent.

FLAPS UP												
KIAS	55	60	70	80	90	100	110	120	130	140	150	160
KCAS	60	64	73	82	91	100	110	119	128	137	146	156
FLAPS 20°												
KIAS	45	50	60	70	80	90	100	110	120	---	---	---
KCAS	51	55	63	72	81	90	100	110	120	---	---	---
FLAPS FULL												
KIAS	40	50	60	70	80	90	95	---	---	---	---	---
KCAS	48	55	63	72	82	92	97	---	---	---	---	---

Figure 5-1 (Sheet 1 of 2)

AIRSPEED CALIBRATION

ALTERNATE STATIC SOURCE

NOTE

Windows closed, ventilators closed, cabin heater, cabin air, and defroster on maximum.

CONDITIONS:

Power required for level flight or maximum power descent.

FLAPS UP												
KIAS	55	60	70	80	90	100	110	120	130	140	150	160
ALT KIAS	52	58	71	82	93	103	113	122	131	139	147	155
FLAPS 20°												
KIAS	50	60	70	80	90	100	110	120	---	---	---	---
ALT KIAS	52	61	70	79	89	99	110	121	---	---	---	---
FLAPS FULL												
KIAS	40	50	60	70	80	90	95	---	---	---	---	---
ALT KIAS	37	47	57	68	78	88	93	---	---	---	---	---

Figure 5-1 (Sheet 2)

ALTIMETER CORRECTION
ALTERNATE STATIC SOURCE

NOTE

Add correction to desired altitude to obtain indicated altitude to fly. Windows closed, ventilators closed, cabin heater, cabin air, and defroster on maximum.

CONDITIONS:

Power required for level flight or maximum power descent cruise configuration. Altimeter corrections for the takeoff configuration are less than 50 feet.

CONDITION FLAPS UP	CORRECTION TO BE ADDED-FEET KIAS - alternate static source **ON**					
	60	80	100	120	140	160
S.L.	30	10	-20	-20	-10	40
2000 FT	30	10	-20	-30	-10	40
4000 FT	30	10	-20	-30	-10	40
6000 FT	40	10	-20	-30	-10	40
8000 FT	40	10	-20	-30	-10	50
10,000 FT	40	10	-20	-30	-10	50
12,000 FT	40	10	-20	-30	-10	50
14,000 FT	40	10	-30	-40	-10	50

Figure 5-2

TEMPERATURE CONVERSION CHART

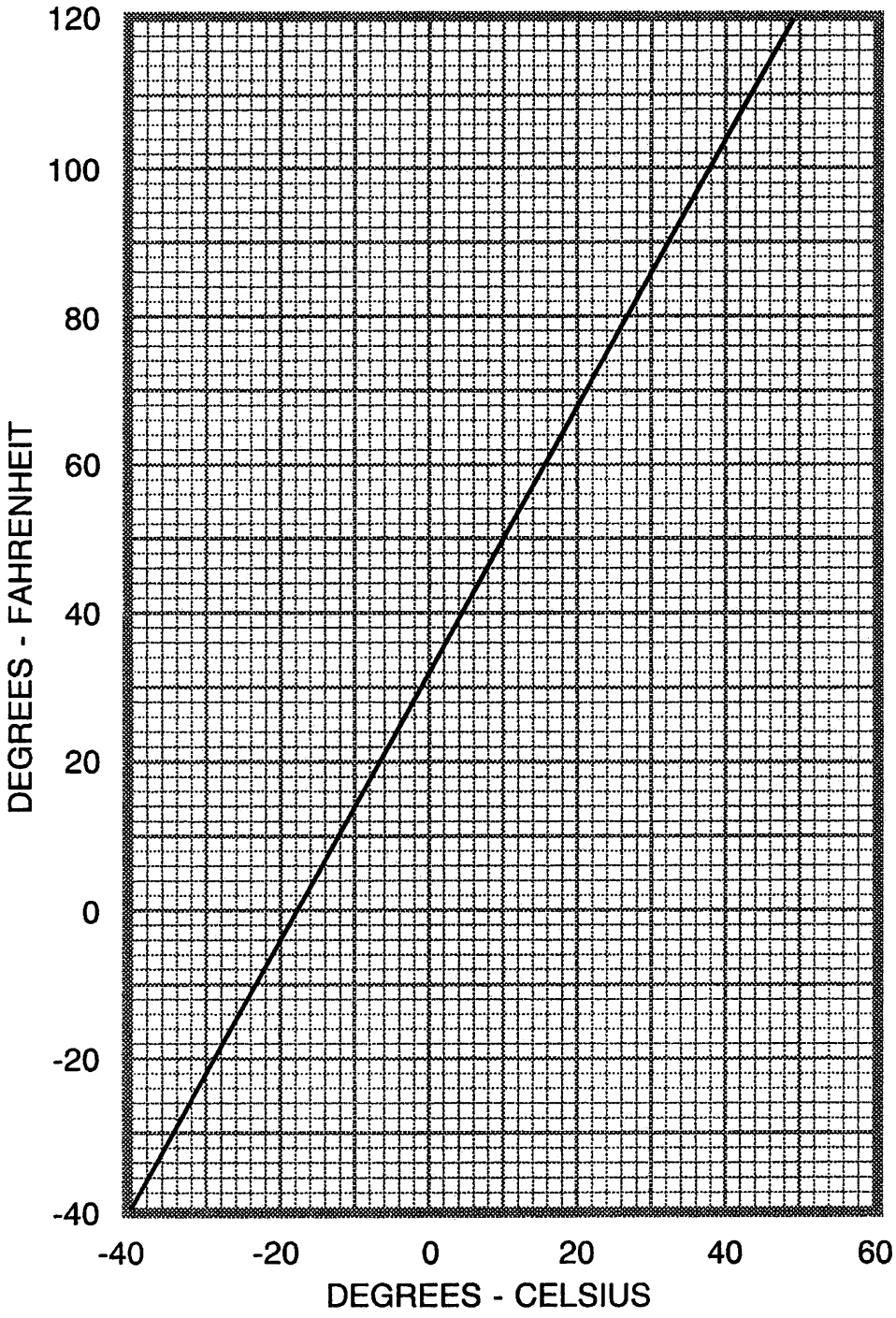


Figure 5-3

STALL SPEEDS AT 3100 POUNDS

CONDITIONS:

Power OFF

MOST REARWARD CENTER OF GRAVITY

FLAP SETTING	ANGLE OF BANK							
	0°		30°		45°		60°	
	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
UP	50	54	54	58	59	64	71	76
20°	43	50	46	54	51	59	61	71
FULL	40	49	43	53	48	58	57	69

MOST FORWARD CENTER OF GRAVITY

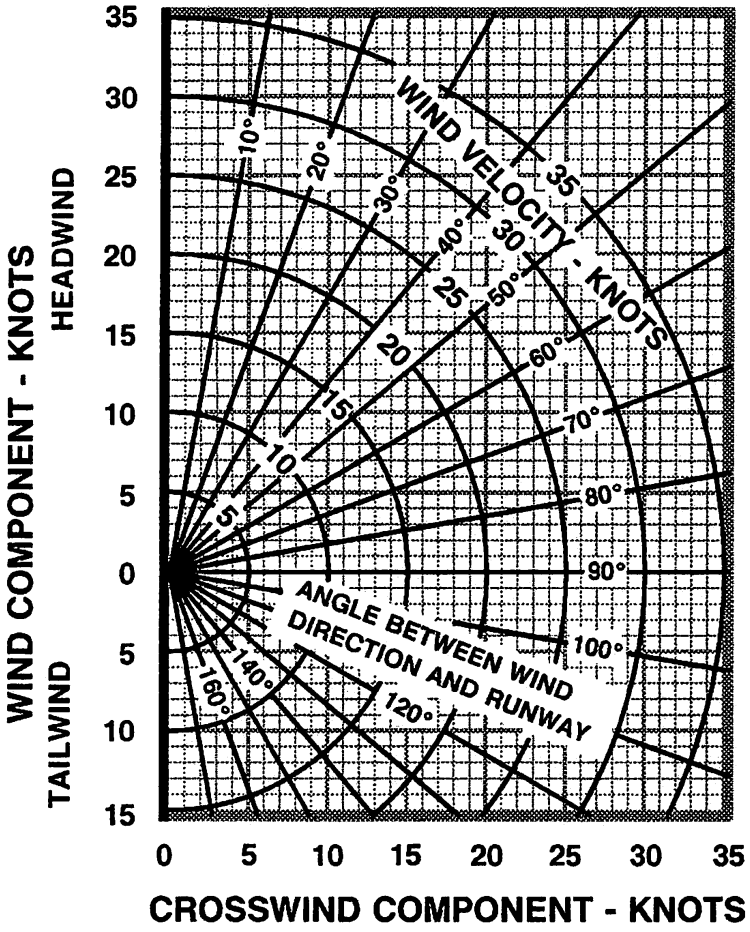
FLAP SETTING	ANGLE OF BANK							
	0°		30°		45°		60°	
	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
UP	51	56	55	60	61	67	72	79
20°	44	52	47	56	52	62	62	74
FULL	41	50	44	54	49	59	58	71

NOTE

1. Altitude loss during a stall recovery may be as much as 250 feet.
2. KIAS values are approximate.

Figure 5-4

CROSSWIND COMPONENT



NOTE

Maximum demonstrated crosswind velocity is 15 knots (not a limitation).

Figure 5-5

SHORT FIELD TAKEOFF DISTANCE AT 3100 POUNDS

CONDITIONS:

Flaps 20°
2400 RPM, 32 inches Hg. and Mixture set at 24 GPH Prior to Brake Release
Cowl Flaps Open
Paved, Level, Dry Runway
Zero Wind
Lift Off: 54 KIAS
Speed at 50 Feet: 60 KIAS

Press Alt - Feet	0°C		10°C		20°C		30°C		40°C	
	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst
S. L.	700	1255	750	1340	800	1430	860	1525	915	1620
1000	740	1320	795	1410	850	1505	910	1605	975	1710
2000	785	1390	845	1485	905	1585	965	1690	1035	1800
3000	835	1465	895	1565	960	1670	1030	1780	1100	1900
4000	890	1545	955	1650	1020	1760	1095	1880	1170	2010
5000	945	1630	1015	1740	1090	1865	1165	1990	1245	2125
6000	1010	1720	1085	1845	1160	1975	1245	2110	1330	2255
7000	1075	1825	1155	1955	1240	2090	1325	2235	1420	2390
8000	1145	1930	1235	2070	1325	2215	1415	2370	1515	2535

NOTE

1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 9 knots headwind. For operation with tail winds up to 10 knots, increase distances by 10% for each 2 knots.
3. For operation on dry, grass runway, increase distances by 15% of the "ground roll" figure.

Figure 5-6 (Sheet 1 of 3)

SHORT FIELD TAKEOFF DISTANCE AT 2700 POUNDS

CONDITIONS:

Flaps 20°
2400 RPM, 32 inches Hg. and Mixture set at 24 GPH Prior to Brake Release
Cowl Flaps Open
Paved, Level, Dry Runway
Zero Wind
Lift Off: 50 KIAS
Speed at 50 Feet: 55 KIAS

Press Alt In Feet	0°C		10°C		20°C		30°C		40°C	
	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst
S. L.	510	925	545	985	585	1050	625	1115	665	1185
1000	540	975	580	1035	620	1100	665	1170	710	1245
2000	575	1020	615	1090	660	1160	705	1230	755	1310
3000	610	1075	655	1145	700	1220	750	1300	800	1380
4000	650	1130	695	1205	745	1285	800	1370	850	1455
5000	690	1195	740	1275	795	1355	850	1445	910	1540
6000	735	1260	790	1345	845	1435	905	1530	970	1630
7000	785	1330	845	1420	905	1520	965	1620	1035	1725
8000	840	1410	900	1505	965	1605	1030	1715	1100	1825

NOTE

1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 9 knots headwind. For operation with tail winds up to 10 knots, increase distances by 10% for each 2.5 knots.
3. For operation on dry, grass runway, increase distances by 15% of the "ground roll" figure.

Figure 5-6 (Sheet 2)

SHORT FIELD TAKEOFF DISTANCE AT 2300 POUNDS

CONDITIONS:

Flaps 20°
2400 RPM, 32 inches Hg. and Mixture set at 24 GPH Prior to Brake Release
Cowl Flaps Open
Paved, Level, Dry Runway
Zero Wind
Lift Off: 45 KIAS
Speed at 50 Feet: 50 KIAS

Press Alt In Feet	0°C		10°C		20°C		30°C		40°C	
	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst
S. L.	355	660	380	700	410	745	435	790	465	835
1000	380	695	405	735	435	780	465	830	495	880
2000	400	730	430	775	460	820	490	870	525	925
3000	425	765	455	815	490	865	525	915	560	970
4000	455	805	485	855	520	910	555	965	595	1025
5000	485	845	520	900	555	960	595	1020	635	1080
6000	515	895	550	950	590	1015	630	1075	675	1145
7000	550	945	590	1005	630	1070	675	1140	720	1210
8000	585	995	630	1065	675	1130	720	1205	770	1280

NOTE

1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 9 knots headwind. For operation with tail winds up to 10 knots, increase distances by 10% for each 2.5 knots.
3. For operation on dry, grass runway, increase distances by 15% of the "ground roll" figure.

Figure 5-6 (Sheet 3)

MAXIMUM RATE-OF-CLIMB AT 3100 POUNDS

CONDITIONS:

Flaps Up
2400 RPM, 32 inches Hg. and Mixture set at 24 GPH
Cowl Flaps Open

PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
		-20°C	0°C	20°C	40°C
S.L.	84	1165	1095	1020	950
2000	83	1125	1050	975	900
4000	83	1085	1005	930	850
6000	82	1040	960	875	795
8000	82	995	910	830	745
10,000	82	950	865	780	695
12,000	81	905	815	730	640
14,000	81	855	760	670	585
16,000	81	805	715	625	540
18,000	80	755	665	575	495
20,000	80	705	610	530	450

Figure 5-7

TIME, FUEL AND DISTANCE TO CLIMB AT 3100 POUNDS

MAXIMUM RATE-OF-CLIMB

CONDITIONS:

Flaps Up
2400 RPM, 32 inches Hg. and Mixture set at 24 GPH
Cowl Flaps Open
Standard Temperature

PRESS ALT FT	CLIMB SPEED KIAS	RATE-OF-CLIMB FPM	FROM SEA LEVEL		
			TIME IN MIN	FUEL USED GAL	DIST NM
S.L.	84	1040	0	0.0	0
2000	83	1010	2	0.8	3
4000	83	980	4	1.6	6
6000	82	945	6	2.4	9
8000	82	915	8	3.3	12
10000	82	885	10	4.2	16
12000	81	855	13	5.1	19
14000	81	820	15	6.1	23
16000	81	790	18	7.1	28
18000	80	760	20	8.1	32
20000	80	725	23	9.2	37

NOTE

1. Add 2.0 gallons of fuel for engine start, taxi and takeoff allowance.
2. Increase time, fuel and distance by 10% for each 10° above standard temperature.
3. Distances shown are based on zero wind.

Figure 5-8 (Sheet 1 of 2)

TIME, FUEL AND DISTANCE TO CLIMB AT 3100 POUNDS

NORMAL CLIMB - 95 KIAS

CONDITIONS:

Flaps Up
2400 RPM, 25 inches. Hg. or Mixture 16 GPH
Cowl Flaps Open
Standard Temperature

PRESS ALT FT	CLIMB SPEED KIAS	RATE-OF-CLIMB FPM	FROM SEA LEVEL		
			TIME IN MIN	FUEL USED GAL	DIST NM
S.L.	95	560	0	0.0	0
2000	95	545	4	1.0	6
4000	95	530	7	2.0	12
6000	95	510	11	3.0	19
8000	95	495	15	4.1	26
10000	95	470	19	5.2	34
12000	95	440	24	6.3	42

NOTE

1. Add 2.0 gallons of fuel for engine start, taxi and takeoff allowance.
2. Increase time, fuel and distance by 10% for each 8° C above standard temperature.
3. Distances shown are based on zero wind.

Figure 5-8 (Sheet 2)

CRUISE PERFORMANCE
PRESSURE ALTITUDE SEA LEVEL

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

1. For best economy, operate at peak T.I.T.
2. Power settings not approved for cruising are indicated by dashes.

RPM	MP	20°C BELOW STANDARD TEMP -5°C			STANDARD TEMPERATURE 15°C			20°C ABOVE STANDARD TEMP 35°C		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	28	88	139	18.4	83	139	16.8	78	138	15.4
	26	81	134	16.2	76	134	14.9	72	133	13.8
	24	74	130	14.3	70	129	13.4	66	128	12.5
	22	65	123	12.4	62	122	11.7	58	121	11.1
	20	57	115	10.9	54	114	10.4	50	113	9.9
2300	28	87	138	16.9	82	138	15.7	77	137	14.5
	26	79	133	15.1	75	133	14.0	70	132	13.1
	24	72	128	13.5	68	128	12.7	64	126	11.9
	22	63	121	11.7	59	120	11.1	56	118	10.5
	20	55	114	10.5	52	113	10.0	49	111	9.5
2200	28	85	137	15.7	80	137	14.7	75	136	13.8
	26	77	132	14.1	73	132	13.2	68	130	12.4
	24	70	127	12.7	66	126	12.0	62	125	11.4
	22	60	118	11.0	56	117	10.5	53	116	10.0
	20	54	112	10.1	51	111	9.6	48	109	9.2
	18	46	104	8.9	44	102	8.5	41	98	8.1
2100	28	81	134	14.7	76	134	13.7	72	133	12.9
	26	73	129	13.1	69	129	12.4	65	127	11.7
	24	66	124	11.9	63	123	11.3	59	122	10.7
	22	58	116	10.5	54	115	10.0	51	113	9.5
	20	51	110	9.6	48	108	9.1	45	106	8.7
	18	44	100	8.4	41	98	8.1	39	94	7.7
2000	28	77	132	13.7	73	132	12.9	68	130	12.1
	26	69	126	12.3	66	126	11.7	62	124	11.0
	24	63	121	11.2	59	120	10.7	56	118	10.1
	22	56	114	10.1	52	113	9.6	49	111	9.2
	20	49	107	9.1	46	105	8.7	43	102	8.3
	18	41	97	8.0	39	94	7.6	37	90	7.2

Figure 5-9 (Sheet 1 of 11)

CRUISE PERFORMANCE
PRESSURE ALTITUDE 2000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

1. For best economy, operate at peak T.I.T.
2. Power settings not approved for cruising are indicated by dashes.

RPM	MP	20°C BELOW STANDARD TEMP -9°C			STANDARD TEMPERATURE 11°C			20°C ABOVE STANDARD TEMP 31°C		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	28	- - -	- - -	- - -	84	142	17.1	79	142	15.7
	26	83	138	16.6	78	138	15.3	73	137	14.1
	24	76	133	14.7	71	133	13.7	67	131	12.8
	22	67	127	12.8	63	126	12.0	60	124	11.3
	20	59	119	11.2	56	118	10.7	52	116	10.2
2300	28	88	141	17.2	83	141	15.9	78	141	14.8
	26	81	136	15.4	76	136	14.3	71	135	13.3
	24	74	132	13.8	69	131	12.9	65	130	12.1
	22	65	124	12.0	61	124	11.4	57	122	10.8
	20	57	118	10.8	54	116	10.2	51	114	9.7
2200	28	86	140	15.9	81	140	14.9	76	139	13.9
	26	78	135	14.3	74	135	13.4	69	133	12.6
	24	71	130	13.0	67	129	12.2	63	128	11.6
	22	62	122	11.4	58	121	10.8	55	120	10.3
	20	55	116	10.3	52	114	9.8	49	112	9.4
	18	48	107	9.2	45	105	8.8	43	102	8.4
2100	28	82	137	14.8	77	137	13.9	73	136	13.0
	26	74	132	13.3	70	132	12.5	66	130	11.8
	24	67	127	12.1	64	126	11.5	60	125	10.9
	22	59	120	10.8	56	119	10.3	53	117	9.8
	20	53	113	9.8	50	111	9.3	47	109	8.9
	18	45	104	8.7	43	101	8.3	40	98	7.9
2000	28	78	135	13.9	73	134	13.0	69	133	12.3
	26	71	129	12.5	67	129	11.8	63	127	11.2
	24	64	124	11.4	60	123	10.8	57	121	10.3
	22	57	117	10.3	54	116	9.8	50	114	9.3
	20	50	110	9.3	47	108	8.9	44	105	8.4
	18	43	100	8.2	40	97	7.8	38	93	7.4

Figure 5-9 (Sheet 2)

CRUISE PERFORMANCE
PRESSURE ALTITUDE 4000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

1. For best economy, operate at peak T.IT.
2. Power settings not approved for cruising are indicated by dashes

RPM	MP	20°C BELOW STANDARD TEMP -13°C			STANDARD TEMPERATURE 7°C			20°C ABOVE STANDARD TEMP 27°C		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	28	- - -	- - -	- - -	86	145	17.5	80	145	16.0
	26	84	141	17.1	79	141	15.7	75	140	14.4
	24	77	137	15.1	73	136	14.0	68	135	13.0
	22	69	130	13.2	65	129	12.4	61	128	11.6
	20	61	123	11.6	57	122	11.0	54	120	10.5
2300	28	- -	- - -	- - -	84	144	16.2	79	144	15.0
	26	82	140	15.7	77	140	14.6	72	138	13.6
	24	75	135	14.1	71	134	13.2	66	133	12.4
	22	67	128	12.4	63	127	11.7	59	126	11.1
	20	59	121	11.0	56	120	10.5	52	118	10.0
2200	28	87	143	16.1	82	143	15.1	77	142	14.1
	26	79	138	14.5	75	138	13.6	70	136	12.8
	24	72	133	13.2	68	132	12.4	64	131	11.7
	22	64	126	11.7	61	125	11.2	57	124	10.6
	20	57	119	10.5	53	118	10.0	50	115	9.6
	18	50	111	9.5	47	109	9.1	44	106	8.6
2100	28	83	140	15.0	78	140	14.1	73	139	13.1
	26	75	135	13.5	71	135	12.7	67	133	12.0
	24	69	130	12.3	65	129	11.6	61	128	11.0
	22	61	123	11.1	58	122	10.5	54	120	10.0
	20	54	116	10.0	51	114	9.5	48	112	9.1
	18	47	107	8.9	44	105	8.5	42	101	8.1
2000	28	79	137	14.0	74	137	13.1	70	136	12.4
	26	72	132	12.7	68	132	12.0	63	130	11.3
	24	65	127	11.6	61	126	11.0	57	124	10.4
	22	58	120	10.5	55	119	10.0	51	117	9.5
	20	51	113	9.5	48	111	9.0	46	108	8.6
	18	44	103	8.4	42	100	8.0	39	96	7.6

Figure 5-9 (Sheet 3)

CRUISE PERFORMANCE
PRESSURE ALTITUDE 6000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

1. For best economy, operate at peak T.I.T
2. Power settings not approved for cruising are indicated by dashes.

RPM	MP	20°C BELOW STANDARD TEMP -17°C			STANDARD TEMPERATURE 3°C			20°C ABOVE STANDARD TEMP 23°C		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	28	--	---	---	86	149	17.7	81	148	16.2
	26	85	144	17.3	80	144	15.9	75	143	14.6
	24	78	140	15.4	74	139	14.2	69	138	13.2
	22	70	134	13.5	66	133	12.6	62	131	11.9
	20	62	126	11.8	59	125	11.2	55	123	10.7
2300	28	--	---	---	85	147	16.3	79	147	15.1
	26	83	143	15.9	78	143	14.8	73	141	13.7
	24	76	138	14.3	72	137	13.4	67	136	12.5
	22	68	132	12.7	64	131	12.0	60	129	11.3
	20	60	124	11.3	57	123	10.7	53	121	10.2
2200	28	88	146	16.3	83	146	15.2	78	145	14.2
	26	80	141	14.7	75	141	13.8	71	139	12.9
	24	73	136	13.4	69	135	12.6	65	134	11.9
	22	66	130	12.0	62	129	11.4	58	127	10.8
	20	58	122	10.7	55	121	10.2	51	118	9.7
	18	51	114	9.7	48	112	9.3	45	109	8.8
2100	28	83	143	15.1	79	143	14.2	74	142	13.2
	26	76	138	13.7	72	138	12.9	68	136	12.1
	24	70	133	12.4	66	132	11.8	62	130	11.2
	22	62	126	11.3	59	125	10.7	55	123	10.2
	20	55	119	10.2	52	117	9.7	49	114	9.2
	18	48	110	9.1	46	108	8.7	43	104	8.3
2000	28	79	140	14.1	74	140	13.2	70	138	12.4
	26	72	135	12.8	68	134	12.1	64	133	11.4
	24	66	129	11.7	62	128	11.1	58	127	10.5
	22	59	123	10.6	56	122	10.1	52	119	9.6
	20	52	116	9.6	49	114	9.2	46	110	8.7
	18	45	106	8.6	43	103	8.2	40	98	7.8

Figure 5-9 (Sheet 4)

CRUISE PERFORMANCE
PRESSURE ALTITUDE 8000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

1. For best economy, operate at peak T.I.T
2. Power settings not approved for cruising are indicated by dashes.

RPM	MP	20°C BELOW STANDARD TEMP -21°C			STANDARD TEMPERATURE -1°C			20°C ABOVE STANDARD TEMP 19°C		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	28	- -	- - -	- - -	86	152	17.8	81	151	16.2
	26	85	147	17.3	80	147	15.9	75	146	14.6
	24	79	143	15.5	74	142	14.4	70	141	13.3
	22	71	137	13.7	67	136	12.8	63	134	12.0
	20	63	129	12.0	60	128	11.3	56	126	10.8
2300	28	- -	- - -	- - -	85	150	16.4	80	150	15.2
	26	83	146	15.9	78	145	14.8	73	144	13.8
	24	77	141	14.5	72	140	13.5	68	139	12.6
	22	69	135	12.9	65	134	12.1	61	132	11.4
	20	61	127	11.4	58	126	10.9	54	123	10.3
2200	28	88	149	16.3	83	149	15.3	78	148	14.2
	26	81	144	14.8	76	144	13.9	71	142	13.0
	24	74	139	13.5	70	138	12.7	66	137	12.0
	22	67	132	12.2	63	132	11.5	59	130	10.9
	20	59	125	10.9	56	124	10.4	52	121	9.9
	18	52	117	9.9	49	115	9.4	46	111	9.0
2100	28	84	146	15.2	79	146	14.2	74	145	13.3
	26	77	141	13.8	72	140	12.9	68	139	12.2
	24	70	136	12.6	66	135	11.9	62	133	11.2
	22	63	129	11.4	60	128	10.8	56	126	10.3
	20	56	122	10.3	53	120	9.8	50	117	9.3
	18	49	113	9.3	46	110	8.9	44	106	8.4
2000	28	79	143	14.1	75	142	13.3	70	141	12.5
	26	73	138	12.9	69	137	12.2	64	135	11.5
	24	66	132	11.8	62	131	11.2	59	129	10.6
	22	60	126	10.7	56	125	10.2	53	122	9.7
	20	53	118	9.7	50	116	9.3	47	113	8.8
	18	46	109	8.7	44	106	8.3	41	101	7.9

Figure 5-9 (Sheet 5)

CRUISE PERFORMANCE
PRESSURE ALTITUDE 10,000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

1. For best economy, operate at peak T.I.T
2. Power settings not approved for cruising are indicated by dashes.

RPM	MP	20°C BELOW STANDARD TEMP -25°C			STANDARD TEMPERATURE -5°C			20°C ABOVE STANDARD TEMP 15°C		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	28	---	---	---	87	155	17.8	81	154	16.2
	26	85	150	17.3	80	150	15.9	75	148	14.7
	24	79	146	15.7	75	145	14.5	70	144	13.4
	22	72	140	13.9	68	139	13.0	64	137	12.2
	20	64	132	12.2	60	131	11.5	57	128	10.9
2300	28	---	---	---	85	154	16.4	80	152	15.2
	26	83	149	16.0	78	148	14.9	74	147	13.8
	24	77	144	14.6	73	143	13.6	68	142	12.8
	22	70	138	13.1	66	137	12.3	62	135	11.6
	20	62	130	11.6	59	129	11.0	55	126	10.4
2200	28	88	152	16.4	83	152	15.3	78	151	14.3
	26	81	147	14.9	76	146	14.0	72	145	13.1
	24	75	142	13.6	71	141	12.9	66	140	12.1
	22	68	135	12.3	64	135	11.7	60	133	11.1
	20	60	128	11.1	57	127	10.5	53	124	10.0
	18	53	120	10.0	50	118	9.6	47	114	9.1
2100	28	84	149	15.2	79	149	14.3	74	147	13.3
	26	77	144	13.9	73	143	13.0	68	142	12.2
	24	71	138	12.7	67	138	12.0	63	136	11.3
	22	64	132	11.5	60	131	11.0	57	128	10.4
	20	57	125	10.4	54	122	9.9	50	119	9.4
	18	50	116	9.4	47	113	9.0	45	109	8.6
2000	28	79	146	14.1	75	145	13.3	70	144	12.5
	26	73	140	13.0	69	139	12.2	65	138	11.5
	24	67	135	11.9	63	134	11.3	59	132	10.6
	22	60	129	10.9	57	127	10.3	54	124	9.8
	20	54	121	9.8	51	118	9.4	48	115	8.9
	18	47	111	8.8	44	108	8.4	42	103	8.0

Figure 5-9 (Sheet 6)

CRUISE PERFORMANCE
PRESSURE ALTITUDE 12,000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

1. For best economy, operate at peak T.I.T
2. Power settings not approved for cruising are indicated by dashes.

RPM	MP	20°C BELOW STANDARD TEMP -29°C			STANDARD TEMPERATURE -9°C			20°C ABOVE STANDARD TEMP 11°C		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	28	---	---	---	87	158	17.8	81	156	16.2
	26	85	153	17.3	80	152	15.9	75	151	14.6
	24	79	148	15.7	75	148	14.5	70	146	13.5
	22	73	143	14.0	69	142	13.1	65	140	12.3
	20	64	135	12.2	61	134	11.6	57	131	11.0
2300	28	---	---	---	85	156	16.4	80	155	15.2
	26	83	151	16.0	78	151	14.9	74	149	13.8
	24	77	146	14.6	73	145	13.6	68	144	12.7
	22	70	140	13.1	66	139	12.3	62	138	11.6
	20	62	133	11.6	59	131	11.0	55	128	10.5
2200	28	88	155	16.3	83	155	15.3	78	153	14.2
	26	81	150	14.8	76	149	13.9	72	147	13.1
	24	74	144	13.6	70	143	12.8	66	142	12.0
	22	67	138	12.3	64	137	11.6	60	134	11.0
	20	60	130	11.1	57	128	10.5	53	125	10.0
	18	54	122	10.1	50	119	9.6	47	115	9.1
2100	28	84	152	15.2	79	151	14.2	74	150	13.3
	26	77	146	13.8	73	145	13.0	68	144	12.2
	24	71	141	12.6	67	140	11.9	63	138	11.3
	22	64	134	11.5	60	133	10.9	57	130	10.4
	20	57	127	10.4	54	124	9.9	51	121	9.5
	18	50	118	9.5	48	114	9.0	45	110	8.6
2000	28	79	148	14.1	75	147	13.3	70	146	12.5
	26	73	143	12.9	69	142	12.2	65	140	11.5
	24	67	137	11.9	63	136	11.3	59	133	10.6
	22	60	131	10.9	57	129	10.3	54	126	9.8
	20	54	122	9.9	51	120	9.4	48	116	9.0
	18	47	113	8.9	45	109	8.5	42	104	8.1

Figure 5-9 (Sheet 7)

CRUISE PERFORMANCE
PRESSURE ALTITUDE 14,000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

1. For best economy, operate at peak T.I.T
2. Power settings not approved for cruising are indicated by dashes.

RPM	MP	20°C BELOW STANDARD TEMP -33°C			STANDARD TEMPERATURE -13°C			20°C ABOVE STANDARD TEMP 7°C		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	28	---	---	---	87	160	17.8	81	159	16.2
	26	85	155	17.2	80	155	15.8	75	153	14.6
	24	80	151	15.8	75	150	14.6	71	149	13.5
	22	73	145	14.1	69	144	13.2	65	143	12.3
	20	65	137	12.3	61	136	11.6	57	133	11.0
2300	28	---	---	---	85	159	16.4	80	157	15.2
	26	83	154	15.9	78	153	14.8	73	152	13.8
	24	77	149	14.6	73	148	13.6	68	147	12.7
	22	70	143	13.2	66	142	12.4	62	140	11.6
	20	63	135	11.7	59	133	11.1	55	130	10.5
2200	28	88	158	16.3	83	157	15.2	78	156	14.2
	26	81	152	14.8	76	151	13.9	72	150	13.0
	24	74	146	13.5	70	145	12.7	66	144	12.0
	22	67	140	12.3	63	139	11.6	60	136	11.0
	20	60	132	11.1	57	130	10.5	53	126	10.0
	18	54	124	10.1	51	121	9.6	48	116	9.2
2100	28	83	154	15.1	79	153	14.2	74	152	13.2
	26	77	148	13.8	72	148	12.9	68	146	12.2
	24	70	143	12.6	66	142	11.9	62	140	11.3
	22	64	136	11.5	60	135	10.9	57	132	10.4
	20	57	128	10.5	54	126	10.0	51	122	9.5
	18	51	119	9.5	48	116	9.1	45	111	8.6
2000	28	79	150	14.1	74	150	13.2	70	148	12.4
	26	73	145	12.9	69	144	12.2	64	142	11.5
	24	67	139	11.9	63	138	11.3	59	135	10.6
	22	60	133	10.9	57	130	10.3	54	127	9.8
	20	54	124	9.9	51	121	9.4	48	117	9.0
	18	48	114	9.0	45	110	8.5	42	104	8.1

Figure 5-9 (Sheet 8)

CRUISE PERFORMANCE
PRESSURE ALTITUDE 16,000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

1. For best economy, operate at peak T.I.T
2. Power settings not approved for cruising are indicated by dashes.

RPM	MP	20°C BELOW STANDARD TEMP -37°C			STANDARD TEMPERATURE -17°C			20°C ABOVE STANDARD TEMP 3°C		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	28	---	---	---	---	---	---	---	---	---
	27	88	161	18.2	83	160	16.7	78	159	15.3
	26	84	158	17.1	80	157	15.7	75	156	14.5
	24	80	154	15.8	75	153	14.6	71	151	13.5
	22	73	148	14.2	69	147	13.2	65	145	12.4
	20	65	140	12.4	61	138	11.7	58	135	11.0
2300	28	---	---	---	---	---	---	---	---	---
	27	86	159	16.6	81	158	15.5	76	157	14.3
	26	82	156	15.8	78	155	14.7	73	154	13.7
	24	77	151	14.5	72	150	13.5	68	149	12.7
	22	70	145	13.1	66	144	12.4	62	141	11.6
	20	63	137	11.7	59	135	11.1	55	131	10.5
2200	28	---	---	---	---	---	---	---	---	---
	27	83	157	15.4	79	156	14.4	74	155	13.5
	26	80	154	14.7	76	153	13.8	71	152	12.9
	24	73	148	13.4	69	147	12.6	65	145	11.9
	22	67	142	12.2	63	140	11.6	59	137	10.9
	20	60	133	11.0	56	131	10.5	53	127	10.0
2100	28	---	---	---	---	---	---	---	---	---
	27	79	154	14.4	75	153	13.5	70	151	12.6
	26	76	151	13.7	72	150	12.9	68	148	12.1
	24	70	145	12.5	66	144	11.9	62	141	11.2
	22	64	138	11.5	60	136	10.9	56	133	10.3
	20	57	130	10.4	54	127	9.9	50	123	9.4
2000	28	---	---	---	---	---	---	---	---	---
	27	76	150	13.4	71	149	12.6	67	147	11.9
	26	72	147	12.8	68	146	12.1	64	144	11.5
	24	67	141	11.9	63	140	11.2	59	137	10.6
	22	60	134	10.8	57	132	10.3	54	128	9.8
	20	54	126	9.9	51	123	9.4	48	117	9.0
	18	48	116	9.0	45	111	8.6	43	104	8.2

Figure 5-9 (Sheet 9)

CRUISE PERFORMANCE
PRESSURE ALTITUDE 18,000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

1. For best economy, operate at peak T.I.T
2. Power settings not approved for cruising are indicated by dashes.

RPM	MP	20°C BELOW STANDARD TEMP -41°C			STANDARD TEMPERATURE -21°C			20°C ABOVE STANDARD TEMP -1°C		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	28	---	---	---	---	---	---	---	---	---
	27	87	163	18.0	82	162	16.5	77	161	15.1
	26	84	160	16.9	79	159	15.5	74	158	14.3
	24	79	156	15.7	75	155	14.5	70	154	13.4
	22	73	151	14.2	69	150	13.2	65	147	12.4
	20	65	142	12.4	62	140	11.7	58	137	11.1
2300	28	---	---	---	---	---	---	---	---	---
	27	85	161	16.4	80	160	15.3	75	159	14.2
	26	81	158	15.6	77	157	14.5	72	156	13.5
	24	76	153	14.4	72	152	13.4	67	150	12.6
	22	70	147	13.1	66	146	12.3	62	143	11.6
	20	62	139	11.6	59	136	11.0	55	132	10.4
2200	28	---	---	---	---	---	---	---	---	---
	27	82	159	15.1	78	158	14.2	73	157	13.3
	26	79	156	14.5	75	155	13.6	70	154	12.8
	24	73	150	13.2	68	149	12.5	64	146	11.8
	22	66	143	12.1	62	141	11.4	59	138	10.8
	20	59	134	10.9	56	131	10.4	52	127	9.9
2100	28	---	---	---	---	---	---	---	---	---
	27	79	156	14.2	74	155	13.3	70	153	12.5
	26	76	153	13.6	71	152	12.8	67	150	12.0
	24	69	147	12.4	65	145	11.8	62	142	11.1
	22	63	140	11.4	60	137	10.8	56	134	10.3
	20	56	131	10.4	53	127	9.9	50	122	9.4
2000	28	---	---	---	---	---	---	---	---	---
	27	75	152	13.3	71	151	12.6	67	149	11.8
	26	72	149	12.8	68	148	12.1	64	145	11.4
	24	66	143	11.8	62	141	11.2	59	138	10.6
	22	60	136	10.8	57	133	10.3	53	129	9.8
	20	54	127	9.9	51	123	9.4	48	118	9.0
	18	48	117	9.0	45	112	8.6	43	103	8.2

Figure 5-9 (Sheet 10)

CRUISE PERFORMANCE
PRESSURE ALTITUDE 20,000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

1. For best economy, operate at peak T.I.T
2. Power settings not approved for cruising are indicated by dashes.

RPM	MP	20°C BELOW STANDARD TEMP -45°C			STANDARD TEMPERATURE -25°C			20°C ABOVE STANDARD TEMP -5°C		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	28	---	---	---	---	---	---	---	---	---
	27	86	165	17.8	82	165	16.3	77	163	14.9
	26	83	162	16.7	78	162	15.4	73	160	14.2
	24	79	159	15.6	75	158	14.4	70	156	13.4
	22	73	153	14.2	69	152	13.2	65	149	12.4
	20	65	145	12.4	62	142	11.7	58	138	11.1
2300	28	---	---	---	---	---	---	---	---	---
	27	84	163	16.2	79	162	15.1	74	161	14.0
	26	81	160	15.4	76	159	14.3	71	158	13.4
	24	76	156	14.2	71	155	13.3	67	152	12.5
	22	70	150	13.0	66	148	12.2	62	144	11.5
	20	62	140	11.6	58	138	11.0	55	133	10.4
2200	28	---	---	---	---	---	---	---	---	---
	27	81	161	14.9	76	160	14.0	72	158	13.1
	26	78	158	14.3	74	157	13.4	69	155	12.6
	24	72	152	13.1	68	150	12.3	64	147	11.6
	22	65	145	11.9	62	142	11.3	58	138	10.7
	20	58	135	10.8	55	132	10.3	52	126	9.8
2100	28	---	---	---	---	---	---	---	---	---
	27	78	158	14.0	73	157	13.2	69	154	12.3
	26	75	155	13.4	71	154	12.6	66	151	11.9
	24	69	149	12.3	65	146	11.7	61	143	11.0
	22	63	141	11.3	59	139	10.8	56	134	10.2
	20	56	132	10.3	53	128	9.8	50	122	9.3
2000	28	---	---	---	---	---	---	---	---	---
	27	75	155	13.3	70	154	12.5	66	150	11.8
	26	72	152	12.7	68	150	12.0	64	147	11.4
	24	66	145	11.7	62	143	11.1	58	139	10.5
	22	60	137	10.8	57	134	10.3	53	130	9.8
	20	54	128	9.8	51	124	9.4	48	117	8.9
	18	48	118	9.0	46	112	8.6	43	103	8.2

Figure 5-9 (Sheet 11)

RANGE PROFILE
45 MINUTES RESERVE
64 GALLONS USABLE FUEL

CONDITIONS:
3100 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTE

This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during a normal climb up to 12,000 feet and maximum climb above 12,000 feet.

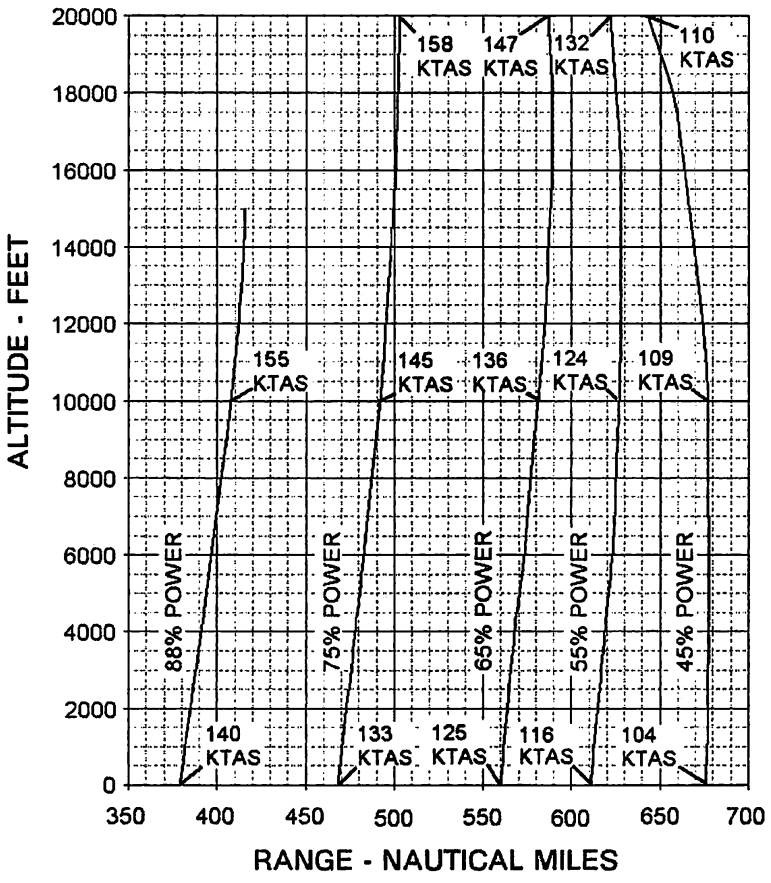


Figure 5-10 (Sheet 1 of 2)

RANGE PROFILE
45 MINUTES RESERVE
87 GALLONS USABLE FUEL

CONDITIONS:

3100 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTE

This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during a normal climb up to 12,000 feet and maximum climb above 12,000 feet.

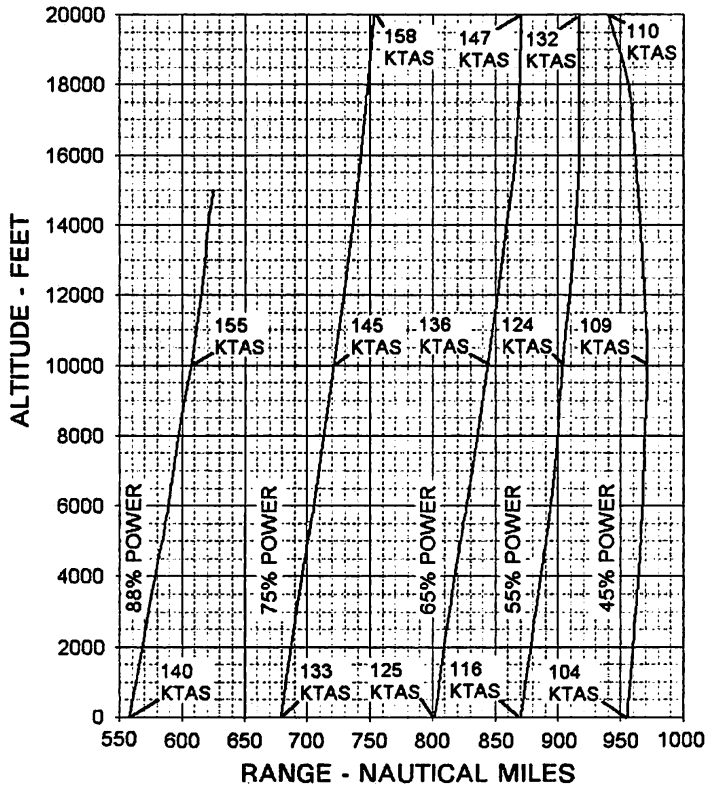


Figure 5-10 (Sheet 2)

ENDURANCE PROFILE
45 MINUTES RESERVE
64 GALLONS USABLE FUEL

CONDITIONS:
3100 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTE

This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during a normal climb up to 12,000 feet and maximum climb above 12,000 feet.

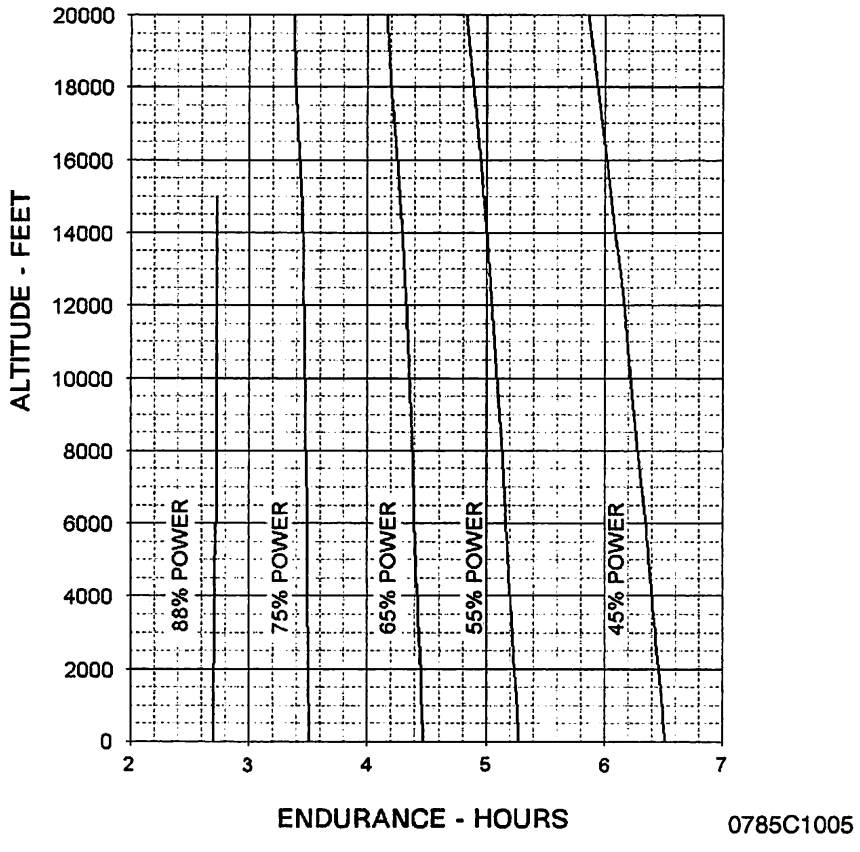


Figure 5-11 (Sheet 1 of 2)

ENDURANCE PROFILE
45 MINUTES RESERVE
87 GALLONS USABLE FUEL

CONDITIONS:
3100 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTE

This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during a normal climb up to 12,000 feet and maximum climb above 12,000 feet.

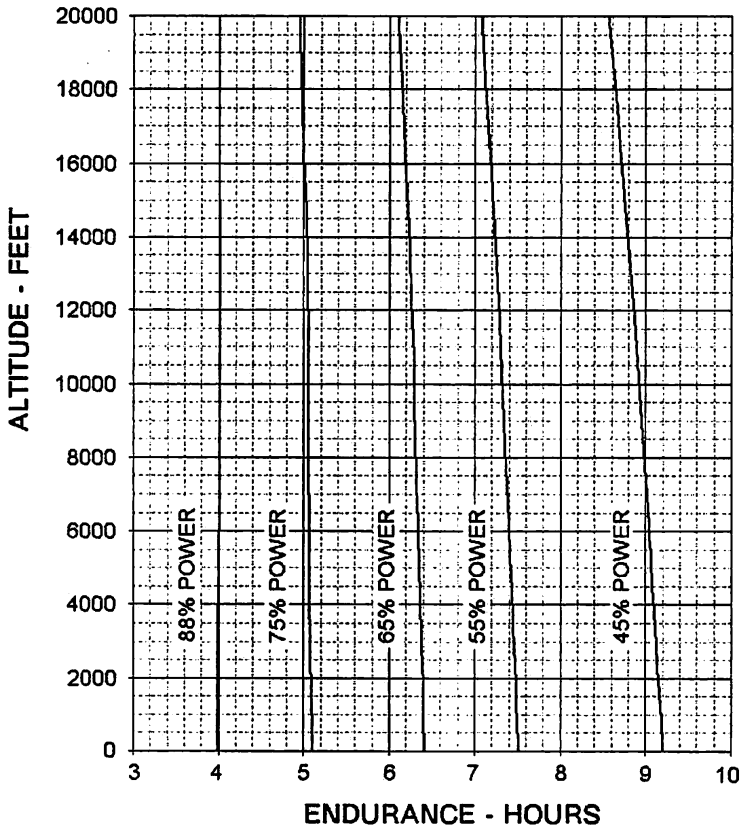


Figure 5-11 (Sheet 2)

SHORT FIELD LANDING DISTANCE AT 2950 POUNDS

CONDITIONS:

Flaps FULL
Power Off
Maximum Braking
Paved, level, dry runway
Zero Wind
Speed at 50 Feet: 60 KIAS

Press Alt In Feet	0°C		10°C		20°C		30°C		40°C	
	Grnd Roll Ft	Total Ft To Clear 50 Ft Obst	Grnd Roll Ft	Total Ft To Clear 50 Ft Obs	Grnd Roll Ft	Total Ft To Clear 50 Ft Obs	Grnd Roll Ft	Total Ft To Clear 50 Ft Obs	Grnd Roll Ft	Total Ft To Clear 50 Ft Obs
S. L.	560	1300	580	1335	600	1365	620	1400	640	1435
1000	580	1265	600	1365	620	1400	645	1440	665	1475
2000	600	1370	625	1405	645	1440	670	1480	690	1515
3000	625	1410	645	1445	670	1485	695	1525	715	1560
4000	650	1450	670	1485	695	1525	720	1565	740	1600
5000	670	1485	695	1525	720	1565	745	1610	770	1650
6000	700	1530	725	1575	750	1615	775	1660	800	1700
7000	725	1575	750	1615	780	1665	805	1710	830	1750
8000	755	1625	780	1655	810	1715	835	1760	865	1805

NOTE

1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 9 knots headwind. For operation with tail winds up to 10 knots, increase distances by 10% for each 2 knots.
3. For operation on dry, grass runway, increase distances by 45% of the "ground roll" figure.
4. If a landing with flaps up is necessary, increase the approach speed by 10 KIAS and allow for 40% longer distances.

Figure 5-12