SECTION 5

PERFORMANCE

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5.1 INTRODUCTION

The performance charts and tables in this section provide the necessary planning information so the pilot may know, with reasonable accuracy, what to expect from the airplane in various conditions. The data in the charts has been computed from flight tests using average piloting techniques and using an airplane and engine in good condition.

WARNING

To ensure that published performance figures can be duplicated, the airplane and engine must be maintained in good condition. Pilot proficiency and thorough preflight planning for all phases of flight are necessary to assure performance predictions are achieved with adequate margins of safety.

Notes have been provided on various charts and tables which indicate the approximate effects on performance when the inertial separator is in the BYPASS position. The actual effect will vary depending on temperature, altitude and airspeed. At lower altitudes the effect will be less as the engine's performance margins may allow torque recovery with power lever advance within other normal engine limitations. Refer to Section 2 for details on engine operating limits.

Reserve fuel referred to in the range and endurance sections is computed as 45 minutes at the best range power setting for the altitude used for the flight. Factors such as engine and propeller condition and turbulence may produce variations in range and endurance of 10% or more. Accurate fuel management requires the regular in-flight monitoring of the fuel contents and consumption as well as an awareness of environmental and operational factors to ensure that safe fuel reserves are maintained.

USE OF PERFORMANCE CHARTS

Performance charts and tables are organized in logical sequence and follow the normal flight progression from takeoff – climb – cruise – descent – landing. Where appropriate, instructions and worked examples are included in the introduction to each sub section. As a further guide the following paragraphs work through to performance planning for a sample flight.

SAMPLE FLIGHT PLANNING PROBLEM

Airplane Configuration

Takeoff Weight	7500 lbs
Useable Fuel	1459 lbs (829 litres)

Takeoff Conditions

Airfield Pressure Altitude	1250 ft
Temperature	20ºC (ISA +7ºC)
Wind Component	12 knot headwind
Field Length	3500 ft

Cruise

Total Distance	450 nm
Pressure Altitude	11,500 ft
Temperature	+2ºC (ISA +10ºC)
Wind En-route	10 knot headwind

Landing Conditions

Airfield Pressure Altitude	2000 ft
Temperature	20ºC (ISA +9ºC)
Field Length	3500 ft

TAKEOFF

The takeoff distance is calculated from the table shown in Figure 5-7. It should be noted that these distances are based on the short field takeoff technique detailed in Section 4. When actual conditions do not correspond exactly with table conditions, conservative planning figures can be established by reading the chart at the next higher value of weight, altitude or temperature, as appropriate. For example, in the sample conditions presented above, the takeoff distance information presented for a weight of 7500 lbs, pressure altitude of 2000 ft and temperature of ISA +10ºC, should be used. This results in the following takeoff distances:

Ground Roll	1457 ft
Total To Clear 50 ft Obstacle	1974 ft

These figures are well within the field length available. Note 2 from the takeoff table in Figure 5-7 indicates that a correction for the effects of headwind should be made. The correction is as follows:

$$\frac{12\text{ kt}}{5\text{ kt}} \times 7\% = 16\ \%\text{ decrease.}$$

This results in the following distances, adjusted for wind:

Ground Roll Zero Wind	1457 ft
Decrease In Ground Roll (1475 X 16%)	233 ft
Corrected Ground Roll	1224 ft
Total Distance To Clear A 50 ft Obstacle	1974 ft
Decrease In Total Distance (1974 X 16%)	316 ft
Corrected Total Distance	1658 ft

CRUISE

The selection of cruising altitude should be based on a consideration of airplane climb capability (at the operating weight), cruise sector length, and winds at altitude, as well as any applicable minimum safe altitude and air traffic requirements. There is further discussion on the selection of cruise speed and altitude under the heading of “Fuel Conservation” later in this section.

With forecast headwinds aloft the sample flight is planned at a high cruise power setting. Studying the tables for 10,000 ft and 15,000 ft in Figure 5-10 it is evident that the higher torque value of 52 psi at 10,000 ft with 91.2% Np is not attainable at 15,000 ft with 91.2% Np. As planned cruise is above 10,000 ft the next figure down (45 psi) is used. A comparison of these two altitudes also shows that the lower altitude provides the more conservative fuel flow and true airspeed figures for planning.

The table for 10,000 ft pressure altitude is used and in the 91.2% Np band the torque of 45 psi is selected. Forecast temperature aloft is 10ºC above standard (ISA +10ºC). The true airspeed and fuel flow figures, presented for ISA and ISA +20ºC are as follows;

ISA			ISA +20ºC		
KTAS	LPH	(pph)	KTAS	LPH	(pph)
156	192	(338)	161	195	(344)

Interpolating between the respective true airspeed and fuel flow values it can be established that the ISA + 10ºC figures are approximately:

True Airspeed	158 KTAS	
Cruise Fuel Flow	194 LPH	(342 pph)

Fuel Required

The total fuel requirements for the planned flight are established by adding the following:

Start, Taxi and Takeoff Fuel	-	22 litres, (39 lbs)
Climb Fuel	-	(from Figure 5-9)
Cruise Fuel	-	(cruise fuel flow x time spent at cruise)
Descent Fuel	-	(from Figure 5-11)
Holding Or Contingency Fuel	-	(as appropriate due to weather and operation requirements)
Reserve Fuel	-	(45 minutes at cruise fuel flow)

Note

If prolonged taxi or holding delays are anticipated prior to takeoff the standard allowance of 40 lbs should be increased appropriately.

Assuming a maximum rate climb, Figure 5-9 is used to determine the time, distance and fuel used to climb to cruise altitude. The table figures are based on a climb from sea level. For climbs initiated above sea level the difference between the values shown at cruise and departure altitudes may be used. The departure airfield in the sample problem is at 1250 ft with a temperature of ISA + 7ºC. Conservative figures can be determined by using the figures based on a climb from sea level in ISA +10ºC conditions.

This results in the following:

Time	13 minutes
Distance	22 nm
Fuel used	49 litres (87 lbs)

Similarly, Figure 5-11 is used to determine the time, distance and fuel for a descent from cruise altitude. Using the figures for a descent from 12,000 ft (nearest to planned cruise of 11,500 ft), to sea level, the following values are established:

Time	15 minutes
Distance	40 nm
Fuel used	39 litres (69 lbs)

The distances shown on the climb and descent tables are for zero wind conditions. The correction for wind is made as follows:

Climb Distance in Zero Wind	22 nm
Decrease in Distance Due to Wind (13 min/60 X 10 knots headwind)	2 nm
Corrected Distance to Climb	20 nm

A similar correction is made to the descent distance as follows:

Descent Distance in Zero Wind	40 nm
Decrease in Distance Due To Wind (15 min/60 X 10 knots headwind)	≅ 3 nm
Corrected Distance to Descend	37 nm

The cruise distance is then determined by subtracting the distance for climb and descent from the total distance.

Total Distance	450 nm
Distance During Climb And Descent	-57 nm
Cruise Distance	393 nm

With a forecast headwind of 10 knots the expected groundspeed is expected to be:

True Airspeed In Cruise	158 KTAS
Wind Component	-10 knots
Ground Speed	148 knots

Therefore, the time required to complete the cruise portion of the flight is:

$$\frac{393\text{ nm}}{148\text{ kts}} = 2.66\text{ hours}$$

The fuel required for the cruise portion of the flight is:

2.66 hours X 194 LPH (342 pph) = 517 litres (910 lbs)

The 45 minute reserve fuel is calculated as follows:

$$\frac{45}{60}\text{ X 194 LPH (342 pph)} = 146\text{ litres (257 lbs)}$$

Assuming no additional holding or contingency fuel is required to satisfy air traffic, weather or operational requirements, the total fuel required is estimated as follows:

Start, Taxi and Takeoff Fuel	22 litres (39 lbs)
Climb	49 litres (87 lbs)
Cruise	517 litres (910 lbs)
Descent	39 litres (69 lbs)
Reserve	146 litres (257 lbs)
Total Fuel Required For Fight	773litres (1362 lbs)

The above figure is a planning estimate only. In flight monitoring of groundspeed and fuel flow is essential to establish a basis for accurate fuel management and to ensure that adequate reserves of fuel are maintained for the safe completion of the flight.

LANDING

The method used to determine landing distance from Figure 5-14 is similar to that used for takeoff calculations. The landing weight must be estimated as follows:

Takeoff Weight	7500 lbs
Fuel Required For Takeoff, Climb, Cruise and Descent	1105 lbs (627 litres)
Landing Weight	6395 lbs

This is below the maximum allowable landing weight of 7,125 lbs.

The landing distances shown in Figure 5-14 assume a short landing technique as defined in Section 4. The one table is valid for all landing weights and using the figures for a landing at 2,000 ft pressure altitude, in ISA + 10ºC conditions, the following distances are determined:

Total Distance Over A 50 ft Obstacle	2172 ft
Ground Roll	915 ft

These figures are well within the field length available. Note 2, from Figure 5-14, indicates that a correction for the effects of headwind may also be made. If such a correction was considered necessary, due to limited field length available, the correction should be made using the same method that applies to the takeoff distance.

FUEL CONSERVATION

Familiarity with this section and thorough planning will optimize fuel conservation and ensure efficient airplane operations. Of particular interest are the climb, cruise, descent, range and endurance sections.

The selection of a cruising altitude should be guided by an awareness of the reducing fuel flow and increasing true airspeed as altitude increases. These figures are available from the cruise tables. At high weights the degraded climb performance may warrant a lower cruising altitude to avoid prolonged time in a low speed climb. Short flight sectors may also warrant a slightly lower cruising altitude, to minimize the time penalty of a long climb with insufficient cruise time to achieve an economy gain. Route minimum safe altitude or air traffic requirements must also be adhered to.

As the airplane is unpressurized, the descent should be planned to allow sufficient time for passengers to equalize the pressure in their ears. Commence descent at a point which will avoid unnecessary maneuvering overhead the destination airfield. The descent table provides figures based on a constant 800 fpm descent rate. For passengers comfort it may be necessary to reduce the descent rate to about 500 fpm, particularly at altitudes below 10,000 ft. If this is anticipated the descent should be initiated slightly earlier to avoid delays overhead the destination.

The descent should be flown at reduced power, and close to the rough air penetration speed, in case turbulence is encountered on descent. A descent at high power and high speed is not recommended as it will compromise both fuel efficiency and passenger comfort.

When extreme range, rather than flight time, is the principle requirement the range profile should be used as shown in Figure 5-12. It demonstrates that increasing altitude will generally improve range. A reduction from maximum cruising speed will also benefit range, within limits. The effects of headwind and tailwind may vary predictions to a considerable degree. As a general principle the range speed should be increased in a headwind and reduced in a tailwind.

When required to hold at a particular position the fuel consumption will be minimum when flying at minimum power speed. Below 15,000 ft the best endurance speed is 90 knots. If absolute maximum endurance is not essential, a practical holding airspeed is 100 KIAS. The economy gains from further speed reduction are minimal and at this speed airplane handling is more comfortable with a safe margin above the stall. Endurance flight times are greatest below 10,000 ft as can be seen from the endurance profile shown in Figure 5-13.

5.2 AIRSPEED CALIBRATION

NORMAL STATIC SYSTEM

CONDITIONS

Weight: 7,500 lbs

Power: For level flight or maximum power for descent.

NOTE

Airspeed values which would fall below the stalling speed for the configuration or are above the approved maximum operating speed have been replaced with dashed lines.

Flaps Up								
KIAS	---	80	100	120	140	160	170	---
KCAS	---	82	102	121	141	161	171	---
Flaps 20º								
KIAS	60	70	80	90	100	110	120	130
KCAS	62	72	81	91	100	110	119	128
Flaps 40º								
KIAS	50	60	70	80	90	100	110	120
KCAS	52	61	71	80	89	99	108	117

Figure 5-1, Airspeed Calibration

5.3 ALTIMETER CORRECTION

NORMAL STATIC SYSTEM

CONDITIONS

Weight: 7,500 lbs

Power: For level flight or maximum power for descent.

NOTE

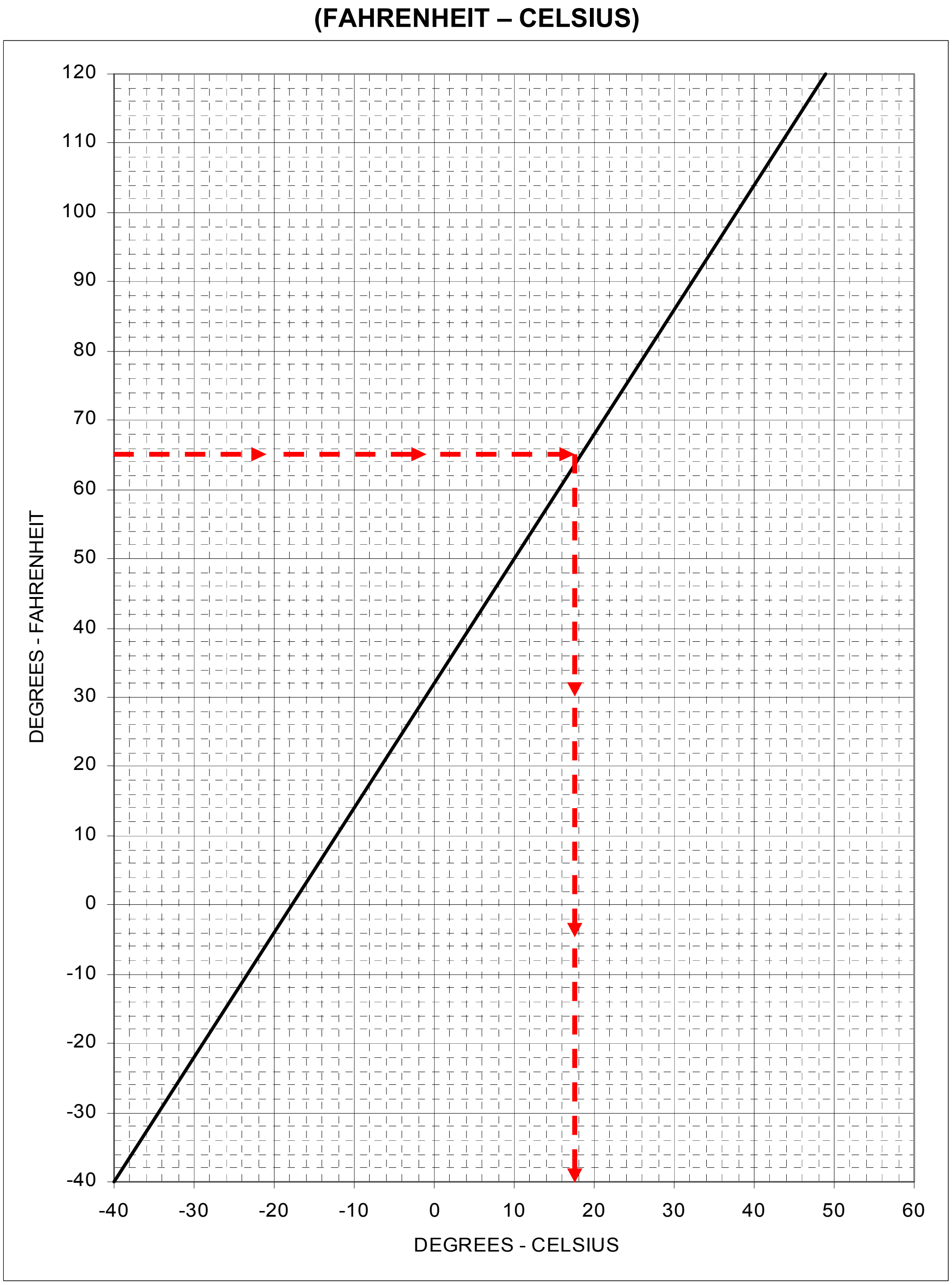
Where values have been replaced by dashed lines the correction is not necessary as the condition is not attainable in level flight or is outside of approved operating limits.

Add correction to desired altitude to obtain indicated altitude to fly.

Condition	**Correction to be added – feet**							
	KIAS							
Flaps Up	60	70	80	100	120	140	155	170
	---	-20	-15	-15	-10	-10	-15	-15
	KIAS							
Flaps 20º	60	70	80	90	100	110	120	130
	-15	-10	-5	0	0	5	10	-15
	KIAS							
Flaps 40º	50	60	70	80	90	100	110	120
	---	-10	-5	0	10	15	20	25

Figure 5-2, Altitude Correction

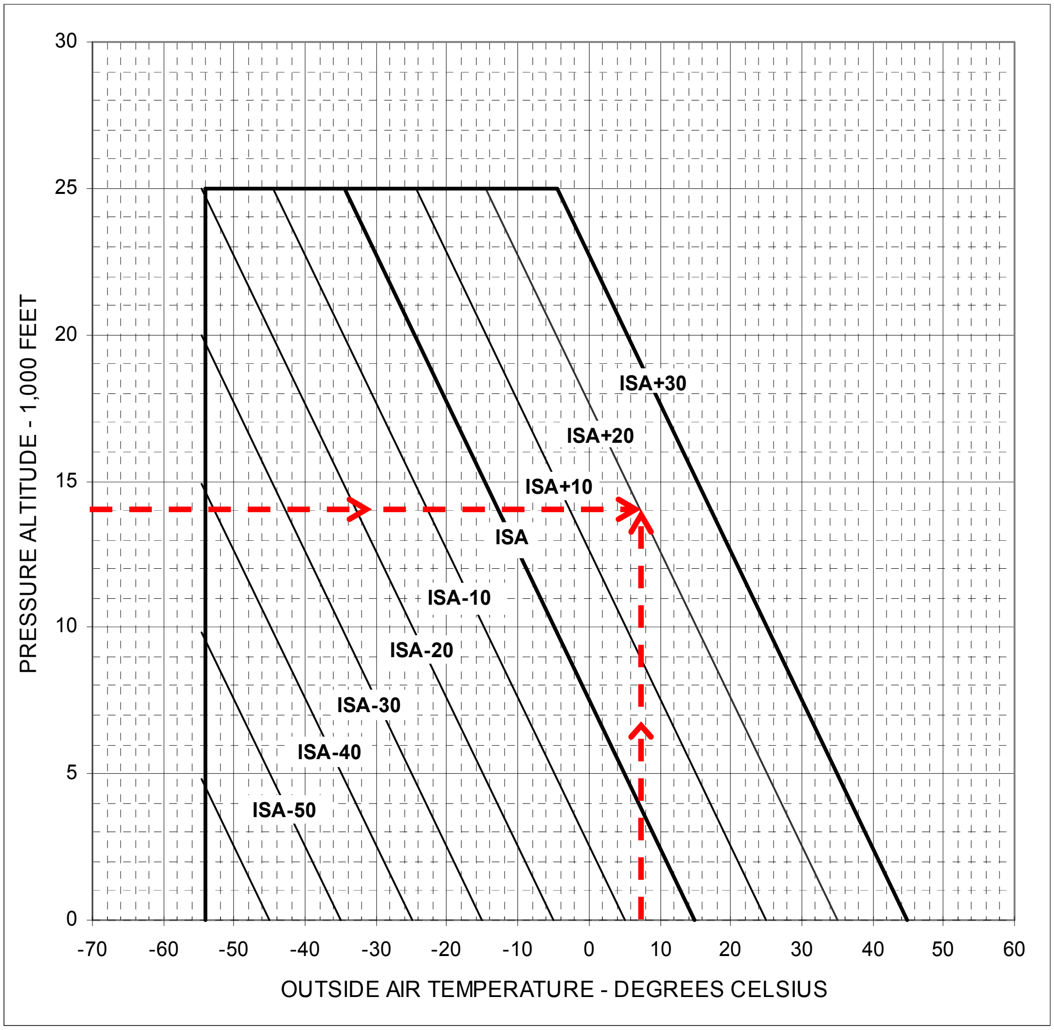
5.4 TEMPERATURE CONVERSION CHART



Example: - 65ºF equals + 18ºC

Figure 5-3, Temperature Conversion Chart

ISA TEMPERATURE CONVERSION CHART



Example:

At a pressure altitude of 14,000 ft an outside air temperature of +7ºC equates to ISA +20ºC

Figure 5-4, ISA Temperature Conversion Chart

5.5 WIND COMPONENT CALCULATION CHART

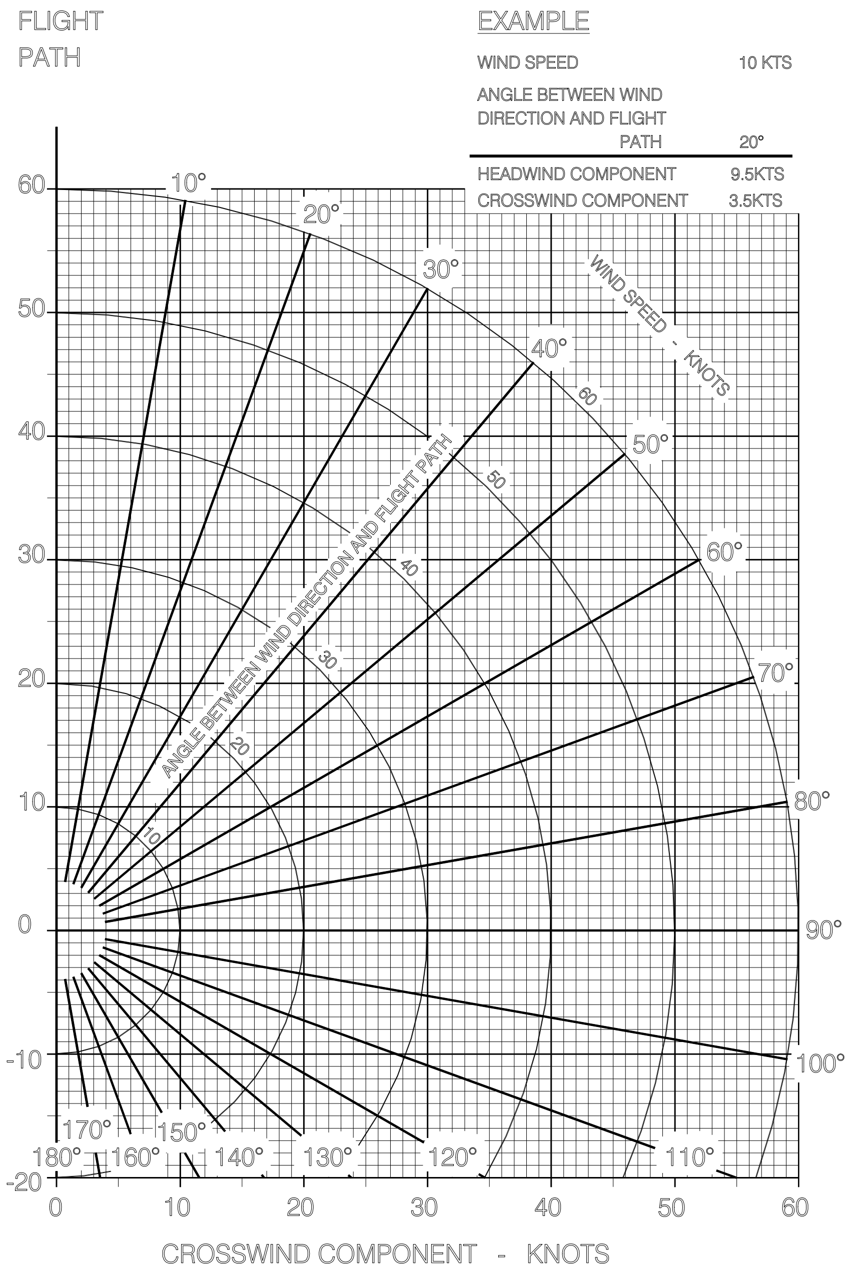


Figure 5-5, Wind Component Calculation Chart

5.6 STALL SPEEDS

CONDITIONS

Power Lever: Idle

Fuel Condition Lever: Flight Idle

Note

Altitude loss during stall recovery may be as much as 300 ft from a wings level stall, or even greater from a turning stall.

Stall speeds shown are at most forward center of gravity

WEIGHT lbs	FLAP SETTING	ANGLE OF BANK							
		0º		30º		45º		60º	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
7,500	UP	69	71	74	76	82	84	99	100
	20º	61	63	67	68	74	75	89	89
	40º	58	59	62	63	70	70	83	83
7,125	40º	57	58						
5,500	40º	51	53						
4,000	40º	45	47						

Figure 5–6, Stall Speeds

5.7 TAKEOFF PERFORMANCE

TAKE OFF PERFORMANCE

NORMAL TAKEOFF TECHNIQUE

Conditions:

Power	Takeoff power set before brake release
Flap	20°
Propeller	91.2% Np (2,006 RPM)
Inertial Separator	Normal
Runway	Paved, Level, Dry Surface

Temperature expressed as deviation from ISA.

Use temperature conversion charts if required.

Notes:

1. Normal Takeoff technique as specified in Section 4.
2. Decrease distances 7% for each 5 kts of headwind.
3. Up to 10 kts of tailwind increase distances by 12% for each 2.5 kts.
4. For operations off dry grass surfaces increase distances by 15% of the ground roll figure.
5. Sloping runways. Decrease distances by 4% per 1% down slope and increase distances by 6% per 1% of up slope.
6. With Inertial Separator in BYPASS increase distances by 3%.

TAKEOFF WEIGHT (lbs)	TAKE OFF SPEED KNOTS ~ IAS		PRESS ALT (ft)	ISA - 10°C		ISA		ISA +10°		ISA +20°C		ISA +30°C	
	Rotate Speed	Speed at 50ft		Ground Roll (ft)	Total to Clear 50ft (ft)	Ground Roll (ft)	Total to Clear 50ft (ft)	Ground Roll (ft)	Total to Clear 50ft (ft)	Ground Roll (ft)	Total to Clear 50ft (ft)	Ground Roll (ft)	Total to Clear 50ft (ft)
7500	61	74	S.L.	1176	1606	1244	1695	1313	1785	1425	1956	1571	2208
			2,000	1287	1752	1366	1854	1457	1974	1594	2205	1758	2495
			4,000	1418	1922	1507	2036	1638	2237	1793	2507	1973	2844
			6,000	1565	2111	1692	2294	1852	2559	2028	2882	2229	3293
			8,000	1830	2481	1998	2751	2187	3085	2397	3497	2639	4055
			10,000	2161	2977	2363	3325	2589	3753	2840	4310	3124	5096
6500	57	69	S.L.	941	1341	996	1414	1051	1487	1141	1626	1256	1822
			2,000	1031	1461	1094	1545	1167	1644	1276	1826	1405	2048
			4,000	1136	1600	1207	1694	1312	1856	1435	2064	1576	2317
			6,000	1253	1754	1354	1903	1481	2111	1617	2351	1780	2653
			8,000	1466	2056	1599	2268	1748	2523	1914	2825	2104	3209
			10,000	1730	2450	1888	2629	2067	2920	2266	3268	2492	3693
5500	53	64	S.L.	694	1028	734	1083	776	1140	841	1242	925	1384
			2,000	761	1119	808	1183	862	1259	942	1391	1034	1550
			4,000	838	1224	891	1296	969	1416	1058	1566	1160	1746
			6,000	925	1341	1000	1452	1093	1604	1195	1778	1310	1985
			8,000	1082	1567	1180	1723	1260	1877	1410	2119	1547	2374
			10,000	1276	1859	1393	2051	1523	2274	1667	2538	1829	2858
4500	49	59	S.L.	490	769	519	810	548	852	594	926	652	1028
			2,000	537	837	571	884	608	940	665	1035	729	1148
			4,000	592	915	630	968	684	1072	747	1162	818	1288
			6,000	654	1012	707	1083	772	1191	843	1314	923	1458
			8,000	764	1188	833	1279	910	1410	995	1558	1091	1757
			10,000	900	1379	983	1515	1074	1673	1175	1854	1289	2069

Figure 5-7, Takeoff Performance

5.8 RATE OF CLIMB

RATE OF CLIMB PREDICTIONS.

The airplane's climb capability can be predicted for a known weight, altitude and temperature, at various altitudes by using the table in Figure 5-8.

Instructions

1. Select the table for the appropriate airplane weight.
2. Enter the table in the left hand column at the nominated altitude.
3. Move to the right, noting the best rate of climb airspeed.
4. Continue right into the column which represents the appropriate temperature and read the predicted rate of climb.

Example: 1

6,500 lb airplane at 12,000 ft in ISA conditions will climb at 1144 fpm.

Interpolation of intermediate readings

1. The easiest method is to simply round intermediate values up to the next higher weight, altitude or temperature, as appropriate, and accept the rate of climb displayed. This figure will be conservative and provide an increased safety margin for planning.
2. It is also acceptable to interpolate between the higher and lower values of the relevant variables. Variations in rate of climb are not linear with altitude; therefore, figures derived by this method will be approximate only.

Example: 2

Calculate rate of climb and best rate of climb speed for the following conditions:

Airplane Weight: 7,000 lbs
Altitude: 5,000 ft
OAT: 15ºC (ISA +10ºC from the ISA conversion chart in Figure 5-4)

1. From the 7,500 lb table the ISA + 10ºC rates of climb at 4,000 ft and 8,000 ft are 997 and 930 fpm respectively. As 5,000 ft lies ¼ of the way between 4,000 and 8,000 ft, subtract ¼ of the difference from the 4,000 ft value. (rate of climb decreases with increase in altitude)

e.g. Step 1. 997 – 930 = 67

Step 2. ¼ of 67 ≅ 17 therefore the rate of climb at 5,000 ft, at 7,500 lbs, is 997 -17 ≅ 980 fpm.

2. Repeat the same steps on the 6,500 lb table.

   e.g. Step 1. 1321 – 1255 = 66

   Step 2. ¼ of 67 ≅ 17 therefore the rate of climb at 5,000 ft, at 6,500 lbs, is 1321 -17 ≅ 1304 fpm.

3. The example airplane weights 7,000 lbs (half way between 6,500 lbs and 7,500 lbs), therefore rate of climb will be half way between 980 and 1304 fpm;

   (980 + 1304)/ 2 = 1142 fpm (approximate rate of climb)

4. The best rate of climb speed is extrapolated using the climb speed from the 7500 lb table of 91 KIAS and the climb speed from the 6500 lb table of 88 KIAS. The example airplane weighs 7000 lbs (halfway between 6500 lbs and 7500lbs); therefore, the best climb speed is halfway between the speed for 7500 lbs and 6500 lbs.

   89 ½ (or ≅ 90 KIAS)

RATE OF CLIMB TABLES

CONDITIONS

Flaps: Up
Power: Maximum continuous power (54 psi) or lesser power as limited by altitude and within the engine limits of Ng 101.6% and ITT 740ºC.
Propeller Lever: Max rpm

7,500 lbs		Rate of Climb (feet per minute)				
Altitude (ft)	KIAS	ISA -10°C	ISA	ISA +10°C	ISA +20°C	ISA +30°C
0	91	1,081	1,067	1,052	1,039	1,026
4,000	91	1,033	1,015	997	981	908
8,000	91	974	951	930	828	689
12,000	91	887	823	727	615	495
16,000	91	617	515	407	279	148
20,000	91	429	338	246	132	5

6,500 lbs						
Altitude (ft)	KIAS	ISA -10°C	ISA	ISA +10°C	ISA +20°C	ISA +30°C
0	88	1,399	1,384	1,371	1,359	1,347
4,000	88	1,355	1,337	1,321	1,305	1,223
8,000	88	1,298	1,277	1,255	1,144	987
12,000	88	1,212	1,144	1,038	915	787
16,000	88	992	901	795	670	539
20,000	88	719	624	525	401	264

5,500 lbs						
Altitude (ft)	KIAS	ISA -10°C	ISA	ISA +10°C	ISA +20°C	ISA +30°C
0	85	1,811	1,795	1,783	1,772	1,760
4,000	85	1,767	1,752	1,734	1,720	1,630
8,000	85	1,714	1,694	1,675	1,547	1,368
12,000	85	1,630	1,550	1,432	1,296	1,152
16,000	85	1,388	1,286	1,168	1,028	883
20,000	85	1,089	988	874	733	583

4,500 lbs						
Altitude (ft)	KIAS	ISA -10°C	ISA	ISA +10°C	ISA +20°C	ISA +30°C
0	81	2,369	2,355	2,341	2,329	2,316
4,000	81	2,324	2,307	2,294	2,279	2,173
8,000	81	2,273	2,257	2,240	2,089	1,884
12,000	81	2,197	2,103	1,966	1,806	1,643
16,000	81	1,922	1,803	1,669	1,508	1,345
20,000	81	1,585	1,474	1,344	1,180	1,009

Figure 5-8, Rate of Climb

5.9 TIME, FUEL AND DISTANCE TO CLIMB

Time, fuel and distance figures may be calculated from the table shown in Figure 5-9. The time, fuel and distance figures are based on a climb from sea level.

Instructions

For a climb from sea level:

1. Enter the table from the left at the planned top of climb altitude.
2. Select the line which represents the airplane takeoff weight.
3. Move to the right into the columns which represent the forecast operating temperature expressed as deviation from ISA conditions.
4. Read off the time, distance and fuel from the respective columns.

For a climb initiated above sea level proceed as follows:

1. First establish the time, distance and fuel required to reach planned altitude assuming the climb was initiated from sea level as above.
2. Now determine the time, distance and fuel figures for a climb from sea level to the starting altitude for the actual planned climb.
3. These values of time, distance and fuel are now deducted from the initial figures established in Step 1.

Example

Calculate time, distance and fuel used for a climb in the following conditions:

Airplane Weight At Takeoff:	6,500 lbs
Forecast Temperature Range:	ISA +10ºC
Climb Commenced From:	4,000 ft to 16,000 ft

1. Enter the table at the 16,000 ft band. From the line of figures for a 6,500lb takeoff weight read time distance and fuel in the ISA +10ºC columns.

   Time = 14 minutes   Distance = 24 nm   Fuel = 50 litres (88 lbs)

2. Now enter the table in the 4,000 ft band at 6,500 lbs. The ISA +10ºC values are:
3. Time = 3 minutes   Distance = 5 nm   Fuel = 12 litres (22 lbs)

4. Subtracting the 4,000 ft values from the 16,000 ft values gives the required time distance and fuel to climb from 4,000 ft to 16,000 ft.

Time = 11 minutes   Distance = 19 nm   Fuel = 38 litres (66 lbs)

NOTE

The variation in climb performance is not linear with increasing altitude. Interpolating directly between altitude bands is likely to produce erroneous figures. The planning purposes the preferred method is to round up to the next higher level. This will provide a conservative figure for planning with an increased safety margin.

TIME, FUEL AND DISTANCE TO CLIMB TABLES

CONDITIONS

Flaps:	Up
Power:	Maximum continuous power (54 psi torque) or lesser power as limited by altitude and within the maximum climb limits of Ng 101.6% and ITT 740ºC.
Propeller Lever:	Max rpm
Airspeed:	For maximum rate of climb

Notes

1. *Add 22 litres (39 lbs of fuel) for start, taxi and takeoff allowance.*
2. *Distances shown are based on zero wind conditions.*
3. *With inertial separator in BYPASS increase time fuel and distances figures by 1% per 1,000 ft of climb.*

			Temperature								
			ISA – 10°C			ISA			ISA + 10°C		
Pressure Altitude ft	Climb Speed KIAS	Takeoff Weight lbs	From Sea Level								
			Time min	Dist nm	Fuel litres (lbs)	Time min	Dist nm	Fuel litres (lbs)	Time min	Dist nm	Fuel litres (lbs)
Sea Level	91	7,500	-	-	-	-	-	-	-	-	-
	88	6,500	-	-	-	-	-	-	-	-	-
	85	5,500	-	-	-	-	-	-	-	-	-
	81	4,500	-	-	-	-	-	-	-	-	-
4,000	91	7,500	4	6	15 (27)	4	6	15 (27)	4	6	16 (29)
	88	6,500	3	4	12 (22)	3	5	12 (22)	3	5	12 (22)
	85	5,500	2	3	9 (16)	2	3	9 (16)	2	3	10 (18)
	81	4,500	2	2	7 (13)	2	2	7 (13)	2	3	7 (13)
8,000	91	7,500	8	13	30 (53)	8	13	31 (55)	8	14	31 (55)
	88	6,500	6	9	23 (41)	6	10	23 (41)	6	10	24 (43)
	85	5,500	5	7	18 (32)	5	7	18 (32)	5	7	18 (32)
	81	4,500	3	5	14 (25)	3	5	14 (25)	3	5	14 (25)
12,000	91	7,500	12	20	46 (81)	12	21	47 (83)	13	22	49 (87)
	88	6,500	9	15	35 (62)	9	15	35 (62)	10	16	36 (64)
	85	5,500	7	11	27 (48)	7	11	27 (48)	7	12	27 (48)
	81	4,500	5	8	20 (36)	5	8	20 (36)	5	8	20 (36)
16,000	91	7,500	17	30	64 (113)	18	33	67 (118)	20	36	71 (125)
	88	6,500	13	21	47 (83)	13	23	49 (87)	14	24	50 (88)
	85	5,500	10	16	35 (62)	10	16	36 (64)	10	17	37 (66)
	81	4,500	7	11	27 (48)	7	12	27 (48)	8	12	28 (50)
20,000	91	7,500	25	46	88 (155)	28	52	95 (168)	32	62	106 (187)
	88	6,500	17	30	62 (110)	18	33	64 (113)	20	37	68 (120)
	85	5,500	13	22	46 (81)	13	23	47 (83)	14	25	48 (85)
	81	4,500	9	15	34 (60)	10	16	35 (62)	10	17	35 (62)

Figure 5-9, Time, Fuel and Distance To Climb

5.10 CRUISE

The cruise tables in Figure 5-10 provide information to assist in the selection of cruising altitudes and power settings. Tables provide information at 5 different pressure altitudes: - 500 ft, 5000 ft, 10,000 ft, 15,000 ft and 20,000 ft. Cruise details also cover 3 different propeller rpm settings: - 91.2% Np (2006 rpm), 85% Np (1870 rpm) and 80% Np (1760 rpm).

Select the table which is closest to the intended cruising altitude. Three propeller rpm bands are represented on each table (except the 20,000 ft table which assumes maximum rpm only). Representative torque settings (psi) are displayed in each band and by moving to the right into the appropriate temperature column (expressed as deviation from ISA) the values of true airspeed (KTAS) and fuel flow LPH and pph are displayed.

The tables show some torque values which exceed maximum continuous power settings. These torque readings are identified with an asterix (*) and associated true airspeed and fuel flow figures are displayed on a shaded background. These values have been included to provide a more complete trend picture of power available and fuel flow versus airspeed at lower altitudes. These power settings are not to be used in cruise flight.

The cruise performance figures are for a 7,500 lb airplane. For planning purposes these figures should be used for all weights. At lighter weights the figures will be conservative.

CRUISE TABLES

Cruise Performance

Pressure Altitude: 500 feet

Prop rpm	Torque (psi)	(ISA -20ºC) KTAS	(ISA -20ºC) LPH (pph)	Standard Temperature (ISA) KTAS	Standard Temperature (ISA) LPH (pph)	(ISA +20ºC) KTAS	(ISA +20ºC) LPH (pph)
91.2% Np 2006 rpm	64*	162	268 (472)	168	269 (474)	-	-
	52	155	252 (444)	161	252 (444)	168	255 (450)
	50	146	218 (384)	151	222 (391)	156	225 (396)
	45	139	203 (358)	144	207 (365)	149	211 (372)
	40	130	183 (323)	135	187 (330)	140	191 (337)
	35	122	171 (301)	127	175 (308)	131	178 (314)
85% Np 1870 rpm	64*	159	257 (453)	165	260 (458)	-	-
	52	155	246 (434)	161	251 (443)	168	256 (451)
	50	143	208 (367)	148	212 (374)	153	216 (381)
	45	136	193 (340)	141	196 (345)	146	200 (352)
	40	130	181 (319)	135	185 (326)	140	189 (333)
	35	119	163 (287)	124	166 (293)	128	170 (300)
80% Np 1760 rpm	64*	156	249 (439)	162	253 (446)	168	258 (455)
	50	141	204 (360)	146	208 (367)	151	212 (374)
	45	133	185 (326)	138	189 (333)	143	194 (342)
	40	126	171 (301)	131	175 (308)	135	179 (316)
	35	118	158 (279)	122	162 (286)	127	166 (293)

Pressure Altitude: 5,000 ft

Prop rpm	Torque (psi)	(ISA -20ºC) KTAS	(ISA -20ºC) LPH (pph)	Standard Temperature (ISA) KTAS	Standard Temperature (ISA) LPH (pph)	(ISA +20ºC) KTAS	(ISA +20ºC) LPH (pph)
91.2% Np 2006 rpm	61*	166	252 (444)	-	-	-	-
	53	156	225 (397)	162	228 (402)	168	231 (408)
	50	152	212 (374)	158	215 (379)	164	219 (386)
	45	146	195 (344)	152	198 (349)	157	202 (356)
	40	138	178 (314)	143	181 (319)	148	185 (326)
	35	129	161 (284)	133	164 (289)	138	168 (296)
85% Np 1870 rpm	63*	157	252 (444)	163	255 (449)	169	246 (433)
	50	145	200 (352)	151	204 (360)	156	207 (365)
	45	139	187 (330)	144	190 (335)	149	194 (342)
	40	132	170 (300)	137	174 (307)	141	177 (312)
	35	122	155 (273)	127	158 (279)	131	162 (286)
80% 1760 rpm	64*	160	245 (432)	166	249 (439)	-	-
	53	156	236 (416)	162	240 (423)	168	244 (430)
	50	144	190 (335)	150	194 (342	155	198 (349)
	45	136	178 (314)	141	182 (321)	146	186 (328)
	40	131	166 (293)	136	170 (300)	140	174 (307)
	35	117	148 (261)	122	152 (268)	126	156 (275)

Figure 5-10, Cruise Table (Sheet 1 of 2)

Pressure Altitude: 10,000 ft		Standard Temperature					
Prop rpm	Torque (psi)	**(ISA -20º)**		**(ISA)**		**(ISA +20º)**	
		KTAS	LPH (pph)	KTAS	LPH (pph)	KTAS	LPH (pph)
91.2% Np 2006 rpm	52	161	215 (379)	167	218 (384)	-	-
	49	156	204 (359)	163	206 (364)	169	209 (369)
	45	150	189 (333)	156	192 (338)	161	195 (344)
	40	142	170 (300)	147	173 (305)	153	176 (310)
	35	133	155 (273)	138	158 (279)	143	161 (284)
85% Np 1870 rpm	54	162	215 (379)	168	219 (386)	-	-
	49	156	200 (352)	163	203 (358)	169	206 (364)
	45	150	182 (321)	156	185 (326)	161	189 (333)
	40	141	164 (289)	146	167 (294)	152	170 (300)
	35	131	148 (261)	136	151 (266)	141	154 (272)
80% Np 1760 rpm	56*	157	215 (379)	164	219 (386)	170	214 (377)
	45	143	169 (298)	149	172 (303)	154	175 (308)
	40	133	157 (277)	138	161 (284)	143	164 (289)
	35	122	140 (247)	127	144 (254)	131	147 (259)

Pressure Altitude: 15,000 ft		Standard Temperature					
Prop rpm	Torque (psi)	**(ISA -20º)**		**(ISA)**		**(ISA +20º)**	
		KTAS	LPH (pph)	KTAS	LPH (pph)	KTAS	LPH (pph)
91.2% Np 2006 rpm	45	157	193 (340)	163	195 (344)	169	185 (326)
	40	147	167 (294)	153	169 (298)	159	172 (303)
	35	135	145 (256)	141	148 (261)	146	150 (264)
85% Np 1870 rpm	46	152	183 (323)	158	186 (328)	164	179 (316)
	40	141	159 (280)	147	162 (286)	153	165 (291)
	35	128	141 (249)	133	144 (254)	138	147 (259)
80% Np 1760 rpm	47	152	183 (323)	158	186 (328)	164	181 (319)
	40	136	154 (272)	142	157 (277)	147	161 (284)
	35	119	134 (236)	124	137 (242)	129	140 (247)

Pressure Altitude: 20,000 ft		Standard Temperature					
Prop rpm	Torque (psi)	**(ISA -20º)**		**(ISA)**		**(ISA +20º)**	
		KTAS	LPH (pph)	KTAS	LPH pph	KTAS	LPH (pph)
91.2% Np 2006 rpm	38	149	165 (291)	155	169 (298)	162	154 (272)
	35	140	147 (259)	146	149 (263)	152	145 (256)

Figure 5-10, Cruise Tables (Sheet 2 of 2)

5.11 TIME, FUEL AND DISTANCE TO DESCEND

CONDITIONS

Flaps: Up
Descent Rate: 800 fpm
Power: As required to maintain 140 KIAS
Propeller Lever: Max rpm

Notes

1. *At very high altitude the available power may not be sufficient to achieve 140 KIAS with a constant descent rate of 800 fpm. In this case the table assumes the constant descent rate was maintained rather than the airspeed.*

2. *Distances shown are based on zero wind conditions.*

3. *Table figures assume a descent to sea level.*

4. *Variations in airplane weight and temperature will have a minimal effect on the table figures. Figures are therefore assumed valid for all weights and temperatures.*

Instructions

Descent to sea level:

1. Read time, distance and fuel figures from the line that represents the desired cruising level.

Descent to intermediate level:

1. Carry out Step 1 above.

2. Deduct the corresponding figures which are displayed at the level off altitude.

Interpolation.

Variations between altitudes are approximately linear therefore it is acceptable to interpolate between tabled figures. As the incremental change between levels is small the preferred method is to round up to the next higher level and use table figures for planning.

Pressure Altitude (ft)	Time (min)	Distance (nm)	Fuel litres (lbs)
20,000	25	71	64 (113)
16,000	20	55	51 (90)
12,000	15	40	39 (69)
8,000	10	26	26 (46)
4,000	5	13	13 (23)
Sea Level	0	0	0 (0)

Figure 5–11, Time, Fuel and Distance To Descend

5.12 RANGE PROFILE

CONDITIONS

Takeoff Weight: 7500 lbs
Takeoff Fuel: 829 litres (1459 lbs)
Graph is based on a mid mission weight.

NOTES

1. Range includes start, taxi, takeoff, climb and descent with 45 minutes reserve fuel at maximum range power.
2. Distances are based on zero wind conditions.
3. The indicated airspeeds for best range, at 7500 lbs, are;
   125 KIAS at sea level
   115 KIAS at 10,000 feet
   110 KIAS at 15000 feet
4. Set desired Np, adjust power lever to maintain indicated airspeed for best range.
5. Reduced rpm settings apply to cruise phase of flight only.

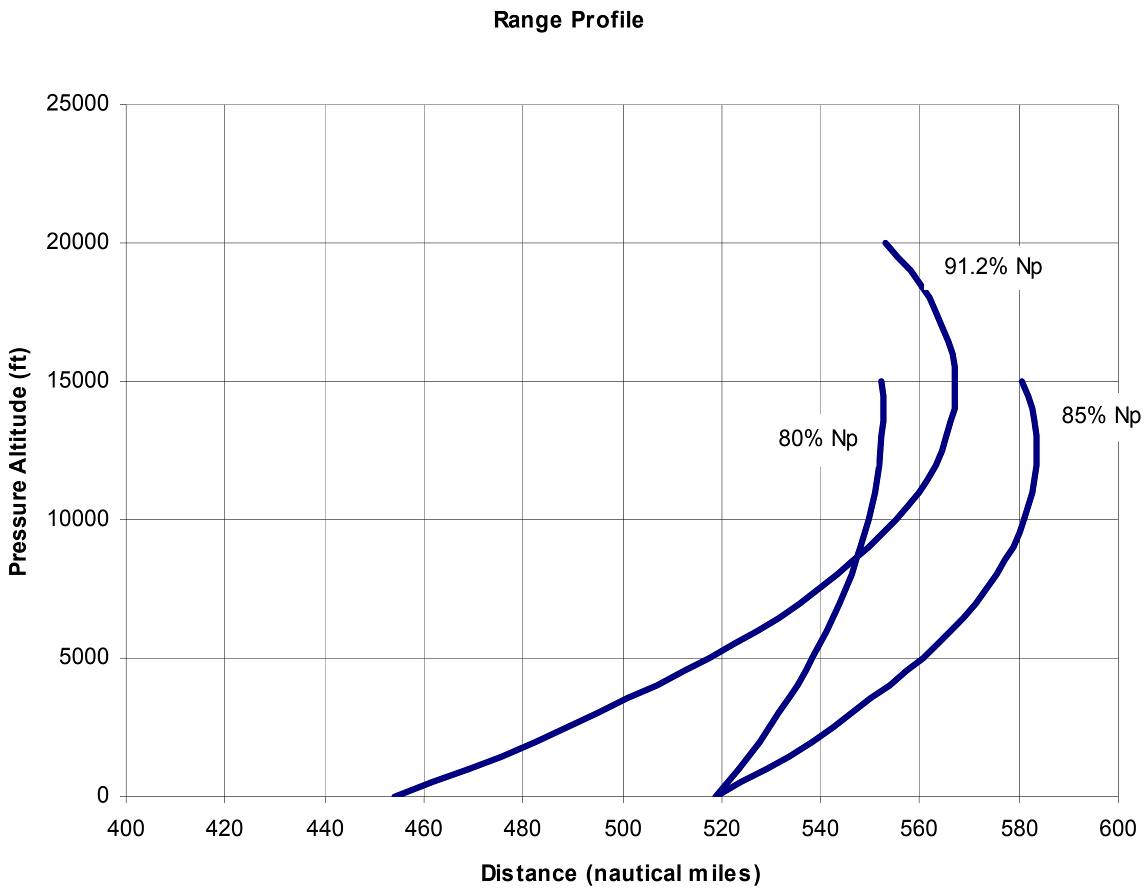


Figure 5-12, Range Profile

5.13 ENDURANCE PROFILE

CONDITIONS

Takeoff Weight: 7500 lbs
Takeoff Fuel: 829 litres (1459 lbs)

NOTES

1. Endurance time includes takeoff from sea level, maximum rate climb (as in Section 5.9) and descent (as in Section 5.11) with 45 minutes reserve fuel (at maximum range power) remaining after landing.
2. Best endurance speed is 90 KIAS below 15,000 ft.
3. Set desired Np, adjust power lever to maintain indicated airspeed for best endurance.
4. Reduced rpm settings apply to cruise phase of flight only.

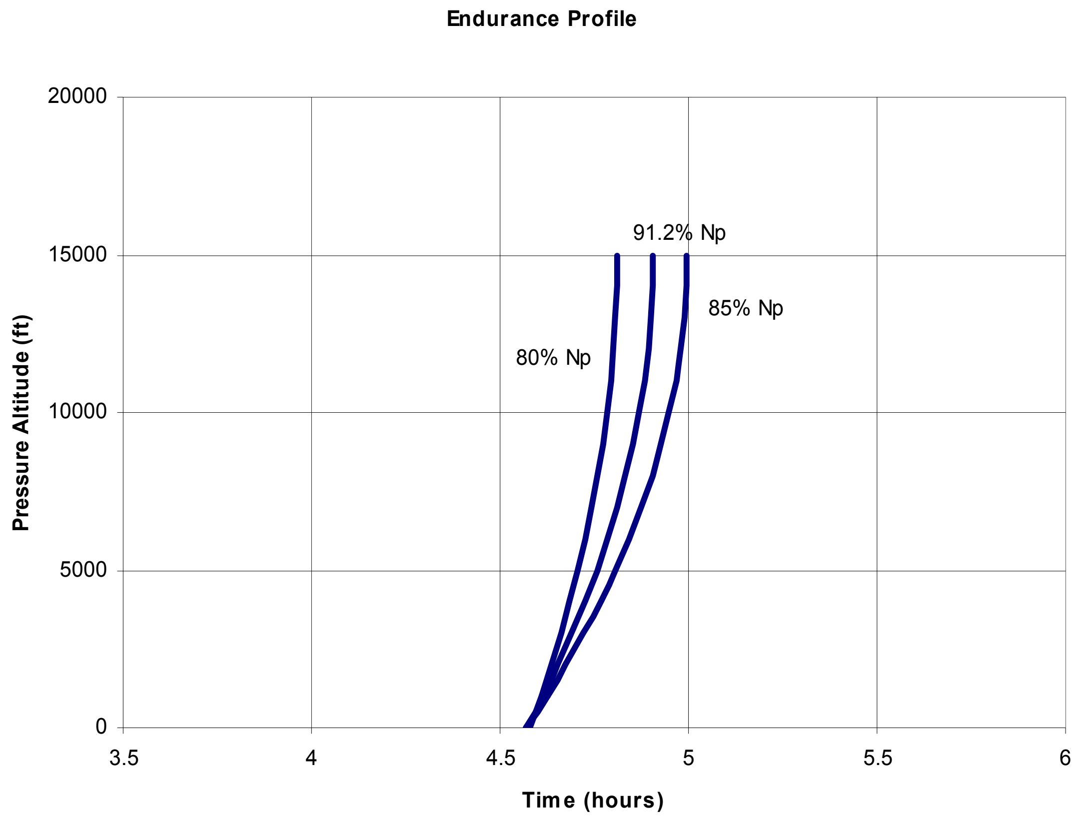


Figure 5-13, Endurance Profile

5.14 LANDING DISTANCE

NORMAL LANDING TECHNIQUE

CONDITIONS:

Power:	To maintain a 3º approach angle to touchdown.
Flap:	40º
Propeller Lever:	Maximum rpm
Airspeed:	1.3 Vso to 50 ft then reducing.
Braking:	Maximum wheel braking.
Surface:	Paved, level, dry runway.

NOTES

1. *Normal Landing technique as specified in Section 4.*
2. *Decrease distance by 7% for each 5 knots of headwind.*
3. *Up to 10 knots of tailwind increase distances by 12% for each 2.5 knots of tailwind.*
4. *For operations on dry grass, increase ground roll distance by 15%.*
5. *If required to land flaps up, add 8 to 13 knots to the approach speed (8 knots at 4,000 lbs weight up to 13 knots at maximum landing weight of 7,125 lbs) and increase the required landing distance by 25%.*
6. *Use of beta and reverse thrust may reduce ground roll distance on a dry runway by 5%.*

(7,125 lbs and all lesser weights)

Pressure Altitude (ft)	ISA Deviation (^{o}C)	Ground Roll (ft)	Total distance over a 50' obstacle (ft)
0	-10	791	1,928
	0	866	2,075
	10	851	2,046
	20	881	2,105
	30	911	2,164
2,000	-10	851	2,045
	0	883	2,108
	10	915	2,172
	20	948	2,236
	30	980	2,301
4,000	-10	916	2,173
	0	951	2,242
	10	985	2,312
	20	1,020	2,382
	30	1,055	2,452
6,000	-10	987	2,315
	0	1,024	2,390
	10	1,062	2,466
	20	1,099	2,542
	30	1,137	2,618

Figure 5-14, Landing Distance, Sheet 1 of 2

Pressure Altitude (ft)	ISA Deviation (^oC)	Ground Roll (ft)	Total distance over a 50' obstacle (ft)
8,000	-10	1,065	2,570
	0	1,105	2,656
	10	1,146	2,741
	20	1,186	2,828
	30	1,227	2,914
10,000	-10	1,150	2,856
	0	1,194	2,953
	10	1,237	3,050
	20	1,281	3,148
	30	1,325	3,245

Figure 5-14, Landing Distance, Sheet 2 of 2

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