Section 5
Performance Data

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Introduction

Performance data in this section are presented for operational planning so that you will know what performance to expect from the airplane under various ambient and field conditions. Performance data are presented for takeoff, climb, and cruise (including range & endurance).

Associated Conditions Affecting Performance

Computed performance data in this section are based upon data derived from actual flight testing with the airplane and engine in good condition and using average piloting techniques. Unless specifically noted in the "Conditions" notes presented with each table, ambient conditions are for a standard day *(refer to Section 1).* Flap position as well as power setting technique is similarly noted with each table.

The charts in this section provide data for ambient temperatures from –20° C (–4° F) to 40° C (104° F). If ambient temperature is below the chart value, use the lowest temperature shown to compute performance. This will result in more conservative performance calculations. **If ambient temperature is above the chart value, use extreme caution as performance degrades rapidly at higher temperatures.**

All fuel flow data for cruise is based on the recommended lean mixture setting detailed in Section 4 – Normal Procedures.

Flight Planning

The performance tables in this section present sufficient information to predict airplane performance with reasonable accuracy. However, variations in fuel metering, mixture leaning technique, engine & propeller condition, air turbulence, and other variables encountered during a particular flight may account for variations of 10% or more in range and endurance. Therefore, utilize all available information to estimate the fuel required for a particular flight. Additionally, verify that the weather, field length, wind, anticipated turbulence, and other conditions that affect aircraft performance are judged to be satisfactory and conducive to safe operations and compliant with the Federal Aviation Regulations (FARs) or governing regulations, as applicable.

• Note •

Whenever possible, select the most conservative values from the following charts to provide an extra margin of safety and to account for events that could occur during a flight.

Sample Problem

The following sample flight problem uses information derived from the airplane performance charts and tables to determine the predicted performance for a typical flight.

The first step in flight planning is to determine the aircraft weight and center of gravity, as well as information about the flight. For this sample problem, the following information is known:

Airplane Configuration:

- Takeoff weight.....3400 Pounds
- Usable fuel.....81 Gallons

Takeoff Conditions:

- Field pressure altitude .....1750 Feet
- Temperature .....25° C (ISA + 13° C)
- Wind component along runway .....11 knot headwind
- Runway Condition .....Dry, level, paved
- Field length.....3000 Feet

Cruise Conditions:

- Total distance .....560 Nautical Miles
- Pressure altitude .....6500 Feet
- Temperature .....20° C (ISA + 17° C)
- Expected wind enroute.....10 Knot Headwind

Landing Conditions:

- Field pressure altitude .....2000 Feet
- Temperature .....20° C (ISA + 10° C)
- Field length.....3000 Feet

Takeoff

The takeoff distance tables, Figure 5-9, show the takeoff ground roll and horizontal distance to reach 50 feet above ground level. The distances shown are based on the short field technique.

Conservative distances can be established by reading the tables 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 3400 pounds, takeoff field pressure altitude of 2000 feet, and a temperature of 30° C should be used. Using the conservative values results in the following:

- Ground roll ..... 1385 Feet
- Total distance to clear a 50 foot obstacle .....2107 Feet

Since the takeoff distance tables are based upon a zero wind conditions, a correction for the effect of winds must be made. Use the wind components chart, Figure 5-8 to determine the crosswind and the headwind (or tailwind) component of the reported winds.

Using the 11-knot headwind component, the following corrections can be made:

- Correction for headwind (10% for each 12 knots) 9.2%
- Ground roll, zero wind ..... 1385 feet
- Decrease in ground roll (1385 feet x 0.092) ..... 127 feet
- Corrected ground roll..... 1258 feet
- Total distance to clear a 50 foot obstacle, zero wind ... 2107 feet

- Decrease in total distance (2107 feet x 0.092) ..... 194 feet
- Corrected total distance to clear 50 foot obstacle ..... 1913 feet

Corrections for grass runways and sloped runways are also applicable and should be applied. These corrections are calculated in the same manner as the wind correction above. *Refer to Figure 5-9* for correction factors to be applied.

Climb

The takeoff and enroute rate-of-climb and climb gradient tables, Figures 5-10 through 5-13, present maximum rate of climb and climb gradient for various conditions. The time, fuel, and distance to climb table, Figure 5-14, allows determination of the time, fuel, and distance to climb from sea level to a specified pressure altitude. To determine the values to be used for flight planning, the start-of-climb time, fuel, and distance values are subtracted from the end-of-climb (cruise altitude) values. Again, conservative values are obtained by using the next lower altitude value for start of climb or next higher altitude values for end of climb. Using conservative values for the sample data, the following calculations are made:

Start-of-climb values (SL to 1750 feet):

- Time to climb ..... 0.7 minutes
- Distance to climb ..... 1.0 NM
- Fuel to climb ..... .0.3 Gal.

End-of-climb values (SL to 6500 feet):

- Time to climb ..... 6.0 minutes
- Distance to climb ..... 10.5 NM
- Fuel to climb ..... 2.4 Gal.

Climb values (1750 to 6500 feet):

- Time to climb (end 6.0 - start 0.7) ..... 5.3 minutes
- Distance to climb (end 10.5 - start 1.0) ..... 9.5 NM
- Fuel to climb (end 2.4 - start 0.3) ..... 2.1 Gal.

The above values reflect climb for a standard day and are sufficient for most flight planning. However, further correction for the effect of temperature on climb can be made. The effect of a temperature on

climb performance is to increase the time, fuel, and distance to climb by approximately 10% for each 10° C above ISA. In our example, using a temperature of ISA + 13° C, the correction to be applied is 13%.

The fuel estimate for climb is:

- Fuel to climb (standard temperature) ..... 2.1 Gal.
- Increase due to non-standard temp (2.1 x 0.13) ..... 0.3 Gal.
- Corrected fuel to climb (2.1 + 0.3) ..... 2.4 Gal.

Procedure for the distance to climb is:

- Distance to climb, standard temperature ..... 9.5 NM
- Increase due to non-standard temp (9.5 x 0.13) ..... 1.2 NM
- Corrected distance to climb (9.5 + 1.2) ..... 10.7 NM

Cruise

The selected cruise altitude should be based upon airplane performance, trip length, and winds aloft. A typical cruise altitude and the expected winds aloft are given for this sample problem. Power selection for cruise should be based upon the cruise performance characteristics tabulated in Figure 5-15, and the range/endurance profile for maximum power is presented in Figure 5-16.

The relationship between power and range as well as endurance is shown in the range/endurance profile chart, Figure 5-16. Note that fuel economy and range are substantially improved at lower power settings.

The cruise performance chart, Figure 5-15, is entered at 6000 feet altitude and 30° C above standard temperature. These values are conservative for the planned altitude and expected temperature conditions. The engine speed chosen is 2500 RPM at approximately 55% power, which results in the following:

- Power (MAP = 19.5) 56%
- True airspeed ..... 157 Knots
- Cruise fuel flow ..... 15.3 GPH

Fuel Required

The total fuel requirement for the flight may be estimated using the performance information obtained from Figures 5-14 and 5-15. The resultant cruise distance is:

- Total distance (from sample problem) ..... 560.0 NM
- Climb distance (corrected value from climb table)..... 10.7 NM
- Cruise distance (total distance - climb distance) ..... 549.3 NM

Using the predicted true airspeed from the cruise performance table, Figure 5-15, and applying the expected 10-knot headwind, the ground speed for cruise is expected to be 147 knots. Therefore, the time required for the cruise portion of the trip is:

- 549.3 NM/147 knots = 3.7 hours.

The fuel required for cruise is:

- 3.7 hours x 15.3 GPH = 56.6 gallons.

From the 6000 ft Cruise Table (Figure 5-15), a 45 minute IFR reserve at approximately 55% power requires:

- 45/60 x 15.3 GPH = 11.5 gallons

The total estimated fuel required is as follows:

- Engine start, taxi, and takeoff ..... 1.5 gallons
- Climb ..... 2.4 gallons
- Cruise ..... 56.6 gallons
- Reserve ..... 11.5 gallons
- Total fuel required ..... 72.0 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.

Landing

A procedure similar to takeoff should be used for estimating the landing distance at the destination airport. Figure 5-19 presents landing distance information for the short field technique. The distances corresponding to 2000 feet and 20° C are as follows:

- Ground roll ..... 1248 Feet
- Total distance to land over a 50 foot obstacle ..... 2476 Feet

A correction for the effect of wind may be made based on the headwind and tailwind corrections presented with the landing chart using the same procedure as outlined for takeoff. Corrections for runway slope and dry grass may also be applied in like manner.

Demonstrated Operating Temperature

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

Airspeed Calibration

Normal Static Source

Conditions:

- Power for level flight or maximum continuous, whichever is less.

Example:

Flaps 50%
Indicated Airspeed ..... 85 Knots

Calibrated Airspeed ..... 85 Knots

• Note •

- Indicated airspeed values assume zero instrument error.
- KIAS = Knots Indicated Airspeed
- KCAS = Knots Calibrated Airspeed

KIAS	KCAS		
	Flaps 0%	Flaps 50%	Flaps 100%
60			58
70		68	69
80	79	80	80
90	90	91	90
100	100	101	100
110	110	111	
120	121	121	
130	131		
140	142		
150	152		
160	162		
170	172		
180	183		
190	193		
200	203		

Figure 5-1

Airspeed Calibration

Alternate Static Source

Conditions:

- Power for level flight or maximum continuous, whichever is less.
- Heater, Defroster & Vents .....ON

Example:

Flaps.....50%
Indicated Airspeed.....85 Knots

Calibrated Airspeed.....86 Knots

• Note •

- Indicated airspeed values assume zero instrument error.
- KIAS = Knots Indicated Airspeed
- KCAS = Knots Calibrated Airspeed

KIAS	KCAS		
	Flaps 0%	Flaps 50%	Flaps 100%
60			62
70		71	73
80	80	81	82
90	90	91	92
100	100	101	101
110	110	111	
120	120	121	
130	130		
140	140		
150	150		
160	160		
170	170		
180	180		
190	190		
200	199		

Figure 5-2

Altitude Correction

Normal Static Source

Conditions:

- Power for level flight or maximum continuous, whichever is less.

Example:

Flaps 0%
Indicated Airspeed ..... 120 Knots
Desired Altitude..... 12,000 FT
Altitude Correction .....-13 FT

Altitude to Fly ..... 11,987 FT

• Note •

- Indicated airspeed values assume zero instrument error.
- KIAS = Knots Indicated Airspeed
- KCAS = Knots Calibrated Airspeed

Flaps	Press Alt	CORRECTION TO BE ADDED - FEET									
		Normal Static Source - KIAS									
		60	70	80	90	100	120	140	160	180	200
0%	S.L		8	6	3	0	-9	-19	-31	-44	-56
	5000		10	7	4	0	-10	-23	-36	-51	-65
	10000		11	8	5	0	-12	-26	-42	-59	-76
	15000		13	10	5	0	-14	-31	-50	-70	-90
50%	S.L		14	3	-6	-12	-6				
	5000		17	4	-7	-14	-7				
	10000		19	4	-9	-17	-8				
100%	S.L	13	8	3	0	-1					
	5000	15	9	3	0	-1					
	10000	17	10	4	0	-2					

Figure 5-3

Altitude Correction

Alternate Static Source

Conditions:

- Power for level flight or maximum continuous, whichever is less.
- Heater, Defroster, & Vents.....ON

Example:

Flaps.....0%
Indicated Airspeed.....120 Knots
Desired Altitude ..... 12,000 FT
Altitude Correction..... -4 FT

Altitude to Fly..... 11,996 FT

• Note •

- Indicated airspeed values assume zero instrument error.
- KIAS = Knots Indicated Airspeed
- KCAS = Knots Calibrated Airspeed

Flaps	Press Alt	CORRECTION TO BE ADDED - FEET									
		Normal Static Source - KIAS									
		60	70	80	90	100	120	140	160	180	200
0%	S.L		1	0	-1	-1	-3	-3	-1	4	13
	5000		2	0	-1	-2	-3	-3	-1	5	15
	10000		2	1	-1	-2	-4	-4	-1	6	18
	15000		2	1	-1	-2	-4	-4	-1	7	21
50%	S.L		-7	-6	-5	-5	-9				
	5000		-8	-7	-6	-6	-10				
	10000		-9	-8	-7	-7	-12				
100%	S.L	-14	-17	-18	-16	-10					
	5000	-16	-20	-21	-19	-12					
	10000	-18	-23	-25	-22	-14					

Figure 5-4

Temperature Conversion

• Note •

- To convert from Celsius (°C) to Fahrenheit (°F), find, in the shaded columns, the number representing the temperature value (°C) to be converted. The equivalent Fahrenheit temperature is read to the right.
  ➔ **EXAMPLE:** 38° C = 100° F.
- To convert from Fahrenheit (°F) to Celsius (°C), find in the shaded columns area, the number representing the temperature value (°F) to be converted. The equivalent Celsius temperature is read to the left.
  ➔ **EXAMPLE:** 38° F = 3° C.

Temp to Convert °C or °F			Temp to Convert °C or °F			Temp to Convert °C or °F		
°C	←→	°F	°C	←→	°F	°C	←→	°F
-50	-58	-72	-17	2	36	17	62	144
-49	-56	-69	-16	4	39	18	64	147
-48	-54	-65	-14	6	43	19	66	151
-47	-52	-62	-13	8	46	20	68	154
-46	-50	-58	-12	10	50	21	70	158
-44	-48	-54	-11	12	54	22	72	162
-43	-46	-51	-10	14	57	23	74	165
-42	-44	-47	-9	16	61	24	76	169
-41	-42	-44	-8	18	64	26	78	172
-40	-40	-40	-7	20	68	27	80	176
-39	-38	-36	-6	22	72	28	82	180
-38	-36	-33	-4	24	75	29	84	183
-37	-34	-29	-3	26	79	30	86	187
-36	-32	-26	-2	28	82	31	88	190
-34	-30	-22	-1	30	86	32	90	194
-33	-28	-18	0	32	90	33	92	198
-32	-26	-15	1	34	93	34	94	201
-31	-24	-11	2	36	97	36	96	205
-30	-22	-8	3	38	100	37	98	208
-29	-20	-4	4	40	104	38	100	212
-28	-18	0	6	42	108	39	102	216
-27	-16	3	7	44	111	40	104	219
-26	-14	7	8	46	115	41	106	223
-24	-12	10	9	48	118	42	108	226
-23	-10	14	10	50	122	43	110	230
-22	-8	18	11	52	126	44	112	234
-21	-6	21	12	54	129	46	114	237
-20	-4	25	13	56	133	47	116	241
-19	-2	28	14	58	136	48	118	244
-18	0	32	16	60	140	49	120	248

Figure 5-5

Outside Air Temperature for ISA Condition

Example:

Pressure Altitude.....8000 FT
Outside Air Temp..... 48° F

ISA Condition ..... ISA + 10° C

Press Alt Feet	ISA-40°C		ISA-20°C		ISA		ISA+10°C		ISA+20°C	
	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
SL	-25	-13	-5	23	15	59	25	77	35	95
1000	-27	-18	-7	18	13	54	23	72	33	90
2000	-29	-20	-9	16	11	52	21	70	31	88
3000	-31	-24	-11	12	9	48	19	66	29	84
4000	-33	-27	-13	9	7	45	17	63	27	81
5000	-35	-31	-15	5	5	41	15	59	25	77
6000	-37	-34	-17	2	3	38	13	56	23	74
7000	-39	-38	-19	-2	1	34	11	52	21	70
8000	-41	-42	-21	-6	-1	30	10	48	20	66
9000	-43	-45	-23	-9	-3	27	7	45	17	63
10000	-45	-49	-25	-13	-5	23	5	41	15	59
11000	-47	-52	-27	-16	-7	20	3	38	13	56
12000	-49	-56	-29	-20	-9	16	1	34	11	52
13000	-51	-59	-31	-23	-11	13	-1	31	9	49
14000	-53	-63	-33	-27	-13	9	-3	27	7	45
15000	-55	-67	-35	-31	-15	6	-5	23	5	41
16000	-57	-71	-37	-34	-17	2	-7	20	3	38
17000	-59	-75	-39	-38	-19	-2	-9	16	1	34
17500	-60	-76	-40	-40	-20	-3	-10	14	0	32

Figure 5-6

Stall Speeds

Conditions:

- Weight ..... 3400 LB
- C.G. ..... Noted
- Power..... Idle
- Bank Angle ..... Noted

Example:

Flaps ..... Up (0%)
Bank Angle..... 15°
C.G..... Forward

Stall Speed..... 71 KIAS | 70 KCAS

• Note •

- Altitude loss during wings level stall may be 250 feet or more.
- KIAS values may not be accurate at stall.

Weight	Bank Angle	STALL SPEEDS					
		Flaps 0%Full Up		Flaps 50%		Flaps 100%Full Down	
LB	Deg	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
3400 Most FWD C.G.	0	70	69	67	64	59	59
	15	71	70	68	65	62	60
	30	75	74	72	69	66	64
	45	84	82	80	76	73	70
	60	99	97	95	90	87	84
3400 Most AFT C.G.	0	68	67	66	62	61	59
	15	69	68	67	63	62	60
	30	73	72	71	67	65	63
	45	81	79	78	74	72	70
	60	96	94	93	88	86	83

Figure 5-7

Wind Components

Conditions:

- Runway Heading.....10°
- Wind Direction.....60°
- Wind Velocity.....15 Knots

Example:

Wind/Flight Path Angle..... 50°
Crosswind Component.....12 Knots
Headwind Component.....10 Knots

• Note •

- The maximum demonstrated crosswind is 20 knots. Value not considered limiting.

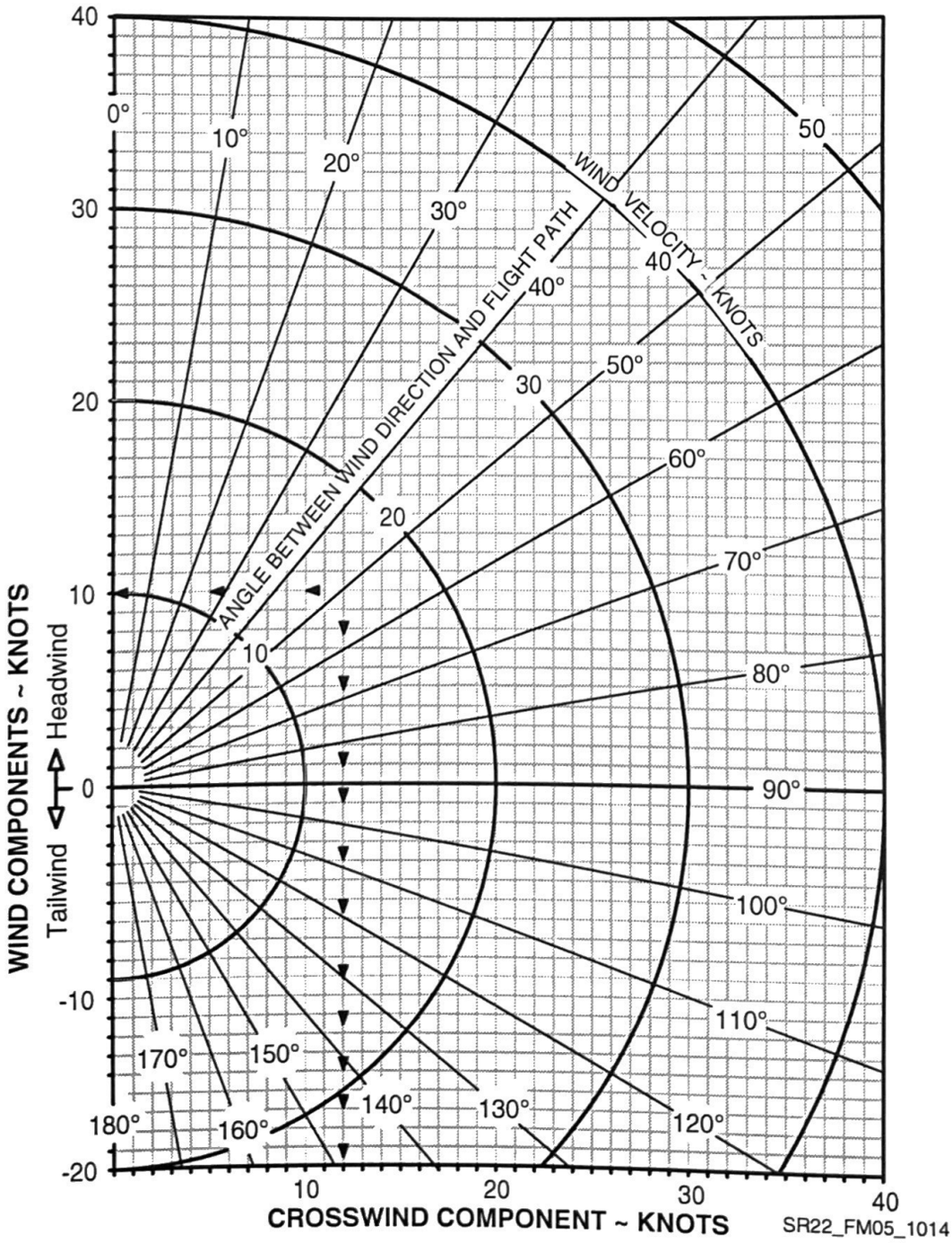

Figure 5-8

Takeoff Distance

Conditions:

- Winds ..... Zero
- Runway ..... Dry, Level, Paved
- Flaps 50%
- Power ..... Full Throttle
- Mixture ..... Set per Placard

Example:

Outside Air Temp	20°C
Weight	3400 LB
Pressure Altitude	2000 FT
Headwind	Zero
Runway	Dry, Paved
Liftoff Speed	72 KIAS
Obstacle Speed	78 KIAS
Takeoff Ground Roll	1299 FT
Dist. over 50' Obstacle	1995 FT

Factors:

The following factors are to be applied to the computed takeoff distance for the noted condition:

- Headwind - Subtract 10% from computed distance for each 12 knots headwind.
- Tailwind - Add 10% for each 2 knots tailwind up to 10 knots.
- Grass Runway, Dry - Add 20% to ground roll distance.
- Grass Runway, Wet - Add 30% to ground roll distance.
- Sloped Runway - Increase table distances by 22% of the ground roll distance at Sea Level, 30% of the ground roll distance at 5000 ft, 43% of the ground roll distance at 10,000 ft for each 1% of upslope. Decrease table distances by 7% of the ground roll distance at Sea Level, 10% of the ground roll distance at 5000 ft, and 14% of the ground roll distance at 10,000 ft for each 1% of downslope.

• Caution •

The above corrections for runway slope are required to be included herein. These corrections should be used with caution since published runway slope data is usually the net slope from one end of the runway to the other. Many runways will have portions of their length at greater or lesser slopes than the published slope, lengthening (or shortening) takeoff ground roll estimated from the table.

- If brakes are not held while applying power, distances apply from point where full throttle and mixture setting is complete.
- For operation in outside air temperatures colder than this table provides, use coldest data shown.
- For operation in outside air temperatures warmer than this table provides, use extreme caution.

Takeoff Distance

WEIGHT = 3400 LB
Speed at Liftoff = 73 KIAS
Speed over 50 Ft. Obstacle = 78 KIAS
Flaps - 50% · Takeoff Pwr · Dry Paved

Headwind: Subtract 10% for each 12 knots headwind.
Tailwind: Add 10% for each 2 knots tailwind up to 10 knots.
Runway Slope: Ref. Factors.
Dry Grass: Add 20% to Ground Roll.
Wet Grass: Add 30% to Ground Roll.

PRESS ALT FT	DISTANCE FT	TEMPERATURE ~ °C 0	10	20	30	40	ISA
SL	Grnd Roll	917	990	1067	1146	1229	1028
	50 ft	1432	1539	1650	1764	1883	1594
1000	Grnd Roll	1011	1092	1176	1264	1355	1117
	50 ft	1574	1691	1813	1939	2069	1728
2000	Grnd Roll	1116	1206	1299	1395	1496	1215
	50 ft	1732	1861	1995	2133	2276	1874
3000	Grnd Roll	1234	1332	1435	1542	1653	1323
	50 ft	1907	2049	2196	2349	2507	2035
4000	Grnd Roll	1365	1474	1588	1706	1829	1441
	50 ft	2102	2259	2422	2590	2764	2212
5000	Grnd Roll	1512	1633	1758	1889	2025	1572
	50 ft	2320	2493	2673	2858	3051	2407
6000	Grnd Roll	1676	1810	1950	2095	2245	1717
	50 ft	2564	2755	2953	3159	3371	2622
7000	Grnd Roll	1861	2009	2164	2325	2492	1877
	50 ft	2837	3048	3267	3494	3729	2859
8000	Grnd Roll	2068	2233	2405	2584	2770	2054
	50 ft	3142	3376	3619	3871	4131	3122
9000	Grnd Roll	2302	2485	2677	2875	3082	2250
	50 ft	3485	3744	4014	4293	4581	3412
10000	Grnd Roll	2564	2769	2982	3204	3434	2468
	50 ft	3870	4158	4457	4767	5088	3733

Figure 5-9
Sheet 1 of 2

Takeoff Distance

WEIGHT = 2900 LB
Speed at Liftoff = 70 KIAS
Speed over 50 Ft Obstacle = 74 KIAS
Flaps - 50% · Takeoff Pwr · Dry Paved

Headwind: Subtract 10% for each 12 knots headwind.
Tailwind: Add 10% for each 2 knots tailwind up to 10 knots.
Runway Slope: Ref. Factors.
Dry Grass: Add 20% to Ground Roll.
Wet Grass: Add 30% to Ground Roll.

PRESS ALT FT	DISTANCE FT	TEMPERATURE ~ °C 0	10	20	30	40	ISA
SL	Grnd Roll	610	659	710	763	818	684
	50 ft	971	1043	1118	1195	1275	1080
1000	Grnd Roll	673	727	783	841	902	743
	50 ft	1066	1146	1228	1313	1401	1170
2000	Grnd Roll	743	802	864	929	995	809
	50 ft	1173	1260	1351	1444	1541	1269
3000	Grnd Roll	821	887	955	1026	1100	880
	50 ft	1292	1388	1487	1590	1697	1378
4000	Grnd Roll	908	981	1057	1135	1217	959
	50 ft	1424	1530	1639	1753	1871	1498
5000	Grnd Roll	1006	1086	1170	1257	1348	1046
	50 ft	1571	1688	1809	1935	2065	1630
6000	Grnd Roll	1116	1205	1298	1394	1494	1143
	50 ft	1736	1865	1999	2138	2281	1775
7000	Grnd Roll	1238	1337	1440	1547	1659	1249
	50 ft	1920	2063	2211	2365	2523	1936
8000	Grnd Roll	1376	1486	1601	1720	1843	1367
	50 ft	2127	2285	2449	2619	2795	2113
9000	Grnd Roll	1532	1654	1781	1914	2051	1498
	50 ft	2359	2534	2716	2904	3099	2309
10000	Grnd Roll	1707	1843	1985	2132	2285	1643
	50 ft	2619	2814	3016	3225	3441	2527

Figure 5-9
Sheet 2 of 2

Takeoff Climb Gradient

Conditions:

- Power ..... Full Throttle
- Mixture ..... Set per Placard
- Flaps 50%
- Airspeed ..... Best Rate of Climb

Example:

Outside Air Temp ..... 20° C
Weight ..... 3400 LB
Pressure Altitude ..... 4000 FT

Climb Airspeed ..... 89 Knots
Gradient ..... 654 FT/NM

• Note •

- Climb Gradients shown are the gain in altitude for the horizontal distance traversed expressed as Feet per Nautical Mile.
- Fuel flow must be set to the placarded limit for all takeoffs and climbs.
- Cruise climbs or short duration climbs are permissible at best power as long as altitudes and temperatures remain within those specified in the table.
- For operation in air colder than this table provides, use coldest data shown.
- For operation in air warmer than this table provides, use extreme caution.

Weight	Press Alt	Climb Speed	CLIMB GRADIENT ~ Feet per Nautical Mile				
			Temperature ~ °C				
LB	FT	KIAS	-20	0	20	40	ISA
3400	SL	91	939	896	853	811	864
	2000	90	834	793	75.2	711	770
	4000	89	734	694	654	615	680
	6000	88	638	600	561	524	594
	8000	87	546	509	472	436	510
	10000	86	458	422	387	353	431
2900	SL	91	1172	1122	1070	1019	1083
	2000	90	1049	1000	950	902	972
	4000	89	931	884	836	790	867
	6000	88	818	773	727	683	766
	8000	87	711	667	623	581	669
	10000	86	608	566	524	484	576

Figure 5-10

Takeoff Rate of Climb

Conditions:

- Power.....Full Throttle
- Mixture.....Set per Placard
- Flaps..... 50%
- Airspeed .....Best Rate of Climb

Example:

Outside Air Temp ..... 10° C
Weight.....3400 LB
Pressure Altitude.....6000 FT

Climb Airspeed.....88 Knots
Rate of Climb .....948 FPM

• Note •

- Rate-of-Climb values shown are change in altitude for unit time expended expressed in Feet per Minute.
- Fuel flow must be set to the placarded limit for all takeoffs and climbs.
- Cruise climbs or short duration climbs are permissible at best power as long as altitudes and temperatures remain within those specified in the table.
- For operation in air colder than this table provides, use coldest data shown.
- For operation in air warmer than this table provides, use extreme caution.

Weight	Press Alt	Climb Speed	RATE OF CLIMB ~ Feet per Minute				
			Temperature ~ °C				
LB	FT	KIAS	-20	0	20	40	ISA
3400	SL	91	1326	1317	1300	1277	1304
	2000	90	1214	1200	1179	1153	1189
	4000	89	1100	1082	1057	1028	1074
	6000	88	985	962	934	901	958
	8000	87	869	842	809	774	843
	10000	86	851	719	683	644	727
2900	SL	91	1646	1638	1621	1598	1626
	2000	90	1518	1505	1484	1457	1494
	4000	89	1389	1371	1346	1316	1363
	6000	88	1259	1236	1207	1172	1232
	8000	87	1128	1100	1066	1028	1101
	10000	86	995	962	924	883	971

Figure 5-11

Enroute Climb Gradient

Conditions:

- Power ..... Full Throttle
- Mixture ..... Full Rich
- Flaps .....0% (UP)
- Airspeed..... Best Rate of Climb

Example:

Outside Air Temp.....20° C
Weight ..... 3400 LB
Pressure Altitude ..... 4000 FT

Climb Airspeed.....98 Knots
Gradient.....639 FT/NM

• Note •

- Climb Gradients shown are the gain in altitude for the horizontal distance traversed expressed as Feet per Nautical Mile.
- Fuel flow must be set to the placarded limit for all takeoffs and climbs.
- Cruise climbs or short duration climbs are permissible at best power as long as altitudes and temperatures remain within those specified in the table.
- For operation in air colder than this table provides, use coldest data shown.
- For operation in air warmer than this table provides, use extreme caution.

Weight	Press Alt	Climb Speed	CLIMB GRADIENT - Feet per Nautical Mile				
			Temperature ~ °C				
LB	FT	KIAS	-20	0	20	40	ISA
3400	SL	101	911	867	823	781	834
	2000	100	813	771	729	689	748
	4000	98	720	679	639	600	665
	6000	97	630	590	552	515	584
	8000	96	544	505	468	433	507
	10000	95	461	424	388	354	433
	12000	94	381	346	312	279	361
	14000	93	304	271	238	207	292
	16000	92	231	199	168	139	226
2900	SL	101	1130	1078	1026	975	1039
	2000	100	1015	965	915	867	937
	4000	98	905	857	809	763	840
	6000	97	800	753	708	664	746
	8000	96	699	654	611	569	656
	10000	95	603	560	518	478	570
	12000	94	610	469	429	391	487
	14000	93	422	382	344	308	407
	16000	92	337	299	263	229	331

Figure 5-12

Enroute Rate of Climb

Conditions:

- Power.....Full Throttle
- Mixture.....As Required
- Flaps.....0% (UP)
- Airspeed .....Best Rate of Climb

Example:

Outside Air Temp ..... 10° C
Weight.....3400 LB
Pressure Altitude.....6000 FT

Climb Airspeed.....97 Knots
Rate of Climb .....1030 FPM

• Note •

- Rate-of-Climb values shown are change in altitude in feet per unit time expressed in Feet per Minute.
- Fuel flow must be set to the placarded limit for all takeoffs and climbs.
- Cruise climbs or short duration climbs are permissible at best power as long as altitudes and temperatures remain within those specified in the table.
- For operation in air colder than this table provides, use coldest data shown.
- For operation in air warmer than this table provides, use extreme caution.

Weight	Press Alt	Climb Speed	RATE OF CLIMB ~ Feet per Minute				
			Temperature ~ °C				
LB	FT	KIAS	-20	0	20	40	ISA
3400	SL	101	1428	1414	1392	1366	1398
	2000	100	1311	1292	1267	1238	1279
	4000	98	1193	1170	1141	1108	1160
	6000	97	1074	1046	1013	977	1041
	8000	96	953	921	884	845	922
	10000	95	830	794	754	712	803
	12000	94	706	666	623	577	684
	14000	93	581	537	490	441	565
	16000	92	454	406	355	303	446
2900	SL	101	1761	1748	1726	1698	1732
	2000	100	1629	1610	1584	1552	1596
	4000	98	1494	1471	1441	1405	1461
	6000	97	1359	1331	1296	1257	1326
	8000	96	1222	1189	1151	1108	1191
	10000	95	1084	1046	1004	958	1056
	12000	94	945	902	855	806	921
	14000	93	804	757	706	653	787
	16000	92	662	610	556	499	653

Figure 5-13

Enroute Rate of Climb Vs Density Altitude

Conditions:

- Power ..... Full Throttle
- Mixture ..... Per Schedule - Section 4, Max Power Fuel Flow
- Flaps ..... 0% (UP)
- Airspeed ..... Best Rate of Climb

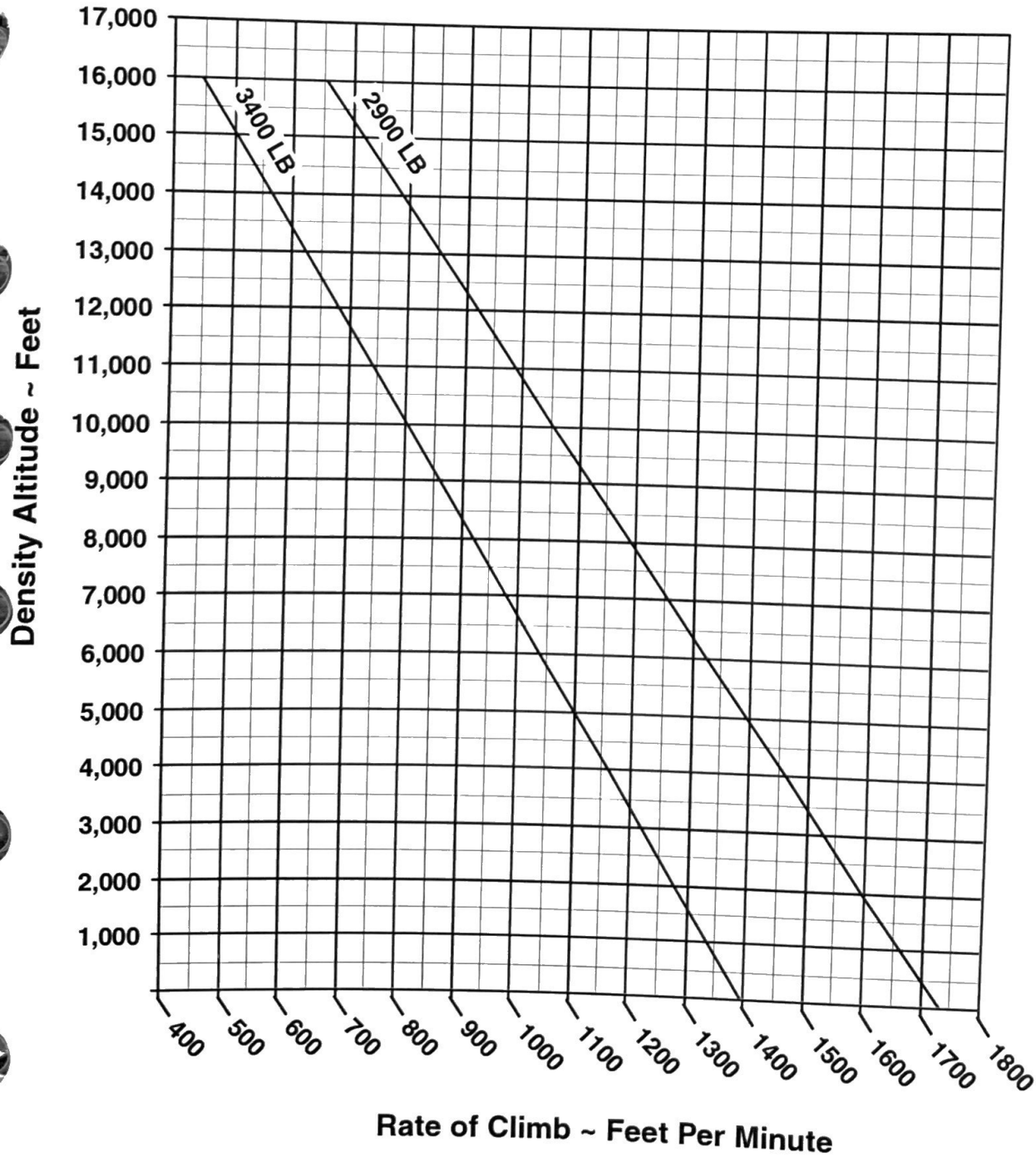

Figure 5-14

Time, Fuel and Distance to Climb

Conditions:

- Power.....Full Throttle
- Mixture..... Per Schedule, Section 4
- Fuel Density..... 6.0 LB/GAL
- Weight ..... 3400 LB
- Winds..... Zero
- Climb Airspeed ..... Noted

Example:

Outside Air Temp ..... ISA
Weight.....3400 LB
Airport Press..... 1000 FT
Pressure Altitude..... 12000 FT

Time to Climb..... 11.3 Minutes
Fuel to Climb..... 5.6 Gallon
Distance to Climb..... 20.5 NM

Factors:

- Taxi Fuel - Add 1.5 gallon for start, taxi, and takeoff.
- Temperature - Add 10% to computed values for each 10° C above standard.
- Fuel flow must be set to the placarded limit for all takeoffs and climbs.
- Cruise climbs or short duration climbs are permissible at best power as long as altitudes and temperatures remain within those specified in the table.

Press Alt FT	OAT (ISA) °C	Climb Speed KIAS	Rate Of Climb FPM	TIME, FUEL, DISTANCE ~ From Sea Level		
				Time Minutes	Fuel U.S. Gal	Distance NM
SL	15	101	1398	0.0	0.0	0.0
1000	13	100	1339	0.7	0.3	1.0
2000	11	100	1279	1.5	0.7	2.5
3000	9	99	1220	2.5	1.0	4.0
4000	7	98	1160	3.0	1.3	5.5
5000	5	97	1101	4.0	1.7	7.0
6000	3	97	1041	5.0	2.0	8.5
7000	1	96	982	6.0	2.4	10.5
8000	-1	96	922	7.0	2.7	12.0
9000	-3	95	863	8.0	3.1	14.5
10000	-5	95	803	9.5	3.5	16.5
11000	-7	94	744	10.5	3.9	19.0
12000	-9	94	684	12.0	4.4	21.5
13000	-11	93	625	13.5	4.8	24.5
14000	-13	93	565	15.0	5.3	28.0
15000	-15	92	506	17.0	5.8	31.5
16000	-17	92	446	19.0	6.4	35.5
17000	-19	91	387	21.5	7.1	40.0
17500	-20	91	357	24.0	7.8	45.5

Figure 5-15

Cruise Performance

Conditions:

- Mixture ..... Best Power
- Cruise Weight.....2900 LB
- Winds .....Zero

Note: Subtract 10 KTAS if nose wheel pant and fairing removed. Lower KTAS by 10% if nose & main wheel pants & fairings removed.

Cruise Pwr above 85% not recommended.

Example:

Outside Air Temp .....29° C
RPM .....2700 RPM
Cruise Press Alt..... 8000 FT

% Power (24.0 MAP) 75%
True Airspeed ..... 178 Knots
Fuel Flow .....17.7 GPH

2000 Feet Pressure Altitude

		ISA - 30° C (-19° C)			ISA (11° C)			ISA + 30° C (41° C)		
RPM	MAP	PWR	KTAS	GPH	PWR	KTAS	GPH	PWR	KTAS	GPH
2700	27.4	103%	186	24.6	98%	186	23.3	93%	181	22.0
2600	27.4	99%	183	23.5	94%	183	22.2	89%	178	21.5
2500	27.4	93%	179	22.1	88%	179	20.9	84%	174	20.8
2500	26.4	89%	176	21.1	84%	176	19.9	80%	171	20.2
2500	25.4	84%	173	20.0	80%	173	19.0	76%	168	19.5
2500	24.4	80%	170	19.0	76%	170	18.0	72%	165	18.8
2500	23.4	76%	167	18.0	72%	167	17.0	68%	162	18.1

4000 Feet Pressure Altitude

		ISA - 30° C (-23° C)			ISA (7° C)			ISA + 30° C (37° C)		
RPM	MAP	PWR	KTAS	GPH	PWR	KTAS	GPH	PWR	KTAS	GPH
2700	25.4	96%	185	22.9	91%	185	21.6	87%	180	20.8
2600	25.4	92%	182	21.9	87%	182	20.7	83%	177	20.6
2500	25.4	87%	178	20.6	82%	178	19.5	78%	173	19.9
2500	24.4	82%	175	19.5	78%	175	18.5	74%	170	19.2
2500	23.4	78%	172	18.5	74%	172	17.5	70%	167	18.5
2500	22.4	73%	169	17.4	69%	169	16.5	66%	163	17.7
2500	21.4	69%	165	16.4	65%	165	15.5	62%	159	16.9

6000 Feet Pressure Altitude

		ISA - 30° C (-27° C)			ISA (3° C)			ISA + 30° C (33° C)		
RPM	MAP	PWR	KTAS	GPH	PWR	KTAS	GPH	PWR	KTAS	GPH
2700	23.5	89%	184	21.2	85%	184	20.1	81%	179	19.6
2600	23.5	85%	181	20.3	81%	181	19.2	77%	176	19.1
2500	23.5	80%	177	19.1	76%	177	18.1	72%	172	18.3
2500	22.5	76%	174	18.1	72%	174	17.1	68%	169	17.6
2500	21.5	72%	170	17.0	68%	170	16.1	64%	165	16.9
2500	20.5	67%	166	15.9	64%	166	15.1	60%	161	16.1
2500	19.5	63%	162	14.9	59%	162	14.1	56%	157	15.3

Figure 5-16
Sheet 1 of 3

Cruise Performance

8000 Feet Pressure Altitude										
		ISA - 30° C (-31° C)			ISA (-1° C)			ISA + 30° C (29° C)		
RPM	MAP	PWR	KTAS	GPH	PWR	KTAS	GPH	PWR	KTAS	GPH
2700	21.7	83%	183	19.7	78%	183	18.6	75%	178	17.7
2600	21.7	79%	180	18.8	75%	180	17.8	71%	175	17.0
2500	21.7	75%	176	17.7	71%	176	16.8	67%	171	16.0
2500	20.7	70%	172	16.7	66%	172	15.8	63%	167	15.0
2500	19.7	66%	168	15.6	62%	168	14.8	59%	163	14.0
2500	18.7	61%	163	14.5	58%	163	13.8	55%	158	13.1
2500	17.7	57%	159	13.5	54%	159	12.8	51%	153	12.1

10,000 Feet Pressure Altitude										
		ISA - 30° C (-35° C)			ISA (-5° C)			ISA + 30° C (25° C)		
RPM	MAP	PWR	KTAS	GPH	PWR	KTAS	GPH	PWR	KTAS	GPH
2700	20.0	77%	182	18.2	73%	182	17.3	69%	176	16.4
2600	20.0	71%	177	17.0	68%	177	16.1	64%	172	15.3
2500	20.0	67%	173	16.0	64%	173	15.1	61%	167	14.4
2500	19.0	63%	168	14.9	59%	168	14.1	56%	163	13.4
2500	18.0	58%	163	13.8	55%	163	13.1	52%	158	12.5
2500	17.0	54%	158	12.8	51%	158	12.1	48%	153	11.5

12,000 Feet Pressure Altitude										
		ISA - 30° C (-39° C)			ISA (-9° C)			ISA + 30° C (21° C)		
RPM	MAP	PWR	KTAS	GPH	PWR	KTAS	GPH	PWR	KTAS	GPH
2700	18.5	71%	180	16.9	67%	180	16.0	64%	175	15.2
2600	18.5	68%	177	16.2	64%	177	15.3	61%	172	14.5
2500	18.5	64%	173	15.2	60%	173	14.4	58%	167	13.7
2500	17.5	59%	168	14.1	56%	168	13.4	53%	162	12.7
2500	16.5	55%	162	13.0	52%	162	12.3	49%	157	11.7
2500	15.5	50%	156	12.0	48%	156	11.3	45%	151	10.8

14,000 Feet Pressure Altitude										
		ISA - 30° C (-43° C)			ISA (-13° C)			ISA + 30° C (17° C)		
RPM	MAP	PWR	KTAS	GPH	PWR	KTAS	GPH	PWR	KTAS	GPH
2700	17.1	66%	178	15.6	62%	178	14.8	59%	173	14.1
2600	17.1	63%	175	14.9	60%	175	14.1	57%	170	13.5
2500	17.1	59%	171	14.1	56%	171	13.3	53%	165	12.7
2500	16.1	55%	165	13.0	52%	165	12.3	49%	159	11.7
2500	15.1	50%	159	11.9	47%	159	11.2	45%	153	10.7

Figure 5-16
Sheet 2 of 3

Cruise Performance

16,000 Feet Pressure Altitude										
		ISA - 30° C (-47° C)			ISA (-17° C)			ISA + 30° C (13° C)		
RPM	MAP	PWR	KTAS	GPH	PWR	KTAS	GPH	PWR	KTAS	GPH
2700	15.8	61%	176	14.5	58%	176	13.7	55%	171	13.0
2600	15.8	58%	173	13.8	55%	173	13.1	52%	167	12.5
2500	15.8	55%	168	13.0	52%	168	12.3	49%	163	11.7
2500	14.8	50%	162	11.9	47%	162	11.3	45%	156	10.7

17,000 Feet Pressure Altitude										
		ISA - 30° C (-49° C)			ISA (-19° C)			ISA + 30° C (9° C)		
RPM	MAP	PWR	KTAS	GPH	PWR	KTAS	GPH	PWR	KTAS	GPH
2700	15.2	59%	175	13.9	55%	175	13.2	53%	169	12.5
2600	15.2	56%	171	13.3	53%	171	12.6	50%	166	12.0
2500	15.2	53%	167	12.5	50%	167	11.9	47%	162	11.3
2500	14.2	48%	160	11.4	45%	160	10.8	43%	155	10.3

Figure 5-16
Sheet 3 of 3

Range / Endurance Profile

Conditions:

- Weight ..... 3400 LB
- Temperature .....Standard Day
- Winds..... Zero
- Mixture.....Best Economy
- Total Fuel ..... 81 Gallons

Example:

Power Setting 75%
Takeoff Press Alt .....2000 FT
Cruise Press Alt.....6000 FT

Fuel to Climb.....2.0 Gal.
Cruise Fuel Flow..... 17.8 GPH
Endurance..... 3.9 Hr
Range .....689 NM
True Airspeed..... 177 Knots

• Note •

- Fuel Remaining For Cruise is equal to 81.0 gallons usable, less climb fuel, less 9.8 gallons for 45 minutes IFR reserve fuel at 47% power (ISA @ 10,000 ft PA), less descent fuel, less fuel used prior to takeoff.
- Range and endurance shown includes descent to final destination at approximately 178 KIAS and 500 fpm
- Range is decreased by 5% if nose wheel pant and fairings removed.
- Range is decreased by 15% if nose and main wheel pants and fairings removed.

75% POWER — **Mixture = Best Power**

Press Alt FT	Climb Fuel Gal	Fuel Remaining For Cruise Gal	Airspeed KTAS	Fuel Flow GPH	Endurance Hours	Range NM	Specific Range Nm/Gal
SL	0.0	70.8	166	17.8	4.0	661	9.3
2000	0.7	69.0	170	17.8	3.9	670	9.6
4000	1.3	67.2	173	17.8	3.9	680	9.8
6000	2.0	65.3	177	17.8	3.9	689	10.0
8000	2.7	63.5	180	17.8	3.8	700	10.3

Figure 5-17
Sheet 1 of 3

Range / Endurance Profile

65% POWER

Mixture = Best Power

Press Alt FT	Climb Fuel Gal	Fuel Remaining For Cruise Gal	Airspeed KTAS	Fuel Flow GPH	Endurance Hours	Range NM	Specific Range Nm/Gal
SL	0.0	70.8	158	15.4	4.6	725	10.3
2000	0.7	69.0	161	15.4	4.5	735	10.5
4000	1.3	67.2	165	15.4	4.5	745	10.7
6000	2.0	65.3	168	15.4	4.5	755	11.0
8000	2.7	63.5	171	15.4	4.4	765	11.2
10000	3.5	61.6	174	15.4	4.4	775	11.5
12000	4.4	59.8	178	15.4	4.3	785	11.8

55% POWER

Mixture = Best Power

Press Alt FT	Climb Fuel Gal	Fuel Remaining For Cruise Gal	Airspeed KTAS	Fuel Flow GPH	Endurance Hours	Range NM	Specific Range Nm/Gal
SL	0.0	70.8	149	13.1	5.4	806	11.4
2000	0.7	69.0	152	13.1	5.4	815	11.6
4000	1.3	67.2	154	13.1	5.3	825	11.9
6000	2.0	65.3	157	13.1	5.3	835	12.2
8000	2.7	63.5	160	13.1	5.2	845	12.4
10000	3.5	61.6	163	13.1	5.1	856	12.7
12000	4.4	59.8	166	13.1	5.1	865	13.0
14000	5.3	57.8	169	13.1	5.0	875	13.4

Figure 5-17
Sheet 2 of 3

Range / Endurance Profile

55% POWER							Mixture = Best Economy
Press Alt FT	Climb Fuel Gal	Fuel Remaining For Cruise Gal	Airspeed KTAS	Fuel Flow GPH	Endurance Hours	Range NM	Specific Range Nm/Gal
SL	0.0	70.8	149	11.3	6.2	930	13.1
2000	0.7	69.0	152	11.3	6.2	941	13.4
4000	1.3	67.2	154	11.3	6.1	951	13.7
6000	2.0	65.3	157	11.3	6.1	962	14.0
8000	2.7	63.5	160	11.3	6.0	974	14.3
10000	3.5	61.6	163	11.3	5.9	985	14.6
12000	4.4	59.8	166	11.3	5.9	995	15.0
14000	5.3	57.8	169	11.3	5.8	1006	15.4

Figure 5-17
Sheet 3 of 3

Balked Landing Climb Gradient

Conditions:

- Power ..... Full Throttle
- Mixture ..... Set per Placard
- Flaps ..... 100% (DN)
- Climb Airspeed..... V_{REF}

Example:

Outside Air Temp.....20° C
Weight ..... 3400 LB
Pressure Altitude ..... 4000 FT

Climb Airspeed .....77 Knots
Rate of Climb.....633 FT/NM

• Note •

- Balked Landing Climb Gradients shown are the gain in altitude for the horizontal distance traversed expressed as Feet per Nautical Mile.
- For operation in air colder than this table provides, use coldest data shown.
- For operation in air warmer than this table provides, use extreme caution.
- This chart is required data for certification. However, significantly better performance can be achieved by climbing at Best Rate of Climb speeds shown with flaps down or following the Go-Around / Balked Landing procedure in Section 4.

Weight	Press Alt	Climb Speed	CLIMB GRADIENT ~ Feet/Nautical Mile					Best Rate of Climb
			Temperature ~ °C					
LB	FT	KIAS	-20	0	20	40	ISA	KIAS
3400	SL	77	834	835	823	803	827	80
	2000	77	750	744	728	704	736	80
	4000	77	666	654	633	604	648	78
	6000	77	581	564	537	504	560	78
	8000	77	496	472	440	402	473	77
	10000	77	409	379	341	296	387	77
2900	SL	77	1069	1070	1056	1032	1060	
	2000	77	969	962	942	914	953	
	4000	77	869	855	829	796	847	
	6000	77	789	747	716	677	743	
	8000	77	668	639	602	556	641	
	10000	77	565	529	484	432	639	

Figure 5-18

Balked Landing Rate of Climb

Conditions:

- Power.....Full Throttle
- Mixture.....Set per Placard
- Flaps.....100% (DN)
- Climb Airspeed ..... V_{REF}

Example:

Outside Air Temp ..... 20° C
Weight.....3400 LB
Pressure Altitude.....4000 FT

Climb Airspeed..... 77 Knots
Rate of Climb ..... 878 FT/NM

• Note •

- Balked Landing Rate of Climb values shown are the full flaps change in altitude for unit time expended expressed in Feet per Minute.
- For operation in air colder than this table provides, use coldest data shown.
- For operation in air warmer than this table provides, use extreme caution.
- This chart is required data for certification. However, significantly better performance can be achieved by climbing at the Best Rate of Climb speeds shown with flaps down or following the Go-Around / Balked Landing procedure in Section 4

Weight	Press Alt	Climb Speed	RATE OF CLIMB - Feet per Minute					Best Rate of Climb KIAS
			Temperature ~ °C					
LB	FT	KIAS	-20	0	20	40	ISA	
3400	SL	77	996	1035	1057	1067	1053	80
	2000	77	930	959	972	971	966	80
	4000	77	858	876	878	867	878	79
	6000	77	779	784	775	752	784	78
	8000	77	691	683	660	623	684	77
	10000	77	593	571	532	478	578	77
2900	SL	77	1268	1318	1348	1363	1342	
	2000	77	1195	1233	1252	1255	1245	
	4000	77	1115	1140	1146	1137	1144	
	6000	77	1026	1037	1030	1007	1037	
	8000	77	927	923	900	861	923	
	10000	77	817	796	755	696	803	

Figure 5-19

Landing Distance

Conditions:

- Winds .....Zero
- Runway ..... Dry, Level, Paved
- Flaps. 100%
- Power ..... 3° Power Approach to 50 FT obstacle, then reduce power passing the estimated 50 foot point and smoothly continue power reduction to reach idle just prior to touchdown.

Example:

Outside Air Temp	10°C
Weight	3400 LB
Pressure Altitude	2000 FT
Headwind	Zero
Obstacle Speed (V_{REF})	77 KIAS
Landing Ground Roll	1206 FT
Dist. over 50' Obstacle	2436 FT

Factors:

The following factors are to be applied to the computed landing distance for the noted condition:

- Headwind - Subtract 10% from table distances for each 13 knots headwind.
- Tailwind - Add 10% to table distances for each 2 knots tailwind up to 10 knots.
- Grass Runway, Dry - Add 20% to ground roll distance.
- Grass Runway, Wet - Add 60% to ground roll distance.
- Sloped Runway - Increase table distances by 27% of the ground roll distance for each 1% of downslope. Decrease table distances by 9% of the ground roll distance for each 1% of upslope.

• Caution •

The above corrections for runway slope are required to be included herein. These corrections should be used with caution since published runway slope data is usually the net slope from one end of the runway to the other. Many runways will have portions of their length at greater or lesser slopes than the published slope, lengthening (or shortening) landing ground roll estimated from the table.

- For operation in outside air temperatures colder than this table provides, use coldest data shown.
- For operation in outside air temperatures warmer than this table provides, use extreme caution.

Landing Distance

WEIGHT = 3400 LB
Speed over 50 Ft Obstacle = 77 KIAS
Flaps - 100%· Idle · Dry, Level Paved Surface

Headwind: Subtract 10% for each 13 knots headwind.
Tailwind: Add 10% for each 2 knots tailwind up to 10 knots.
Runway Slope: Ref. Factors.
Dry Grass: Add 20% to Ground Roll
Wet Grass: Add 60% to Ground Roll

PRESS ALT FT	DISTANCE FT	TEMPERATURE ~ °C 0	10	20	30	40	ISA
SL	Grnd Roll	1082	1121	1161	1200	1240	1141
	Total	2262	2316	2372	2428	2485	2344
1000	Grnd Roll	1122	1163	1204	1245	1286	1175
	Total	2317	2374	2433	2492	2551	2391
2000	Grnd Roll	1163	1206	1248	1291	1334	1210
	Total	2375	2436	2497	2559	2621	2441
3000	Grnd Roll	1207	1251	1295	1339	1384	1247
	Total	2437	2501	2565	2630	2696	2493
4000	Grnd Roll	1252	1298	1344	1390	1436	1285
	Total	2503	2569	2637	2705	2774	2548
5000	Grnd Roll	1300	1348	1395	1443	1490	1324
	Total	2572	2642	2713	2785	2857	2605
6000	Grnd Roll	1350	1399	1449	1498	1547	1365
	Total	2645	2719	2794	2869	2945	2665
7000	Grnd Roll	1402	1453	1504	1556	1607	1408
	Total	2723	2800	2879	2958	3038	2728
8000	Grnd Roll	1456	1509	1563	1616	1669	1452
	Total	2805	2887	2969	3052	3136	2794
9000	Grnd Roll	1513	1569	1624	1679	1735	1497
	Total	2892	2978	3064	3152	3240	2863
10000	Grnd Roll	1573	1630	1688	1746	1803	1545
	Total	2984	3074	3165	3257	3350	2936

Figure 5-20