

FAA Approved
Supplemental Airplane Flight Manual
for

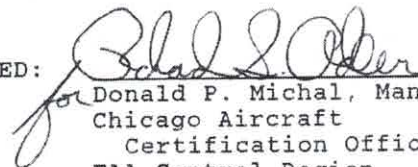
CESSNA MODELS 172N, S/N 17267585 THRU 17271034

REGISTRATION NO. N733V\$

SERIAL NO. 17268588

This supplement must be carried in the aircraft when it is modified by the installation of the O-320-D series engines and gross weight is increased to 2400 lbs in accordance with STC # SA1356GL. The information contained herein supplements or supercedes the basic placards and instrument markings only in those areas listed.

FAA APPROVED:



for Donald P. Michal, Manager
Chicago Aircraft
Certification Office
FAA Central Region

DATE: MAR 01 1989

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Penn Yan Aero Service, Inc.
2499 Bath Road, Airport
Penn Yan, NY 14527-9599

POH and AFM Supplement
for Cessna 172N

SECTION I - General

DESCRIPTIVE DATA

A. Engine

Number of engines: 1
Engine Manufacturer: Textron Lycoming
Engine Model: O-320-D2J, -D2G, -D1A
Horsepower Rating and Speed: 160 rated BHP at 2700 RPM

SECTION II - Limitations

- A. The following placard must be displayed adjacent to the flap position selector switch:

MAXIMUM FLAP TRAVEL IS 30°

B. C.G. Range

Landplane:

Normal category	(+39.5) to (+47.3) at 2400 lb.
	(+35.0) to (+47.3) at 1950 lb. or less
Utility category	(+36.5) to (+40.5) at 2100 lb.
	(+35.0) to (+40.5) at 1950 lb. or less

Floatplane: (Edo 89-2000 or 89A2000 floats)

Normal category	(+39.8) to (+45.5) at 2220 lb.
	(+36.4) to (+45.5) at 1825 lb. or less

Straight line variation between points given.

SECTION III - Emergency Procedures - No Change.

SECTION IV - Normal Procedures - No Change.

SECTION V - Performance - See Pages 3 thru 10.

SECTION VI - Weight and Balance - See Page 11.

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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 5-11 presents landing distance information for the short field technique. The distances corresponding to 2000 feet and 30°C are as follows:

Ground roll 610 Feet
Total distance to clear a 50-foot obstacle 1390 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

CONDITION:
Power required for level flight or maximum rated RPM dive.

FLAPS UP	50	60	70	80	90	100	110	120	130	140	150	160
KIAS	56	62	70	79	89	98	107	117	126	135	145	154
KCAS												
FLAPS 10°	40	50	60	70	80	90	100	110				
KIAS	49	55	62	70	79	89	98	108				
KCAS												
FLAPS 30°	40	50	60	70	80	85						
KIAS	47	53	61	70	80	84						
KCAS												

Figure 5-1. Airspeed Calibration (Sheet 1 of 2)

AIRSPEED CALIBRATION
ALTERNATE STATIC SOURCE

HEATER/VENTS AND WINDOWS CLOSED

FLAPS UP	50	60	70	80	90	100	110	120	130	140	---	---
NORMAL KIAS	51	61	71	82	91	101	111	121	131	141	---	---
ALTERNATE KIAS												
FLAPS 10°	40	50	60	70	80	90	100	110	---	---	---	---
NORMAL KIAS	40	51	61	71	81	90	99	108	---	---	---	---
ALTERNATE KIAS												
FLAPS 30°	40	50	60	70	80	85	---	---	---	---	---	---
NORMAL KIAS	38	50	60	70	79	83	---	---	---	---	---	---
ALTERNATE KIAS												

HEATER/VENTS OPEN AND WINDOWS CLOSED

FLAPS UP	40	50	60	70	80	90	100	110	120	130	140
NORMAL KIAS	36	48	59	70	80	89	99	108	118	128	139
ALTERNATE KIAS											
FLAPS 10°	40	50	60	70	80	90	100	110	---	---	---
NORMAL KIAS	38	49	59	69	79	88	97	106	---	---	---
ALTERNATE KIAS											
FLAPS 30°	40	50	60	70	80	85	---	---	---	---	---
NORMAL KIAS	34	47	57	67	77	81	---	---	---	---	---
ALTERNATE KIAS											

WINDOWS OPEN

FLAPS UP	40	50	60	70	80	90	100	110	120	130	140
NORMAL KIAS	26	43	57	70	82	93	103	113	123	133	143
ALTERNATE KIAS											
FLAPS 10°	40	50	60	70	80	90	100	110	---	---	---
NORMAL KIAS	25	43	57	69	80	91	101	111	---	---	---
ALTERNATE KIAS											
FLAPS 30°	40	50	60	70	80	85	---	---	---	---	---
NORMAL KIAS	25	41	54	67	78	84	---	---	---	---	---
ALTERNATE KIAS											

Figure 5-1. Airspeed Calibration (Sheet 2 of 2)

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2400 lb. GROSS wt.

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CESSNA Aircraft Modified
MODEL 172N Per Penn Yan STC
2400 lb. GROSS wt.

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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 5-8, the range profile charts presented in figure 5-9, and the endurance profile charts presented in figure 5-10.

The relationship between power and range is illustrated by the range profile charts. Considerable fuel savings and longer range result when lower power settings are used. For this sample problem, a cruise power of approximately 65% will be used.

The cruise performance chart, figure 5-8, is entered at 6000 feet 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 2500 RPM, which results in the following:

Power 66%
True airspeed 112 Knots
Cruise fuel flow 7.4 GPH

The power computer may be used to determine power and fuel consumption more accurately during the flight.

FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in figures 5-7 and 5-8. For this sample problem, figure 5-7 shows that a climb from 2000 feet to 6000 feet requires 1.6 gallons of fuel. The corresponding distance during the climb is 10 nautical miles. 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 10°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:

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

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

Fuel to climb, standard temperature 1.6
Increase due to non-standard temperature 0.3
(1.6 × 16%)
Corrected fuel, to climb 1.9 Gallons

Using a similar procedure for the distance to climb results in 12 nautical miles.

The resultant cruise distance is:

Total distance 320
Climb distance $\frac{-12}{308}$ Nautical Miles
Cruise distance

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

112
-10
102 Knots

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

308 Nautical Miles = 3.0 Hours
102 Knots

The fuel required for cruise is:

3.0 hours × 7.4 gallons/hour = 22.2 Gallons

A 45-minute reserve requires:

$\frac{45}{60} \times 7.4$ gallons/hour = 5.6 Gallons

The total estimated fuel required is as follows:

Engine start, taxi, and takeoff 1.1
Climb 1.9
Cruise 22.2
Reserve $\frac{5.6}{30.8}$
Total fuel required 30.8 Gallons

Once the flight is underway, ground speed checks will provide a more accurate basis for estimating the time enroute and the corresponding fuel

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2400 lb. gross wt.
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MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps Up
Full Throttle

NOTE:
Mixture leaned above 3000 feet for maximum RPM.

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°C	0°C	20°C	40°C
2400	S.L.	76	805	745	685	625
	2000	75	695	640	580	525
	4000	74	590	535	480	420
	6000	73	485	430	375	320
	8000	72	380	330	275	220
	10,000	71	275	225	175	---
	12,000	70	175	125	---	---

Figure 5-6. Maximum Rate of Climb

TAKEOFF DISTANCE
2200 LBS AND 2000 LBS

SHORT FIELD

REFER TO SHEET 1 FOR APPROPRIATE CONDITIONS AND NOTES.

WEIGHT LBS	TAKEOFF SPEED KIAS		PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
	LIFT OFF	AT 50 FT		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	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS
2200	49	54	S.L.	650	1195	700	1280	750	1375	805	1470	865	1575
			1000	710	1310	765	1405	825	1510	885	1615	950	1735
			2000	780	1440	840	1545	905	1660	975	1785	1045	1915
			3000	855	1585	925	1705	995	1835	1070	1975	1150	2130
			4000	945	1750	1020	1890	1100	2040	1180	2200	1270	2375
			5000	1040	1945	1125	2105	1210	2275	1305	2485	1405	2665
			6000	1150	2170	1240	2355	1340	2555	1445	2775	1555	3020
			7000	1270	2440	1375	2655	1485	2890	1605	3155	1730	3450
		8000	1410	2760	1525	3015	1650	3305	1785	3630	1925	4005	
2000	46	51	S.L.	525	970	565	1035	605	1110	650	1185	695	1265
			1000	570	1060	615	1135	665	1215	710	1295	765	1385
			2000	625	1160	675	1240	725	1330	780	1425	840	1525
			3000	690	1270	740	1365	800	1465	860	1570	920	1685
			4000	755	1400	815	1500	880	1615	945	1735	1015	1865
			5000	830	1545	900	1660	970	1790	1040	1925	1120	2070
			6000	920	1710	990	1845	1070	1990	1150	2145	1235	2315
			7000	1015	1900	1095	2055	1180	2225	1275	2405	1370	2605
		8000	1125	2125	1215	2305	1310	2500	1410	2715	1520	2950	

Figure 5-5. Takeoff Distance (Sheet 2 of 2)

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SECTION 5
PERFORMANCE

Aircraft Modified
Per Penn Yan STC
2400 lb. GROSS wt.

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STALL SPEEDS

CONDITIONS:
Power Off

- NOTES:
- Altitude loss during a stall recovery may be as much as 230 feet.
 - KIAS values are approximate.

MOST REARWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK											
		0°			30°			45°			60°		
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS		
2400	UP	44	51	47	55	52	61	62	72				
	10°	35	48	38	52	42	57	49	68				
	30°	33	46	35	49	39	55	47	65				

MOST FORWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK											
		0°			30°			45°			60°		
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS		
2400	UP	44	52	47	56	52	62	62	74				
	10°	37	49	40	53	44	58	52	69				
	30°	33	46	35	49	39	55	47	65				

Figure 5-3. Stall Speeds

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Aircraft Modified
Per Penn Yan STC
2400 lb. GROSS wt.

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TAKEOFF DISTANCE
MAXIMUM WEIGHT 2400 LBS
SHORT FIELD

- NOTES:
- Short field technique as specified in Section 4.
 - Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum RPM in a full throttle.
 - Decrease distances 10% for each 9 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2 knots.
 - For operation on a dry, grass runway, increase distances by 15% of the "ground roll" figure.

CONDITIONS:
Flaps 10°
Full Throttle Prior to Brake Release
Paved, Level, Dry Runway
Zero Wind

WEIGHT LBS	TAKEOFF SPEED KIAS	LIFT AT 50 FT	ALT FT	0°C			10°C			20°C			30°C			40°C		
				GRND TOTAL FT	ROLL TO CLEAR 50 FT OBS	FT	GRND TOTAL FT	ROLL TO CLEAR 50 FT OBS	FT	GRND TOTAL FT	ROLL TO CLEAR 50 FT OBS	FT	GRND TOTAL FT	ROLL TO CLEAR 50 FT OBS	FT	GRND TOTAL FT	ROLL TO CLEAR 50 FT OBS	FT
2400	56	56	S.L.	1000	875	1460	1570	1460	1570	1685	1810	1945	1065	1170	1290	1425	1575	
8000	5000	5000	4000	3000	2000	2000	1115	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	
7000	4000	4000	3000	2000	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	
6000	3000	3000	2000	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	1745	
5000	2000	2000	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	1745	1940	
4000	1000	1000	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	1745	1940	
3000	500	500	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	1745	1940	
2000	200	200	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	1745	1940	
1000	100	100	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	1745	1940	
500	50	50	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	1745	1940	
200	20	20	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	1745	1940	
100	10	10	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	1745	1940	
50	5	5	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	1745	1940	
25	2.5	2.5	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	1745	1940	
10	1	1	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	1745	1940	
5	0.5	0.5	1055	1960	1140	1035	1910	1230	1325	1465	1090	1170	1290	1425	1575	1745	1940	

Figure 5-5. Takeoff Distance (Sheet 1 of 2)

CESSNA Aircraft Modified SECTION 5
 MODEL 172N Per Penn Yan STC PERFORMANCE
 2400 lb. gross wt.

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

CONDITIONS:
 Flaps Up
 Full Throttle
 Standard Temperature

NOTES:

1. Add 1.1 gallons of fuel for engine start, taxi and takeoff allowance.
2. Mixture leaned above 3000 feet for maximum RPM.
3. Increase time, fuel and distance by 10% for each 10°C above standard temperature.
4. Distances shown are based on zero wind.

WEIGHT LBS	PRESSURE ALTITUDE FT	TEMP °C	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
					TIME MIN	FUEL USED GALLONS	DISTANCE NM
2400	S.L.	15	76	700	0	0.0	0
	1000	13	76	655	1	0.3	2
	2000	11	75	610	3	0.6	4
	3000	9	75	560	5	1.0	6
	4000	7	74	515	7	1.4	9
	5000	5	74	470	9	1.7	11
	6000	3	73	425	11	2.2	14
	7000	1	72	375	14	2.6	18
	8000	-1	72	330	17	3.1	22
	9000	-3	71	285	20	3.6	26
	10,000	-5	71	240	24	4.2	32
	11,000	-7	70	190	29	4.9	38
	12,000	-9	70	145	35	5.8	47

Figure 5-7. Time, Fuel, and Distance to Climb

CESSNA Aircraft Modified SECTION 5
 MODEL 172N Per Penn Yan STC PERFORMANCE
 2400 lb. gross wt.

RANGE PROFILE
 45 MINUTES RESERVE
 40 GALLONS USABLE FUEL

CONDITIONS:
 2400 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 climb.

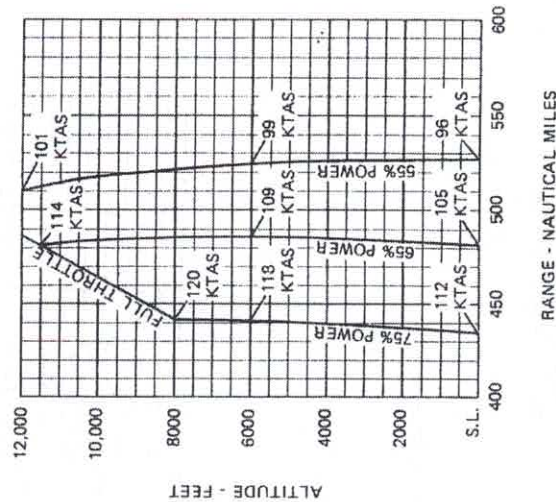


Figure 5-9. Range Profile (Sheet 1 of 3)

SECTION 5 Aircraft Modified
PERFORMANCE Per Penn Yan STC
2400 lb. gross wt.

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SECTION 5 Aircraft Modified
PERFORMANCE Per Penn Yan STC
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CRUISE PERFORMANCE

RANGE PROFILE
45 MINUTES RESERVE
50 GALLONS USABLE FUEL

CONDITIONS:
2400 Pounds
Recommended Lean Mixture (See Section 4, Cruise)

CONDITIONS:
2400 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 climb.

PRESSURE ALTITUDE FT	RPM	20°C BELOW STANDARD TEMP		STANDARD TEMPERATURE		20°C ABOVE STANDARD TEMP	
		% BHP	KTAS	% BHP	KTAS	% BHP	KTAS
2000	2500	77	110	76	114	72	114
	2400	81	109	69	108	65	108
	2300	85	104	62	103	59	102
	2200	89	99	55	97	53	96
	2100	92	92	50	91	48	89
4000	2550	77	115	76	117	72	116
	2500	86	114	73	114	69	113
	2400	89	109	65	108	62	107
	2300	92	104	59	102	57	101
	2200	96	98	54	96	51	94
6000	2100	51	91	48	89	47	88
	2600	77	119	77	119	72	118
	2500	82	113	69	113	66	112
	2400	86	108	63	107	60	106
	2300	90	103	57	101	55	99
8000	2200	54	96	52	95	50	92
	2100	49	90	47	88	46	86
	2650	77	121	77	121	73	120
	2600	87	118	73	118	69	117
	2500	90	113	66	112	63	111
10,000	2400	63	108	60	106	58	104
	2300	67	101	55	100	53	97
	2200	71	95	50	93	49	91
	2600	74	118	70	117	66	115
	2500	81	112	64	111	61	109
12,000	2400	51	106	58	105	56	102
	2300	55	100	53	98	51	96
	2200	59	93	49	91	47	89
	2550	67	114	64	112	61	111
	2500	72	109	61	109	59	107

Figure 5-8. Cruise Performance

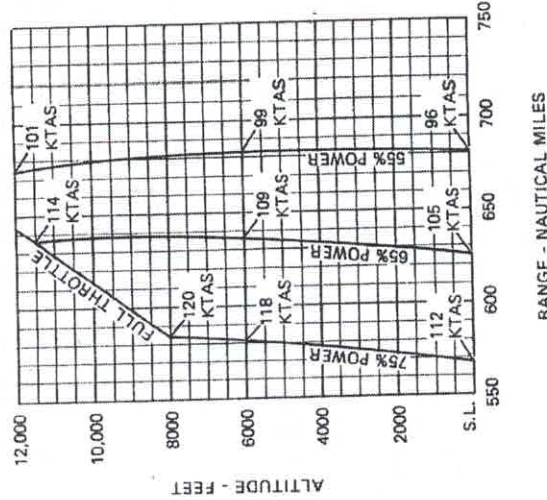


Figure 5-9. Range Profile (Sheet 2 of 3)

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Aircraft Modified
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ENDURANCE PROFILE
45 MINUTES RESERVE
50 GALLONS USABLE FUEL

CONDITIONS:
2400 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTE:
This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during climb.

ENDURANCE PROFILE
45 MINUTES RESERVE
40 GALLONS USABLE FUEL

CONDITIONS:
2400 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTE:
This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during climb.

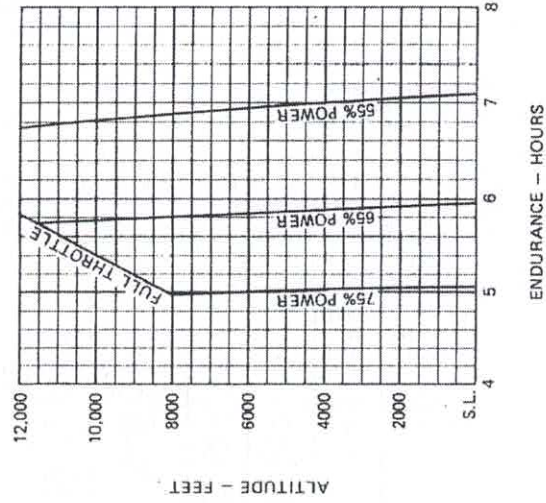


Figure 5-10. Endurance Profile (Sheet 2 of 3)

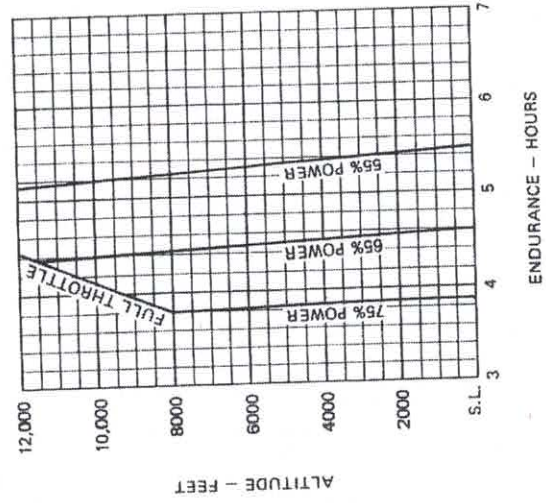


Figure 5-10. Endurance Profile (Sheet 1 of 3)

LANDING DISTANCE

SHORT FIELD

CONDITIONS:

Flaps 30°
Power Off
Maximum Braking
Paved, Level, Dry Runway
Zero Wind

NOTES:

1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 9 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2 knots.
3. For operation on a 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 7 KIAS and allow for 35% longer distances.

WEIGHT LBS	SPEED AT 50 FT KIAS	PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
			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	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS
2400	61	S.L.	510	1235	530	1265	550	1295	570	1325	585	1350
		1000	530	1285	550	1295	570	1325	590	1360	610	1390
		2000	550	1295	570	1330	590	1360	610	1390	630	1425
		3000	570	1330	590	1360	615	1395	635	1430	655	1460
		4000	595	1365	615	1400	635	1430	660	1470	680	1500
		5000	615	1400	640	1435	660	1470	685	1510	705	1540
		6000	640	1435	660	1470	685	1510	710	1550	730	1580
		7000	665	1475	690	1515	710	1550	735	1590	760	1630
		8000	690	1515	715	1555	740	1595	765	1635	790	1675

Figure 5-11. Landing Distance

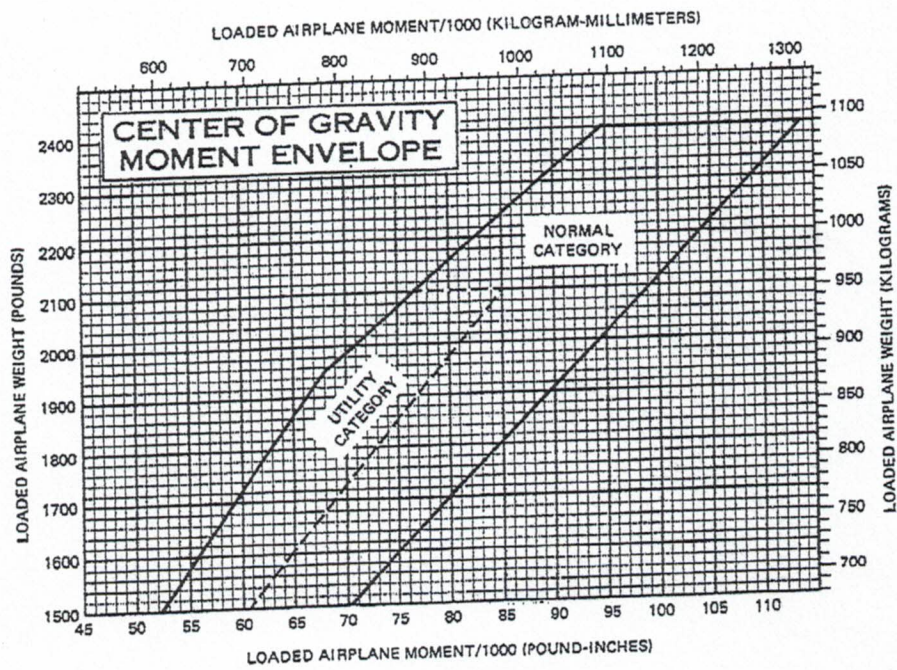


Figure 6-7. Center of Gravity Moment Envelope

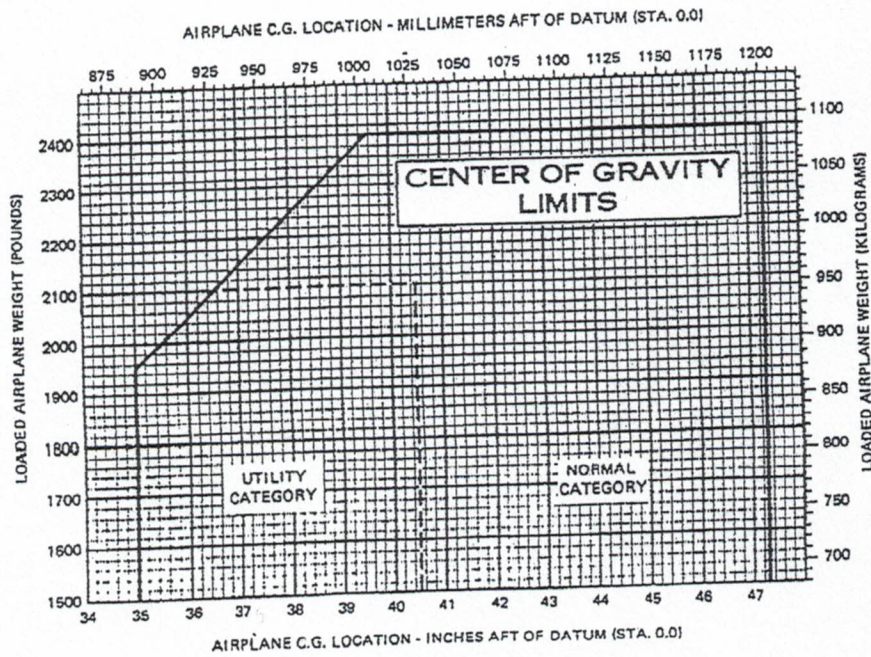


Figure 6-8. Center of Gravity Limits

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