

# DELTAHAWK

FAA APPROVED  
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL  
FOR CESSNA MODELS 172N,  
SERIAL NUMBERS 17267585 THROUGH 17271034  
FOR STC SA-1356GL  
&  
INSTALLATION INSTRUCTIONS OF  
O-320-D2J, D2G, OR D1A 160 HP ENGINE  
IN 1977 THROUGH 1978 CESSNA 172N

*The Power of Experience*



**PENN YAN AERO**  
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FAA Approved  
Supplemental Airplane Flight Manual  
for

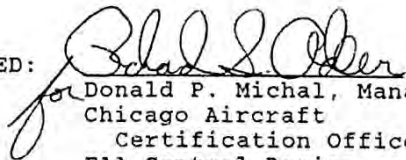
CESSNA MODELS 172N, S/N 17267585 THRU 17271034

REGISTRATION NO. N737WS

SERIAL NO. 17269734

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.

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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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CESSNA Aircraft Modified SECTION 5  
 MODEL 172N Per Penn Yan STC PERFORMANCE  
 2400 lb. GROSS WT.  
 required to complete the trip with ample reserve.

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

**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	120	130	140	150
KIAS	49	55	62	70	79	89	98	108	117	126	135	145
KCAS												
FLAPS 30°	40	50	60	70	80	85	88	91	94	97	100	103
KIAS	47	53	61	70	80	84	87	90	93	96	99	102
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	140	140
NORMAL KIAS	51	61	71	82	91	101	111	121	131	141	141	141
ALTERNATE KIAS												
FLAPS 10°	40	50	60	70	80	90	100	110	120	130	140	140
NORMAL KIAS	40	51	61	71	81	90	99	108	117	126	135	144
ALTERNATE KIAS												
FLAPS 30°	40	50	60	70	80	85	88	91	94	97	100	103
NORMAL KIAS	38	50	60	70	79	83	87	90	93	96	99	102
ALTERNATE KIAS												

**HEATER/VENTS OPEN AND WINDOWS CLOSED**

FLAPS UP	40	50	60	70	80	90	100	110	120	130	140	140
NORMAL KIAS	36	48	59	70	80	89	98	108	118	128	138	148
ALTERNATE KIAS												
FLAPS 10°	40	50	60	70	80	90	100	110	120	130	140	140
NORMAL KIAS	38	49	59	69	79	88	97	106	115	124	133	142
ALTERNATE KIAS												
FLAPS 30°	40	50	60	70	80	85	88	91	94	97	100	103
NORMAL KIAS	34	47	57	67	77	81	85	89	92	95	98	101
ALTERNATE KIAS												

**WINDOWS OPEN**

FLAPS UP	40	50	60	70	80	90	100	110	120	130	140	140
NORMAL KIAS	26	43	57	70	82	93	103	113	123	133	143	143
ALTERNATE KIAS												
FLAPS 10°	40	50	60	70	80	90	100	110	120	130	140	140
NORMAL KIAS	25	43	57	69	80	91	101	111	121	131	141	141
ALTERNATE KIAS												
FLAPS 30°	40	50	60	70	80	85	88	91	94	97	100	103
NORMAL KIAS	25	41	54	67	78	84	88	91	94	97	100	103
ALTERNATE KIAS												

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

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

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  
 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 -12  
 Cruise distance 308 Nautical Miles

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 5.6  
 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!

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

**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:

16°C ÷ 10°C = 16% Increase

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

SECTION 5  
PERFORMANCE

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

**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			

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Figure 5-5. Takeoff Distance (Sheet 2 of 2) Page 5 of 11

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

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

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Per Penn Yan STC  
2400 lb. gross wt.

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

**STALL SPEEDS**

**TAKEOFF DISTANCE**

**SHORT FIELD**

**TAKEOFF DISTANCE**

CESSNA  
MODEL 172N

CESSNA  
MODEL 172N

CESSNA  
MODEL 172N

CESSNA  
MODEL 172N

CONDITIONS:  
Power Off

CONDITIONS:  
Power Off

CONDITIONS:  
Power Off

CONDITIONS:  
Power Off

NOTES:  
1. Altitude loss during a stall recovery may be as much as 230 feet.

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2. KIAS values are approximate.

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1. Short field technique as specified in Section 4.

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2. Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum RPM in a full throttle, static ramp.

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3. Decrease distances 10% for each 8 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2 knots.

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4. For operation on a dry, grass runway, increase distances by 15% of the "ground roll" figure.

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NOTES:

NOTES:

NOTES:

NOTES:

Flaps 10°

Flaps 10°

Flaps 10°

Flaps 10°

Full Throttle Prior to Brake Release

Full Throttle Prior to Brake Release

Full Throttle Prior to Brake Release

Full Throttle Prior to Brake Release

Paved, Level, Dry Runway

Paved, Level, Dry Runway

Paved, Level, Dry Runway

Paved, Level, Dry Runway

Zero Wind

Zero Wind

Zero Wind

Zero Wind

CONDITIONS:

CONDITIONS:

CONDITIONS:

CONDITIONS:



SECTION 5  
PERFORMANCE

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

CESNA  
MODEL 172N

**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.

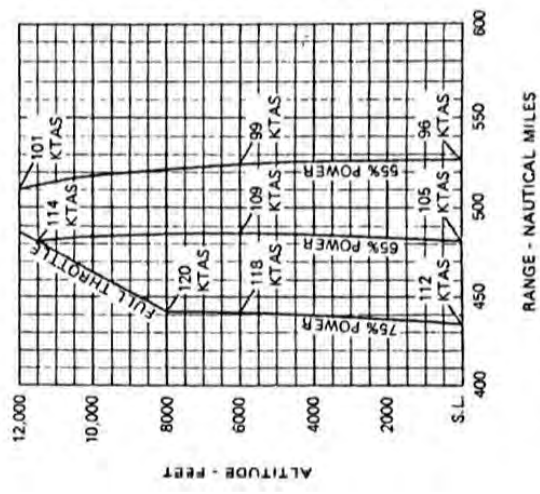


Figure 5-9. Range Profile (Sheet 1 of 3)

SECTION 5  
PERFORMANCE

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

CESNA  
MODEL 172N

**TIME, FUEL, AND DISTANCE TO CLIMB**

**MAXIMUM RATE OF CLIMB**

CONDITIONS:  
Flaps Up  
Full Throttle  
Standard Temperature

NOTE:  
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
2400	S.L.	15	76	700	0	0.0
	1000	13	76	655	1	0.3
	2000	11	75	610	3	0.6
	3000	9	75	560	5	1.0
	4000	7	74	515	7	1.4
	5000	5	74	470	9	1.7
	6000	3	73	425	11	2.2
	7000	1	72	375	14	2.6
	8000	-1	72	330	17	3.1
	9000	-3	71	285	20	3.6
	10,000	-5	71	240	24	4.2
	11,000	-7	70	190	29	4.9
	12,000	-9	70	145	35	5.8
					47	

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

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CESSNA  
MODEL 172N

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

SECTION 5  
PERFORMANCE

**RANGE PROFILE**  
45 MINUTES RESERVE  
50 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.

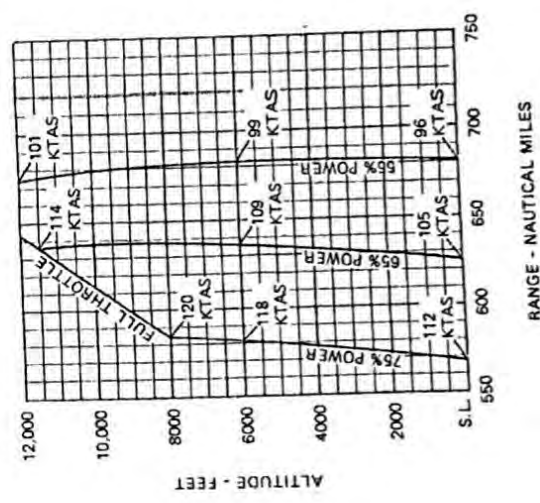


Figure 5-8. Range Profile (Sheet 2 of 3)

CESSNA  
MODEL 172N

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

SECTION 5  
PERFORMANCE

**CRUISE PERFORMANCE**

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

PRESSURE ALTITUDE FT	RPM	20°C BELOW STANDARD TEMP			STANDARD TEMPERATURE			20°C ABOVE STANDARD TEMP		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2000	2500	72	110	8.1	76	114	8.5	72	114	8.1
	2400	65	104	7.3	68	108	7.7	65	108	7.3
	2300	58	98	6.6	52	103	6.9	59	102	6.6
	2200	52	92	6.0	50	97	6.3	53	96	6.1
4000	2500	77	115	8.6	76	114	8.5	72	116	8.1
	2500	77	115	8.6	76	114	8.5	72	116	8.1
	2400	69	109	7.8	65	108	7.3	62	107	7.0
	2300	62	104	7.0	59	102	6.6	57	101	6.4
6000	2500	73	114	8.2	77	119	8.6	72	118	8.1
	2400	66	108	7.4	63	107	7.0	60	106	6.7
	2300	60	103	6.7	57	101	6.4	55	99	6.2
	2200	54	96	6.1	52	95	5.9	50	92	5.8
8000	2500	77	119	8.7	77	121	8.6	73	120	8.1
	2500	77	119	8.7	77	121	8.6	73	120	8.1
	2400	70	113	7.8	66	112	7.4	63	111	7.1
	2300	63	106	7.1	60	106	6.7	58	104	6.5
10,000	2500	74	118	8.3	70	117	7.8	66	115	7.4
	2500	74	118	8.3	70	117	7.8	66	115	7.4
	2400	67	112	7.5	64	111	7.1	61	109	6.8
	2300	61	106	6.8	58	105	6.5	56	102	6.3
12,000	2500	67	114	7.6	64	112	7.1	61	111	6.9
	2500	67	114	7.6	64	112	7.1	61	111	6.9
	2400	59	105	6.6	56	103	6.3	54	100	6.1
	2300	53	98	6.1	51	96	5.9	50	94	5.8

Figure 5-8. Cruise Performance

SECTION 5  
PERFORMANCE

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

CESSNA  
MODEL 172N

CESSNA  
MODEL 172N

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

**ENDURANCE PROFILE**  
45 MINUTES RESERVE  
50 GALLONS USABLE FUEL

SECTION 5  
PERFORMANCE

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

CESSNA  
MODEL 172N

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

**ENDURANCE PROFILE**  
45 MINUTES RESERVE  
50 GALLONS USABLE FUEL

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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.

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.

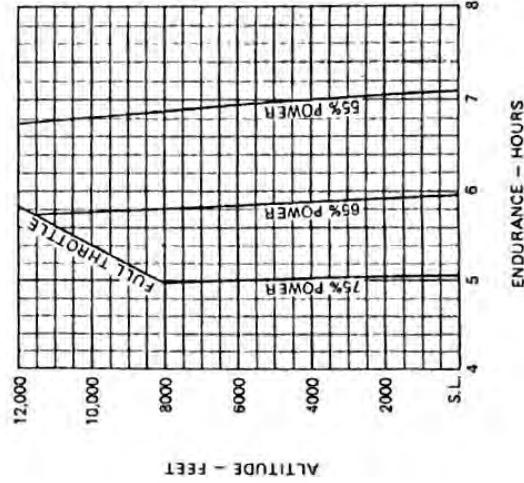


Figure 5-10. Endurance Profile (Sheet 2 of 3)

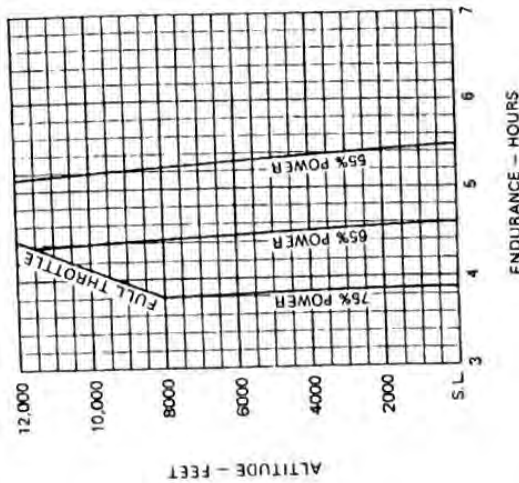


Figure 5-10. Endurance Profile (Sheet 1 of 3)

SECTION 5  
PERFORMANCE

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

CESSNA  
MODEL 172N

## 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	SL	510	1235	530	1265	550	1295	570	1325	585	1350
		1000	530	1265	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

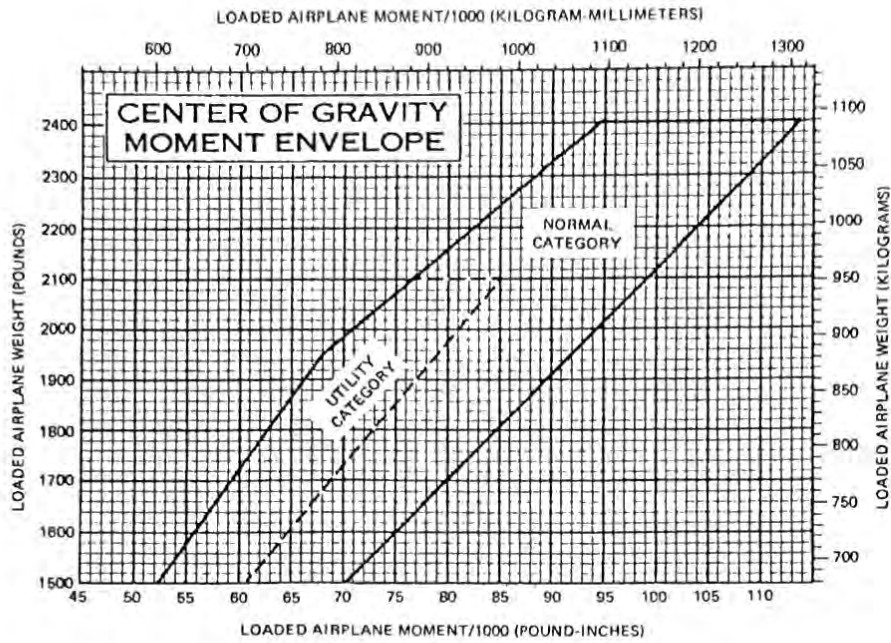


Figure 6-7. Center of Gravity Moment Envelope

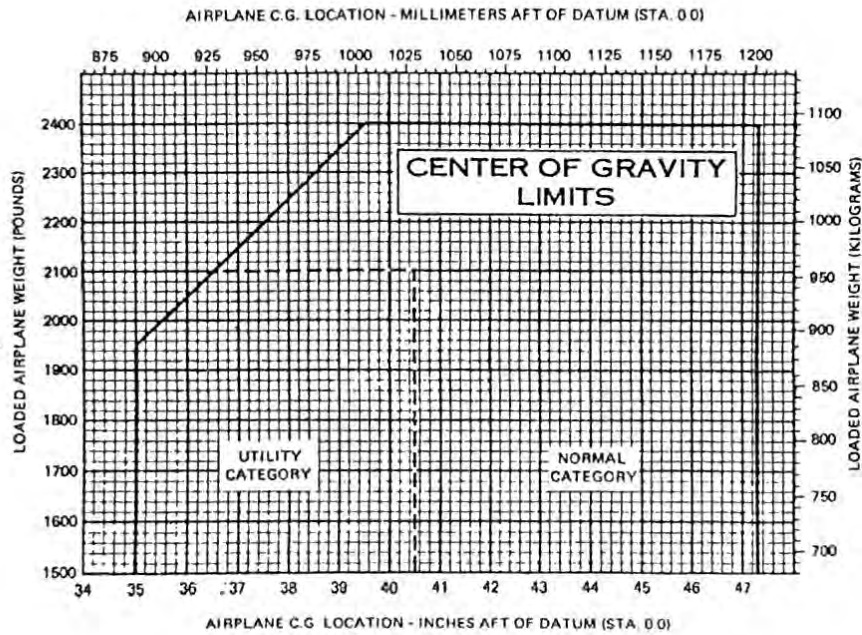


Figure 6-8. Center of Gravity Limits

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