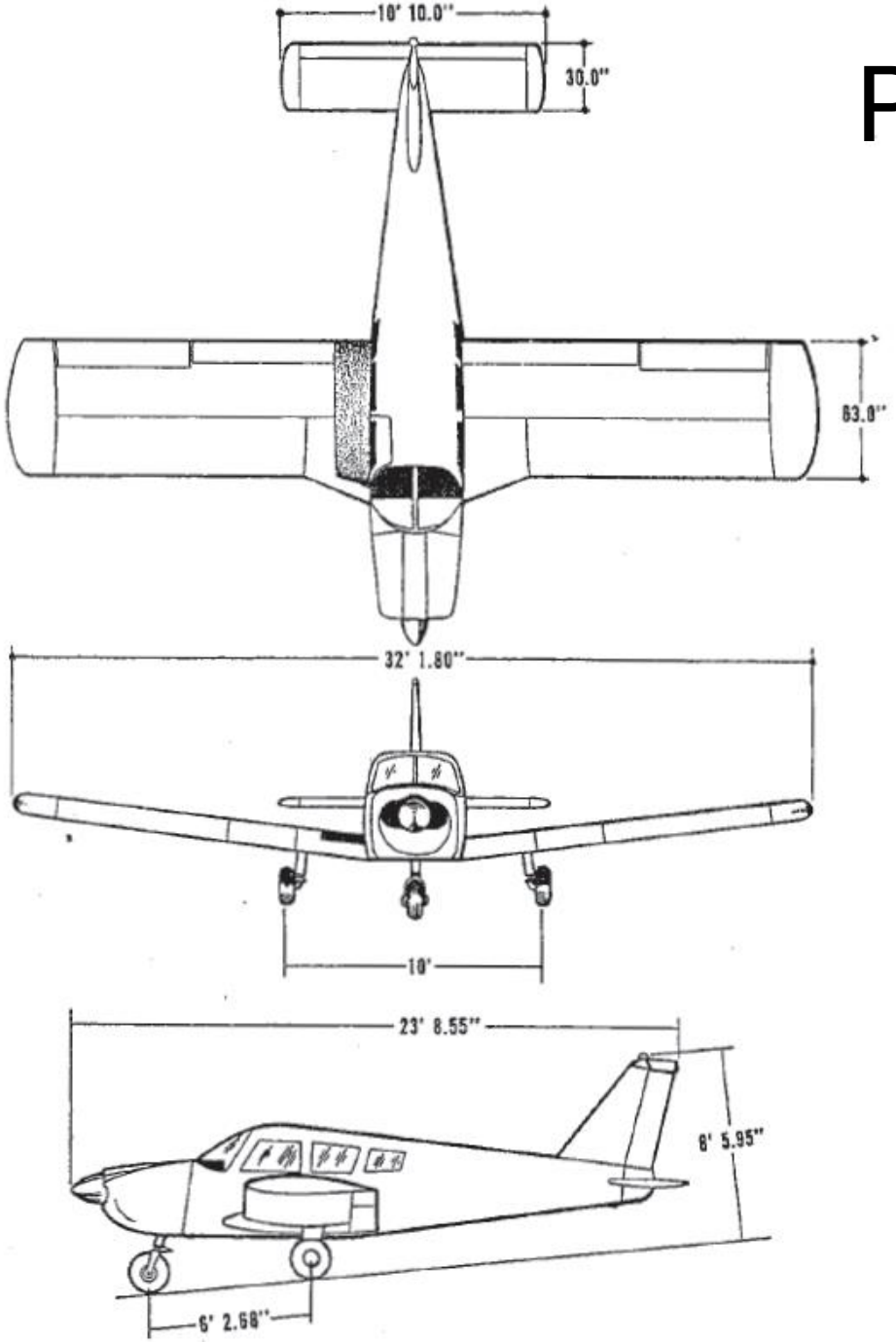
Pathfinder Performance Questions

Texas Flying Club
Charles O’Neill
11 Nov 2024

Slides available at:
https://charles-oneill.com/blog/pathfinder-performance/



PA28-235 Performance

Wing area: $S = 170\ ft^2$

Weight/Area: $\frac{W}{S} = 17\ \frac{lbf}{ft^2}$

Weight/HP: $\frac{W}{P} = 12\ \frac{lbf}{HP}$

Aspect Ratio: $\frac{b^2}{S} = 6$

Horizontal: Smaller 10’ span. Pitch authority.

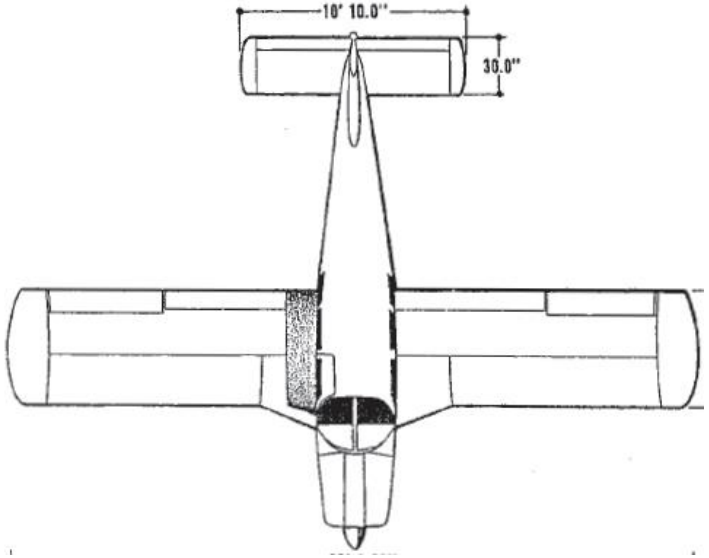
Propulsion: 235 HP Constant Speed Prop

Cessna 172 #s:
$S = 174\ ft^2$
$W/S = 13.8\ ft^2$
$W/P = 15\ ft^2$
$AR = 7.3\ ft^2$
160 HP Fixed pitch

Piper Cherokee Stability & Control: Stabilator

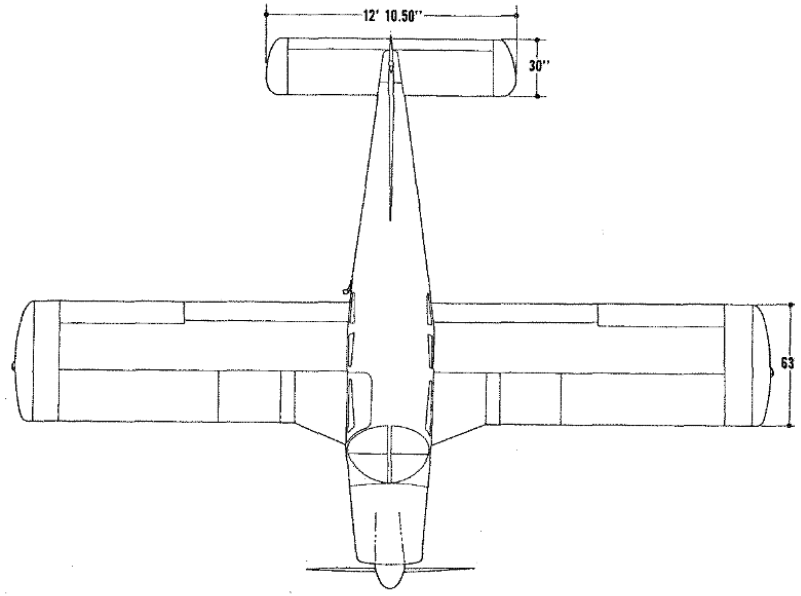
Longitudinal S&C (i.e., How stable and how much pitching moment) depends on the "tail volume": $V_t = L_{fuselage} \cdot Area_{tail}$

10' 10" stab
short fuselage



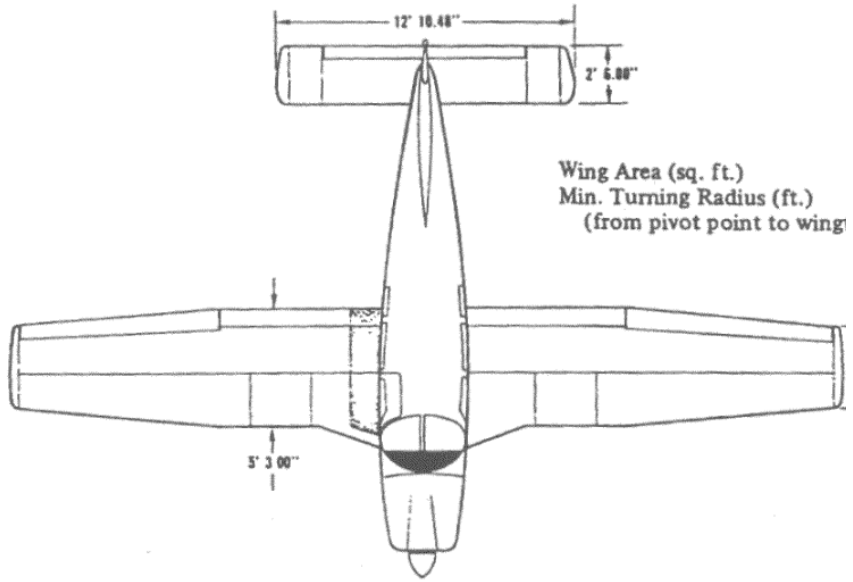
1963-1973

12' 10" stab
long fuselage



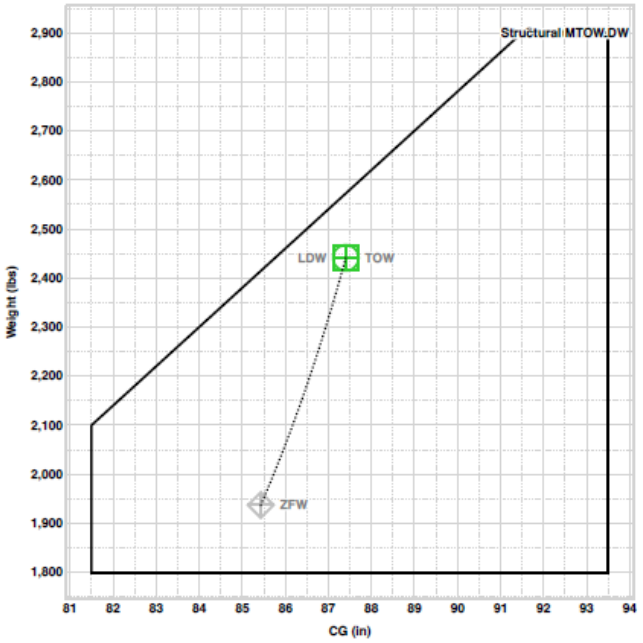
1973-1978

12' 10" stab
long fuselage



Dakota 1979-on

Weight & Balance (from TCDS)



VI - Model PA-28-235 (Cherokee Pathfinder), 4 PCLM (Normal Category), Approved July 15, 1963, for S/N 28-10001 through 28-11378, and 28-7110001 through 28-7210023.

Center of Gravity Range

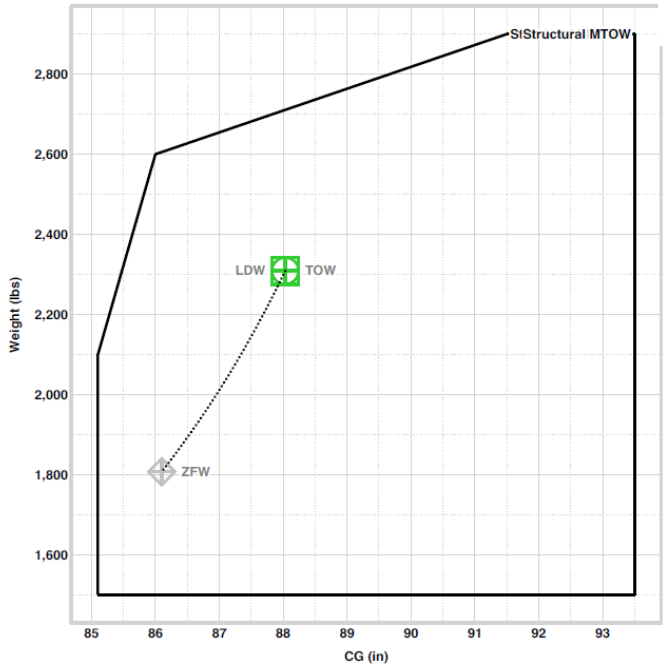
S/N 28-10001 through 28-11378 (See NOTE 16):

(+81.5)	to	(+93.5)	at	2100 lb. or less
(+91.5)	to	(+93.5)	at	2900 lb.

S/N 28-7110001 through 28-7210023:

(+85.1)	to	(+93.5)	at	2100 lb. or less
(+86.0)	to	(+93.5)	at	2600 lb.
(+91.5)	to	(+93.5)	at	2900 lb.

Straight line variation between points given.



XIII - Model PA-28-235 (Cherokee Pathfinder), 4 PCLM (Normal Category), Approved June 9, 1972, for S/N 28E-11, and 28-7310001 through 28-7710089.

Center of Gravity Range

(+79.0)	to	(+91.5)	at	1900 lb. or less
(+82.0)	to	(+91.5)	at	2500 lb.
(+88.0)	to	(+91.5)	at	3000 lb.

Straight line variation between points given.

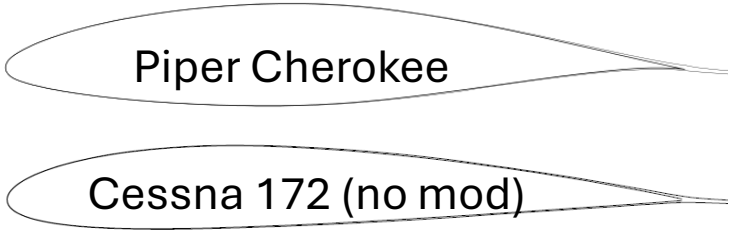
XIX - Model PA-28-236 (Dakota), 4 PCLM (Normal Category), Approved June 1, 1978, for S/N 28-7911001 through 28-8611008; 2811001 through 2811050.

Center of Gravity Range

(+79.8)	to	(+92.0)	at	1900 lb. or less
(+82.5)	to	(+92.0)	at	2500 lb.
(+88.5)	to	(+92.0)	at	3000 lb.

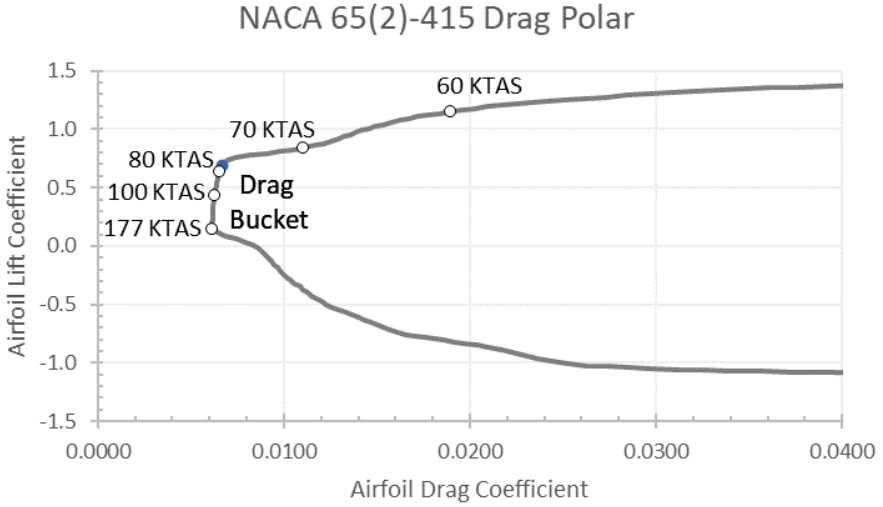
Straight line variation between points given.

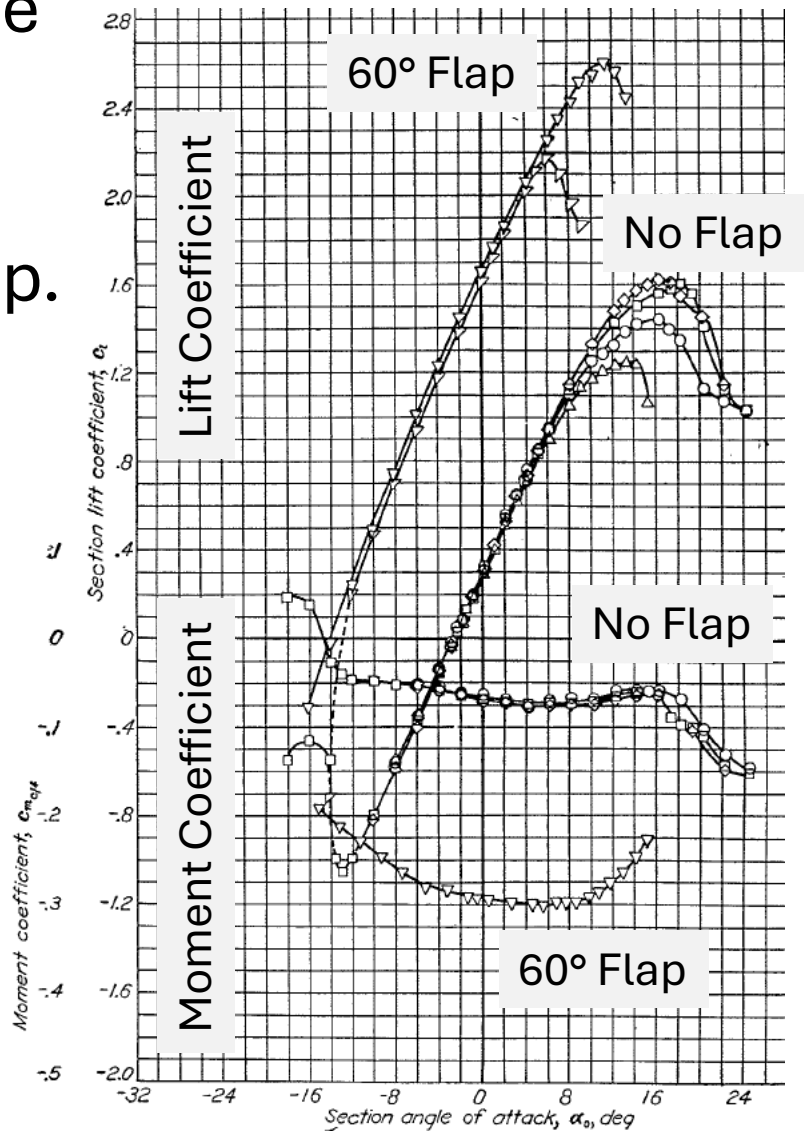
PA28 Airfoil: NACA 65(2)-415



Piper made an excellent choice with the PA28's airfoil

1. 15% Max thickness at 40% gives a nice structural setup.
2. Deep Drag Bucket
3. Stall is gentle and with plenty of warning.

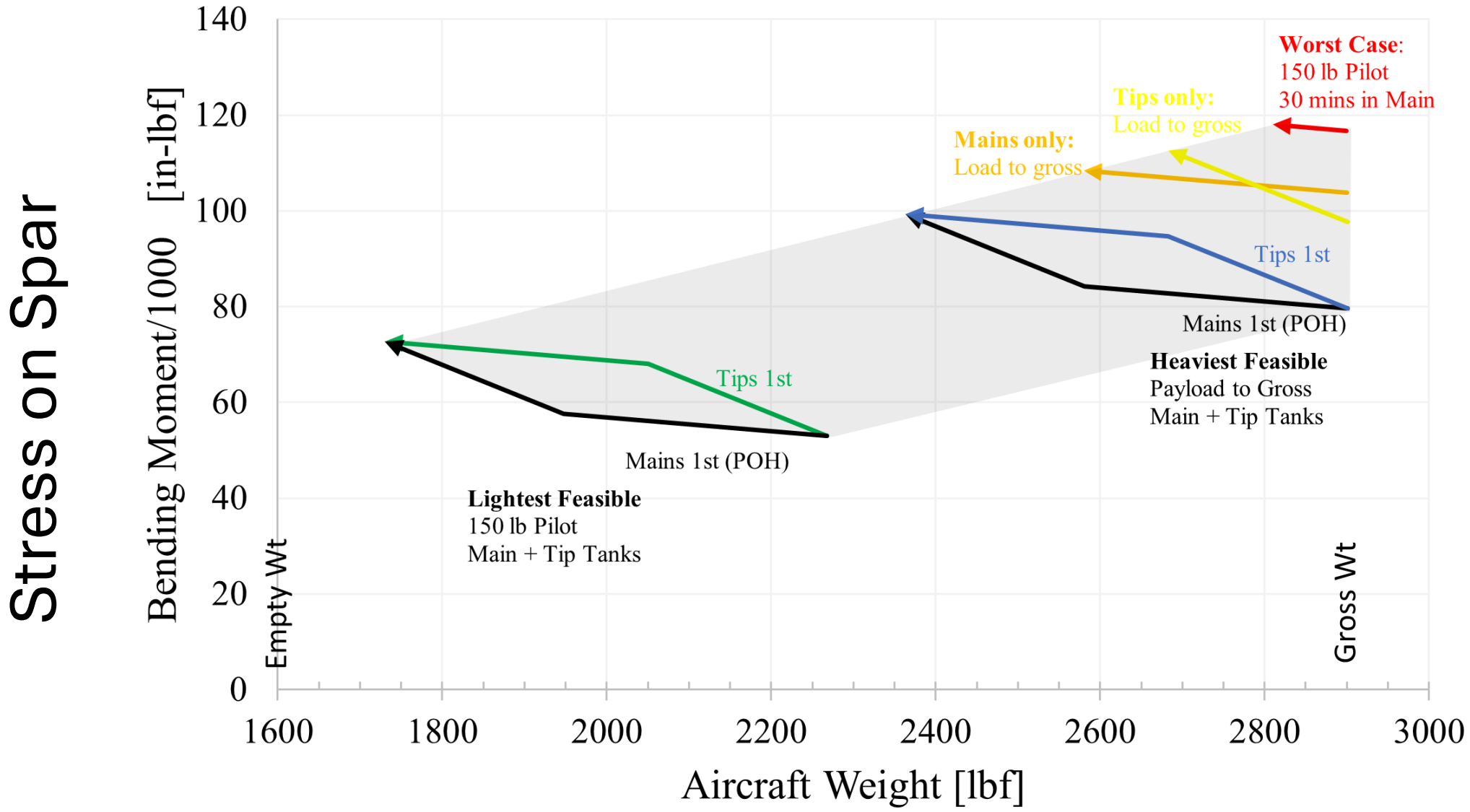




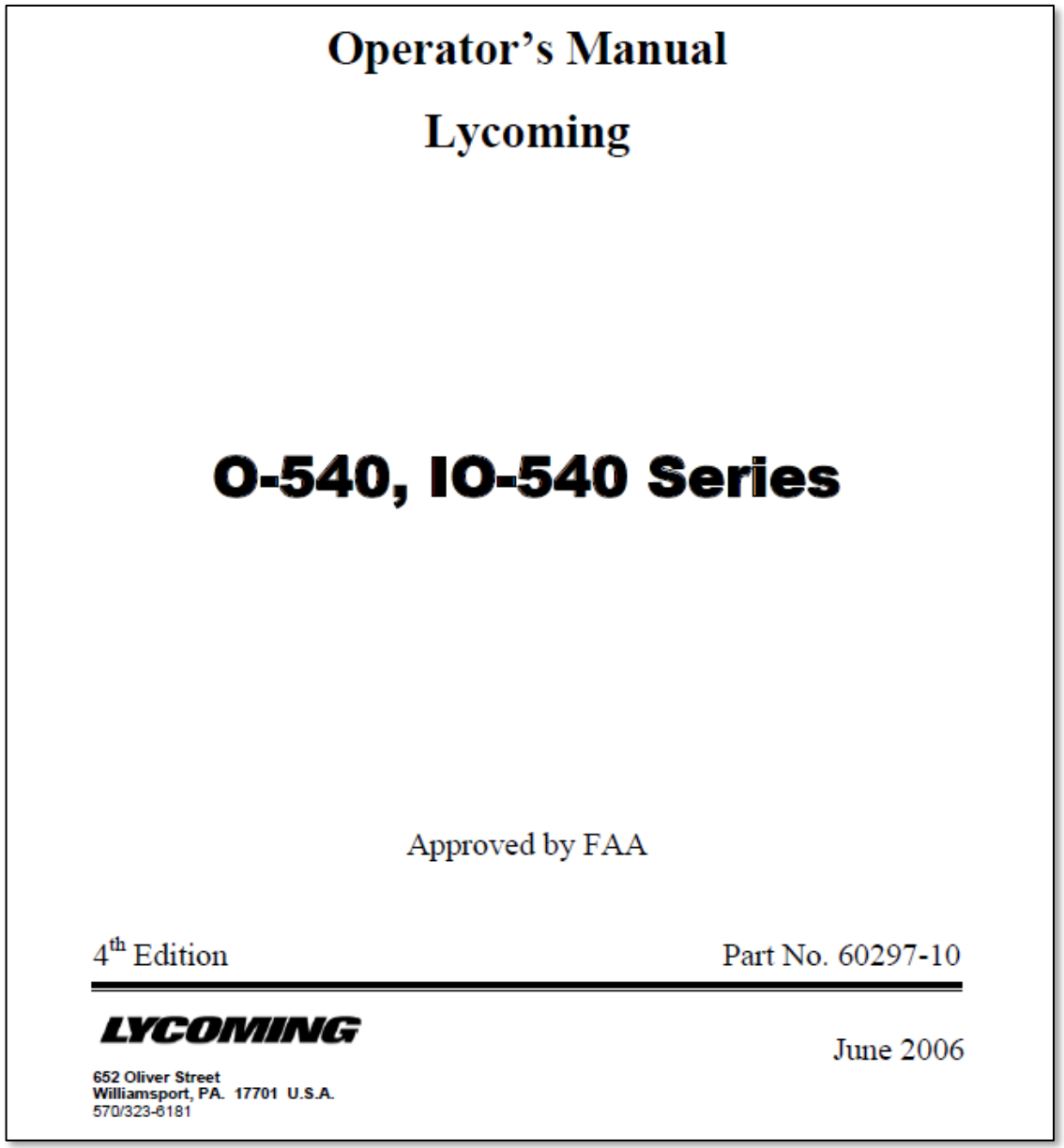
Gentle stall with warning from 14°-18°. Wing gives nose down moment at stall (more stable).

Stall with flaps is sharper and at a lower AOA. Wing moment is negative but with positive slope at stall. Less stable with flaps.

Question: Tips or Main Tank 1st? A: Main 1st.



Lycoming O-540-B


Operator's Manual

Lycoming

O-540, IO-540 Series

Approved by FAA

4th Edition

Part No. 60297-10

LYCOMING

June 2006

652 Oliver Street
Williamsport, PA. 17701 U.S.A.
570/323-6181

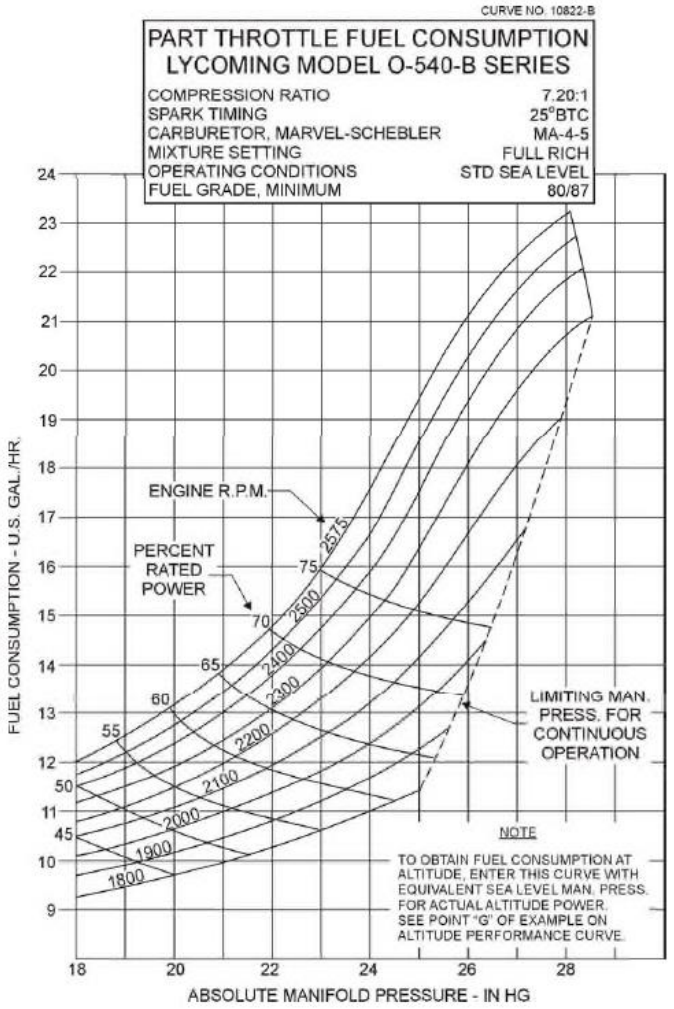
Lycoming has an operator's manual for the O-540 that covers far more information than the sparse pre-1973 Piper POH.

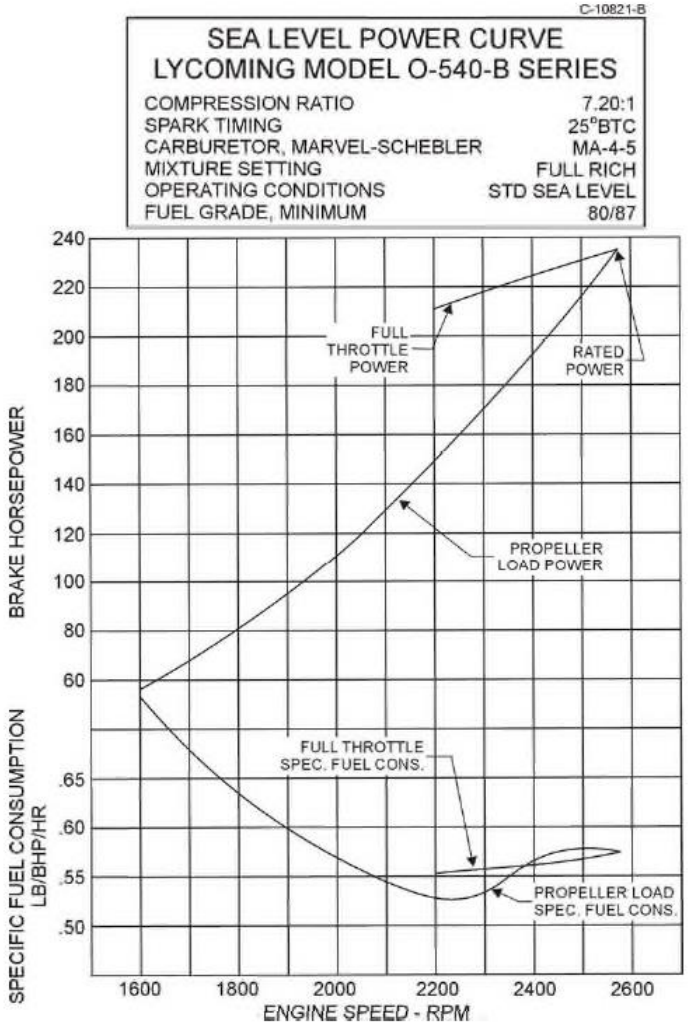
Best of all, the OPMAN has the detailed engine specifications, characteristics, operating, power, and fuel flow information not included in the Pathfinder's POH.

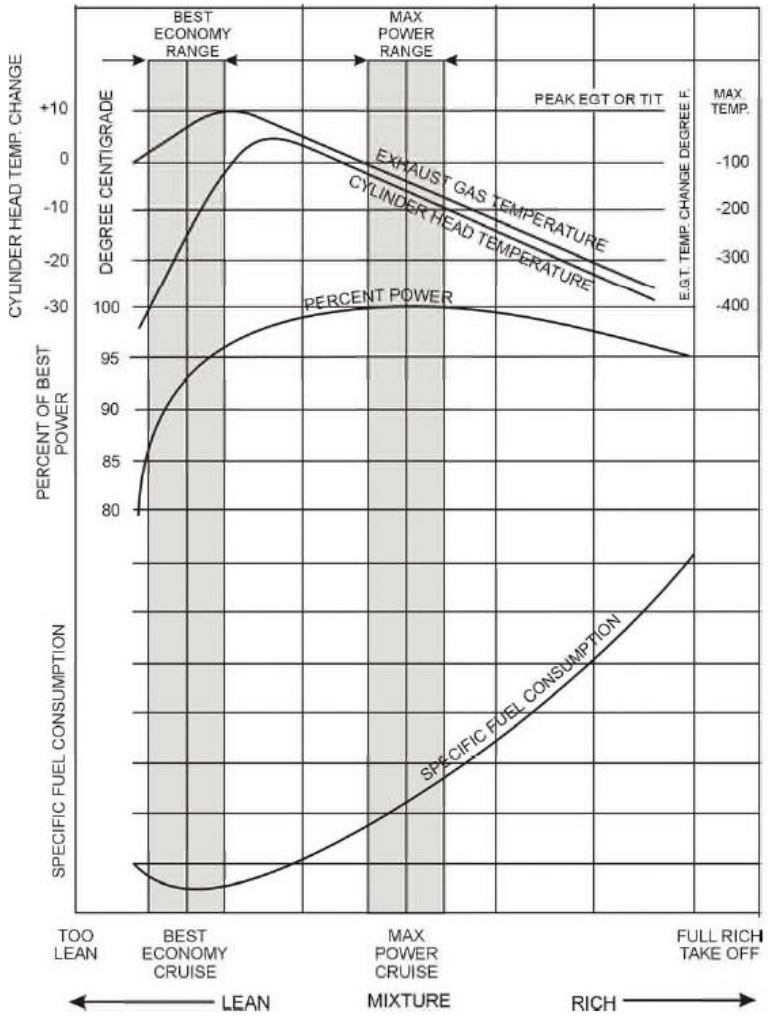
Available online.

Lycoming O-540-B

Many interesting figures that we could perhaps discuss at a future time.







Lycoming O-540-B

Power = RPM x Torque

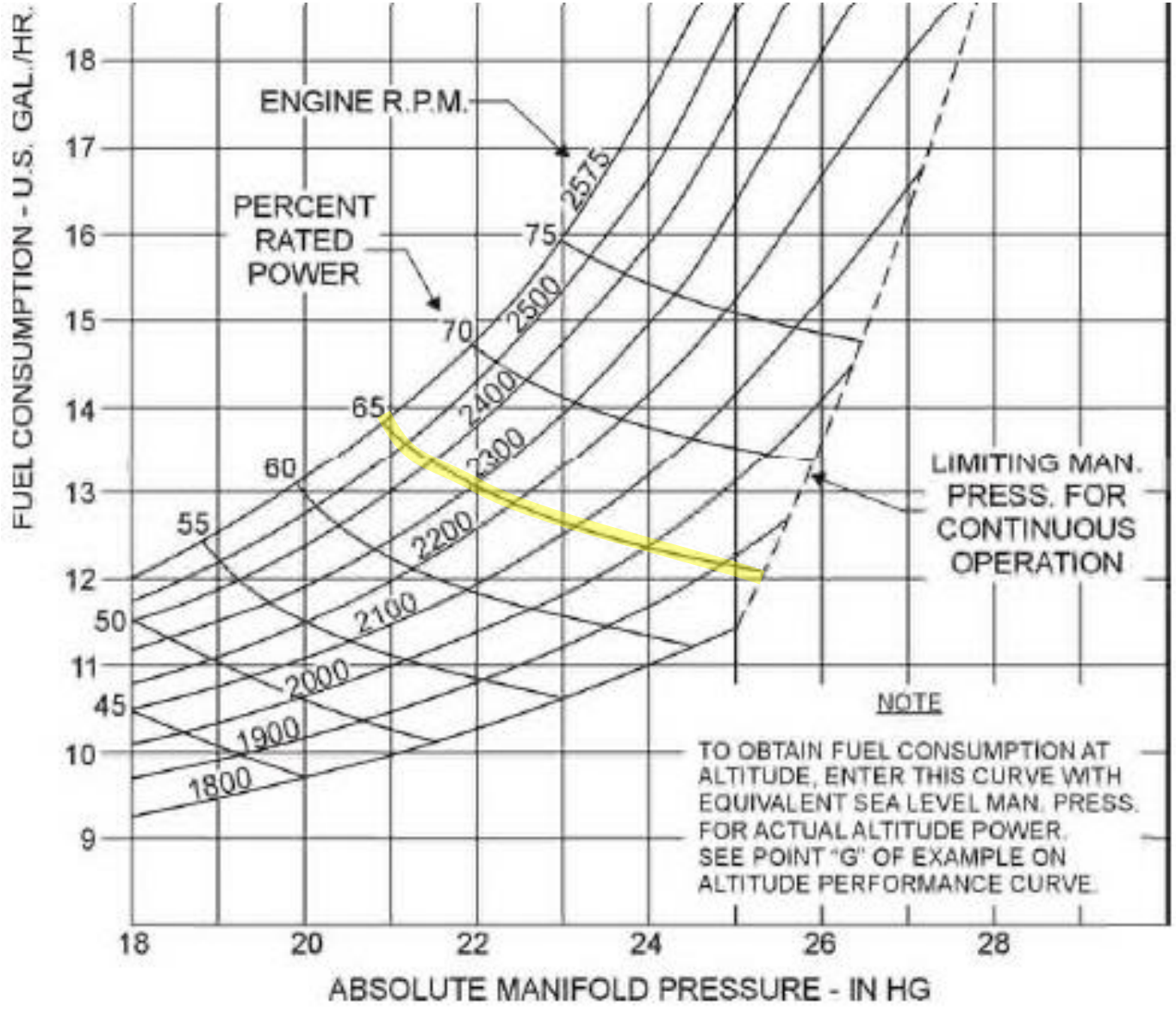
~ RPM x MP

For the same power, drop one and increase the other.

Fuel consumption **varies** with the same power setting.

65% Power:

- 2500 RPM & 21’ MP (13.5gph)
- 2300 RPM & 23’ MP (13 gph)
- 2000 RPM & 24’ MP (12.5 gph)



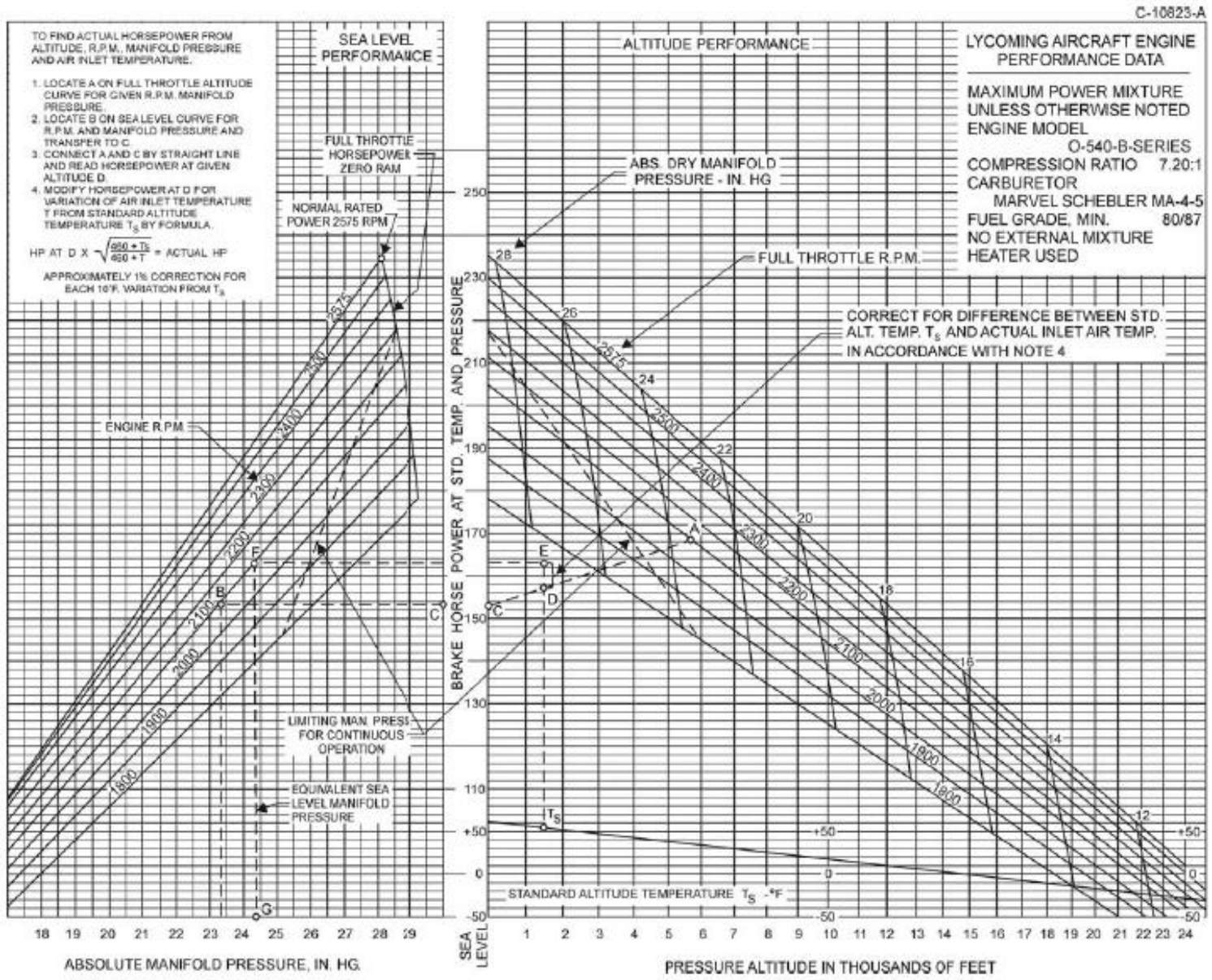
Why? Slower RPM gives longer and more efficient combustion.

Lycoming O-540-B

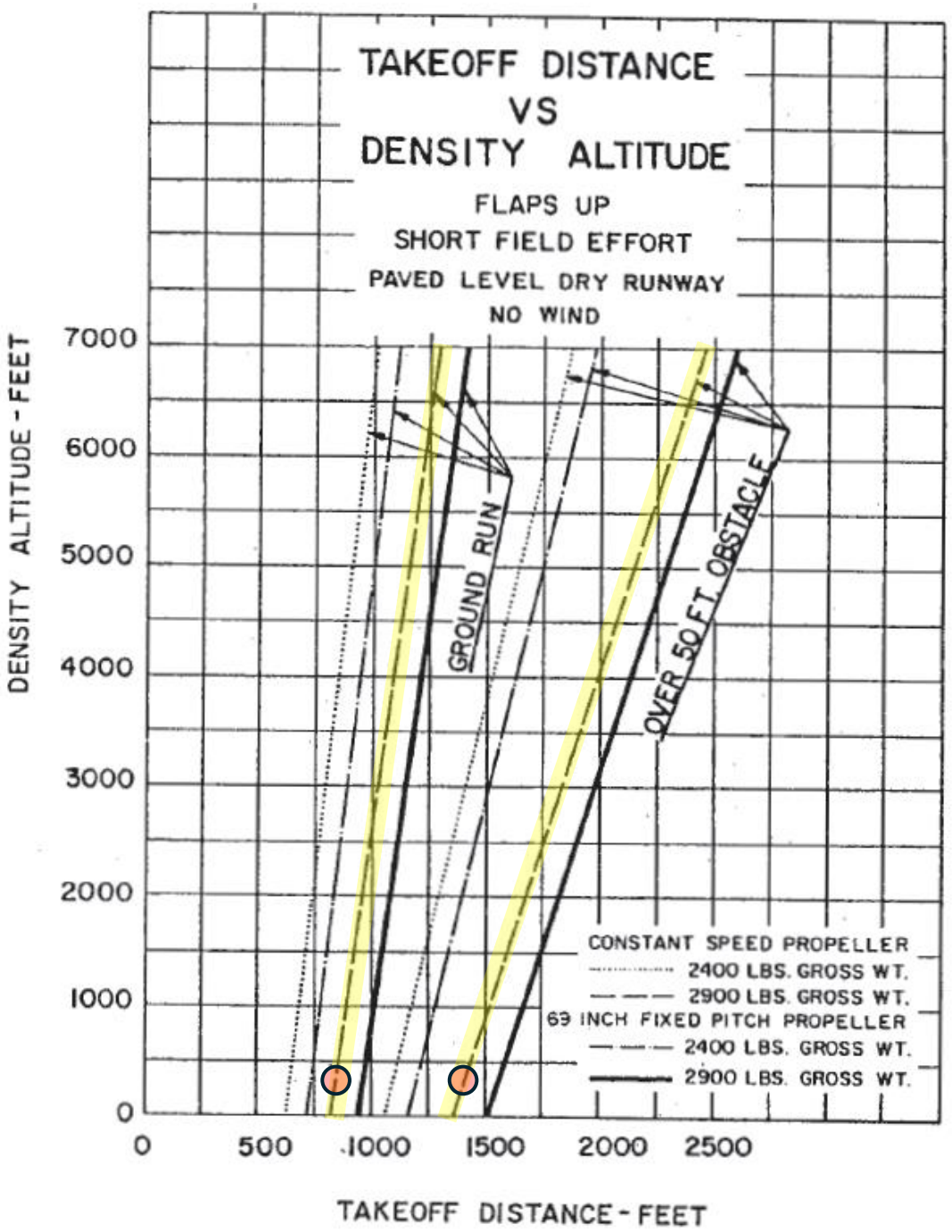
How can you precisely determine the power given a known RPM, MP, and pressure altitude?

This figure is super useful for flight tests.

Follow the example, as this figure has some gotchas.



Q: How does this apply to the written checkout?

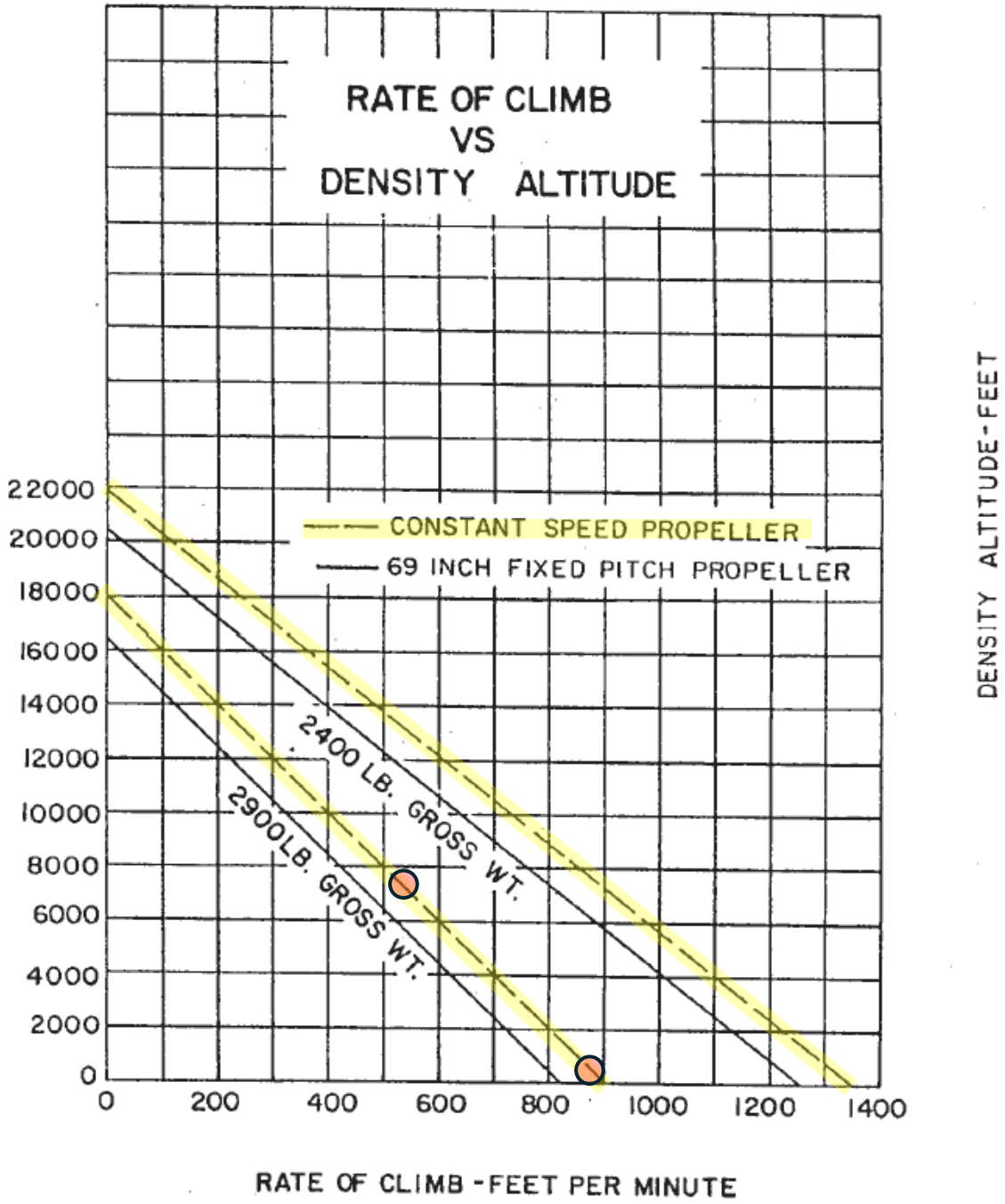


Takeoff Ground Roll

Flaps UP:
850 feet ground roll.
1400 feet over 50-foot obstacle.

Flaps 25: (different POH figure)
780 feet ground roll
1250 feet over 50-foot obstacle.

Warning: Be aware that the POH has constant speed and fixed pitch propeller data. Verify that you are using the correct curve.



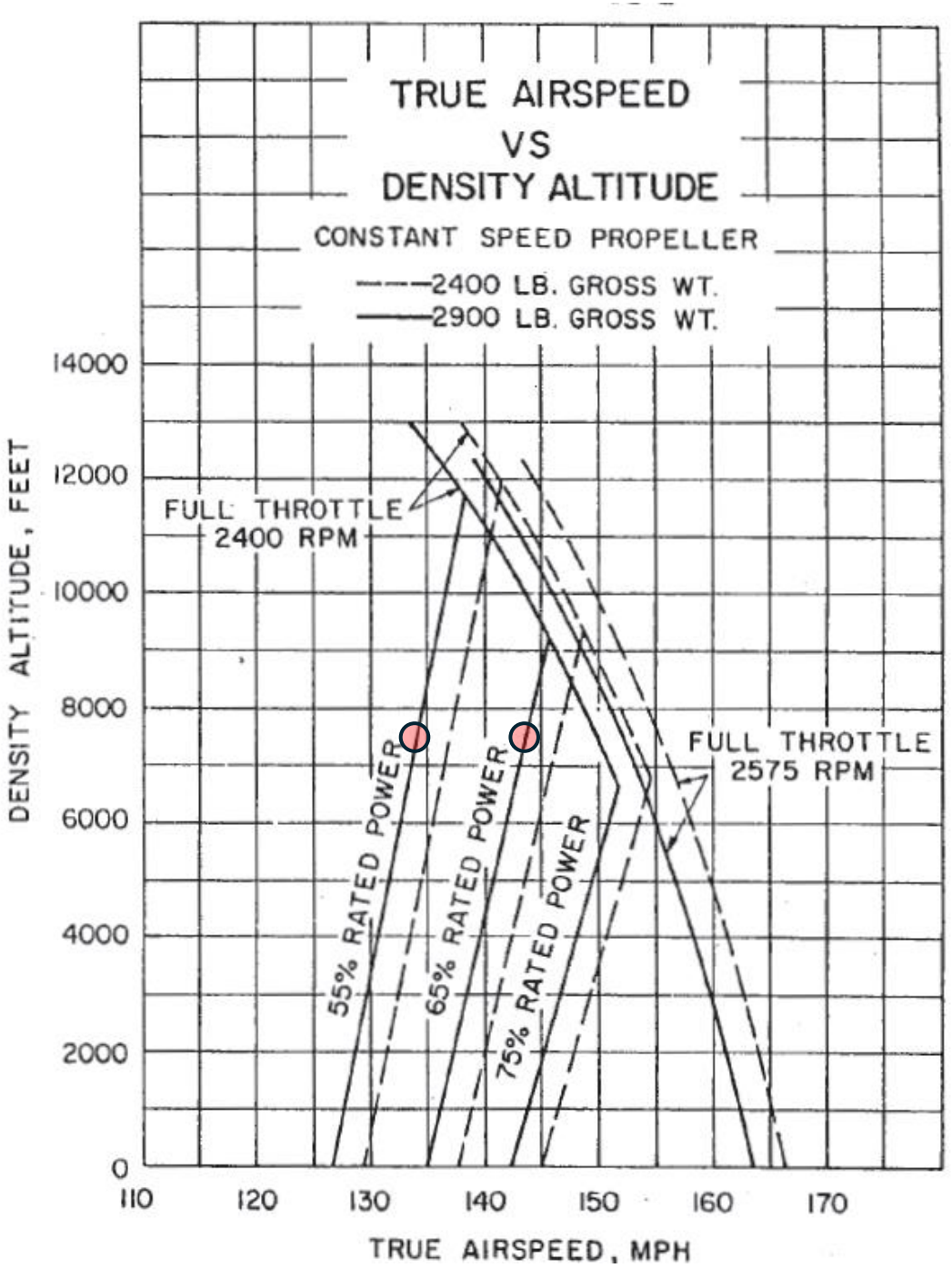
ROC & Time to 7500’

Rule of thumb: Average ROC over the climb is the average of start and stop ROC.

ROC at 360’ ~ 870 fpm
ROC at 7500’ ~ 530 fpm

Average is 700 fpm.

Time is (7500-360)/700 ~ 10 min



TAS at 50% and 65% P

50% Power isn't listed! 55% is.

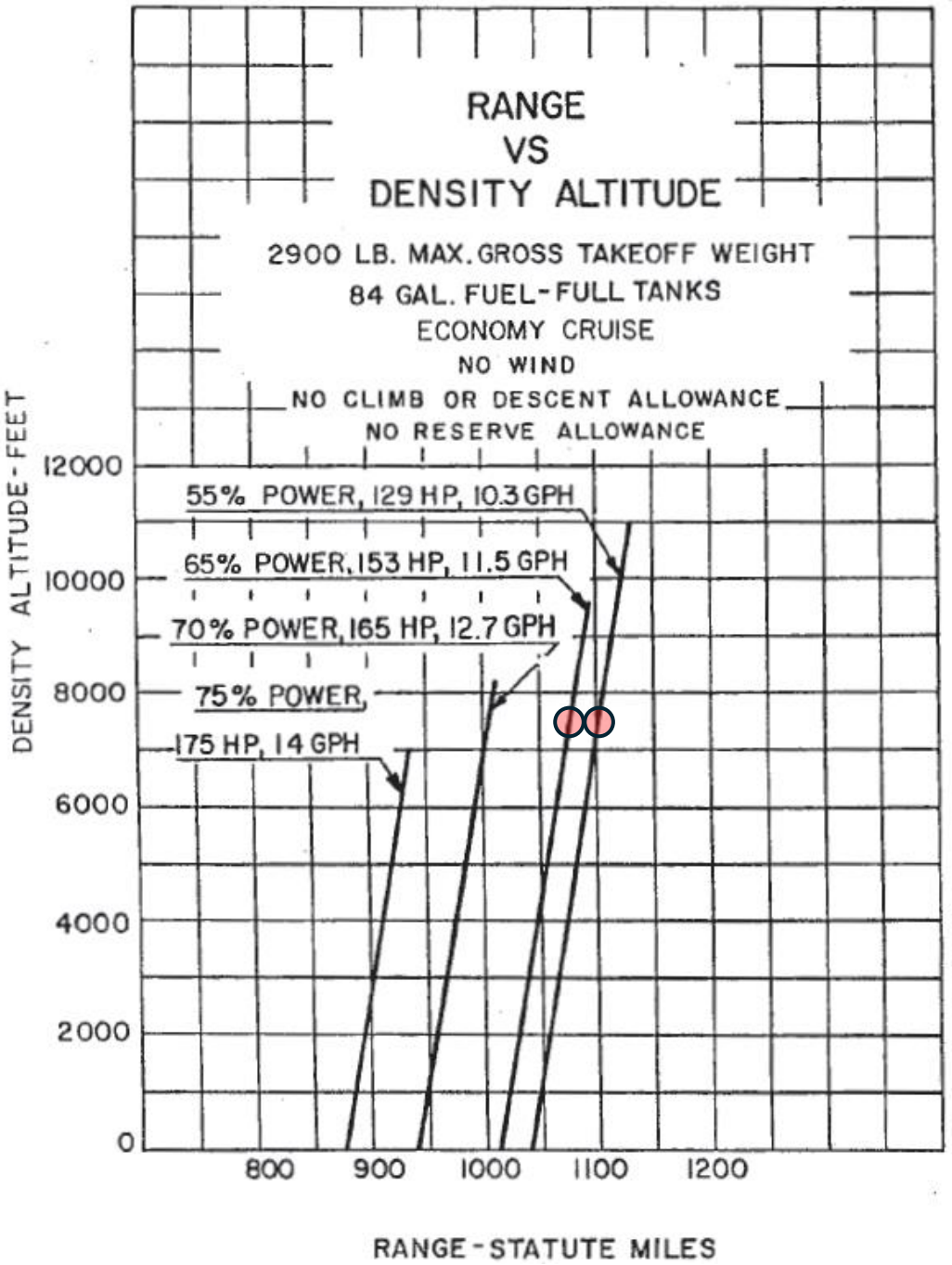
At 7500' and 2900 lbs:

55% Power = 134 mph

65% Power = 143 mph

Warning: One non-official but popular Foreflight performance profile mistakenly transcribed knots rather than mph. This is not a 150 kt airplane!

The maximum TAS at 65% power is 145 mph at 9000 feet.



Range at 50% and 65% P

50% Power isn't listed! 55% is.

At 7500' and 2900 lbs:

55% Power:

1100 sm, 10.3 gph, 129 HP

65% Power:

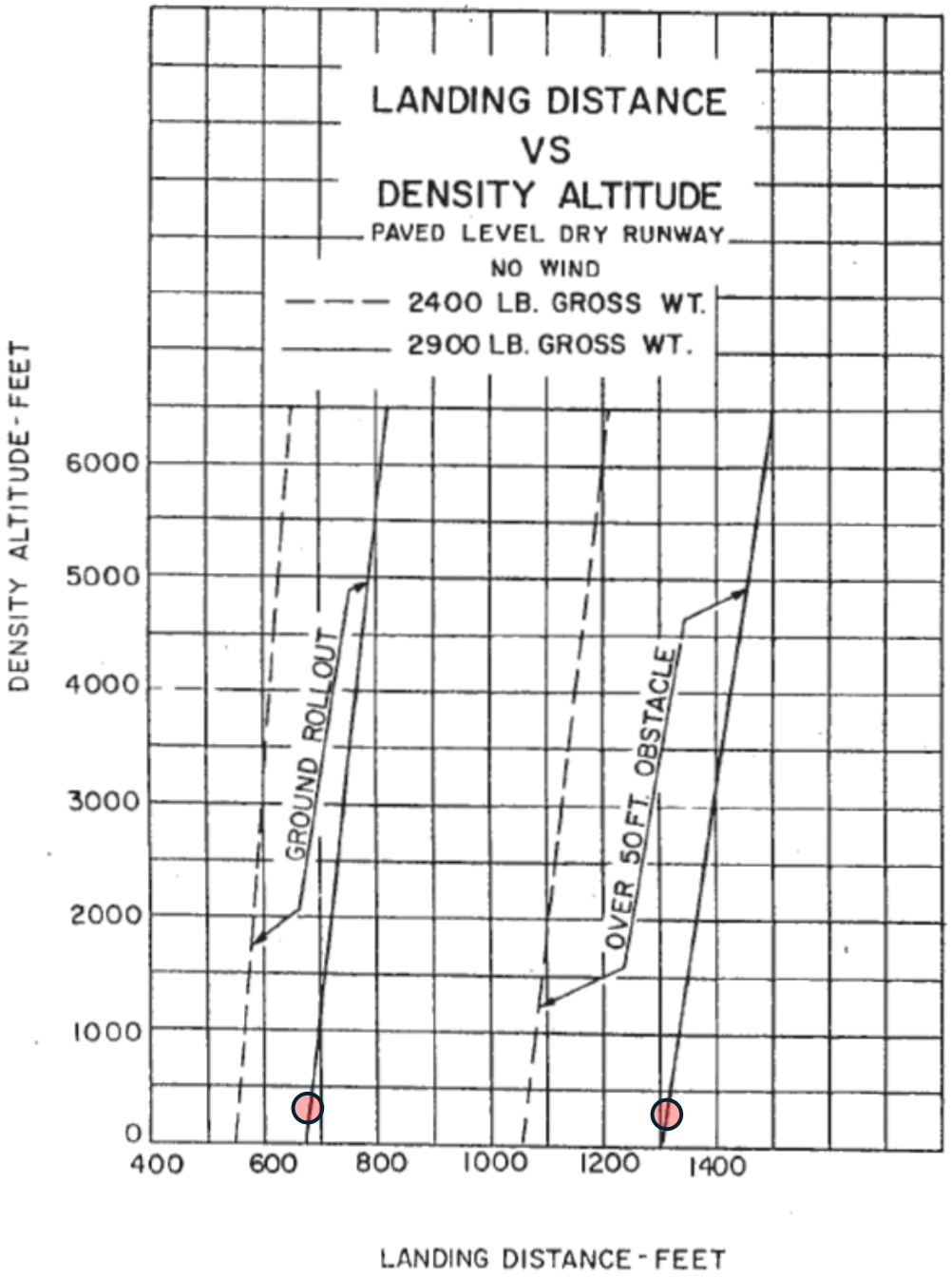
1075 sm, 11.5 gph, 153 HP

75% Power:

1000 sm, 12.7 gph, 165 HP

But wait! What RPM/MP is Piper using?

Landing Distance



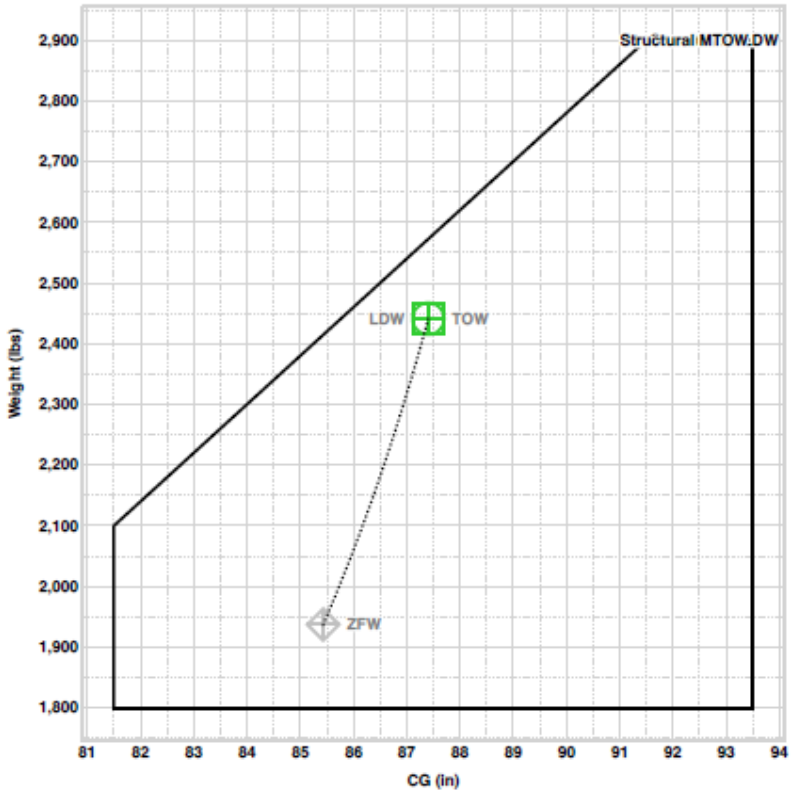
KCFD at 360’ and 2900 lbs

Ground Roll: 670’
Over 50’ Obs: 1320’

“How long can you fly using an hour reserve?”

The interpretation of this question has many possibilities. Please discuss with your checkout CFI.

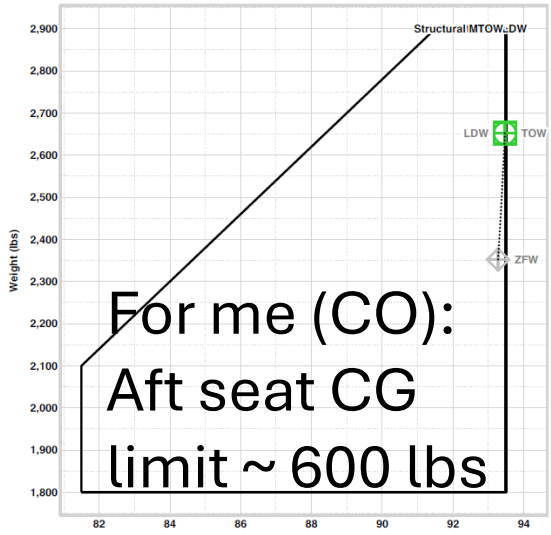
Weight & Balance

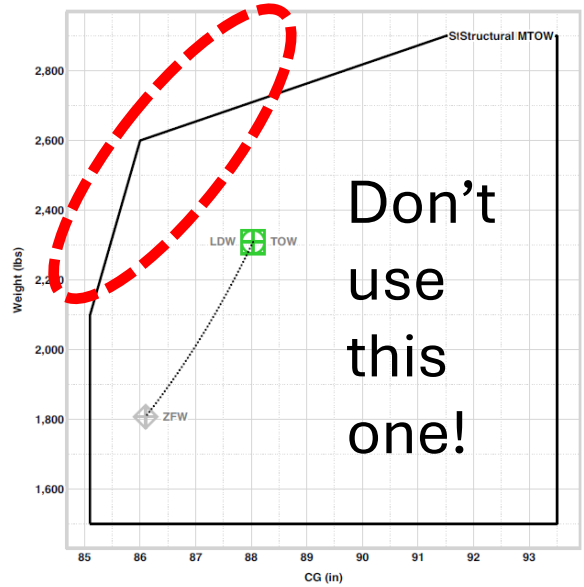


	Weight (lbs)	Limit (lbs)	CG (in)	FWD / AFT Limits (in)
BEW	**1,587**	**-**	**84.4**	**-**
Payload	350	1,313	-	-
Zero Fuel Weight	**1,937**	**2,900**	**85.4**	**81.5 / 93.5**
Wing Tanks	300	300	-	-
Tip Tanks	204	204	-	-
Ramp Weight	**2,441**	**2,900**	**87.4**	**85.8 / 93.5**
Taxi Fuel	0	-	-	-
Takeoff Weight	**2,441**	**2,900**	**87.4**	**85.8 / 93.5**
Fuel To Destination	0	-	-	-
Landing Weight	**2,441**	**2,900**	**87.4**	**85.8 / 93.5**

Key points:

- Fuel burn moves CG forward.
- No ZFW restrictions!
- Forward CG limit is nose-up stabilator limit.
- Rear-seat weight limit is aft CG (for me).
- Warning: Foreflight has a CG profile that is NOT valid for our short-stab Pathfinder!





PA28 Accident Survey

https://asn.flightsafety.org/asndb/type/P28B

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Piper PA-28-235

Piper PA-28-235

1 Piston engine

639 occurrences in the ASN safety database

508 fatalities

>>Add an accident

Filter by country

acc. date	type	reg.	operator	fat.	location	dmg
18 Jan 1964	Piper PA-28-235 Cherokee	N8554W	Non commercial	0	Ruidoso, New Mexico	sub
28 Feb 1964	Piper PA-28-235 Cherokee	N8559W	Commercial	0	Ogden, Utah	sub

Takeaways:

1. Power failure, especially at TO from 200 – 1000 AGL.
2. Fuel management
3. Overstress
4. Don't be this guy.