BONANZA

N [redacted] B

Check Performance Data

COCKPIT BOOK

WILSON JONES
U.S.A.
310-09

About this binder:
Look not a gift horse in the mouth.

Bonanza

Check Lists and Data

Tachometer 0471.9
7 October 1960
Took delivery Meacham fld
Texas

PAUL W. KLIPSCH
P.O. Box 96
Hope, Arkansas

Bonanza 504-B

Ser. No. D-1526

SUMMARY

1960 Tach 0471.9 7 Oct 60

0560.0 30 Dec 60

Hours 88.1

0765.0

205.0 31 Dec 61

TIRES Main 28 # psi

Nose 18 # psi

	Knots
Red Line	176
Max Structural (Normal)	140
Penetrating & Maneuvering	113
Gear Down	90
Flaps	87
Best Rate Climb	~~87~~ 93
" Angle "	~~66~~ 62
Stall, Power off g & f down	48
" g & f down clean	~~56~~ 52

Overhaul C40102 Tach 1148

WEIGHT u/radios etc:
Full main tanks, Normal fuel, Normal empty etc)

Load: Loose junk in cabin (Tools, Rope Fire X, Tape) etc)
ready for pay Load

2040 lbs

CHECK LIST ①

Before Entering Airplane

1. Ignition Switch – OFF
2. Engine Oil
3. Cowling – security
4. Carburator Filter cleanliness & obstructions
5. Propellor – Nicks & security
6. Pitot tube
7. Control Surfaces
8. Fuel – remove & secure caps
9. Inflation – Struts & tires
10. Exterior – obvious damage

After entering Plane

Dry Sump Engine – Do not turn propellor backwards!

1. Cabin – loose junk
2. Parking Brake
3. adjust Rudder Pedals
4. ~~4~~. Switches & Controls
5. Landing Gear Switches – flaps
6. Trim +3
7. Clock – altimeter
8. Flight controls – free full
9. Engine Cowl Flaps Open
10. RADIOS OFF

Start Engine

1. Parking Brake 2. Ign. Sw. to Batt.
3. Fuel Gages (TB) 4. FUEL SELECTOR-L
5. Wing Flaps Up 6. Engine Flaps OPEN
7. Mix – Rich 8. Prop HIGH
9. Throttle ¼" (3/4) 10. Ign BOTH (VACUUM!)
11. PUMP 12. Starter 13. Oil Press. 14. Radios

check list ②

Warm Up 1000 – 1200 oil 100°F
head 300° oil prcs: 80# Max

Pre Takeoff Radios ON

1. Flight Controls Again
2. " flaps "
3. Chk trim tab "
4. 1500 RPM Mags —
   X Loose gravel etc!
5. Full Throttle (?) 2100 static
6. Chk batt chg 2 < amp < 20
7. fuel pressure 9-14#
8. Mix RICH
9. Carb "cold" -- except in very cold conditions
10. oil temp 100°-225° F 30-80 psi
    head T < 525° F

Air Speed zero
Horiz. actuated
alt
DG uncaged
TB – NOD
Compass
Clock – (set)

DOOR

Takeoff – ① Brakes
② full throttle 2600 Max 2250 static
③ at 55 statute 50 N raise nose wheel
let it fly off at 65S 60N
④ at 75 to 80 (70 to 75 N) stable climb – raise wheels
– wait for 55 Knots – don't "pull it off"
& fly it off in a stall. Wait.
⑤ ~~20°~~ 10° flaps for obstructions
⑥ Max angle of climb 70 IAS (60 N) ??
DON'T DO IT – USE 70 N or more!

"Cruising Climb" 135 HP at 115 Knots

CHECK LIST ③

ENGINE FAILURE on Take-Off
lower nose, keep flying speed
try to start engine ...
land straight ahead
if landing area smooth lower wheels
" " " rough land wheels-up

CLIMB -- ① keep full throttle until wheels up
② Throttle back to 23" 2300 (E225)
(2150 for 185-11 engine)
③ Trim.

Best climb to cruise	105 Kts
Max rate	90 *
Max angle	60 **

* reduce one knot per 1000' altitude
** 10° Flaps 24" 2300 RPM?
(this is not a safe speed: too close to stall: use 70 or more)

CRUISE
120 HP Max
250 Miles: 9000' palt or critical: less than 250 mi, proportional

Engine Failure
look around; glide at
80 indicated (Knots)
Check switches, fuel
-- restart if possible

Look around.

Descent 140 Knots indicated (maximum)
control temp w/ cowl flaps (usually ~~generally~~ closed)
lower gear 90 Knots max
" flaps 90 " max
(note: yellow lines at about 100 Knots indicated and these seem to be tolerable speeds)

Downwind leg	80	Knots
base	80	"
final	70	"

Mixture Rich
fuel fullest tank
prop forward
Carb air cold unless icing is indicated.

Lowering gear - check, lights, pointer
Cowls open
wing flaps
Taxi - raise flaps
Radios - all not in use, OFF

Stop - mixture, switches off.
off - radio off.

504B
"BASIC"
~~"EMPTY"~~ weight
2040 lbs

This includes Radios, oil, 240 lb fuel
Loose cabin load (rope, fire X, O2 etc;
35 lbs of Jeppesen)

This allows payload plus
AUX fuel (120) of
610 lbs

2650 gross

Note: experiments indicate 2850 lbs "permissible if not legal"
(depending on Alt, Temp etc)

Std. Air

T_N (°C)	RPM 2300	2200	2100	2000
14000 -13	16.7"			
13 -11	16.9	17.8		
12 -9	17.1	18.0		
11 -7	17.3	18.1	19.0	
10 -5	17.5	18.2	19.1	20.0

add 0.3" per 10°C above T_N

120 kt

PERFORMANCE CLIMB

	18.6	19.0	19.2	19.5			
	19.0	19.2	19.4	19.7	20.0		
	19.1	19.3	19.5	19.8	20.1		
	19.2	19.5	19.7	20.0	20.3	20.6	
	19.3	19.6	19.8	20.1	20.4	20.7	
		19.8	20.0	20.3	20.6	20.9	
		20.0	20.2	20.5	20.8	19.5	
		20.2	20.4	20.7	21.0	19.6	
		20.4	20.6	20.9	19.5	19.8	
		20.6	20.8	~~19.3~~ 21.1	19.6	19.9	
		20.8	21.0	~~19.5~~ 21.3	19.8	20.1	

2100 9.5 gal NORMAL CRUISE

2300

16000	14.2	14.5	14.7			
15	14.3	14.6	14.8			
14	14.4	14.7	14.9			
14	15.8	16.0	16.2			
13	15.9	16.1	16.3			
12	16.1	16.3	16.5			
12	18.2	18.4	18.6			
11		18.5	18.7	19.0		
10		18.7	18.9	19.2		
9		18.1	18.3	18.6		
8		18.2	18.4	18.1		
7		18.3	18.5	18.8		
6			18.7	19.0	19.3	
5			18.9	19.2	19.5	
4			19.1	19.4	19.7	20.0
3			19.3	19.6	19.9	19.1
2			19.5	19.8	19.0	19.3
1			19.7	20.0	19.1	19.4
			19.9	19.0	19.3	19.6

2300 RPM
2100
1900
2000
2100 RPM

ECONOMY CRUISE 44.5% 100 HP

Remark for 2100 RPM

Maneuvering
113 Knots IAS
MAP = 17.7" 1900 RPM

10000	95 HP	70 HP	Same 15"
8	91	68	1900 for
6	87	66	500'/min
4	85	69	descent -
2	83	62	Wheels & Flaps down.

HOLDING 90 KTS
15" MAP

E225 Engine

640412

TR. MK. REG. U.S. PAT. OFF.

P. Alt	-20	-10	0°C	+10	+20	+30	
14000	16.7	16.9					
13	16.9	17.1	17.3				2300 10.3 gal 120 HP 53.5%
12	17.0	17.2	17.4				
11	17.1	17.3	17.5	17.8			
11	18.6	18.8	19.0	18.0			
10	18.6	19.0	19.2	19.5			
9	19.0	19.2	19.4	19.7	20.0		
8	19.1	19.3	19.5	19.8	20.1		
7	19.2	19.5	19.7	20.0	20.3	20.6	2100 9.5 gal NORMAL CRUISE
6	19.3	19.6	19.8	20.1	20.4	20.7	
5		19.8	20.0	20.3	20.6	20.9	
4		20.0	20.2	20.5	20.8	19.5	
3		20.2	20.4	20.7	21.0	19.6	
2		20.4	20.6	20.9	19.5	19.8	
1		20.6	20.8	~~19.3~~ 21.1	19.6	19.9	2300
S.L.		20.8	21.0	~~19.5~~ 21.3	19.8	20.1	

16000	14.2	14.5	14.7				2300 RPM
15	14.3	14.6	14.8				
14	14.4	14.7	14.9				
14	15.8	16.0	16.2				2100
13	15.9	16.1	16.3				
12	16.1	16.3	16.5				
12	18.2	18.4	18.6				
11		18.5	18.7	19.0			1900
10		18.7	18.9	19.2			
9		18.1	18.3	18.6			
8		18.2	18.4	18.1			
7		18.3	18.5	18.8			2000
6			18.7	19.0	19.3		
5			18.9	19.2	19.5		
4			19.1	19.4	19.7	20.0	
3			19.3	19.6	19.9	19.1	
2			19.5	19.8	19.0	19.3	2100 RPM
1			19.7	20.0	19.1	19.4	
S.L.			19.9	19.0	19.3	19.6	

ECONOMY CRUISE 44.5% 100 HP

Rework for 2100 RPM

Maneuvering
113 Knots IAS
MAP = 17.7" 1900 RPM

10000	95 HP	70 HP	Same 15"
8	91	68	1900 for
6	87	66	500'/min
4	85	64	descent -
2	83	62	Wheel, Flaps down.

HOLDING 90 KTS
15" MAP

P.Alt	-10	0°C	+10	+20	+30
9500	20.3				
9000	20.3	20.6	20.9	21.2	
8	20.4	20.7	21.0	21.3	
7	20.5	20.8	21.1	21.4	
6	20.6	20.9	21.2	21.5	
5	20.8	21.1	21.4	21.7	
4	20.9	21.2	21.5	21.8	22.1
3	21.0	21.3	21.6	21.9	22.2
2		21.5	21.8	22.1	22.4
1		21.6	21.9	22.2	22.5
S.L.		21.8	22.1	22.4	22.7

2300 RPM
11.4 gal/HR
HIGH CRUISE
146 HP
65%

Maximum Range IAS ≅ 113 KNOTS
(Same as Maneuvering ; use 17.7" MAP apx)

	HP	MAP (approx)	N.M./gal	TAS
12000	93	17.3	18.3	134
10	88		18.1	129
8	85		18.0	125
6	82		18.0	120
4	79	17.5	17.9	117
2	78	17.8	17.8	115
S.L.	77	18.2	17.8	113

MAP data subject to correction

Max Available HP at Full Throttle

Palt	2300 RPM HP	MAP		Std. Air		
20	94	13.1"	11.7			
19	99	13.7	Max Climb	2300; 23.0"		
18	104	14.5	46.2	F.T.		
17	108	15.2		Take off		
16	113	15.8	50.2	2500	2600	MAP
15	117	16.4				
14	122	17.0	54.3			
13	127	17.8				
12	132	18.5	58.9			
11	137	19.3				
10	142	20.0	63.1	153	159	128
9	146	20.4	65%	158	164	20.8
8	148	20.8		165	170	21.6
7	153	21.6	71.0	172	178	22.2
6	160	22.3	165	177	184	23.1
5	165	23.1	163	185	190	24.0
4	172	24.0	161	191	198	24.8
3	178	24.8	160	198	205	25.7
2	185	25.8	158	205	211	26.7
1			156	211	219	27.7
S.L.			155	218	225	28.7

169 HP = 75%
2300, 23.7" 5400'
4°C

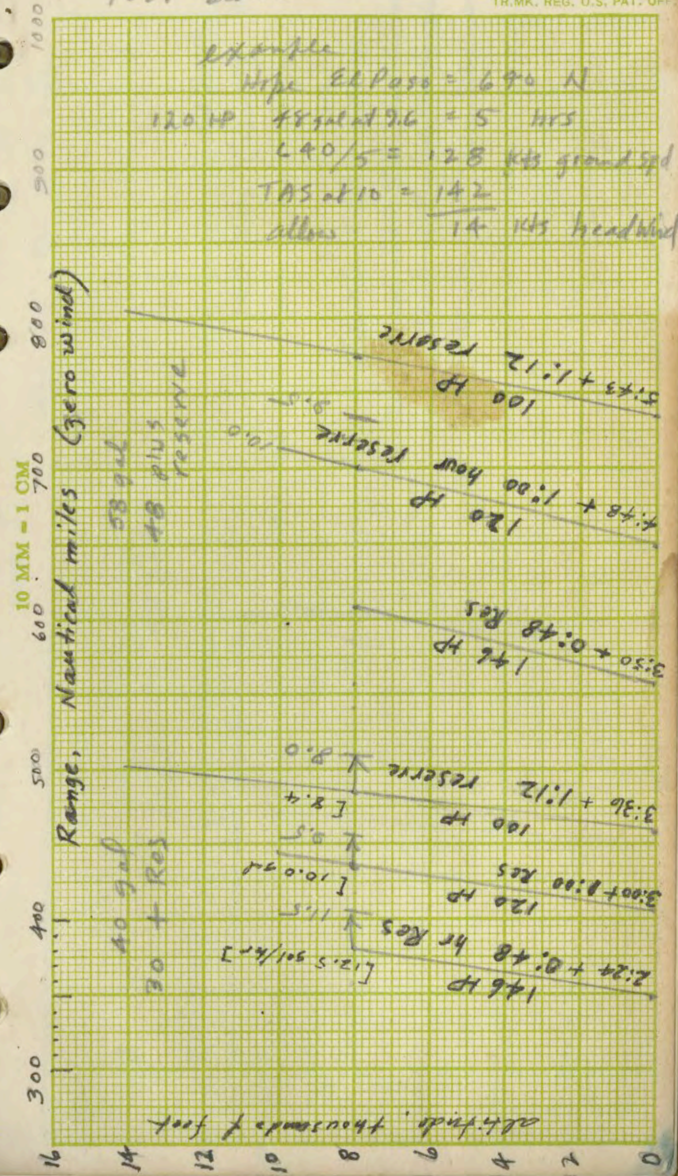
Performance
HP etc

PERFORMANCE

Range for 504 B
computed from latest
test data

641026.

TR.MK. REG. U.S. PAT. OFF.



ORIGINAL COPR. 1910 BY J. C. PARKER

LEFAX, PHILADELPHIA 7, PA., MADE IN U.S.A.

LEFAX, PHILADELPHIA, PA.

MADE IN U.S.A.

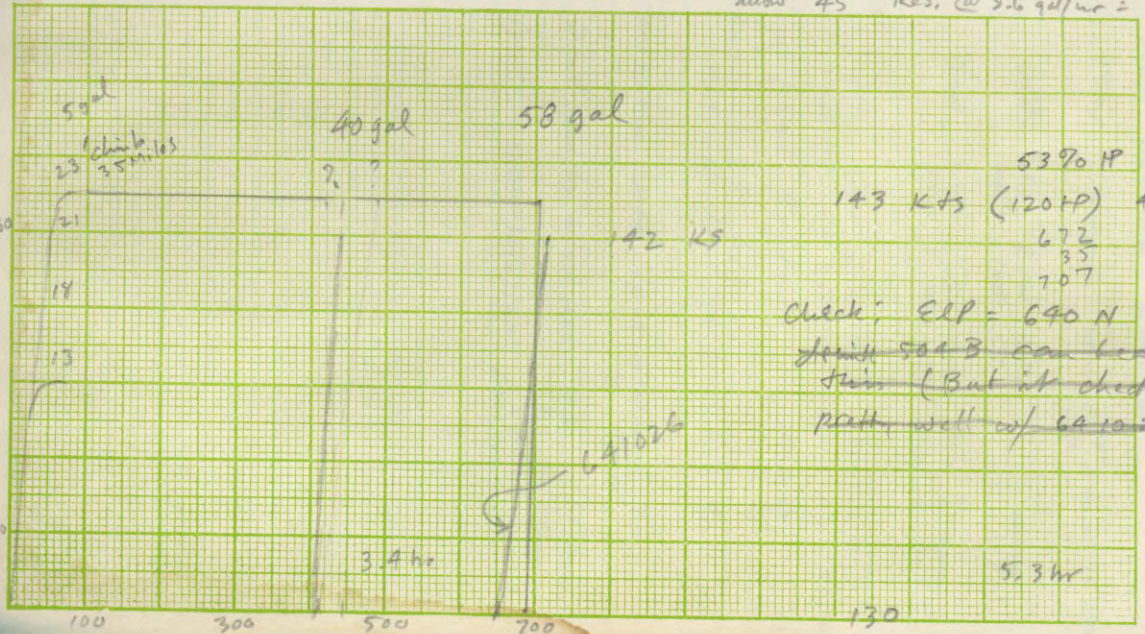
504 B

10 MM = 1 CM

allow 45' Res. @ 9.6 gal/hr = 7.2 gal

5/12

58/46



TRADE MK. REG. U.S. PAT. OFF.

661030

New "Numbers" 640304

TR. MK.REG. U.S. PAT. OFF.

Prop changed from 15° min at 30" sta
to 12° " " "

Old: 2100 RPM Static } approx
2250 take-off } 195 HP

New 2350 static 27.4" } approx
2500 take-off 27.0" } 205 HP

"all Bonanzas since Serial # D-1501 have

		page 60
Limit Load Factor	4.4 G	60
Ultimate " "	6.6 G	66
Static test to ultimate load factor	8.5 G	68

Penetrating speed V_p = Stall speed $V_s \times \sqrt{4.4}$

Stall speed by actual test 48 ~~f~~ flaps down
52 ~~f~~ clean
(kts)

but these were perhaps at 2400 lbs gross.

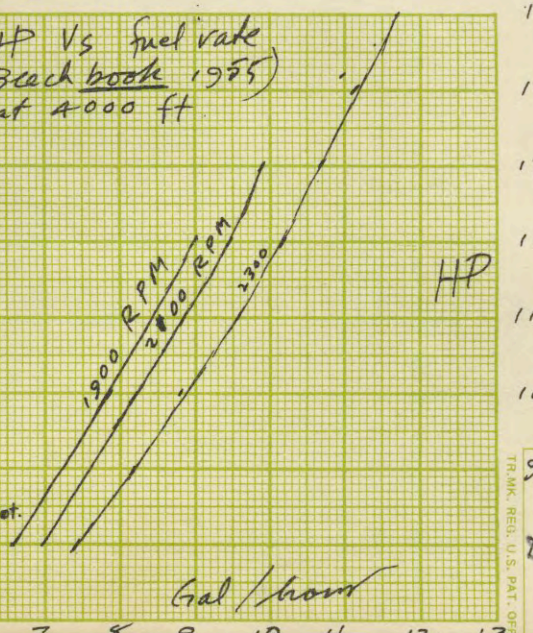
10 MM = 1 CM

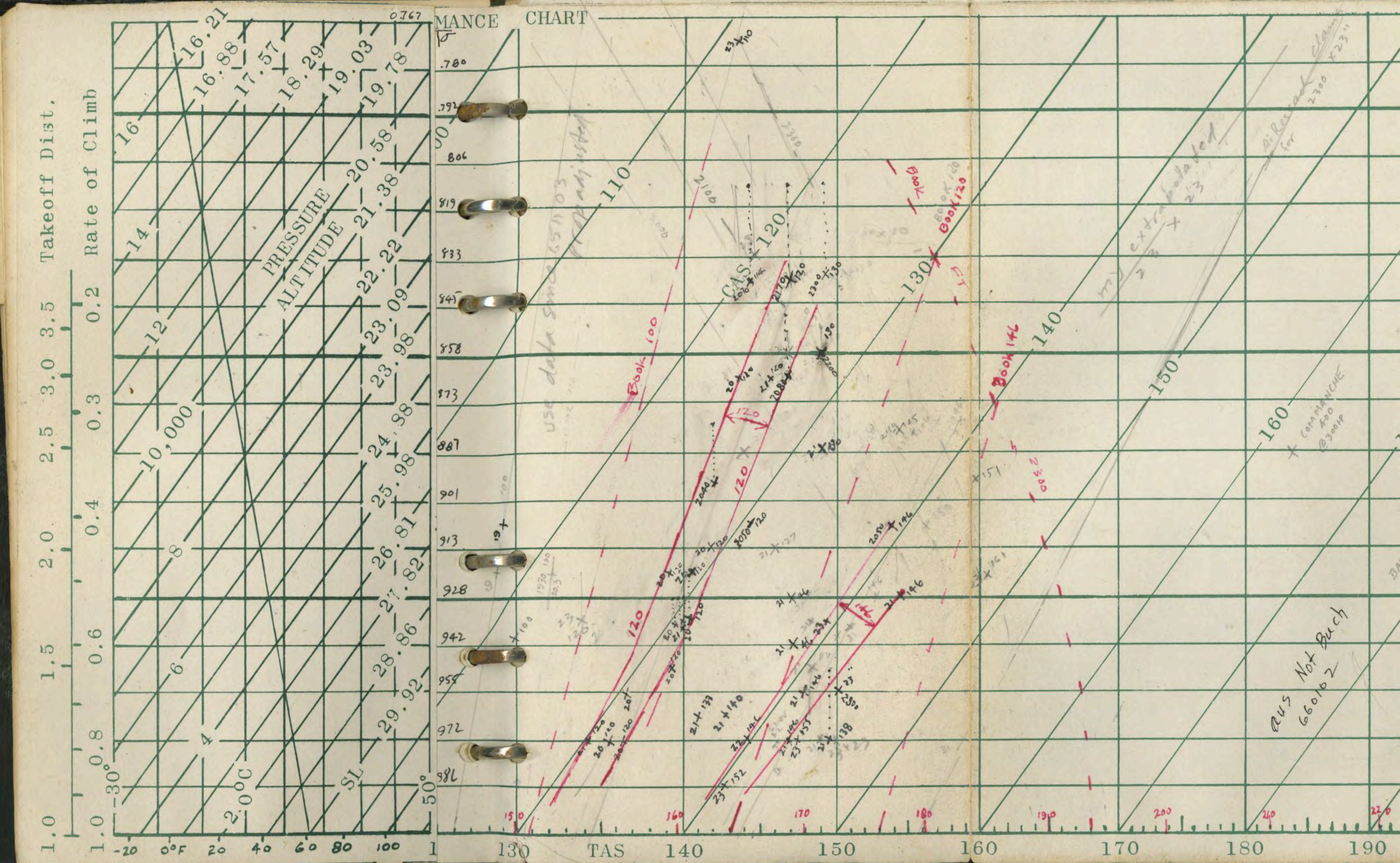
Notes made 5:10:16 based on Tests 65:10:12 - see flight log sheets.

Cruise is about 4 to 5 kts faster at 1900 & 2100 RPM than at 2300, for the same HP. Thus not only better fuel rate per hour but additionally better miles per hour.

1955 Book gives 23.5" @2100 as permissible to give 146HP @ 2000' 40°F

6000' 60°F 23.2" 2100 146 HP slidew 145 24"@70° Not.
4000' 60 23.8 2100 "

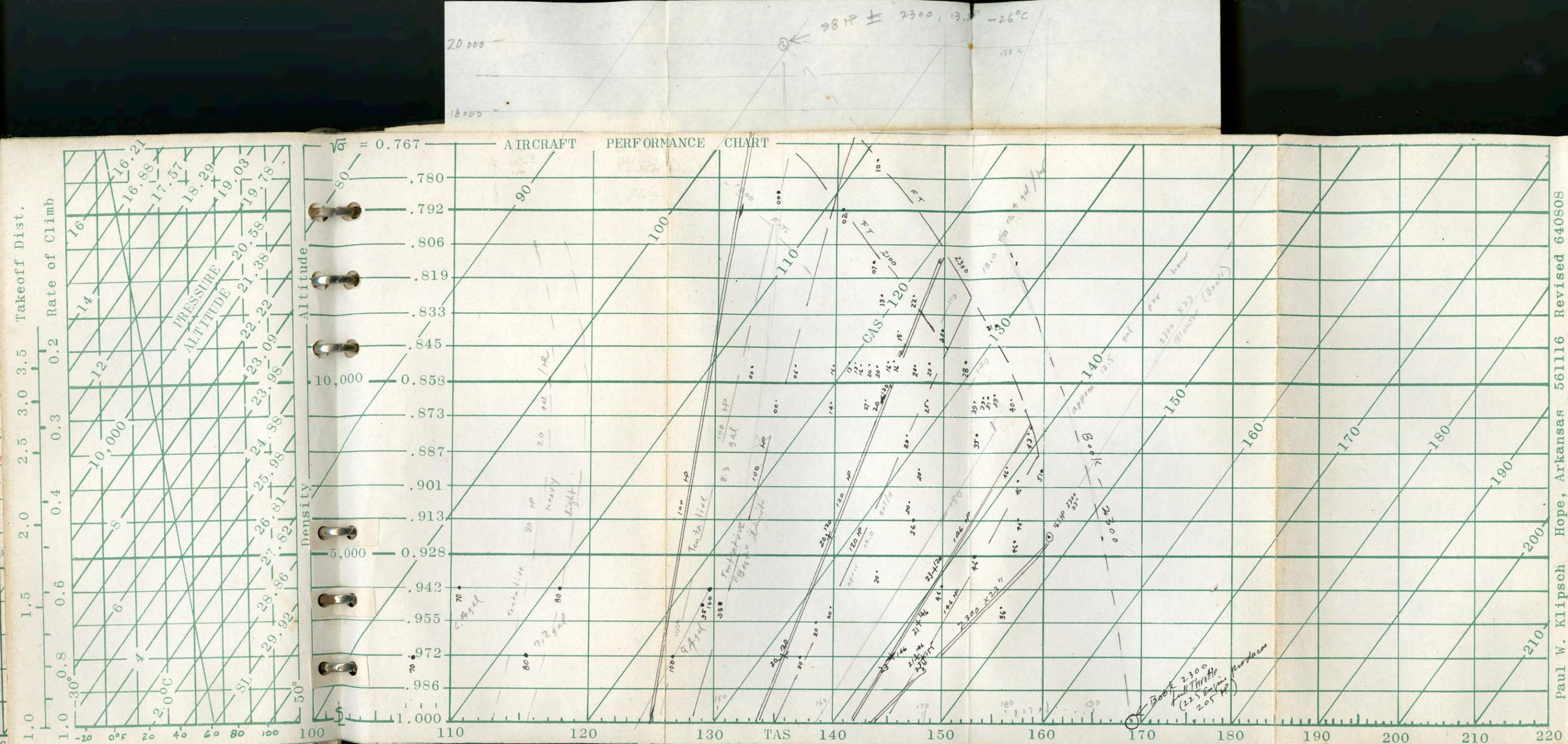




MANCE CHART
Takeoff Dist.
Rate of Climb
PRESSURE ALTITUDE
CAS
TAS
16.21
16.88
17.57
18.29
19.03
19.78
20.58
21.38
22.22
23.09
23.98
24.88
25.98
26.81
27.82
28.86
29.92
16
14
12
10,000
8
6
4
SL
110
120
130
140
150
160
-30°
0°C
50°
1.0
1.5
2.0
2.5
3.0
3.5
0.8
0.6
0.4
0.3
0.2
130
140
150
160
170
180
190
AiResearch Blower off
Book 100
Book 120
Book 146
My extrapolated
AiResearch
COMANCHE
Not such

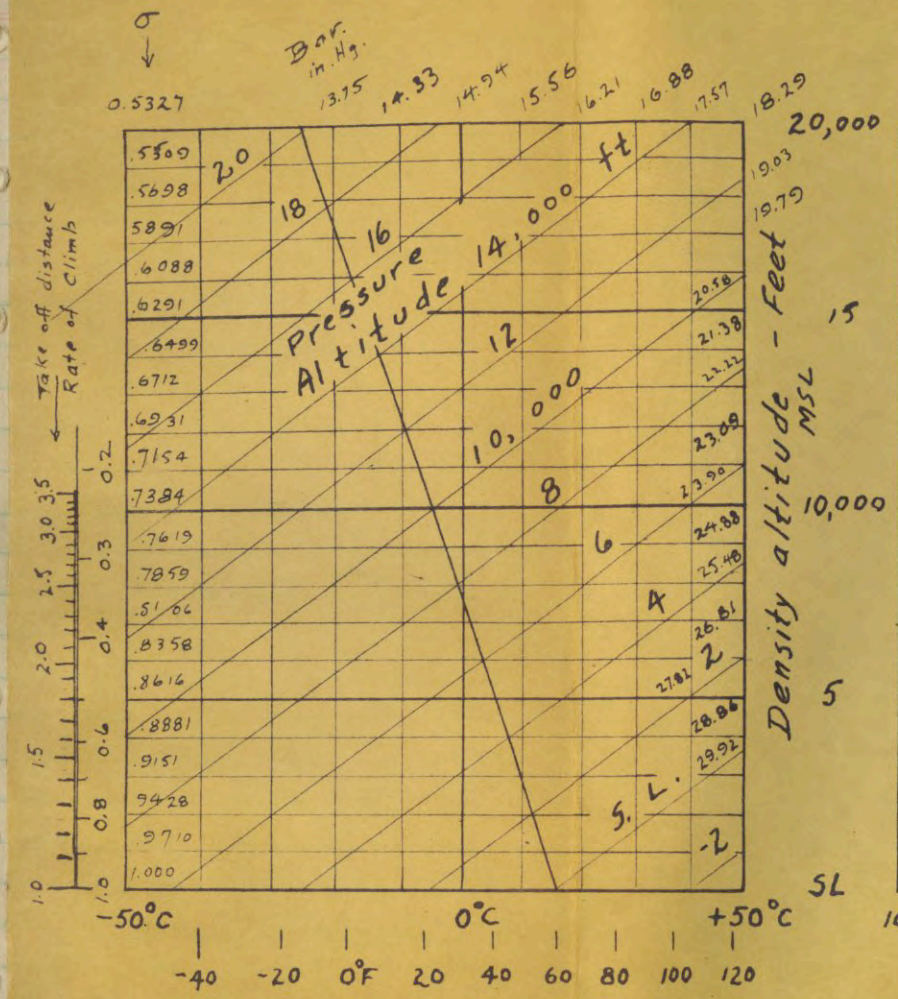
651223 Wheels down cruise at
~~75~~ 135 HP @ 8000# was
93 Knts indicated

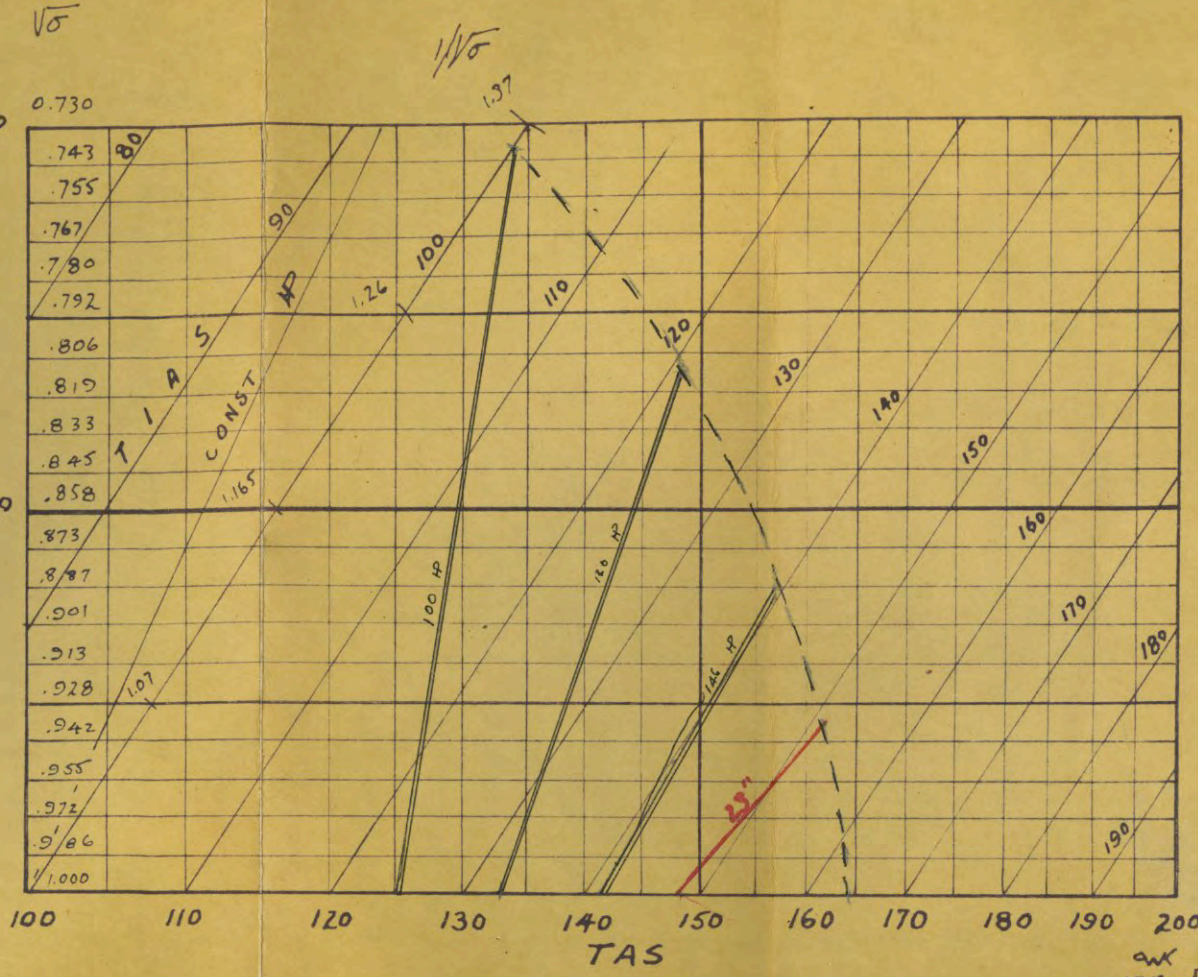
try 2200 x 2k compare to
23 23


AIRCRAFT PERFORMANCE CHART
√σ = 0.767
Takeoff Dist.
Rate of Climb
Pressure Altitude
Density Altitude
CAS
TAS
Paul W. Klipsch Hope, Arkansas 561116 Revised 640808

CRUISE CHART 100-200, 0-20

N 504 B





OWK
15 May 5
Rev. 6 Aug 5
15 Sept 5
30 April

CLIMB

Climb

650926

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New Glide Data

hi pitch

IAS Kts	descent '/min		IAS N/min	IAS '/min	Glide Ratio (and)	Eq. HP (and)
67	450		1.11	6780	15.0	31
70	450		1.17	7100	15.7	31
80	540	*	1.33	8100	15.0	41
90	750		1.50	9100	12.1	57
100	850		1.67	10100	11.9	65

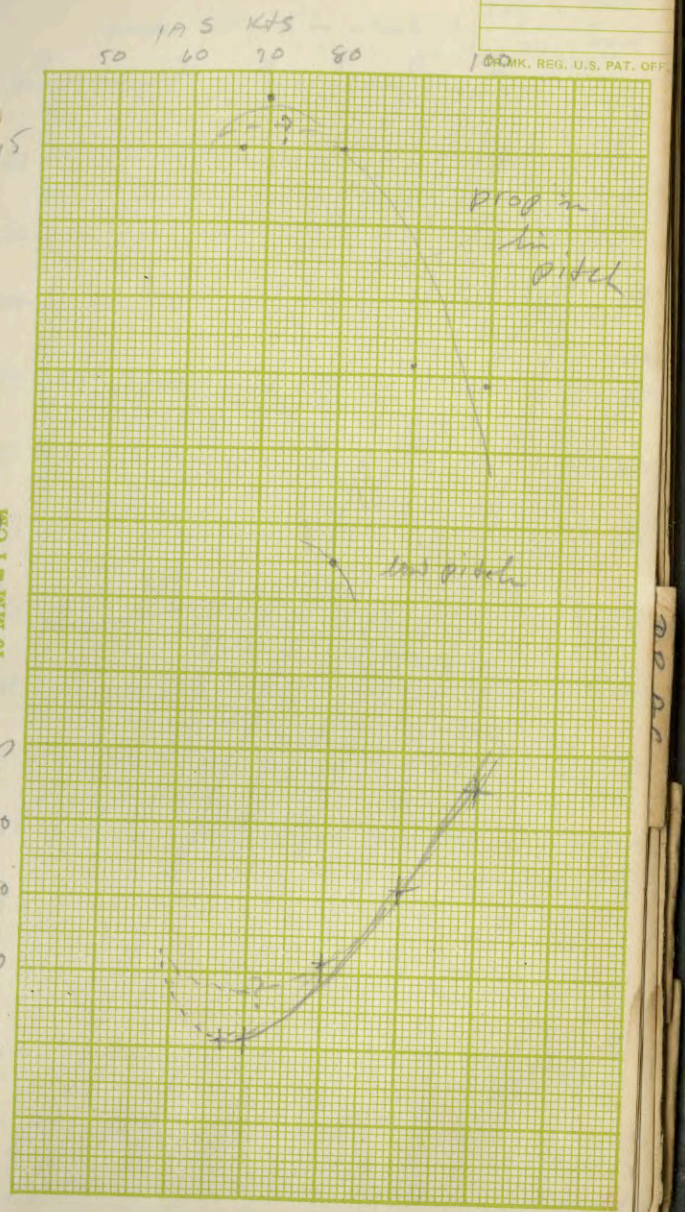
low Pitch

80	850		8100	9.5	65

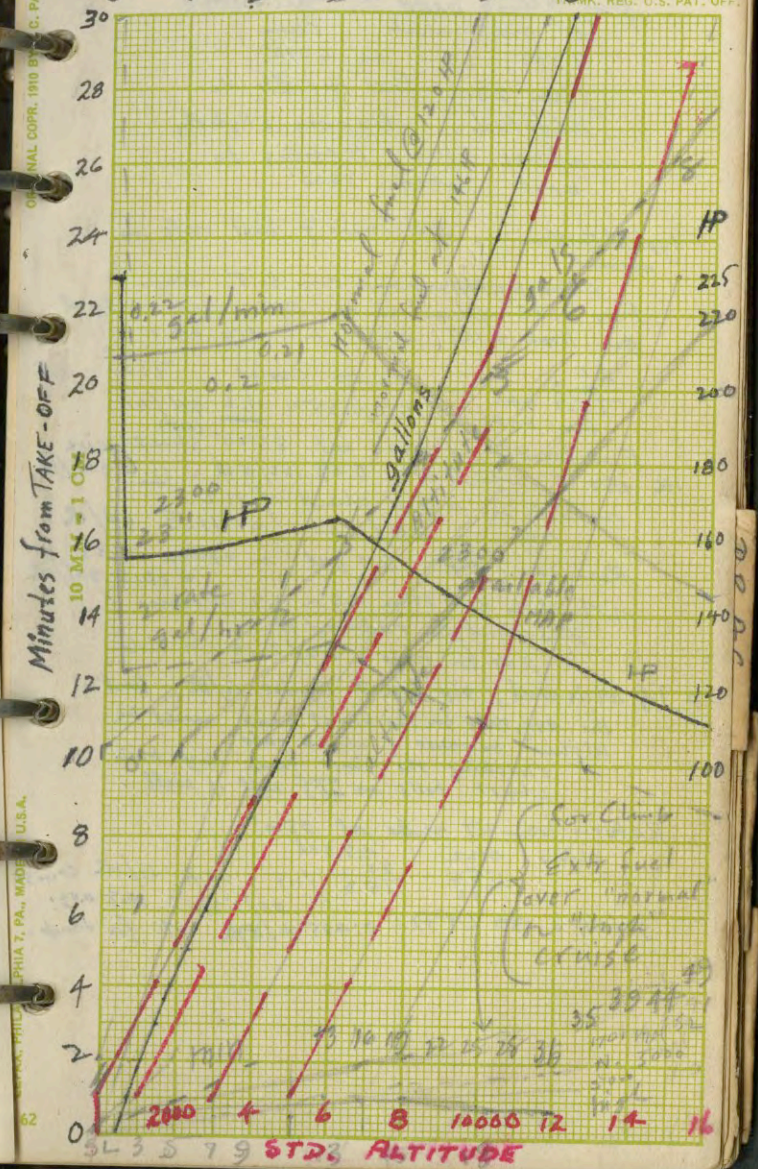
* held 80 IAS ; averaged

650
556
450
500
4 | 2156
540 '/min ↘

I think it would be profitable to repeat & refine these data


IAS Kts
50
60
70
80
15
10
eq HP
60
50
40
30
prop in fine pitch
low pitch
10 MM = 1 CM

650728
Fuel to Climb chart
2300 RPM
(OVER)



fuel to climb based on full throttle for one minute, then 2300, 23" to 6000' then 2300 full throttle to altitude. leaning slightly above 4000' leaning to "best" above 7000'

Typical Problem. Determine if fuel rate is normal.

Climb to altitude and run L.T. dry.

For 8500' Chart gives 0:20 and 4.3 gal.

On Hope → ICT trip LT dry at 1:41.

$\frac{1:41}{:20}$

$\frac{20}{4.3}$ gal / 15.7 gal fuel rate → cruise $\frac{1:21}{1:21} = 1.35$

15.7 / 1.35 = 11.6 gal/hr. (at 15°) should give

Full Throttle at 2300 at 8500' which at 0.48 lbs/HP HR = 11.6 gal/HR which is a good check of 11.6.

Avg. = 20 / 1:41 = 11.9 gal/HR.

Remainder of trip 6.0 gal in approx 0:33 = 10.9 gal/HR

Which is less than 11.6 or 11.7 because of descent & reduced HP.

avg for trip 26 / 2:14 = 11.6

→ If all is well, trip G/HR ≥ cruise G/HR, but the avg. rate for the first tank will be higher because of climb rate. checking the first tank by this chart tells us if all is well.

Return from ICT → Hope at 9500'

climb 0:22 4.7 gal

LT $\frac{1:52}{1:30}$ $\frac{20}{15.3}$ / 1.5 = 10.2 G/HR cruise

20 / 1:52 = 10.7 avg.

9500' HP = 137 (15°+) = 0.485 #/HP/HR o/c for temp.

drag

DRAG

Summarized → 630414

Drag Data, collected over the years

504B	
2300 # Gross	2600 # gross
$\frac{108}{159} \times 375 = \underline{253}$ lbs	$\frac{108}{166} \times 375 = \underline{259}$ lbs
D = drag	

Note: 108 HP based on 90% efficiency and 120 HP shaft HP

8000'	$\frac{108}{169} \times 375 = \underline{240}$	$\frac{108}{166} \times 375 = \underline{244}$
ΔD	= 13	15
ΔV	= 10	10
$\frac{\Delta D}{\Delta V}$	= 1.3	1.5

Avg: $\Delta D/\Delta V$ = 1.4 lbs per statute MPH
per 0.87 Knot
1.6 lbs / knot

504B at "cruise": Drag 244 # at 8ft. alt.

Cessna 2925A "180" @ 7500' (alt)
2500 # 158 HP shaft, 142 # thrust

$\frac{142}{153} \times 375 = 348$ lbs thrust

Commanch 188 HP shaft
169 HP thrust @ 90%

180 statute (Book)
$\frac{169}{180} \times 375 = 342$ lbs ↓ Comanche 180

at 160 MPH	160 MPH 135 HP shaft 121 thrust
$\left(\frac{160}{180}\right)^2 \times 342 = 270$ lbs	$\frac{121}{160} \times 375 = 284$ lbs
166 MPH: $\left(\frac{166}{180}\right)^2 \times 342 = 291$ lbs	

ancient history and subject to considerable error. CESSNA 190. at 17 gal/hour, HP ≃ 200 or more. Thrust HP ≃ 180 or more at 90%

$\frac{180}{150} \times 375 = 450$ lbs thrust. (Wow!)

Base on Obverse page & 23 Sept 60 exp

1.6 lbs / Knot TAS

504B has maybe 10 feet of wire (since King antenna installed which assumed to drag less than 1 lb)

$10 \times \frac{4}{6} = 7$ lbs drag.

This could cost 4 Knots

"Cleanup" 27 Feb 61

Tried so far:		Σ
Nicks in prop	4 MPH	4
New Metal prop	4	8
Headlites	0	8
Wing tips (+ lites)	0	8

There remain:

1. Wingtip, full treatment
2. Root Fairings
3. "Brush" strips in flap-aeleron elevator slots and gaps
4. Antennas
5. fairings over drain cocks.
6. OAT sensor sticks out of highest velocity surface on the plane.

What is a "strip Brush Seal" *

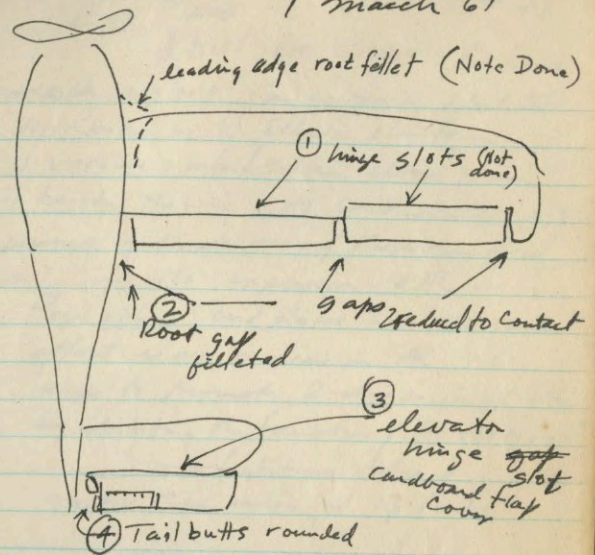
* Raspet & Lambros ONR review 1954 see reprint in "Cleanup" file

I am not impressed with the Swartzberg smooth up which results in sensitivity to dirt particles. Maybe not as bad as "one small inset attached to the wing will trip the boundary layer ..." (STOL paper relating to suction)

Also I didn't get any improvement from headlist cleanup.

630810 wig tip end fillets apparently cost 3 kts at 120 HP, 3000', 25°C.
apparently cost less at 10,000' 10°C

1 march 61



① Wing gaps reduced from 3/4" to about 1/8" or ~~to~~less (actual contact)
② Root gap faired in and sealed on top
③ Elevator hinge gap covered w cardboard flap
④ Tail butts rounded
⑤ Not Done: leading edge root fillet

Well I found out 4 more things that don't ~~work~~ work!

END Plates 630502

I tried 'em 630810 - No Good

Dommasch sec 119: Can approach ideal lift distribution by (1) Elliptic planform 2) varying airfoil section along span 3) twisting the wing, 4) Combination of 1, 2, 3.

Experiment indicates none of these can yield $e = 1$ in the expression eAR.

Page 126 "end plates have the same effect as an increase in AR ... tends to promote 2-dimensional flow by inhibiting the formation of tip vortices".

"-- a fictitious value of e greater than unity w/ tip tanks"

Bonanza span 32' 9 7/8"

32.822 ft : b

S = area = 177.6 ft^2 =

mean chord $\frac{177.6}{32.82} = 5.41$ ft $\bar{c}$

chord at tip 3.67 ft

$AR = \frac{32.82}{5.41} = 6.06$

check: $AR = b^2/S = 32.82^2/177.6 = 6.06$

$\pi AR = 19$

$$C_{Di} = \frac{C_L^2}{\pi AR} \qquad (5:13)$$

which say for min induced drag, AR should be as large as possible

-- span efficiency factor e

$$C_{Di} = \frac{C_L^2}{\pi e AR} \qquad (5:17)$$

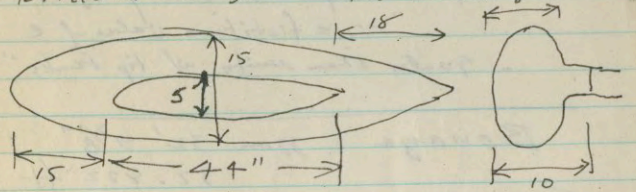
Total - drag coefficient

$C_D = c_d + C_{Di} = c_d + \frac{C_L^2}{\pi e AR}$

c_d = is composed of skin friction and pressure drag. & varies w/ Reynolds number; C_{Di} does not vary w/ " No.

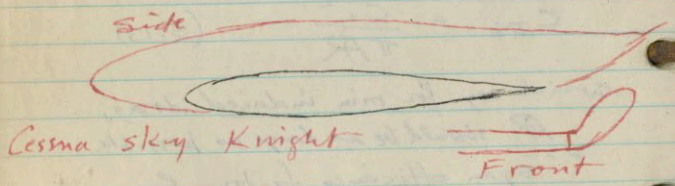
$c_{d_{min}} = c_{d_{max}} \left(\frac{R_{N_2}}{R_{N_1}} \right)^{0.11}$ 4.28

630516 : Debonaire
Brittain 20 gal metal tanks &



all dimensions roughly approximate.

Wilbur Wright "The only bird that talks is the Parrot and he doesn't fly very well"



Airport – Compton
OKLAHOMA Fuel EXEMPTION PERMIT No. 936 331

POWER C
Power Requir

these curves are supposed to be "general" if IHP = $\sqrt{\sigma}$ HP is used as ordinal.
656110 – here is a "payoff"

Farmington → Twin Falls, 16500'
HP = 110 $\sqrt{\sigma}$ = 773 IHP = 85
IAS = 111
This fall exactly "on R_N curve" & I marked it + "

Climb is inseparably related to drag.

$C_D = c_d +$

c_d = is comp...
pressure ...
number ...

c_d ... mn

630516 :
Brittain

15

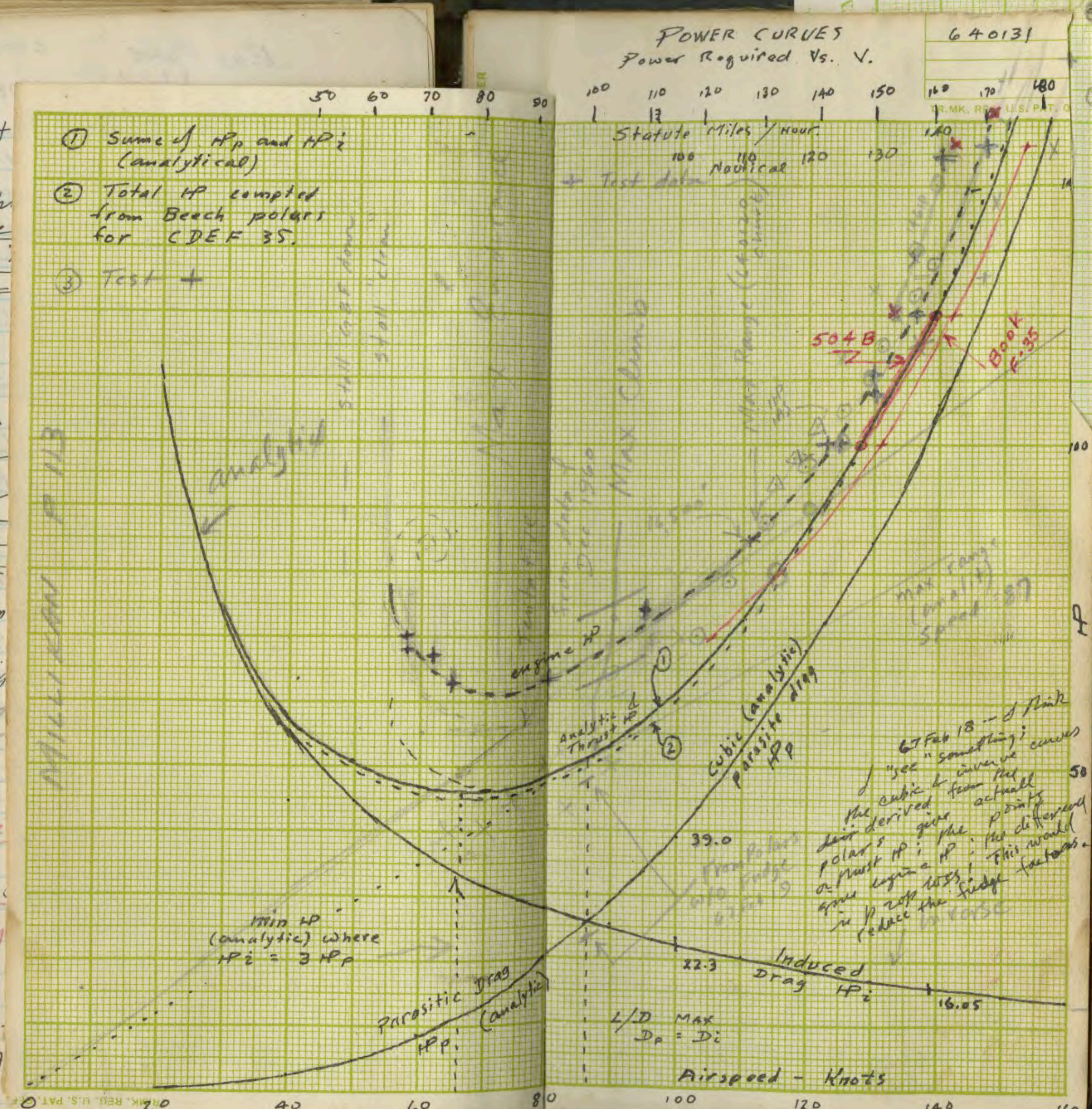
all dim...

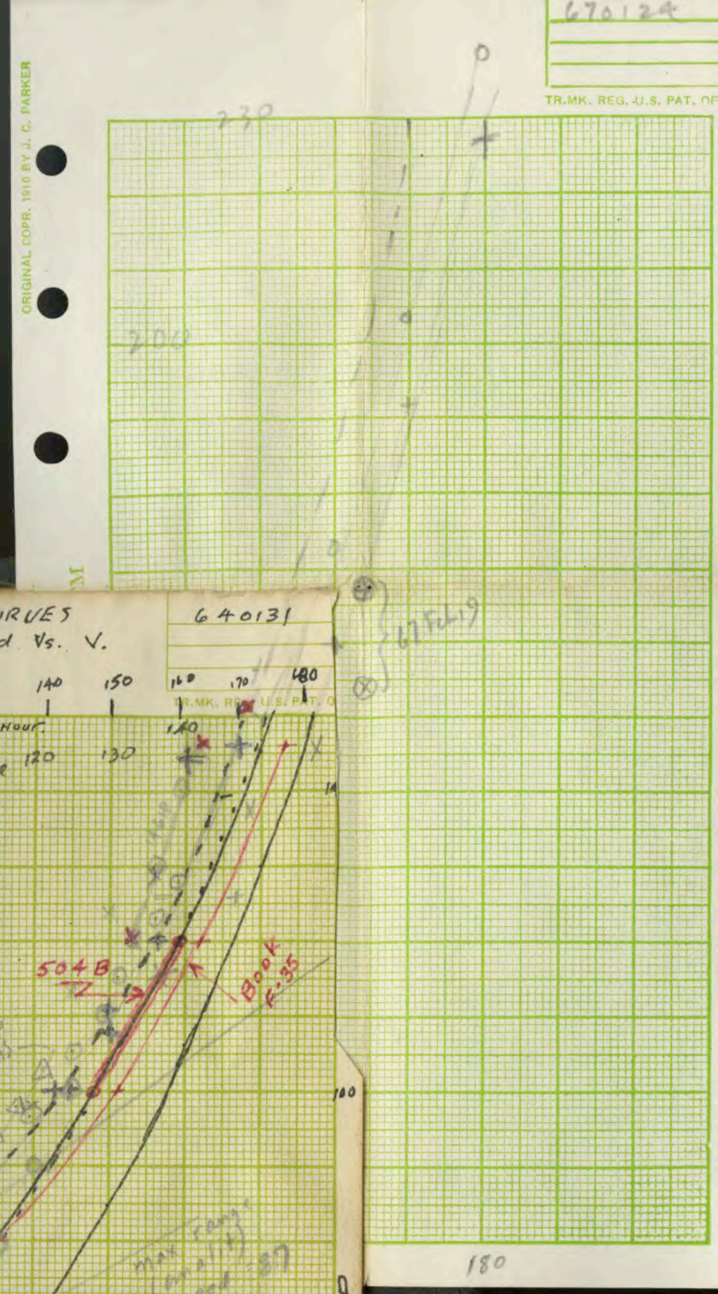
Wilbur Wrig...
that ...
Parr...
fly...

Side...

Cessna sky...

Airport ...
OKLAHOMA





Bonanza 60 4 B

Drag Data

assume 120 shaft HP = 108 prop HP

Sea level

2300 # gross	2600
$\frac{108}{159\ MPH} \times 375 = 253$ lbs	$\frac{105}{156} \times 375 = 261$ lbs

8000 feet

169 MPH	240 lbs	165 MPH	244 lbs
$\Delta D =$	13 lbs		17
$\Delta V =$	10 mph		9
$\frac{\Delta D}{\Delta V} =$	1.3		1.9

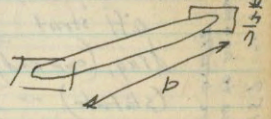
avg $\frac{\Delta D}{\Delta V} = 1.6$ lbs drag per mile per hour.

End Plate Hoerner 7-9

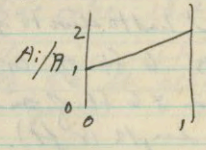
Effect is to increase effective aspect ratio by the same amount that an increased wing area would do. If Ai = aspect ratio increase, A = aspect ratio

$\Delta Ai/A = K\ h/b$

$k \cong 1.7$



page 7-10



In other words, a certain end plate area would give about as much effect if it were simply added as an extension to the wing.

The only advantages of end plates: (1) a place to put vertical antennae (2) storage space due reduced actual span.

19 Feb 62

S+L → IDL
145

of 1927C
1927A = 1527Z

29000 Boeing 707

Holding 0:30'
landed 1230 1730 Z
on the ticket disk 1330 E
In the air 2:03

Ar. BOS approx 10 PM via
New Haven R.R.

Antenna Drag AN-104B 21" long
0.7 lb drag at 175 Kts
4 | 2.75 " " " 350 :: page 27-32
∴ 0.7 @ 175
Collins 37-R-1 is same mast
bent back --- "this reduces aerodynamic
drag". VSWR < 1.4:1 over
118 - 136 MC band.

Experiment date? Summer 1960
Cessna 180 N2925A
Tied 18' of "Rip Cord" (#18 pair) to
left strut at point about 6' apart.
drag, (one end) was 21 lbs at 150 IAS
(statute) -- I had to dive to get 150.
This represents 6 ft of crosswise
wire and 2 x 6 ft of in line wire
(total wire length 18 ft).
The 18 feet was allowed to trail
and the thing flopped too much to read
drag but it might have been a pound or
2 total. Lift strut causes turbulence.

See Dommasch p 157 -- suggests
1.5% of (parasite) drag due to antennas
Total

67 Feb 23

Bonanza Glid Ratios
(2750 gross ... F-35)

Altitude	0 Wind miles	20 MPH headwind	20 MPH tailwind
1000'	2 1/8	1 7/8	2 1/2
2	4 1/2	4	5
4	9	8 1/8	10 1/2
8000	18	16 1/2	21 7/8
Glide Ratios:	12	9.55	14.7

approx 2 1/4 miles per 1000 feet
prop in LOW RPM
"Best Glide Speed"?

Best Glide speed is probably
somewhere between 80 and 100 kts
:: perhaps about 90

(usually glide to normal landing is
with prop in HI RPM and data
based on this would be different
for LOW RPM)

I recall TRAVEL-AIR gives
"approx 2 1/2 miles per
1000 feet" at 120 miles
per hour w/ both props
feathered" ... surprising by
this is same as Bonanza
(nearly)
2.5 miles

Glide ratio 13.2

52.80
10560
2640
13200

Bonanza: 1/8 mile subtracted to get to
field with 50 ft altitude. Restoring
this 1/8 gives 2.25 per 1000 ft
10560
1320
11880 / 1000 ≃ 12.0 : 1

How come TVL AIR is Better than
Bonanza! (can't feather
a Bonanza!)

Bonaza rate of sink

2.25 miles / 1000'

at 90 Kts 105 MPH

2.25 miles in 1.30 minutes [1.28]

$\frac{1000}{1.30} = 770$ ft/min

2750

$HP_T = \frac{770 \times 2750}{33000} = 64$ $HP_E \cong 75$

100 MPH

1.35 min

740'/m

62 HP_T

73

110 MPH

1.24

~~740~~ 800'/min

67 HP_T

78

640201

TR. MK. REG. U.S. PAT. OFF.

The POWER CURVES of 640131 purport to be valid for any altitude if V is indicated IAS and HP is indicated $HP_I = HP\sqrt{\sigma}$.

From Cruise Chart 120 HP at $\frac{1}{2}$ gives

V = 142 (Book) or 139 actual.

at 10000' 155 (Book) or maybe 152 actual

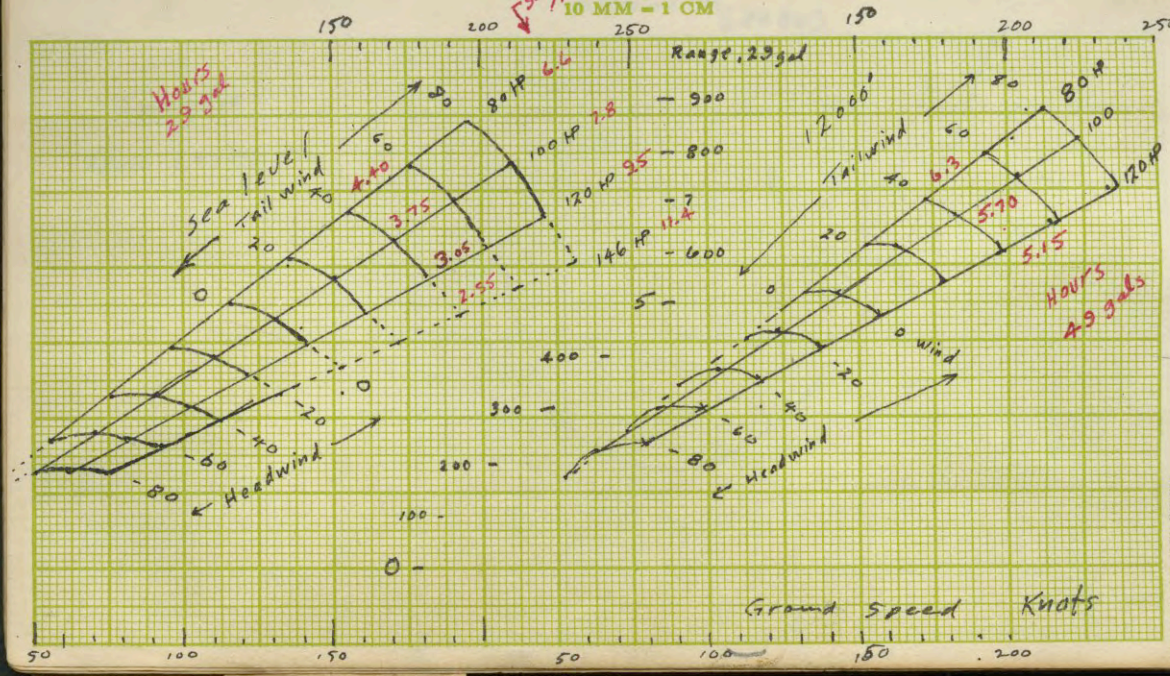
at 10000' these IAS values are 133 and 130

HP_I (10000') = 120 × 0.858 = ~~###~~ 103

133 and 103 fit the "Book" curve

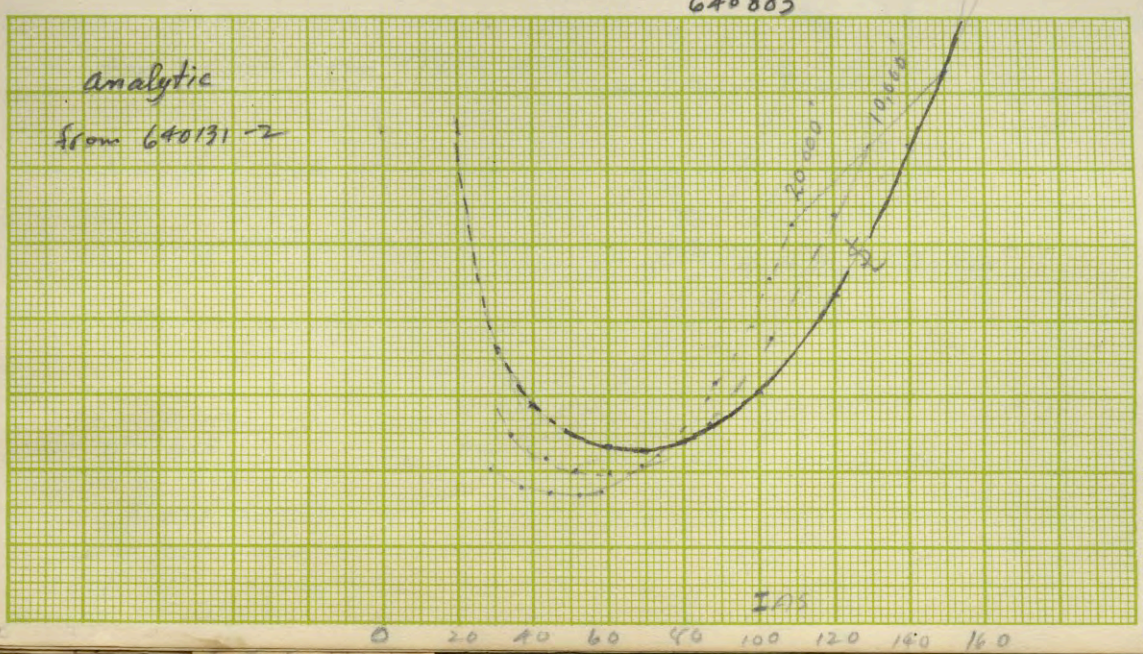
130 and 103 fit the 504B ",

[Nautical Miles]

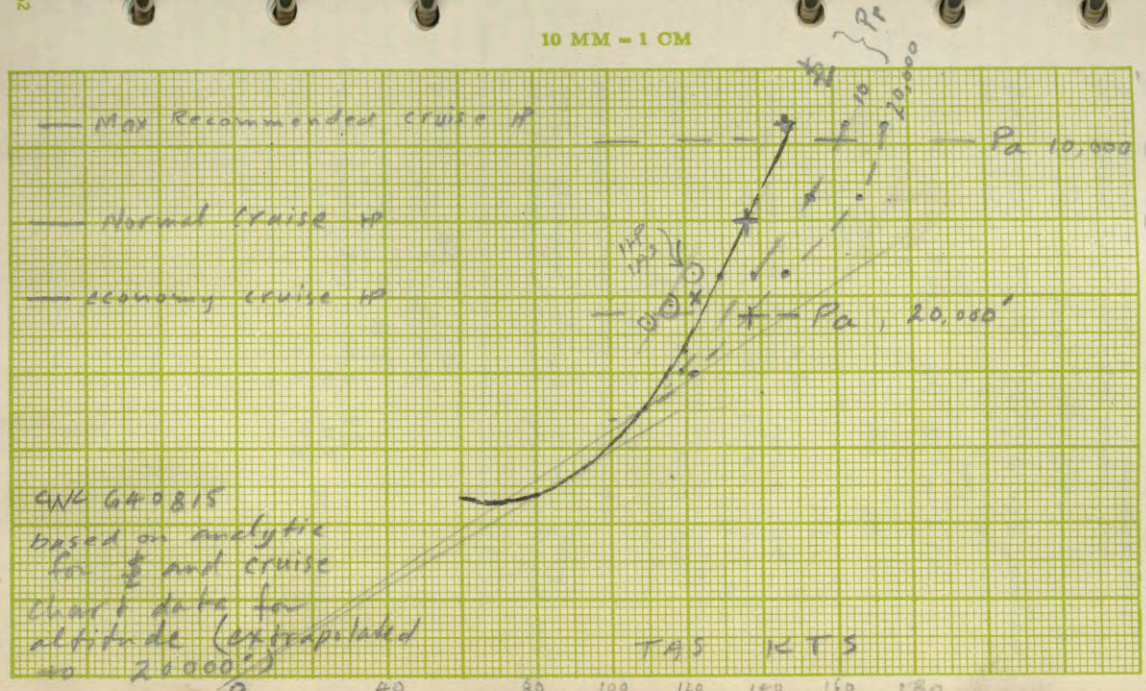


640124

10 MM = 1 CM 640803



10 MM = 1 CM



6 to 8/5

Since the "basic performance curve" --- airspeed vs HP is valid for all altitudes if

$V\sqrt{\sigma}$ and $HP\sqrt{\sigma}$

are used, then the graph would be valid for IAS and "HP" or HP_i

where here $HP_i \equiv HP \cdot \sqrt{\sigma}$

10000' 2300 Full Throttle HP = 142

$\sqrt{\sigma} = 0.858$

$HP_i = 122$

from analytic curve IAS = 138.

Beech book gives 137 IAS kts

161 true "

20000' 2300 13.1" HP = 95

$\sqrt{\sigma}$ 0.73

$HP_i = 69.5$

analytic curve seg 108 IAS

The Blower Boys and my extrapolated curve give about 98 IAS

134 TAS

16500' $HP_i = 110$

$\sqrt{\sigma} = 0.773$

$HP_i = 85$

analy curve seg 120 IAS

I got 114 IAS measured

147 TAS

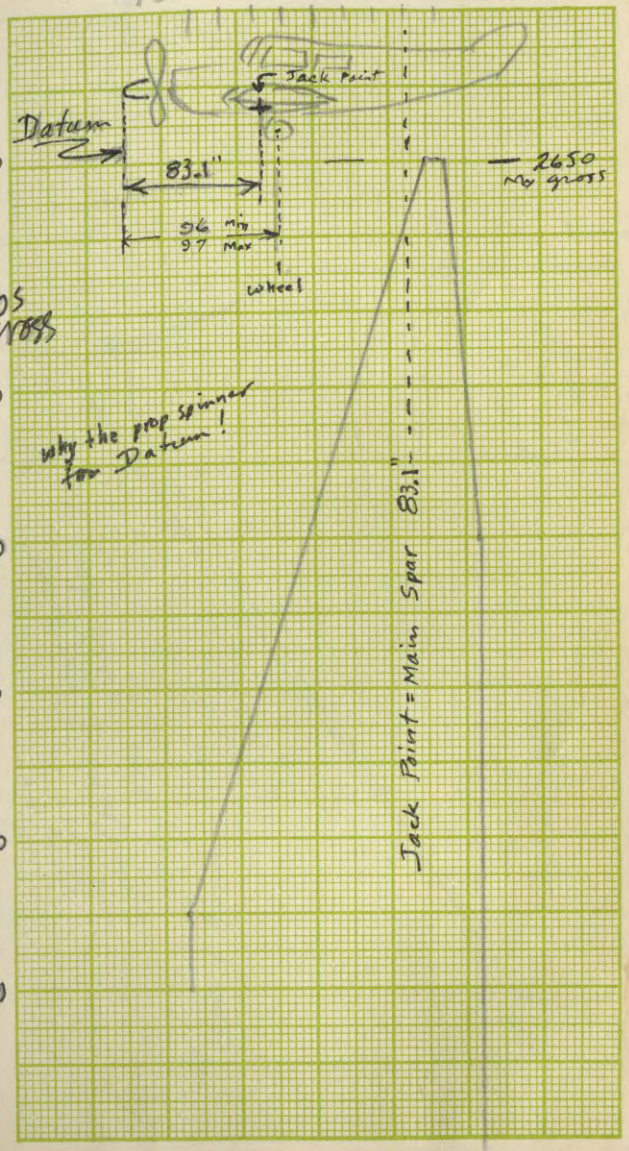
Weight &
Bal

Weight & Bal

Bonanza A-35
504B
640807

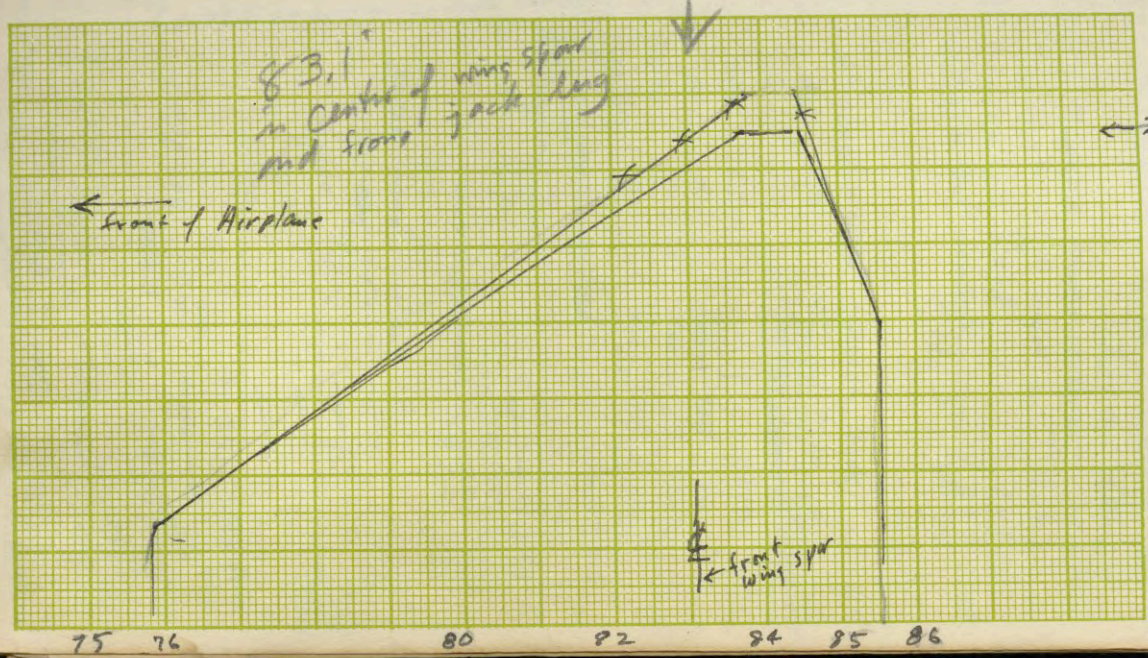
CG aft of datum

75" 80" 85" 90"



165 gross

10 MM = 1 CM



o/a 610211
Revised 651204

504 B

Weighed w/ oil & 348 # fuel
2114 lbs

Removed flares 8 Mar 61 — 17 lbs

net — 2097

fuel — 348

Empty but including OIL — ~~1749~~ 1742 *

6 20929 removed remote compass = -7 lbs

Original Weight (Beech Book) 1580

oil	20	Eng & Prop	18
Paint	10	~~Ballast~~	~~15~~ ~~subtract~~
Aux	17		100
Hor	4	Leer ~~Narco~~ 12E	26
D.G.	4	Narco II	20
Eng. Vac.	4	King 100/200	12
Remote Comp 4	subtract		~~168~~ 158
35 Amplifier	4		1580
	67		~~1748~~ 1738 *
		Mark 12 & Alternator	20
			1728

58

loose load — O_2 12
~~Airbox SF~~ ~~5~~
deice, firex — ~~4~~ 2
tools — ~~5~~ 2
rope — ~~5~~ 2
~~31~~ 26, 18

1728
~~1738~~
348
~~2086~~ 20 2076

1754
~~1780~~

Jeppeson ~~30~~ 20 ~~(onBk) 5~~ 3

~~1810~~ 1784
240
2024

~~1785~~ 1759
240
1999

fuel 240 : optional 348

→ ~~2050~~ 1999 ← "USEFULL" empty weight *

~~1755~~ 1733
1760
~~1773~~
Base Load ~~1780~~ lbs

	light Jepp			heavy		
	~~1785~~	~~1765~~	1760	~~1810~~	~~1790~~	1785
Fuel 240	~~2025~~	~~2005~~	2000	~~2050~~	~~2030~~	2025
					~~630~~	625
Payload	~~625~~	~~645~~	650	~~600~~	~~607~~	
	~~2650~~	2650		~~2650~~	2650	

Optional fuel ~~108~~ 16 extra (185gal)

payload	~~617~~	~~592~~
	~~537~~	~~492~~
	542	~~512~~ 517

651205 Notes

Alternator for Generator 9 lbs
Mark 12 for Mark 2 11 "
saved 20 lbs

data corrected as scratched.
delete Mitchell radio --
no longer licensed.

Revised 651209

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504 B empty but w/ oil 1742

Loose Cabin load:
O_2 = 12
Tools = ~~5~~ 3 17 15
Rope = 5 3 18
Ice, fire = 5 2 27 20
Jeppesen (20) 35 20 62 40 (47)

alternator } 1733
replacing Generator

Mark 12 replace 1722
MK 2 1804
1762 1784

[Min practical gross at 60 lbs fuel } 240 2044 2024 (1)
Me 180]

full wing tanks	240			
Pilot	180	420	2224	2204 (2)
Passenger	170		2394	2374 (3)
2 "	340		2564	2544 (4)
B999	86	106	2650	(5)

1804
full 360
Pilot 180
~~"Passenger"~~ → 540 2344 ~~2588~~
~~extras 62 lbs~~ 2650
~~payload~~
Payload 306 306
2650

Air Fax Aug 64 pp 49-57

Penetration speed
stall speed × √load factor
√4.4 = 2.1

Book values:
stall clean 52 × 2.1 = 109
" G&F 48 = 101
Book 113 (130 statute)

The idea is that plane will stall before it bends -- JE, stall takes place at the "penetrating speed" before reaching 4.4 g loads (overload).
Lightly loaded, use "slightly lower" penetrating speed

Misc

Sales Trip 2 people	350
2 suitcases	70
2 Briefcases	50
Slide projector	40
Camera	10
	520
Misc Oz, Jeppete	47
	567

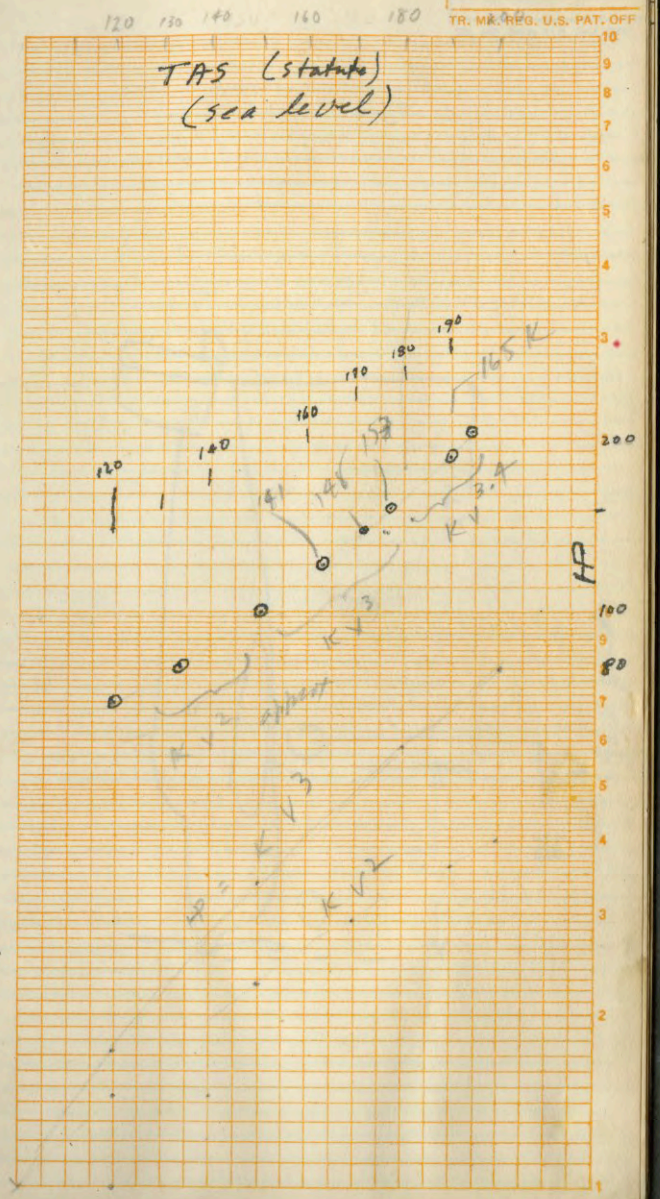
early 1964?

TR. MK. REG. U.S. PAT. OFF.

Load	Amperes	
KX-100	4.50	<
ADF 12 E	5.80	10.30
MK II.	4.00	14.30
Cy. Head Temp.	.12	
flap ind.	.08	14.5
~~300~~		
~~300~~		
~~300~~ -		
~~300~~ -		
fuel ind.	30	
" "	30	60
L.G. ind	8	68
oil Temp	12	80
T & B.	30	110
Trim Tab light	10	120
Compass "	8	128
L.G. ind	10	138
overhead lights	58	196
	58	254
NAV. Lights (wing)	160*	414
" " (Tail)	101	515
BAT. relay	50	565
Pitot	700	1265
		27.15
	2715*	
wing tip * (other side)	+1.60	
	28.75	
	- .12	
	28.63	

Too Tight; STC amb alternate ~~installed about~~ October 1965

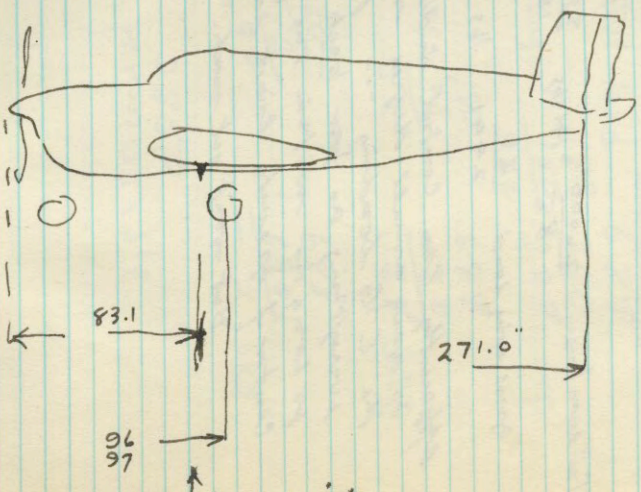
Heated Pitot



42.5
12.5

LEFAX, PHILADELPHIA 7, PA., U.S.A. ORIGINAL COPR. 1918 BY G. PARKER

75



640802

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Assume (guessing only) Center of lift at 86".

	2300 lbs	2650 lbs
CG	76"	84"
CG-℄	10"	2"
moment	26600 inch lbs	5300

tail moment arm to rear of ℄ : 271 − 86 = 185

Tail down force $\frac{26000}{185}$ = 141 lbs $\frac{5300}{185}$ = 29 lbs

gross wing load $\frac{23}{2441}$ lbs $\frac{2650}{2679}$

apparently can control induced drag to very small degree with the CG loading --- put everything as far back as possible as long as within the approved center of gravity limit envelop.

But won't get much.

504B empty but W/oil 1722

full wing tanks 240

1962

Gross 2650

− 1962

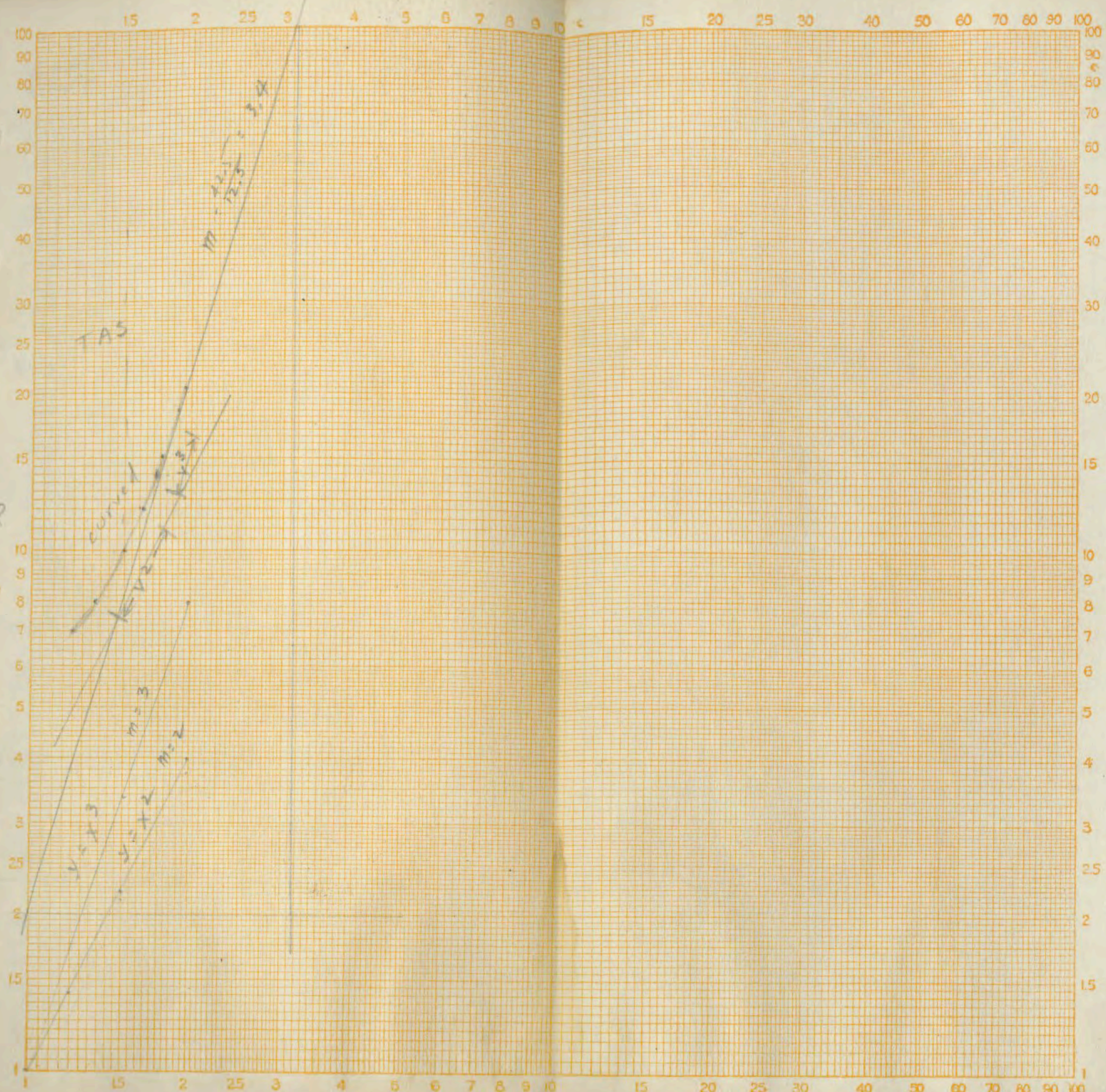
useful load 688

Pilot	180	360
1 passenger	180	328 bag.
	360	

Pilot	180	688
2 passenger	340	520
170	520	168 bag

110 Pilot	180	688
3 pass	510	690
510	690	− 2 bag

2650 permissable


TAS
curved
m = 3
m = 2
y = x3
y = x2

Ground N. Miles/Gal

TR. MK. REG. U.S. PAT. OFF.

12,000' p alt

Wind	80 HP		100 HP		120 HP	
+100		33.3		31.0		27.0
80	212	30.3	222	28.4	237	25.0
60	192	27.3	202	25.9	217	22.9
40	172	24.2	182	23.3	197	20.8
20	152	21.2	162	21.3	177	18.7
ZERO	132/6.6 = 18.2		142/7.8 = 18.2		157/9.5 = 16.6	
-20	112	15.2	122	15.6	137	14.5
-40	92	12.1	102	13.1	117	12.3
-60	72	9.1	82	10.5	97	10.5
-80	52	6.0	62	7.9	77	8.1
-100	32	3.0		5.5		6.0

8000'	85 HP		100		120		146
+100							
80	205		219		232	24.4	
60	185		199		212	223	
40	165		179		192	20.2	
20	145		159		172	18.1	
ZERO	125/6.85 = 18.2		133/7.8 = 17.5		152/9.5 = 16		161/11.4 = 14.1
-20		15.3		15.3		17.9	12.4
40		12.4		12.7		11.8	10.6
60		9.5		10.1		9.7	8.9
80		6.6		7.5		7.6	7.1
100		3.6		5.0		5.5	5.3

4000'	82 HP		100		120		146
+100		32.9		30.0		25.9	22.6
80		29.9		27.4		23.8	20.8
60		26.9		24.8		21.7	19.0
40		23.9		22.3		19.6	17.3
20		20.9		19.7		17.5	15.5
ZERO	120/6.7 = 17.8		134/7.8 = 17.2		146/9.5 = 15.3		157/11.4 = 13.8
-20		15.0		14.6		13.2	12.0
-40		11.9		12.0		11.2	10.3
-60		8.9		9.5		9.1	8.5
-80		6.0		6.9		7.0	6.7
-100		3.0		4.3		4.8	5.0

		80		100		120		146 HP	
+	80	196	27.6	210	26.9	221	23.2	233	20.5
	60	176	26.7	190	24.4	201	21.2	213	18.7
	40	156	23.6	170	21.8	181	19.1	193	16.9
	20	136	20.6	150	19.2	161	16.9	173	15.0
→	0	116	17.5	130	16.6	141	14.9	153	13.4
-	20	96	14.5	110	14.1	121	12.7	133	11.7
75	40	76	11.5	90	11.5	101	10.6	113	9.9
	60	56	8.5	70	9.0	81	8.5	93	8.2
	80		5.4	50	6.4	61	6.4	73	6.4

overload data
→ over →

Altitude	Standard Atmos	Available MAP
20,000	13.75	13.3
19	14.33	13.8
18	14.94	14.5
17	15.56	15.0
16	16.21	15.7
15000	16.88	16.4
145	17.23	16.6
14	17.57	17.0
13.5	17.93	17.4
13	18.29	17.8
12.5	18.66	18.1
12	19.03	18.5
11.5	19.44	18.9
11	19.79	19.3
10.5	20.19	19.7
10000	20.58	20.0
9.5	20.98	20.3
9	21.38	20.7
8.5	21.80	21.1
8	22.22	21.5
7.5	22.66	21.9
7	23.09	22.3
6.5	23.53	22.7
6	23.90	23.0
5000	24.88	
4000	25.88	
3000	26.88	
2000	27.82	
1000	28.86	
SL	27.92	

Based on Test data in flight: MAP values on Gage.

NOTE 504 B MAP gage reads 30.0 for Barometer reading of 29.81 : error in 0.2" at 30". Appears safe to pull 0.2" more on gage than tables indicate

overload data

Oct 1960

575 lbs cabin load plus Ben Moore, old dear radio less King +180 - 40 +12 about 150 lbs

	575	
~~Cabin load~~	725	Pay load
	617	allowable
	108	overload

This got off slow with old wood prop at Santa Anna on a hot afternoon.

Pitot formula

$$V_o = \sqrt{\frac{2g\,P_s - P_o}{\gamma}}$$

P_o = static pressure

P_S = stagnation pressure

γ = fluid density

= 0.00238 lb sec^2/ft^4 @ 15°C 14.696" 760 mm

IAS Knots	S. mile/hour	Inches H_2O		in" H_2O Palo Alto
43.5	50	1.23		0.084 Hg
52.2	60	1.77		
60.7	70	2.41		
	70.7	2.46		
69.6	80	3.15		
78.3	90	3.94		
87.0	100	4.94	4.90	.394
95.7	110	5.95		
104.4	120	7.09	7.15	0.565
113.1	130	8.31		
121.8	140	9.63	9.75	0.773
	141.4	9.86		
130.5	150	11.08		
139.2	160	12.6	12.3	
147.9	120	14.2		1.14

Fuel	Rate	@ 0.525 # / HP H		gal
100%	= 225	gal	250	16.4
75%	= 169	14.8	188	15.3
70	= 158	13.8	175	14.2
65	146	12.8	163	13.1
60	135	11.8	150	12.0
55	122	10.7	138	11.0
50	113	9.8	125	

HP = TE (Nos) × Knots (TAS) / 325

example:

= 375 × 130 / 325 = 150 HP

Test Data

	HP	Cruise MPH	fuel rate	Smiles/gal
Cessna 180	158	153	13	11.7
" 190	180	153	16.8	9.1
50 4B	120	168	9.6	17

Book claims

A-35	120	177	9.6	17.7
Mooney M20	135	181	10.8	16.7
Balanco 260	195	204	16.9	12.0
Bonanza 250	188	200	16.3	12.3
Cessna 210	195	185	16.3	11.3
Comanche 250	188	181	16.3	11.1
" 180	135	161	12.8	15.0

Fuel Tank — Aux

5" × 26" × 38½" = 5005 in³

Close to 21.7 gal

(actually close to 18.° claim 20)

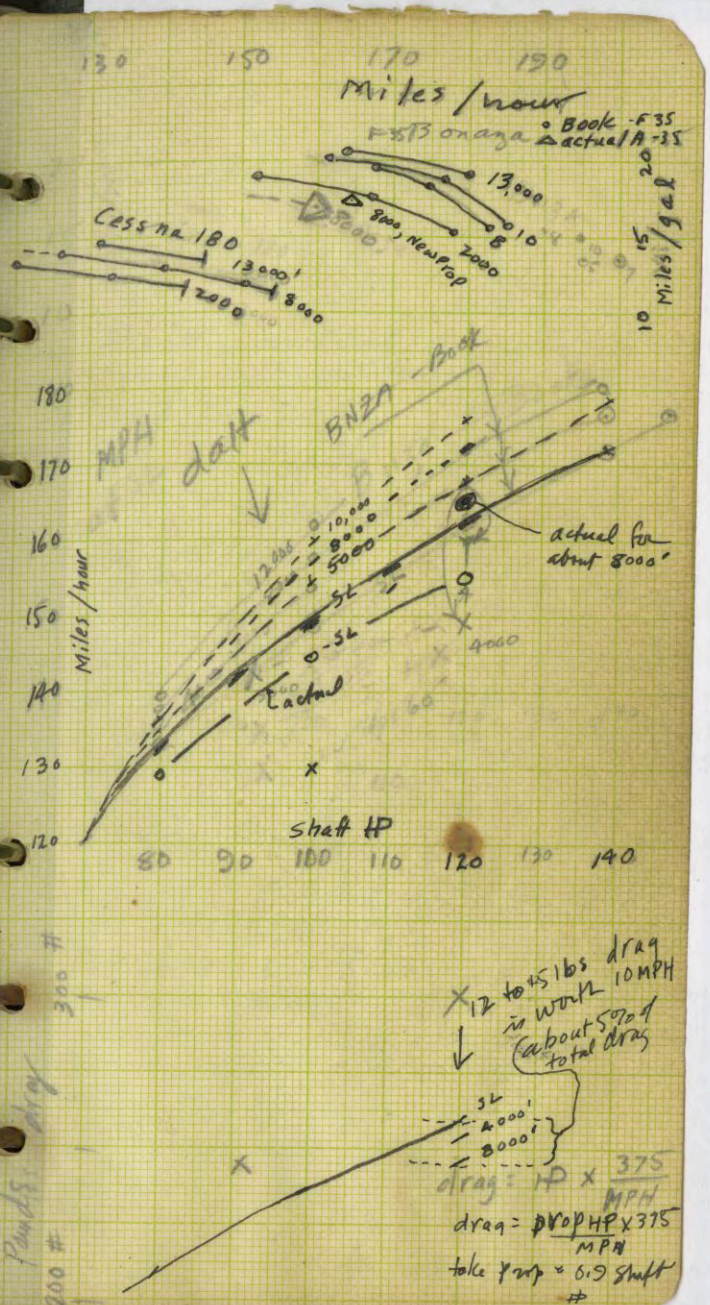
620A15 IAS 133 @7500' 5°C : 80 density

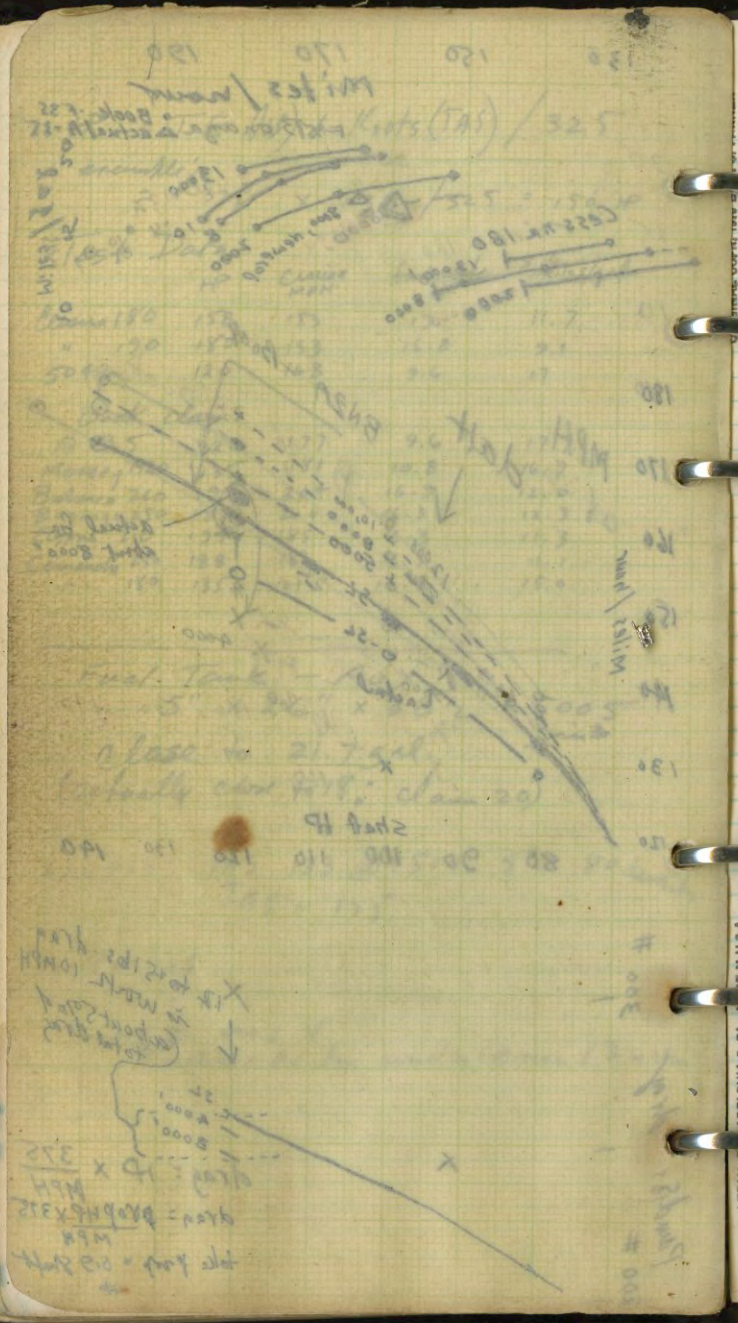
TAS = 175

Dr. Raspet

Super V and 2 V

Southland Av Inc owned by Brennan & Watson





according to the 16500' data on the Farmington NMex → Twin Falls Idaho leg,

IAS = 115, TAS = 147 kts (170 M/H)

Rec HP was about 110 which should call for about 8.7 gal/H.

~~14.7/7.7 = 19.9~~

14.7/7.7 = ~~19.1~~ 16.9 N miles/gal

~~22~~ 19.4 Statute mile/gal

This fuel consumption may be ~~obtimistic~~; 110 HP is predicated on 2300 and 15.5" approx.

for 2100 and 15.6" HP ≅ 100,

at 2300 RPM the fuel consumption may be 5 to 10% more for a given HP than for 2100.

Standard Air Dommasch et al

H	T °F abs	p "Hg	$(\sigma)^{1/2}$	σ	ρ slug/ft³
0	518.4	29.92	1.000		
1000	514.8	8.86	.985	.971	0.00238
2	511.3	7.82	.971	.943	231
3	507.7	6.81	.957	.915	224
4	504.1	5.84	.942	.888	218
5000	500.6	24.89	0.928	0.862	0.00211
6	497.0	3.98	914	836	205
7	493.4	3.09	900	811	199
8	489.9	2.22	887	786	193
9	486.3	1.38	873	761	187
10000	482.7	20.55	0.859	0.738	0.00181
11	479.2	19.79	846	.715	176
12	475.6	9.03	833	.693	170
13	72.0	8.29	819	.671	165
14	68.5	7.59	806	.650	160
15000	464.9	16.88	0.793	0.629	0.00155
16	61.3	6.21	.780	.609	150
17	57.8	5.56	768	.589	145
18	54.2	4.98	755	570	140
19	50.6	4.33	742	551	136
20,000	447.1	13.75	0.730	0.533	0.00131

OPERATOR'S

Continenta

AIRCRAFT

For Your PER

Form No. B-E60
8-15-50