

AVIATION THEORY

Aircraft Operation Performance & Planning

for the Private & Commercial
Pilot Licences

Work Booklet



David Robson

This Work Booklet is also available on our website (Addenda page) as a downloadable PDF for those of you who wish to print it out.

<https://aviationtheory.net.au/updates-addenda/>

Aircraft Operation, Performance and Planning
Work Booklet
Fourth Edition
Copyright 2019 Aviation Theory Centre

First edition	1993
Second edition	2002
Third edition	2014
Fourth edition	2019

Published by:
Aviation Theory Centre Pty Ltd
ACN 088 462 873
aviationtheory.net.au

The contents of this manual are protected by copyright throughout the world under the Berne Union and the universal copyright convention.

All rights reserved. No part of this publication may be reproduced in any manner whatsoever – electronic, photographic, photocopying, facsimile, or stored in a retrieval system – without the prior written permission of the author.

Disclaimer

Nothing in this text supersedes any operational documents issued by the Civil Aviation Safety Authority, Airservices Australia, aircraft, engine and avionics manufacturers, or the operators of aircraft throughout the world.

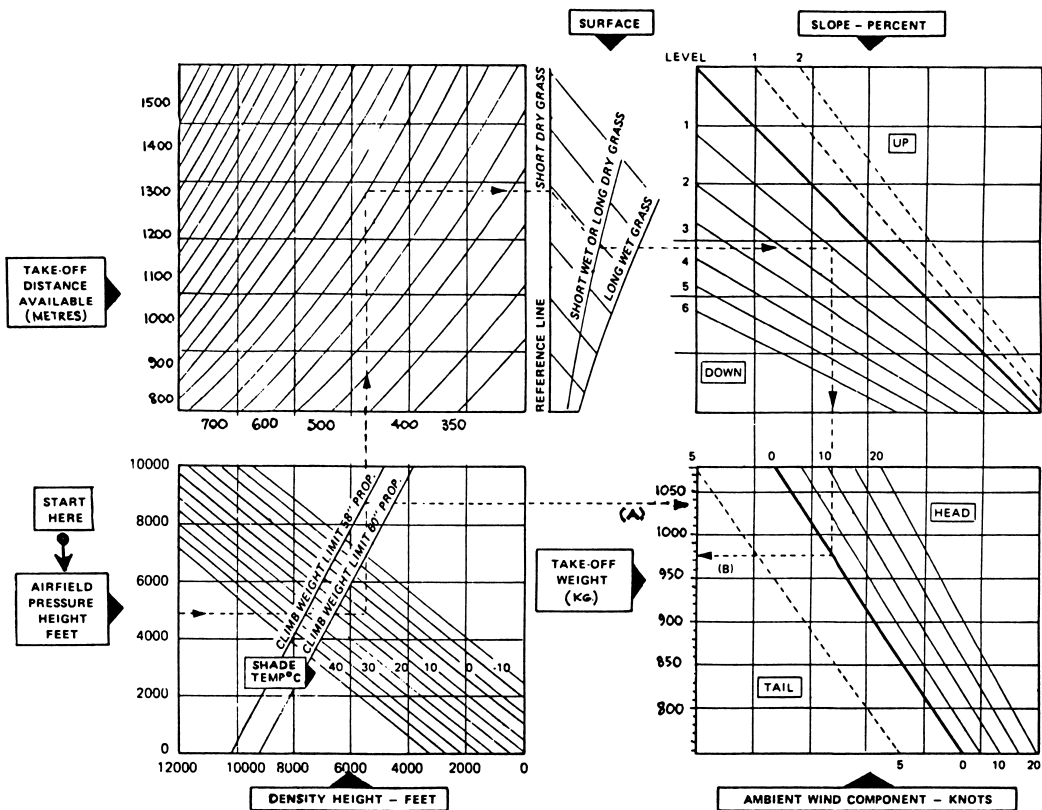
Introduction

This work booklet has been prepared for your use when answering the multiple-choice questions in Appendices 2 and 3 of *Aircraft Operation, Performance and Planning*. Although the tables and graphs are not necessarily those which you will use when sitting the CASA examinations, PPL or CPL, they cover all the areas you are likely to encounter. Note that the tables and graphs in this booklet are samples for study purposes only and are not to be used in conjunction with flight operations or flight planning.

Contents

Cessna Type Take-Off Chart	4
Cessna Type Landing Chart	5
Cessna 172 Climb Performance Table	6
Cessna 172 Cruise Performance Table	7
Turbo Lance Take-Off Performance Graph	8
Turbo Lance Landing Performance Graph	9
Turbo Lance Climb Performance Graph	10
Turbo Lance Cruise Performance Graph	11
Turbo Lance Descent Performance Graph	12
Working Page	13
Working Page	14
Loading System Alpha	15
Loading System Bravo Data	16
Loading System Bravo Graph	17
Loading System Charlie Data	18
Loading System Charlie Graph	19
Echo Take-Off Chart	20
Echo Landing Chart	21
Echo Landing Data	22
Echo Moment Index Graph	23
Echo CG Envelope Graph	24
Load Sheet	25
Working Page	26
Working Page	27

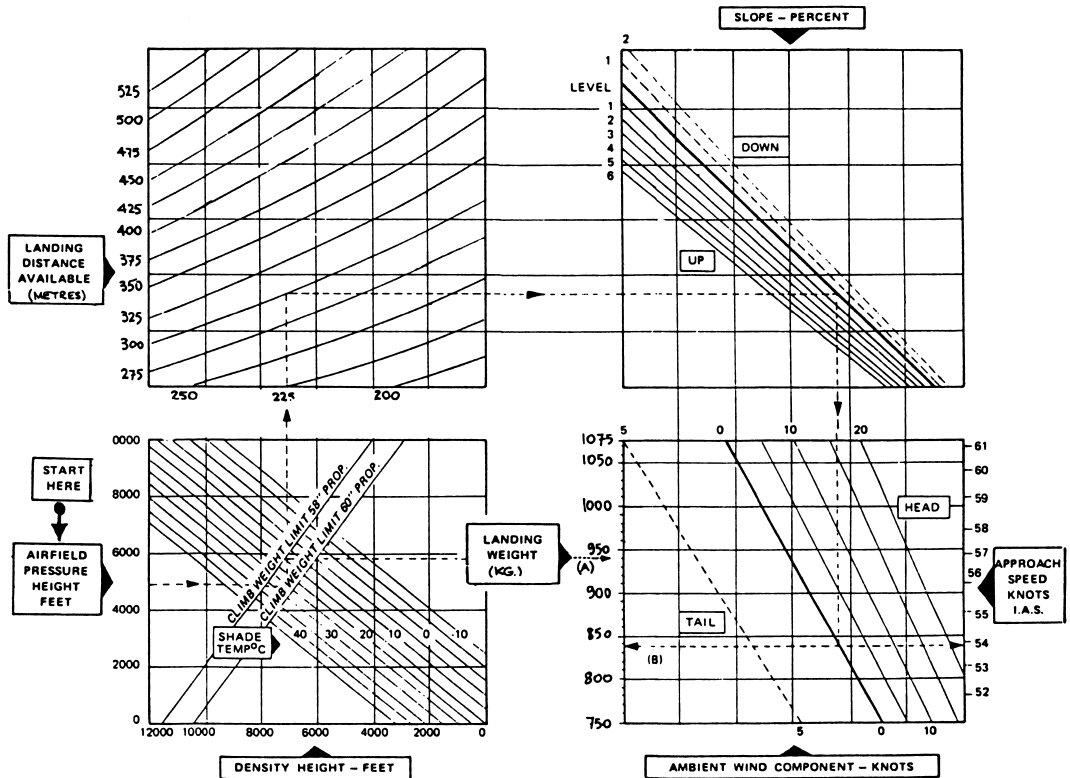
Cessna Type Take-Off Chart



TAKE-OFF WEIGHT CHART		
CESSNA TYPE		
POWER TO BE USED	R.P.M.	See Flight Manual Para. 1.2
	MAN. PRESS	Full Throttle
Flap Setting		0°
Take-off Safety Speed		68 Kts. I.A.S.
Take-off Dist. Factor		1.15

NOTE
THE GROSS WEIGHT AT TAKE-OFF SHALL NOT EXCEED THE LESSER OF (A) AND (B).

Cessna Type Landing Chart



LANDING WEIGHT CHART	
CESSNA TYPE	
Flap Setting	40°
Approach Speed	See scale
Landing Distance Factor	1.15

NOTE
THE GROSS WEIGHT AT LANDING SHALL NOT EXCEED THE LESSER OF (A) AND (B).

Cessna 172 Climb Performance Table

CESSNA
MODEL 172P

PERFORMANCE

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

Cessna 172 Cruise Performance Table

PERFORMANCE

CESSNA
MODEL 172P

CRUISE PERFORMANCE

CONDITIONS:

2400 Pounds

Recommended Lean Mixture

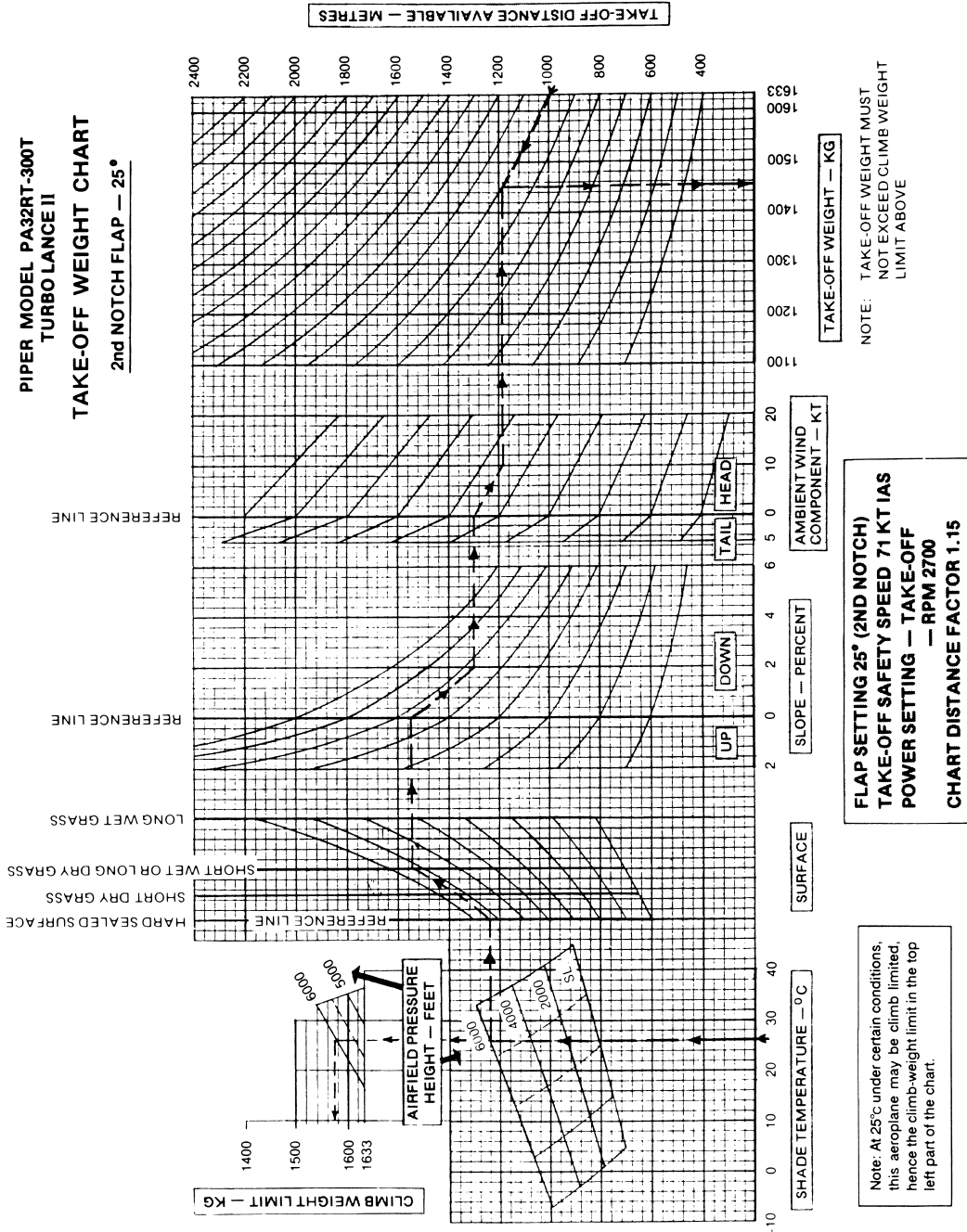
PRESSURE ALTITUDE FT	RPM	20°C BELOW STANDARD TEMP			STANDARD TEMPERATURE			20°C ABOVE STANDARD TEMP		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2000	2500	---	---	---	76	114	8.5	72	114	8.1
	2400	72	110	8.1	69	109	7.7	65	108	7.3
	2300	65	104	7.3	62	103	6.9	59	102	6.6
	2200	58	99	6.6	55	97	6.3	53	96	6.1
	2100	52	92	6.0	50	91	5.8	48	89	5.7
4000	2550	---	---	---	76	117	8.5	72	116	8.1
	2500	77	115	8.6	73	114	8.1	69	113	7.7
	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
	2200	56	98	6.3	54	96	6.1	51	94	5.9
	2100	51	91	5.8	48	89	5.7	47	88	5.5
6000	2600	---	---	---	77	119	8.6	72	118	8.1
	2500	73	114	8.2	69	113	7.8	66	112	7.4
	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
	2100	49	90	5.7	47	88	5.5	46	86	5.5
8000	2650	---	---	---	77	121	8.6	73	120	8.1
	2600	77	119	8.7	73	118	8.2	69	117	7.8
	2500	70	113	7.8	66	112	7.4	63	111	7.1
	2400	63	108	7.1	60	106	6.7	58	104	6.5
	2300	57	101	6.4	55	100	6.2	53	97	6.0
	2200	52	95	6.0	50	93	5.8	49	91	5.7
10,000	2600	74	118	8.3	70	117	7.8	66	115	7.4
	2500	67	112	7.5	64	111	7.1	61	109	6.8
	2400	61	106	6.8	58	105	6.5	56	102	6.3
	2300	55	100	6.3	53	98	6.0	51	96	5.9
	2200	50	93	5.8	49	91	5.7	47	89	5.6
12,000	2550	67	114	7.5	64	112	7.1	61	111	6.9
	2500	64	111	7.2	61	109	6.8	59	107	6.6
	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

Turbo Lance Take-Off Performance Graph

PIPER MODEL PA32RT-300T
TURBO LANCE II

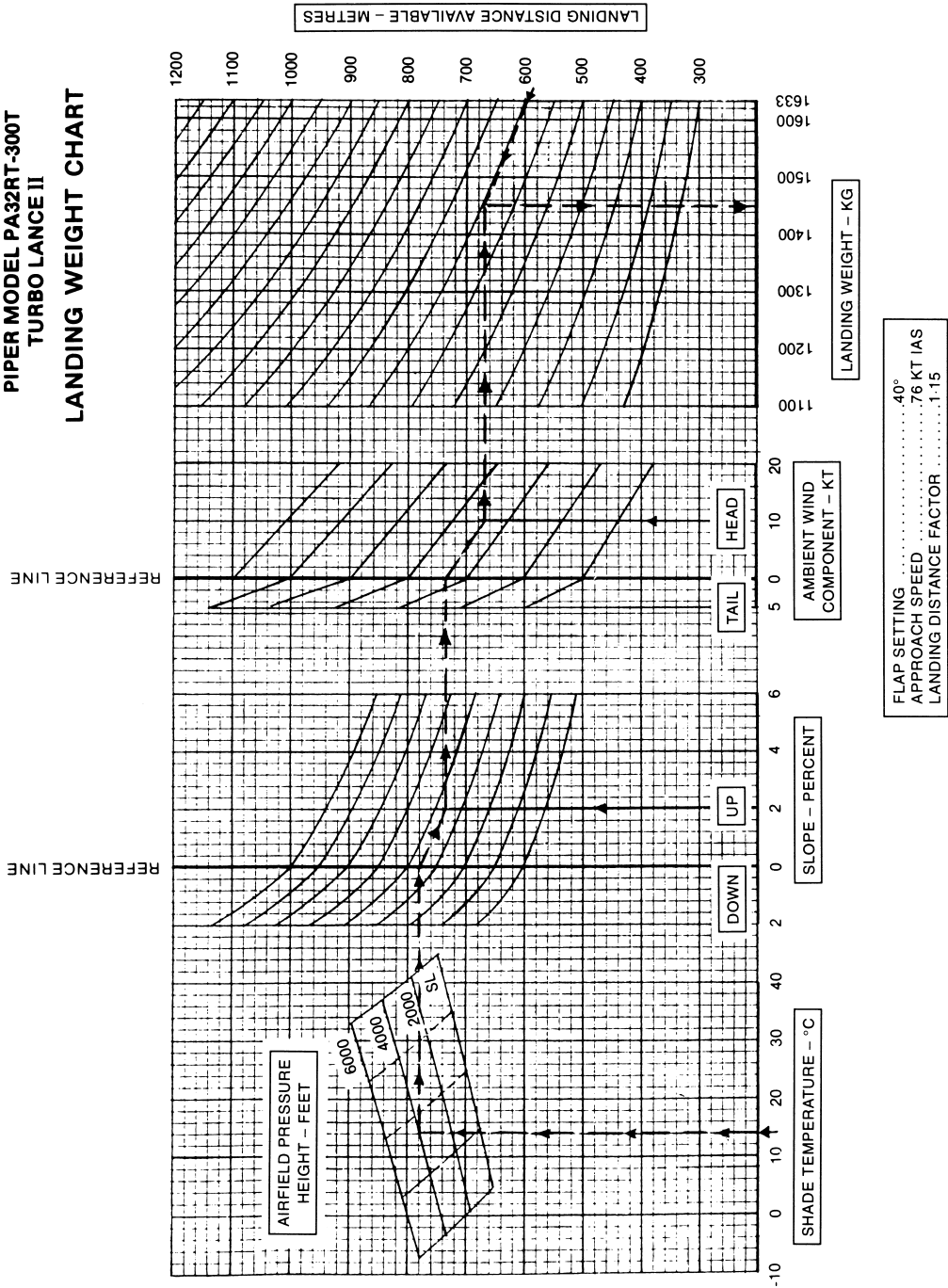
TAKE-OFF WEIGHT CHART

2nd NOTCH FLAP — 25°



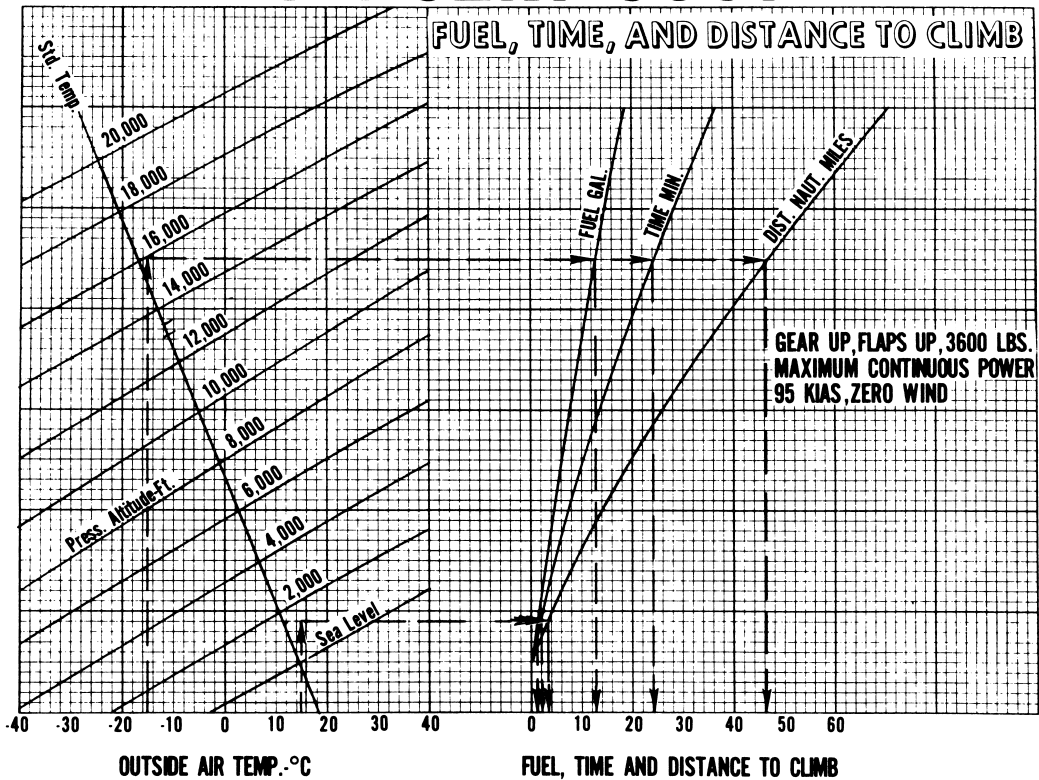
Turbo Lance Landing Performance Graph

PIPER MODEL PA32RT-300T TURBO LANCE II LANDING WEIGHT CHART



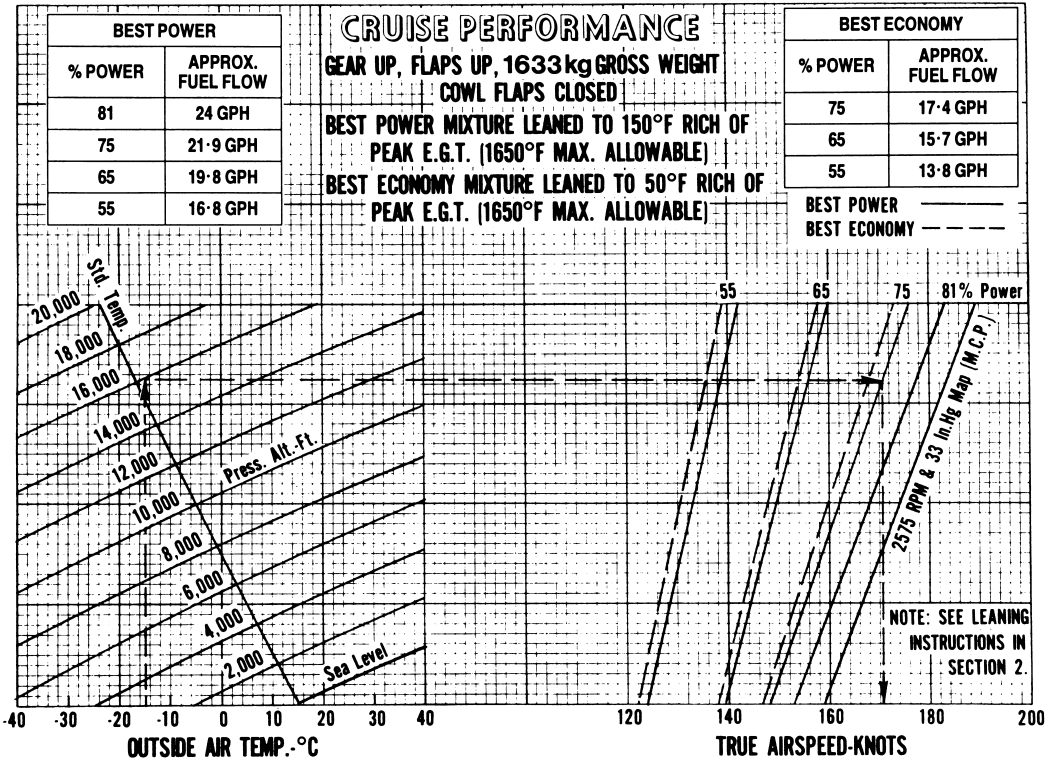
Turbo Lance Climb Performance Graph

PA-32RT-300T



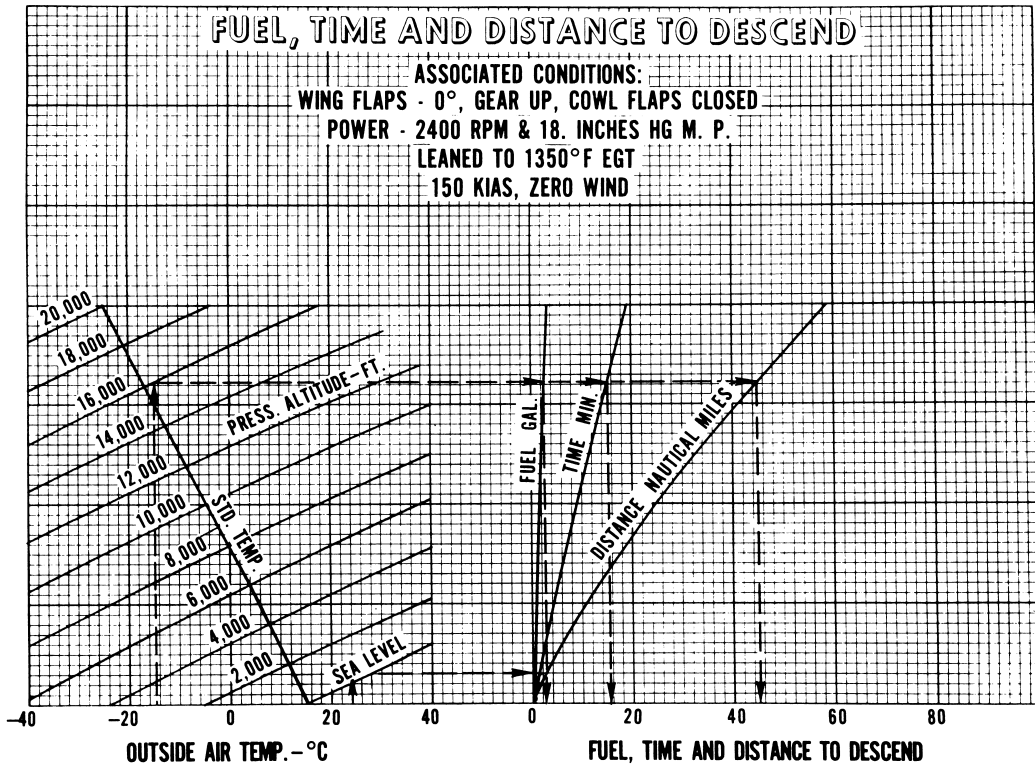
Turbo Lance Cruise Performance Graph

PA-32RT-300T



Turbo Lance Descent Performance Graph

PA-32RT-300T



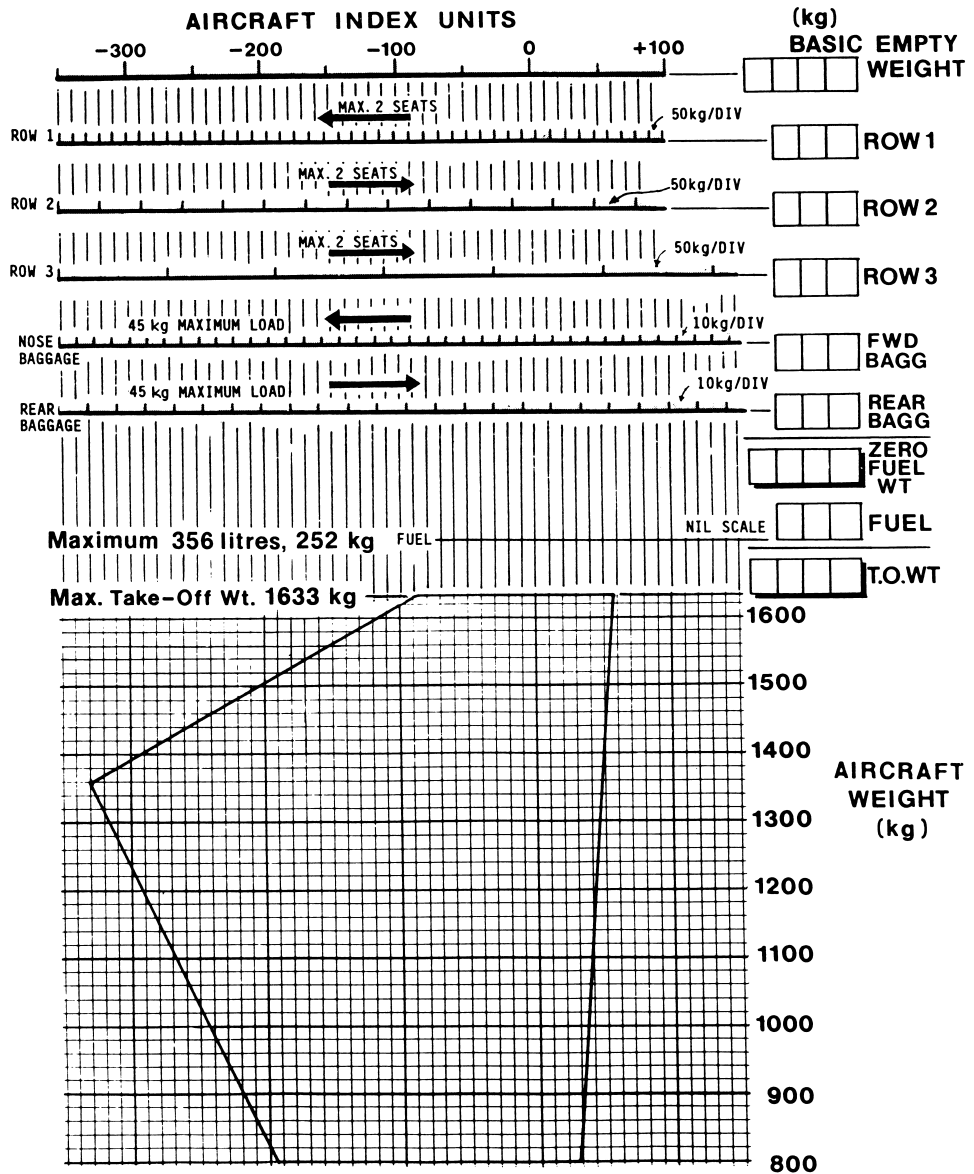
[illegible]

Working Page

[illegible]

Loading System Alpha

SYSTEM ALPHA Load Data Sheet



Loading System Bravo Data

Loading System Bravo Configuration: 4 Seats

Instructions for Use of Loading System

To check the loading of the aircraft before take-off, calculate the total weight and total moments as shown in the example below.

Plot the total weight and moment on the "Centre of Gravity Envelope" chart, and if the intersection point is within the envelope, the loading is acceptable.

Aircraft Limitations

Maximum take-off weight

Normal category: 1000 kg/2200 lbs

Utility category: 841 kg/1850 lbs

Maximum baggage compartment baggage: 53 kg/120 lbs

- Notes:
1. The aircraft is fitted with standard tanks (37 US Gallons at 6 lbs/gallon)
 2. Empty weight includes unusable fuel and undrainable oil
 3. Obtain Moment/1000 inch pounds from the loading graph

Example:

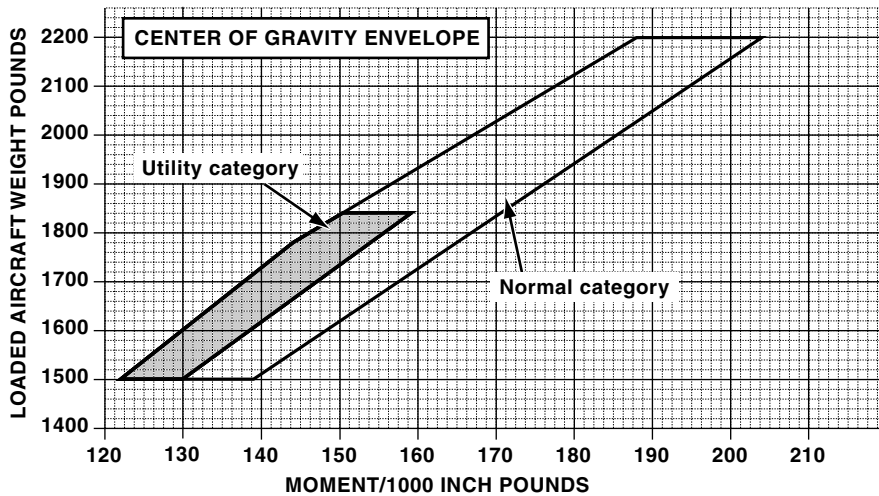
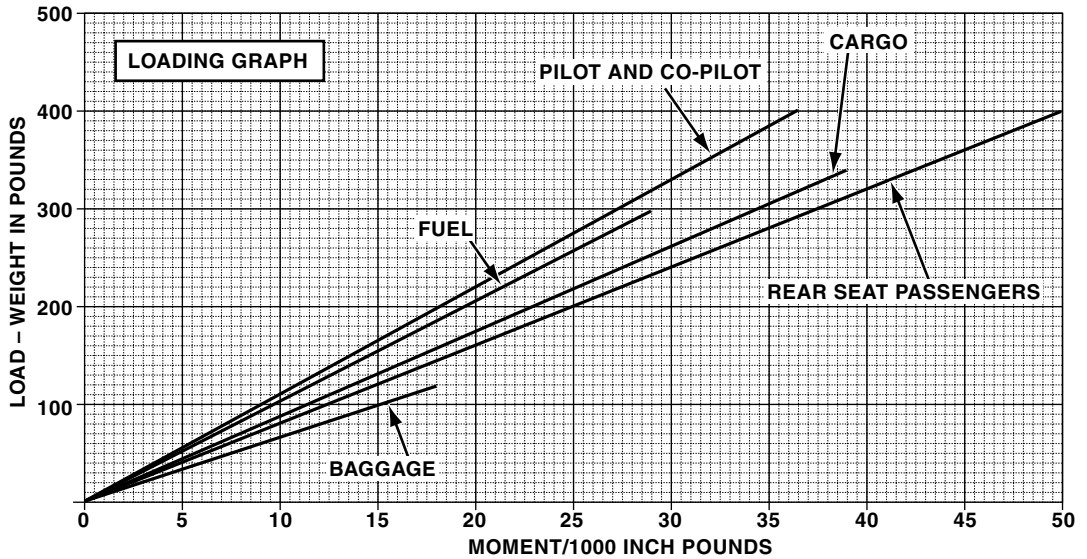
	Weight (lbs)	Arm (in)	Moment/ 1000 in lb
Empty Weight	1260	80	100.80
Oil	15	32	.48
Fuel (141 litres)	222	91	20.02
Pilot & Co-pilot	320	91	29.12
Rear Seat Passengers	350	126	44.10
Baggage	25	151	3.78
Takeoff Weight	2192		198.30

Check CG is within the envelope

Loading System Bravo Graph

LOADING SYSTEM BRAVO

Add weight of items to be carried to aeroplane licensed empty weight.
Add moment/1000 of items to be carried to total aeroplane moment/1000.
Use Center of Gravity Envelope to determine acceptability.



Loading System Charlie Data

Loading System Charlie

Index Units

FUEL	ARM: 2950			BAGGAGE	ARM: 4210
	20	14	413	10	421
	40	28	826	20	842
	60	43	1268	30	1,263
	80	57	1682	40	1,684
	100	71	2095	50	2,105
	120	85	2507	60	2,526
	140	99	2920	70	2,947
	160	114	3363	80	3,368
	180	129	3806	90	3,789
	200	142	4189	100	4,210
	216	153	4513	110	4,631
				122	5,136

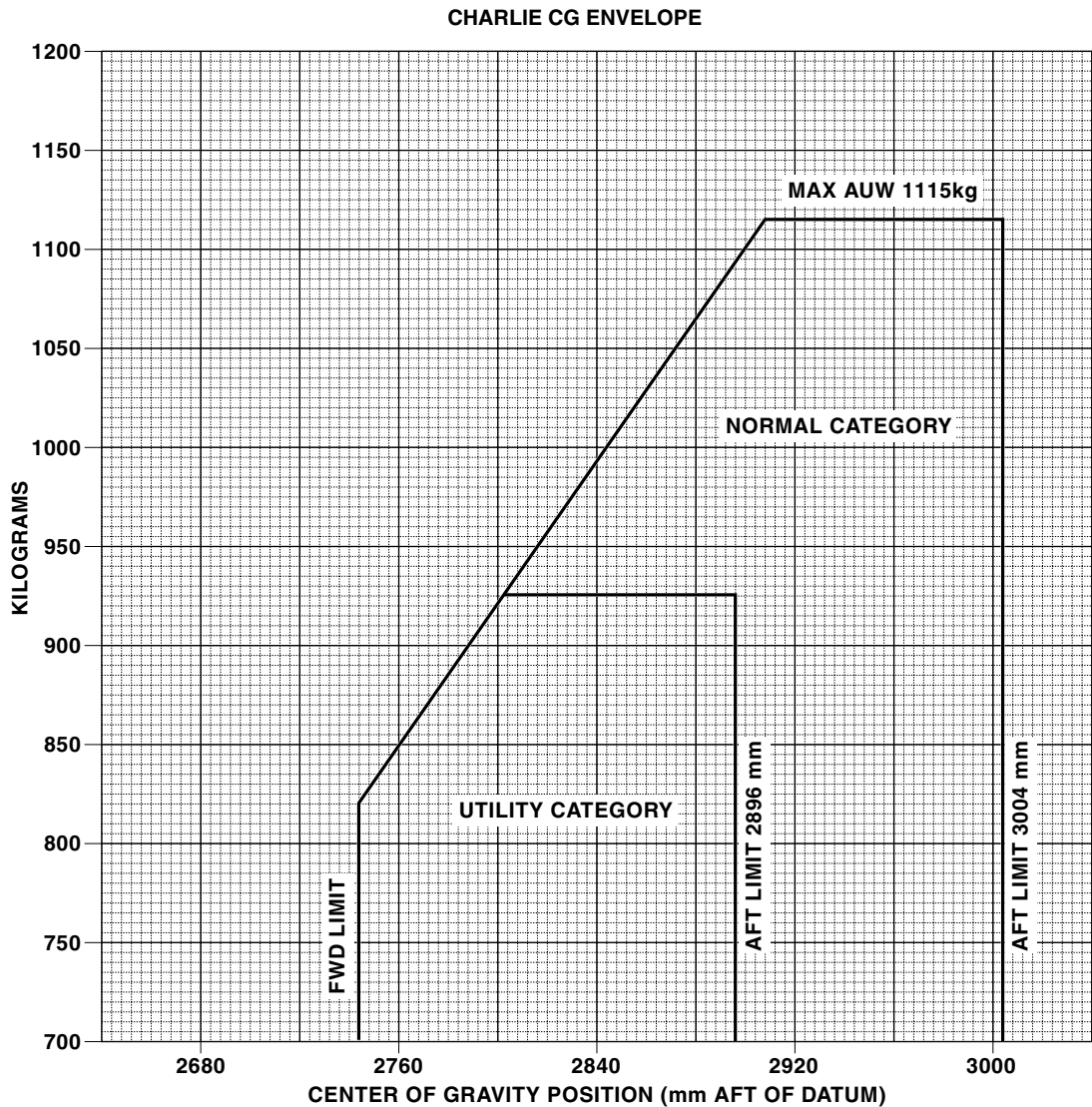
OCCUPANTS

KG	Row 1	Row 2
	ARM: 2750	ARM: 3600
40	1,100	1,440
45	1,237	1,620
50	1,375	1,800
55	1,512	1,980
60	1,650	2,160
65	1,786	2,340
70	1,925	2,520
75	2,062	2,700
80	2,200	2,880
85	2,338	3,060
90	2,475	3,240

OIL ARM: 1230

US Quarts	Litres	KG	Index Units
6	5.7	5.0	62
7	6.6	6.0	74
8	7.6	7.0	86

Loading System Charlie Graph



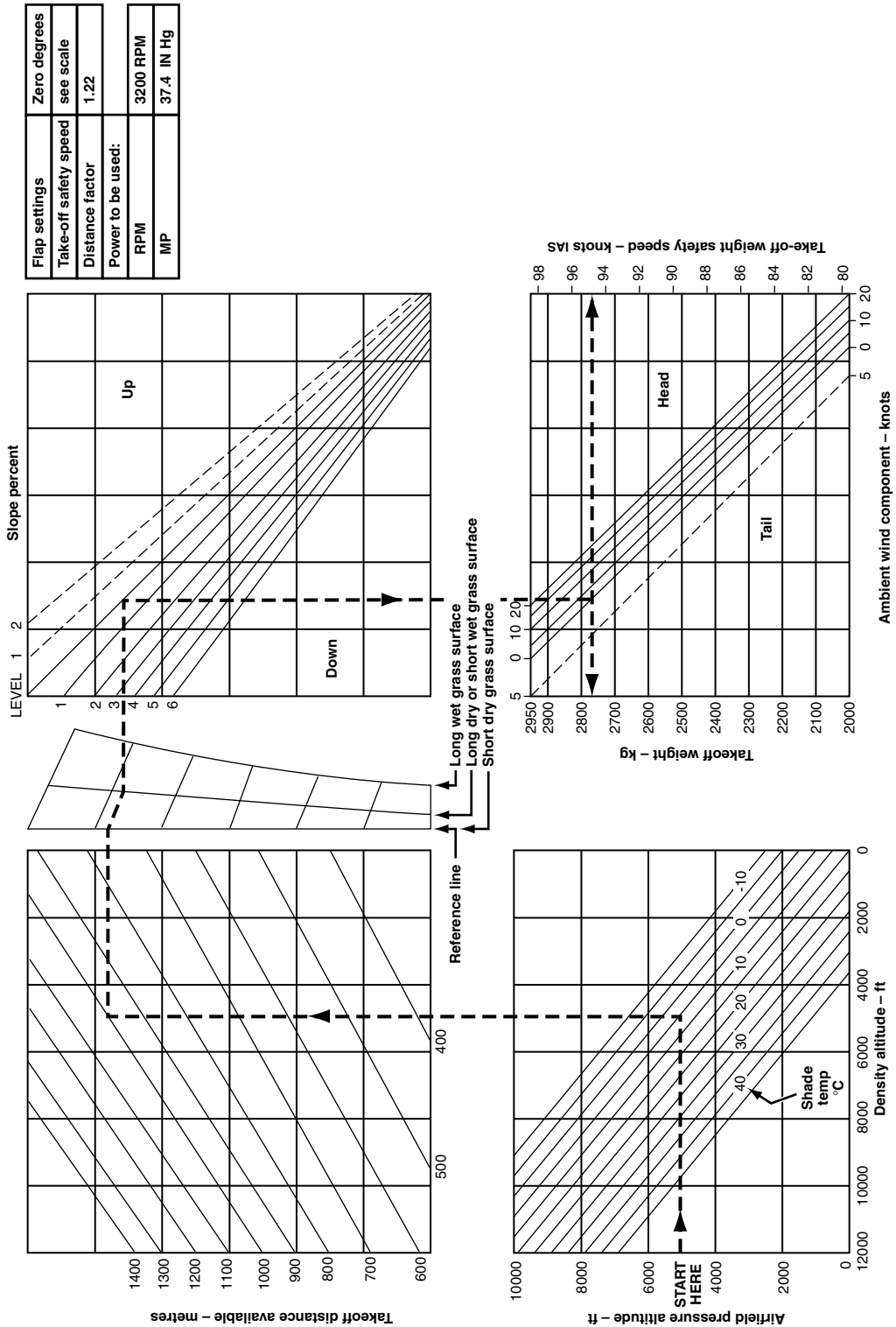
Aircraft Limitations

Maximum take-off weight	
Normal category:	1115 kgs
Utility category:	925 kgs
Maximum baggage compartment baggage:	122 kgs
Aircraft empty weight	687 kg; IU 19,522

- Notes:
1. Aircraft empty weight includes unusable fuel and undrainable oil
 2. All arms are in mm aft of datum
 3. 1 index unit = 100 kg mm

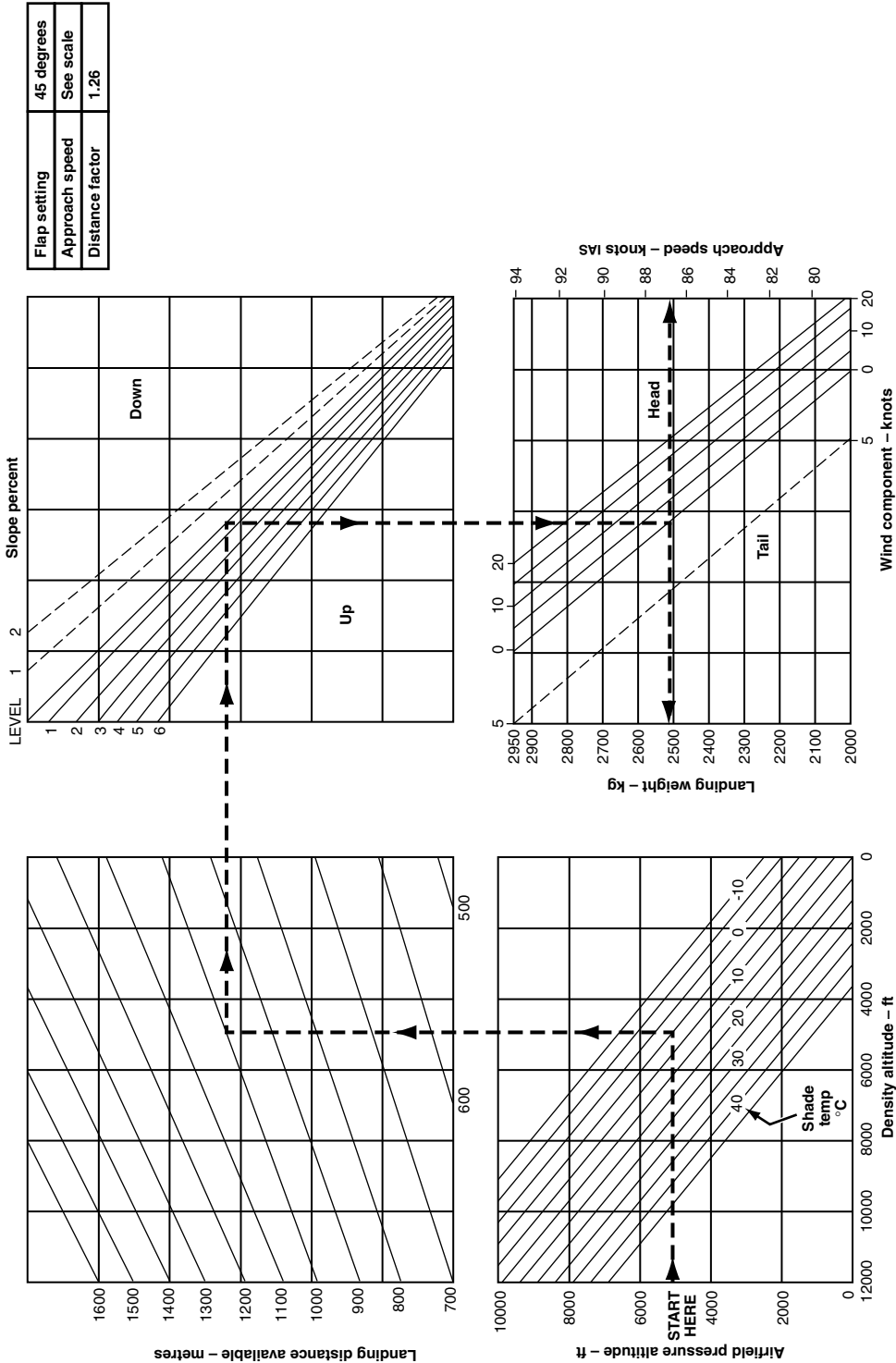
Echo Take-Off Chart

ECHO TAKEOFF CHART



Echo Landing Chart

ECHO LANDING CHART



Echo Landing Data

Loading System Echo Configuration: 6 Seats

Weight Limitations: Maximum Takeoff Weight 2950kg
 Maximum Landing Weight 2725kg
 Maximum Zero Fuel Weight 2630kg

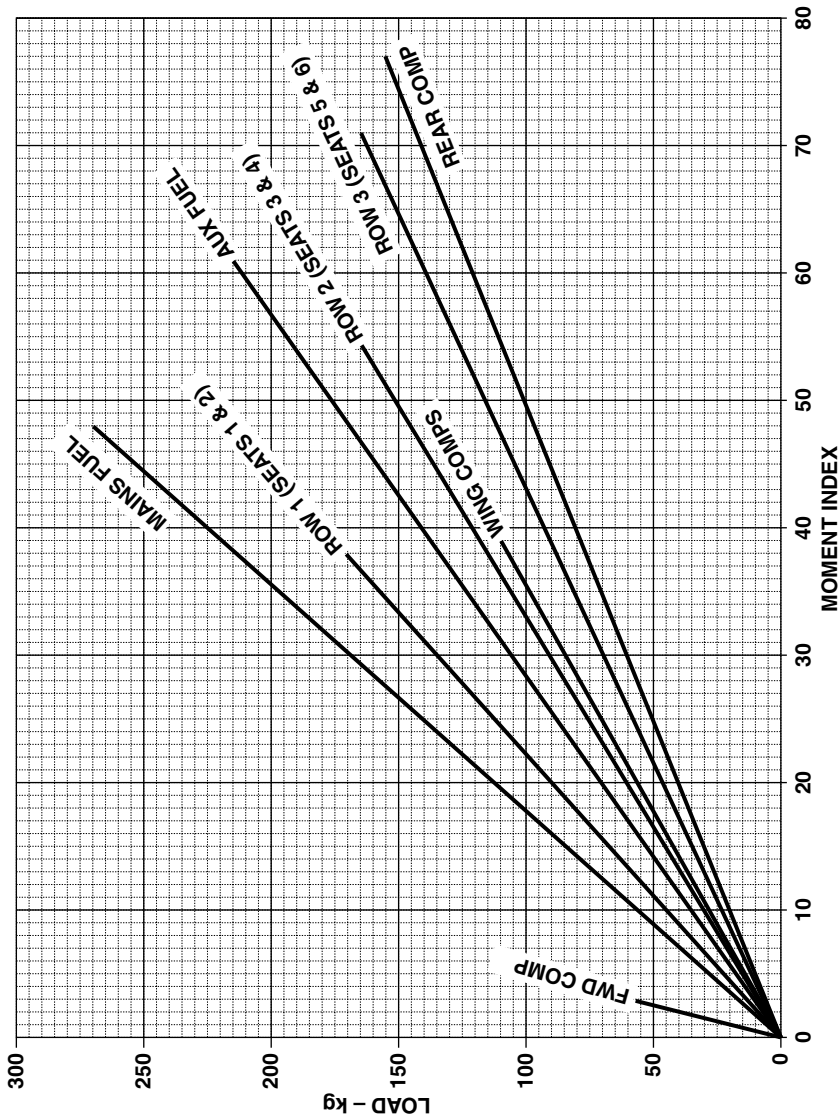
Balance Data: The Mean Aerodynamic Chord (MAC) data is as follows:
 Length of chord 1900mm
 Location of leading edge 2190mm aft of datum
 Centre of Gravity range is as follows:
 2400mm to 2680 mm at 2360kg or less
 2560mm to 2680mm at 2950kg
 Linear variation between the points given

Loading Data:

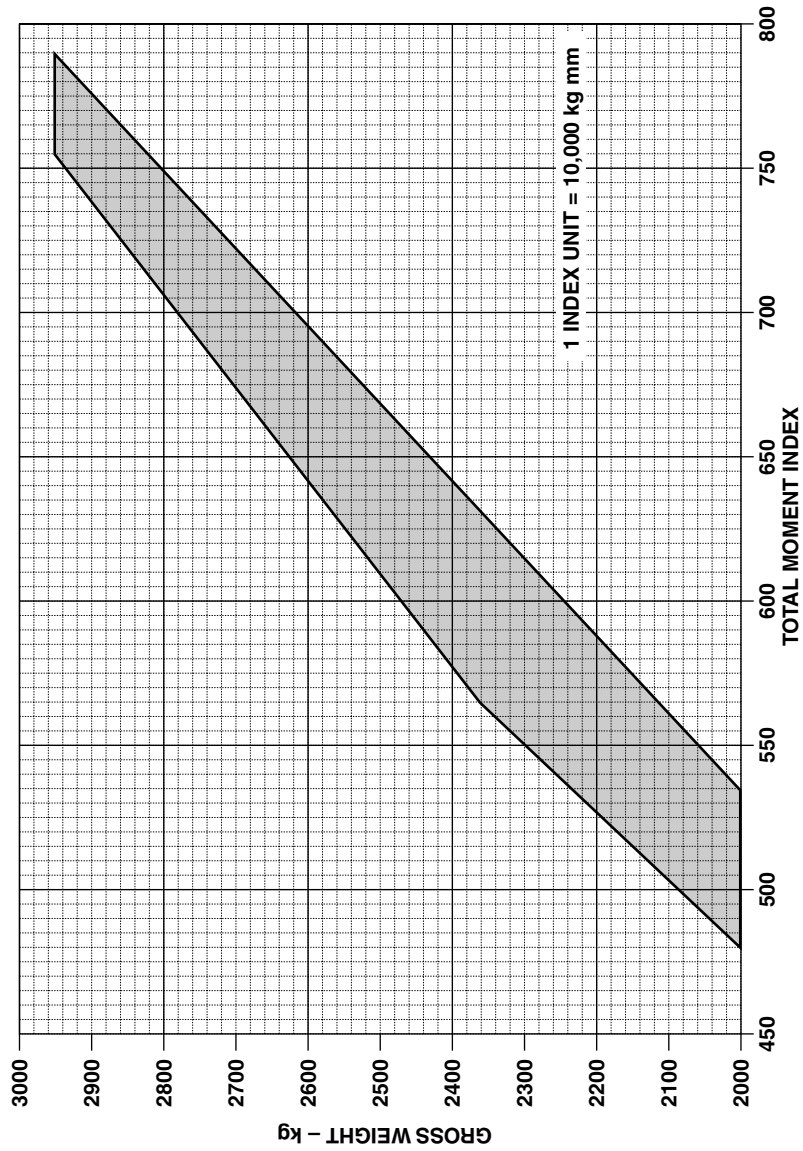
Location	Maximum Permissible Load	Arm (mm Aft of Datum)
Seating:		
Row 1 (Seats 1 & 2)	Pilot + 1 passenger	2290
Row 2 (Seats 3 & 4)	2 passengers	3300
Row 3 (Seats 5 & 6)	2 passengers	4300
Cargo & Baggage Compts:		
Forward Compt.	55kg	500
Left wing Compt.	55kg	3550
Right wing Compt.	55kg	3550
Rear Compartment	155kg	5000
Floor loading Intensity	450 kg/m ² (All Compts)	
Fuel:		
Left main tank	50 USG	1780
Right main tank	50 USG	1780
Left auxiliary tank	40 USG	2800
Right auxiliary tank	40 USG	2800

Note: All Passenger seats weigh 5kg each and may be removed to permit the carriage of additional cargo or baggage in the cabin.
 The maximum permissible load in the area otherwise occupied by a passenger seat is 82kg.
 If a passenger seat is removed, adjust the empty weight and empty moment.

Echo Moment Index Graph



Echo CG Envelope Graph



Load Sheet

[illegible]

Working Page

[illegible]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

