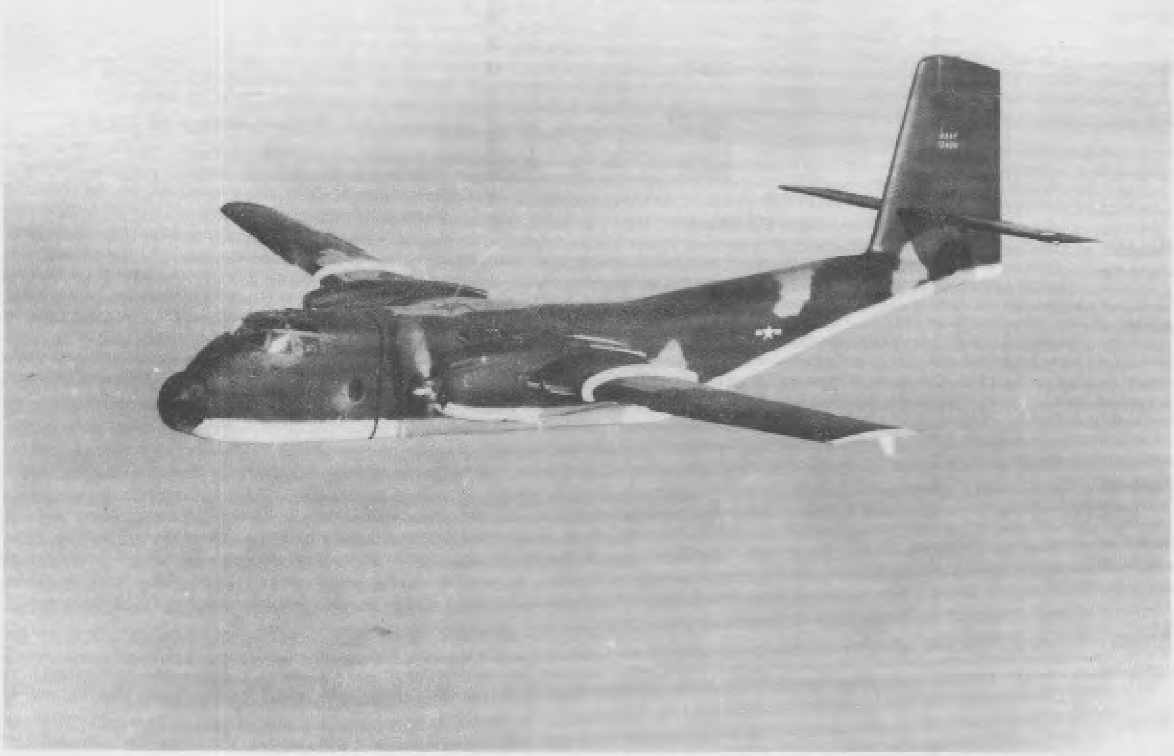
T.O. 1C-7A-1-1

FLIGHT MANUAL

PERFORMANCE DATA

USAF SERIES
C-7A
AIRCRAFT

F09603-72-D-1406-0048



THIS PUBLICATION SUPPLEMENTS T.O. 1C-7A-1.

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Published under authority of the Secretary of the Air Force.

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Total number of pages in this manual is 140 consisting of the following:

Page No.	# Change No.	Page No.	# Change No.	Page No.	# Change No.
Title	4	A5-6	3		
A	4	A5-7	4		
i	0	A5-8	3		
ii Blank	0	A5-9	0		
A1-1	2	A5-10 Blank	0		
A1-2 — A1-14	0	A6-1	0		
A1-15 — A1-17	2	A6-2	3		
A1-18 Blank	2	A6-3 — A6-5	0		
A2-1	3	A6-6	3		
A2-2 — A2-14	0	A6-7 — A6-20	0		
A2-15	3	A7-1	0		
A2-16 — A2-17	0	A7-2 — A7-8	3		
A2-18	3	A7-9	0		
A2-18A	3	A7-10 Blank	0		
A2-18B Blank	3				
A2-19 — A2-26	0				
A3-1	2				
A3-2 — A3-6	0				
A3-7	2				
A3-8	1				
A3-9	2				
A3-10	3				
A3-11	2				
A3-12 — A3-20	0				
A3-20A — A3-20C	2				
A3-20D Blank	2				
A3-21 — A3-23	0				
A3-24 — A3-26	1				
A3-26A	2				
A3-26B Blank	2				
A3-27 — A3-30	4				
A3-30A	4				
A3-30B Blank	4				
A3-31	4				
A3-32	0				
A4-1 — A4-6	3				
A4-7	4				
A4-8	0				
A4-9	4				
A4-10 Blank	4				
A5-1 — A5-2	3				
A5-3 — A5-5	4				

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TABLE OF CONTENTS

PART 1

MISCELLANEOUS

TABLE OF CONTENTS.

INTRODUCTION.

This part contains all performance data charts necessary for preflight and inflight mission planning, and includes explanatory text on the use of the data presented. The information contained on the charts is based on, and is consistent with, the recommended operating procedures and techniques set forth in other parts of this manual. For flight at weights above 28,500 pounds, refer to Section V of T.O. 1C-7A-1.

All airspeeds are given in CAS or TAS, except that IAS is given for take-off and landing data which allows for primary system airspeed calibrations. All airspeeds quoted throughout the manual are applicable to either airspeed indicator. Data basis, either flight test or estimated, is stated in the title block of each chart. The date of data determination is also stated. Unless otherwise noted, the charts are based on zero wind and ICAO standard atmosphere (ISA).

The aircraft configuration and gross weight is presented whenever applicable.

Performance data printed in this manual is based on AFFTC flight test data obtained using R-2000-7M2 engines and 115/145 grade fuel.

GLOSSARY OF TERMS AND ABBREVIATIONS.

Following are terms and abbreviations used in the manual. Table A1-1 lists airspeed terms and abbreviations.

V_s	- stalling speed, power off.
V_{to}	- take-off speed.
BHP	- brake horsepower; the power output of the engine delivered to the propeller shaft.
BMEP	- brake mean effective pressure.
CEILINGS	
Absolute	- the altitude at which the rate of climb is zero at stated weight and engine power.
Combat	- the altitude at which the rate of climb is 300 ft/min at stated weight and engine power.
Service	- the altitude at which the rate of climb is 100 ft/min at stated weight and engine power.
CAT	- carburetor air temperature.
C.G.	- center of gravity.
CRITICAL ALTITUDE	- the maximum pressure altitude at which a specified brake horsepower can be obtained at a specified RPM. (Also known as full throttle height.)
CRITICAL ENGINE FAILURE SPEED	- the speed at which engine failure permits acceleration to take-off speed in the same distance that the aircraft may be decelerated to a stop.
CRITICAL FIELD LENGTH	- the total length of runway required to accelerate on both engines to critical engine failure speed, experience an engine failure, then continue to take off or stop.
DENSITY ALTITUDE	- pressure altitude corrected for temperature.
DEWPOINT	- the temperature at which, under ordinary conditions, condensation begins in a cooling mass of air. This temperature is used as the basis of calculating the effect produced by humidity on the output of the engine.
OAT	- ambient, or outside air temperature.
GS	- ground speed.
ICAO	- International Civil Aviation Organization.
LIMIT BHP	- the maximum brake horsepower which the engine is capable of developing without damage to the engine.
MAC	- the mean aerodynamic chord of a wing is the chord of an imaginary wing which, throughout the flight range, will have the same force vectors as the actual wing. As an aerodynamic consideration, it is used to determine the permissible center of gravity of the aircraft. Center of gravity locations may, therefore, be expressed either as % MAC values or as equivalent station locations.
MAP	- engine manifold absolute pressure (in. Hg).
METO POWER (Maximum except take-off)	- the maximum power available from the engine for continuous operation. Use AUTO RICH mixture, 2550 RPM, and 42.5 in. Hg MAP No time limit.
PRESSURE ALTITUDE	- the altitude in a standard atmosphere at which the air pressure is the same as the pressure under consideration.

RCR - runway condition reading. An arbitrary scale based on the coefficient of friction of a runway under various surface conditions (eg dry, wet, icy, grass, etc). The scale ranges from 02 to 26, with dry, hard surface runway represented by the high end (normally RCR 23).

REFUSAL SPEED - the maximum speed to which the aircraft can accelerate and then stop in the available runway length.

THRESHOLD SPEED - the speed at initiation of roundout.

RPM - engine speed in revolutions per minute.

RUNWAY GRADIENT - the slope of the runway expressed in percent; i.e., change in elevation in feet per hundred feet of horizontal distance.

SFC - specific fuel consumption lb/hr/hp

STANDARD DAY - an arbitrarily assigned air temperature and pressure combination for every altitude which represents an approximation of conditions on an average day (59°F at sea level) in a temperate climate. Refer to Density Altitude Curve.

TOF - Take-off factor

TAKE-OFF GROSS WEIGHT LIMIT - the highest gross weight for a safe take-off in event of an engine failure. (Based on 100 ft/min rate of climb with critical engine inoperative, propeller feathered, landing gear retracted, and Maximum Power in the operative engine.)

TEMPERATURE LAPSE RATE - the rate of change of free air temperature with increasing altitude.

Table A1-1. Airspeed Terms and Abbreviations

TERMS	ABBREVIATION	DEFINITION
INDICATED AIRSPEED	IAS	Indicated reading corrected for instrument error.
CALIBRATED AIRSPEED	CAS	IAS corrected for position error.
EQUIVALENT AIRSPEED	EAS	CAS corrected for compressibility error.
TRUE AIRSPEED	TAS	EAS corrected for relative density.

STANDARD CHARTS.

TEMPERATURE CONVERSION CHART.

A Temperature Conversion chart (figure A1-1) is included to facilitate the conversion of either Fahrenheit temperatures to Centigrade or of Centigrade temperatures to Fahrenheit. After selecting on the appropriate scale the known value and proceeding into the chart to the point of intersection with the plotted line, the corresponding converted value may be read by moving from the intersection point to the other temperature scale.

STANDARD ATMOSPHERE TABLE.

The ICAO Standard Atmosphere Table (figure A1-2) depicts the standard atmospheric values, as defined by ICAO, in increments of 1000 feet from sea level to 30,000 feet. The values of density ratio, temperatures, speed of sound, barometric pressure, and pressure ratio are provided for each altitude increment.

DENSITY ALTITUDE CURVE.

Many of the performance charts are based on density altitude to compensate for temperature variations. The Density Altitude Curve (figure A1-3) provides a means of determining density altitude from a known pressure altitude and free air temperature. A Standard Day temperature line for the altitude range shown is marked on the curves as a convenient guide for this frequently referenced condition. Along the right side of the chart, the reciprocal square root of the density ratio is given to provide a means of computing true airspeed at any altitude from the indicated airspeed read on the airspeed indicator.

By entering the chart at the known free air temperature value and proceeding upward, the known pressure altitude value will be intersected. The corresponding density altitude may be read from the scale at the left opposite this point of intersection.

The value of the reciprocal square root of density ratio corresponding to a selected density altitude may be found by reading across the chart from the left scale to the right scale. Interpolation is required for determining points representing intermediate values between those indicated.

EXAMPLE

Given:	Free air temperature	22°C.
	Pressure altitude	Sea level.

Find: Density altitude.

Procedure: On the Density Altitude Chart select the point representing 22° on the scale at the bottom of the chart. Proceed into the chart along the 22°C line until the Sea Level pressure altitude line is intersected. From this point of intersection, move to the left scale on the chart and find the density altitude which, in this case, is 950 feet. From the same point of intersection, move to the right scale on the chart and find the value of the reciprocal square root of density ratio which, in this case, is approximately 1.013.

PSYCHROMETRIC CHART.

The Psychrometric Chart (figure A1-4) graphically relates the various measures of water vapor in the atmosphere. This chart is used primarily to obtain specific humidity from the dew point and pressure altitude. Specific humidity is the measure of humidity used in determining take-off performance. Although it is the dew point which is commonly furnished the pilot, occasionally humidity may have to be determined from wet and dry bulb temperatures, and less often from relative humidity. To meet all such situations the psychrometric chart provides a means of converting between any of these variables. The following example illustrates the methods of using the chart.

EXAMPLE

Given:	Wet bulb temperature	15°C.
	Dry bulb temperature	25°C.
	Pressure altitude	5000 feet.

Find: Relative humidity, dew point, specific humidity, and vapor pressure.

Procedure: Enter the chart from the dew point temperature line at a wet bulb temperature of 15°C (A), and follow the 5000 foot altitude guide line into the chart grid. Enter the bottom of the chart at a dry bulb temperature of 25°C (B), and read up to the intersection of the wet bulb temperature to find relative humidity of 35% (C). To find the dew point temperature, read across to the dew point temperature line at the left of the grid to find a dew point of 8°C (D). To find specific humidity, read across to the left and follow the guidelines to a pressure altitude of 5000 feet (E), and straight across to a specific humidity of .0085 (F). To find vapor pressure, read across from dew point or relative humidity to the right for a vapor pressure of .33 in. Hg (G).

If the dew point temperature and pressure altitude are known, specific humidity and vapor pressure can be determined by reading directly from the dew point temperature without reference to wet and dry bulb temperatures. In the same respect, relative humidity can be determined from dew point and pressure altitude when wet or dry bulb temperature is given.

PRESSURE ALTITUDE CHART.

The pressure altitude chart (figure A1-5) provides the correction necessary to determine pressure altitude when field elevation and altimeter setting (in. Hg) are known. The method is indicated at the top of the chart.

POSITION ERROR CORRECTION TO INDICATED AIRSPEED.

The position error correction to be applied to indicated airspeed while the aircraft is accelerating on the take-off roll can be determined from figure A1-6. The correction to be applied when the aircraft is airborne and above the influence of ground effect can be determined from figures A1-7 and A1-8. Ground effect is considered insignificant above a height of 50 feet.

POSITION ERROR CORRECTION TO ALTIMETER.

Figures A1-9, A1-10, A1-11 and A1-12 give the altimeter corrections to be applied at various airspeeds, gross weights, and configurations.

TEMPERATURE CONVERSION CHART

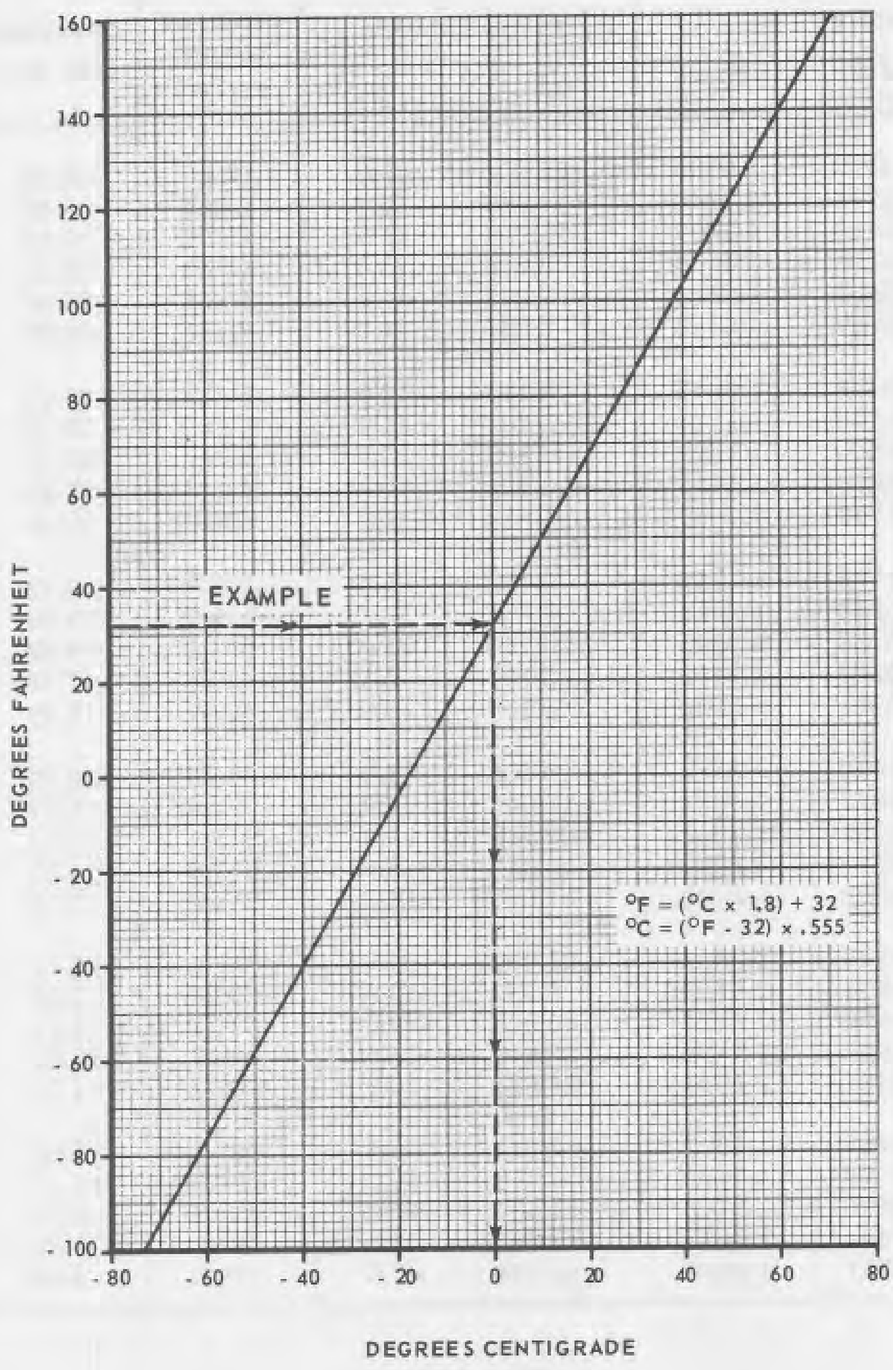


Figure A1-1

STANDARD ATMOSPHERE TABLE

STANDARD S L CONDITIONS:

TEMPERATURE 15°C (59°F)
PRESSURE 29.921 IN. Hg 2116.216 LB/SQ FT
DENSITY .0023769 SLUGS/CU FT
SPEED OF SOUND 1116.89 FT/SEC 661.7 KNOTS

CONVERSION FACTORS:

1 IN. Hg 70.727 LB/SQ FT
1 IN. Hg 0.49116 LB/SQ IN.
1 KNOT 1.151 M P H
1 KNOT 1.688 FT/SEC

ALTITUDE FEET	DENSITY RATIO σ	$\frac{1}{\sqrt{\sigma}}$	TEMPERATURE °C	TEMPERATURE °F	SPEED OF SOUND KNOTS	PRESSURE IN. Hg	PRESSURE RATIO δ
0	1.0000	1.0000	15.000	59.0	661.7	29.92	1.0000
1000	.9711	1.0148	13.019	55.4	659.5	28.86	.9644
2000	.9428	1.0299	11.037	51.9	657.2	27.82	.9298
3000	.9151	1.0454	9.056	48.3	654.9	26.82	.8962
4000	.8881	1.0611	7.075	44.7	652.6	25.84	.8637
5000	.8617	1.0773	5.094	41.2	650.3	24.90	.8320
6000	.8359	1.0938	3.113	37.6	647.9	23.98	.8014
7000	.8106	1.1107	1.132	34.0	645.6	23.09	.7716
8000	.7860	1.1279	-0.850	30.5	643.3	22.22	.7428
9000	.7620	1.1456	-2.831	26.9	640.9	21.39	.7148
10,000	.7385	1.1637	-4.812	23.3	638.6	20.58	.6877
11,000	.7156	1.1822	-6.794	19.8	636.2	19.79	.6614
12,000	.6932	1.2011	-8.775	16.2	633.9	19.03	.6360
13,000	.6713	1.2205	-10.756	12.6	631.5	18.29	.6113
14,000	.6500	1.2403	-12.737	9.1	629.1	17.58	.5874
15,000	.6292	1.2606	-14.718	5.5	626.7	16.89	.5643
16,000	.6090	1.2815	-16.700	1.9	624.3	16.22	.5420
17,000	.5892	1.3028	-18.681	-1.6	621.9	15.57	.5203
18,000	.5699	1.3246	-20.662	-5.2	619.4	14.94	.4994
19,000	.5511	1.3470	-22.643	-8.8	617.0	14.34	.4791
20.000	.5328	1.3700	-24.624	-12.3	614.6	13.75	.4595
21,000	.5150	1.3935	-26.605	-15.9	612.1	13.18	.4406
22,000	.4976	1.4176	-28.587	-19.5	609.6	12.64	.4223
23,000	.4806	1.4424	-30.568	-23.0	607.2	12.11	.4046
24,000	.4642	1.4678	-22.549	-26.6	604.7	11.60	.3876
25,000	.4481	1.4938	-34.530	-30.2	602.2	11.10	.3711
26,000	.4325	1.5206	-36.511	-33.7	599.7	10.63	.3552
27,000	.4173	1.5480	-38.492	-37.3	597.2	10.17	.3398
28,000	.4025	1.5762	-40.473	-40.9	594.7	9.72	.3250
29,000	.3881	1.6052	-42.455	-44.4	592.1	9.30	.3107
30,000	.3741	1.6349	-44.436	-47.0	589.5	8.89	.2970

Figure A1-2

DENSITY ALTITUDE CURVE

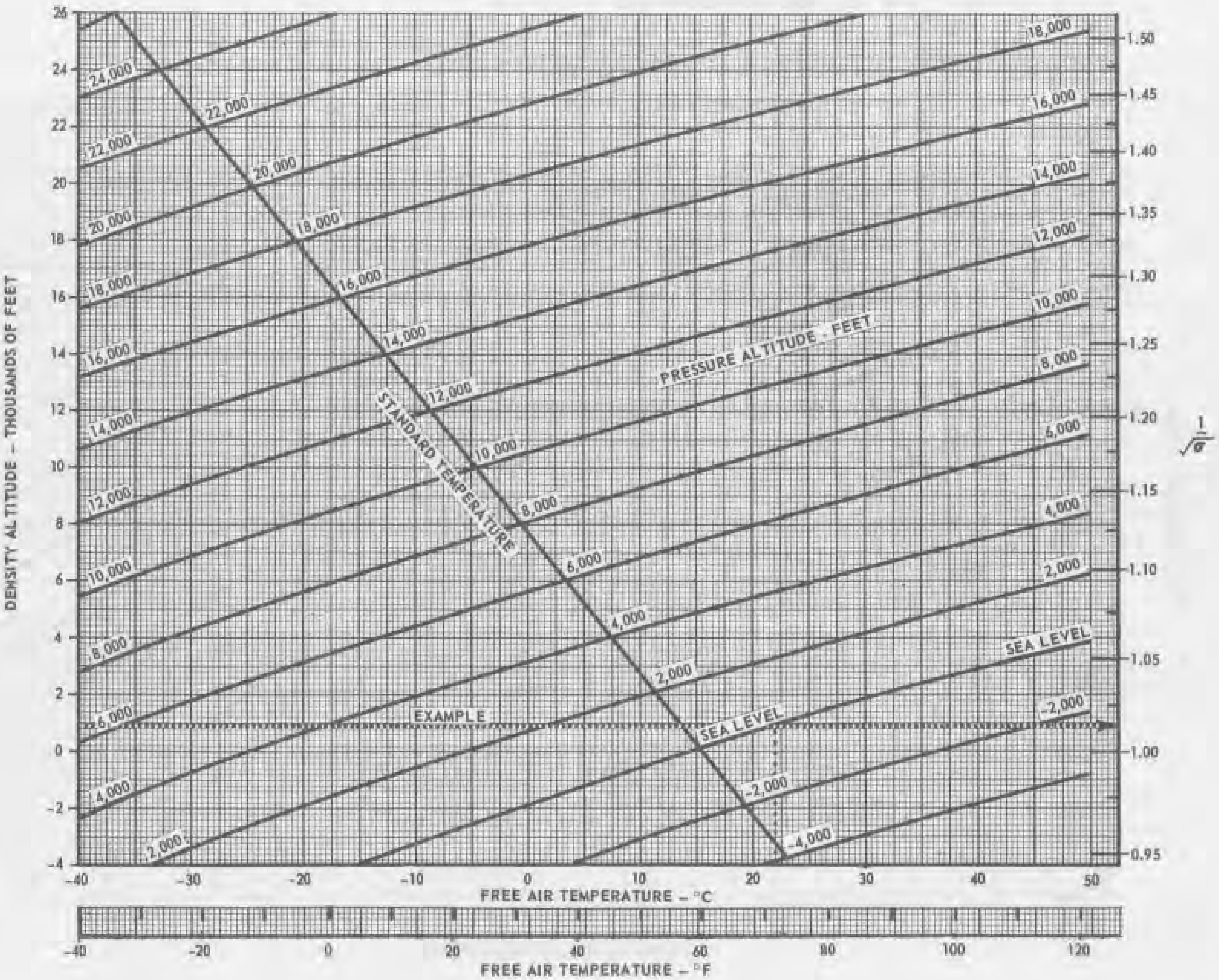


Figure A1-3

PSYCHROMETRIC CHART

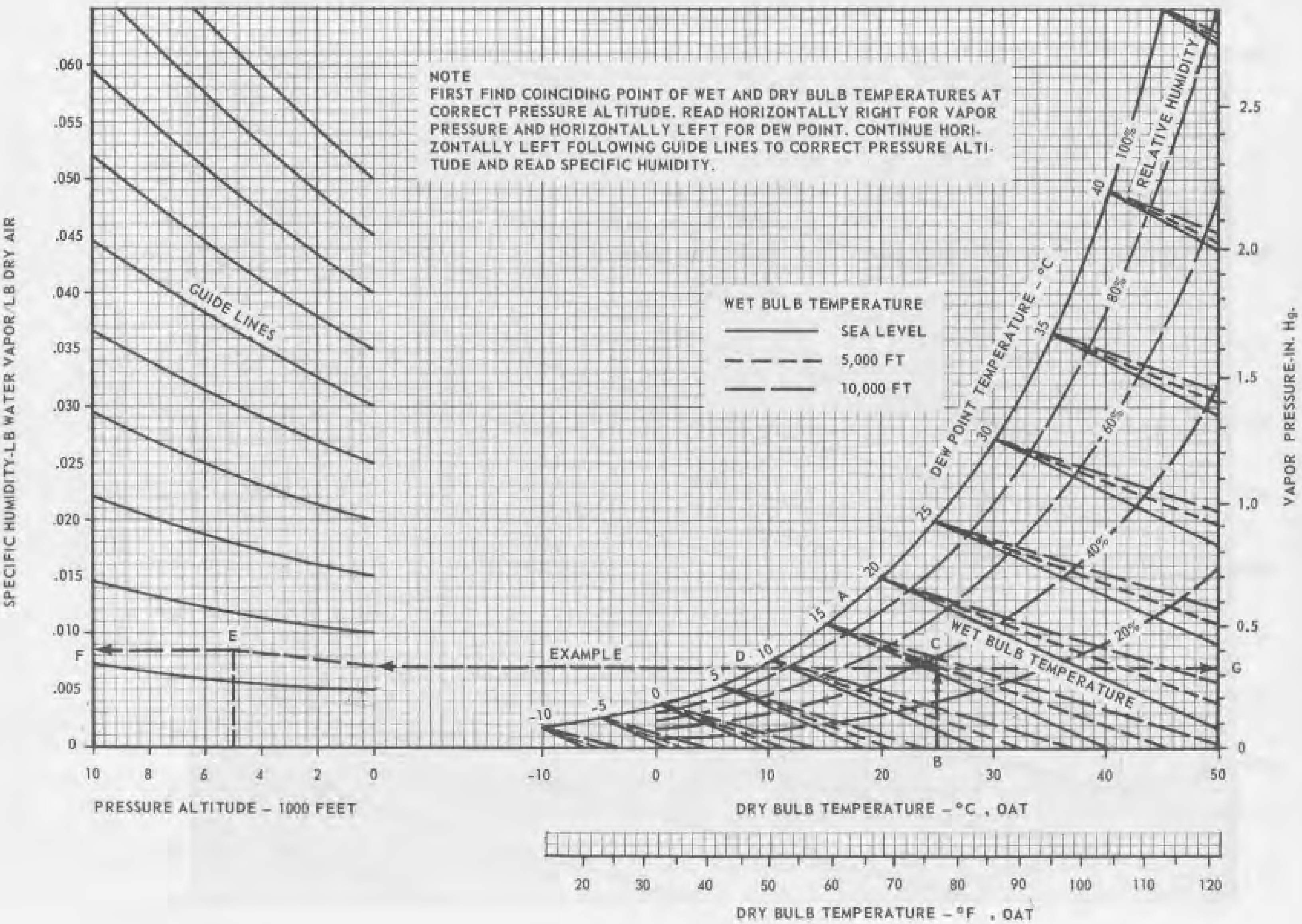


Figure A1-4

PRESSURE ALTITUDE CHART

PRESSURE ALTITUDE = FIELD ELEVATION + ALTITUDE

Altimeter Setting In. Hg	Δ Alt Ft	Altimeter Setting In. Hg	Δ Alt Ft	Altimeter Setting In. Hg	Δ Alt Ft	Altimeter Setting In. Hg	Δ Alt Ft	Altimeter Setting In. Hg	Δ Alt Ft	Altimeter Setting In. Hg	Δ Alt Ft	Altimeter Setting In. Hg	Δ Alt Ft
28.00	1824	28.50	1340	29.00	863	29.50	392	30.00	-73	30.50	-531	31.00	-983
.01	1814	.51	1330	.01	853	.51	382	.01	-82	.51	-540	.01	-992
.02	1805	.52	1321	.02	844	.52	373	.02	-91	.52	-549	.02	-1001
.03	1795	.53	1311	.03	834	.53	364	.03	-100	.53	-558	.03	-1010
.04	1785	.54	1302	.04	825	.54	354	.04	-110	.54	-567	.04	-1019
.05	1776	.55	1292	.05	815	.55	345	.05	-119	.55	-576	.05	-1028
.06	1766	.56	1282	.06	806	.56	336	.06	-128	.56	-585	.06	-1037
.07	1756	.57	1273	.07	796	.57	326	.07	-137	.57	-594	.07	-1046
.08	1746	.58	1263	.08	787	.58	318	.08	-146	.58	-604	.08	-1055
.09	1737	.59	1254	.09	777	.59	308	.09	-156	.59	-613	.09	-1064
28.10	1727	28.60	1244	29.10	768	29.60	298	30.10	-165	30.60	-622	31.10	-1073
.11	1717	.61	1234	.11	758	.61	289	.11	-174	.61	-631		
.12	1707	.62	1225	.12	749	.62	280	.12	-183	.62	-640		
.13	1698	.63	1215	.13	739	.63	270	.13	-192	.63	-649		
.14	1688	.64	1206	.14	730	.64	261	.14	-202	.64	-658		
.15	1678	.65	1196	.15	721	.65	252	.15	-211	.65	-667		
.16	1668	.66	1186	.16	711	.66	242	.16	-220	.66	-676		
.17	1659	.67	1177	.17	702	.67	233	.17	-229	.67	-685		
.18	1649	.68	1167	.18	692	.68	224	.18	-238	.68	-694		
.19	1639	.69	1158	.19	683	.69	215	.19	-248	.69	-703		
28.20	1630	28.70	1148	29.20	673	29.70	205	30.20	-257	30.70	-712		
.21	1620	.71	1139	.21	664	.71	196	.21	-266	.71	-721		
.22	1610	.72	1129	.22	655	.72	187	.22	-275	.72	-730		
.23	1601	.73	1120	.23	645	.73	177	.23	-284	.73	-740		
.24	1591	.74	1110	.24	636	.74	168	.24	-293	.74	-749		
.25	1581	.75	1100	.25	626	.75	159	.25	-303	.75	-758		
.26	1572	.76	1091	.26	617	.76	149	.26	-312	.76	-767		
.27	1562	.77	1081	.27	607	.77	140	.27	-321	.77	-776		
.28	1552	.78	1072	.28	598	.78	131	.28	-330	.78	-785		
.29	1542	.79	1062	.29	589	.79	122	.29	-339	.79	-794		
28.30	1533	28.80	1053	29.30	579	29.80	112	30.30	-348	30.80	-803		
.31	1523	.81	1043	.31	570	.81	103	.31	-358	.81	-812		
.32	1513	.82	1034	.32	560	.82	94	.32	-367	.82	-821		
.33	1504	.83	1024	.33	551	.83	85	.33	-376	.83	-830		
.34	1494	.84	1015	.34	542	.84	75	.34	-385	.84	-839		
.35	1484	.85	1005	.35	532	.85	66	.35	-394	.85	-848		
.36	1475	.86	995	.36	523	.86	57	.36	-403	.86	-857		
.37	1465	.87	986	.37	514	.87	47	.37	-412	.87	-866		
.38	1456	.88	976	.38	504	.88	38	.38	-421	.88	-875		
.39	1446	.89	967	.39	495	.89	29	.39	-431	.89	-884		
28.40	1436	28.90	957	29.40	485	29.90	20	30.40	-440	30.90	-893		
.41	1427	.91	948	.41	476	.91	10	.41	-449	.91	-902		
.42	1417	.92	938	.42	467	.92	1	.42	-458	.92	-911		
.43	1407	.93	929	.43	457	.93	-8	.43	-467	.93	-920		
.44	1398	.94	919	.44	448	.94	-17	.44	-476	.94	-929		
.45	1388	.95	910	.45	439	.95	-26	.45	-485	.95	-938		
.46	1378	.96	900	.46	429	.96	-36	.46	-494	.96	-947		
.47	1369	.97	891	.47	420	.97	-45	.47	-504	.97	-956		
.48	1359	.98	881	.48	410	.98	-54	.48	-513	.98	-965		
.49	1350	.99	872	.49	401	.99	-63	.49	-522	.99	-974		

Figure A1-5

POSITION ERROR CORRECTION TO INDICATED AIRSPEED

DURING GROUND ROLL

MODEL: C–7A
DATE: SEPTEMBER 1967
DATA BASIS: FLIGHT TEST (CONTRACTOR)

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTES: FLAPS 0° TO 25°
ENGINES MAX. POWER
ALL WEIGHTS

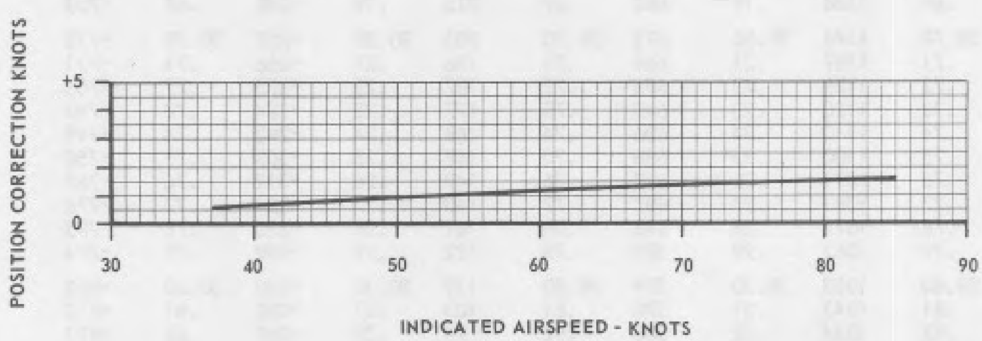


Figure A1-6

POSITION ERROR CORRECTION TO INDICATED AIRSPEED

ALL AIRCRAFT WEIGHTS - CLEAN CONFIGURATION

MODEL: C–7A
DATE: SEPTEMBER 1967
DATA BASIS: FLIGHT TEST (CONTRACTOR)

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTES: POWER FOR LEVEL FLIGHT
INDICATED AIRSPEED (IAS) = INSTRUMENT READING + INSTRUMENT CORRECTION
CALIBRATED AIRSPEED (CAS) = IAS + POSITION CORRECTION

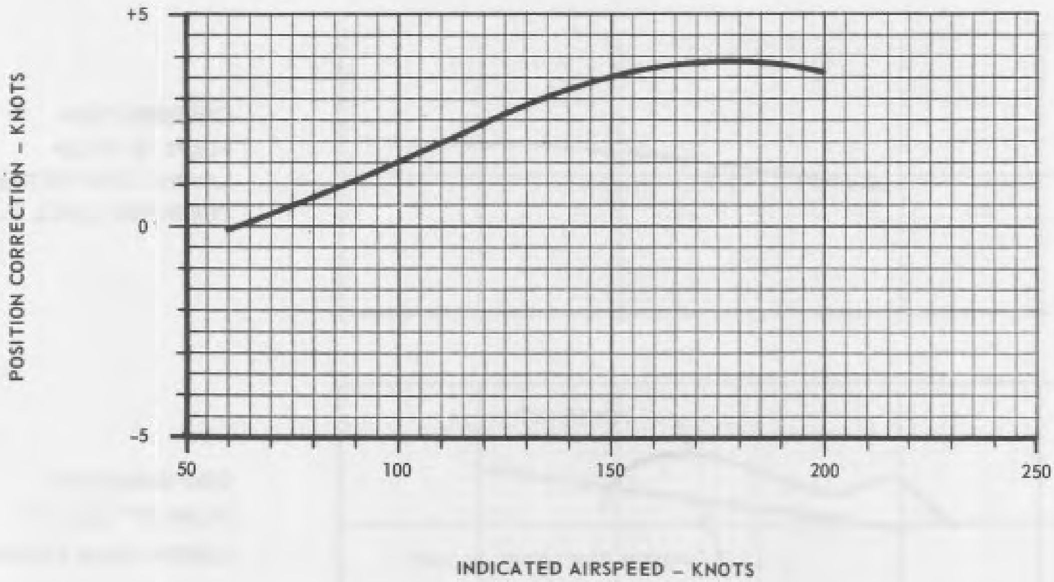


Figure A1-7

POSITION ERROR CORRECTION TO INDICATED AIRSPEED

ALL AIRCRAFT WEIGHTS - VARIOUS CONFIGURATIONS

MODEL: C–7A
DATE: SEPTEMBER 1967
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTES: INDICATED AIRSPEED (IAS) = INSTRUMENT READING + INSTRUMENT CORRECTION
CALIBRATED AIRSPEED (CAS) = IAS + POSITION CORRECTION

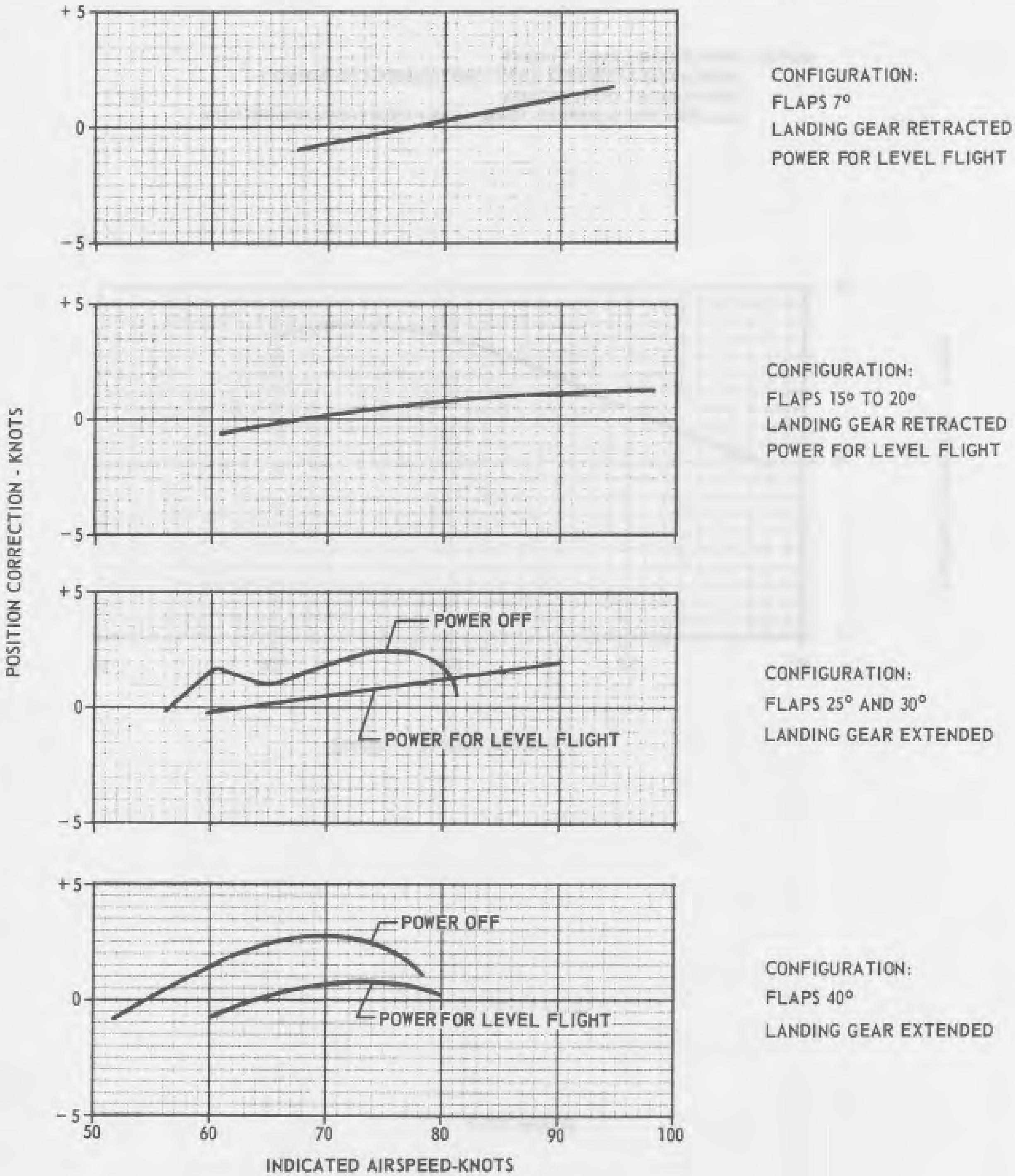


Figure A1-8

POSITION ERROR CORRECTION TO PILOTS ALTIMETER
ALL AIRCRAFT WEIGHTS – CLEAN CONFIGURATION

MODEL: C-7A
DATE: APRIL 1971
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

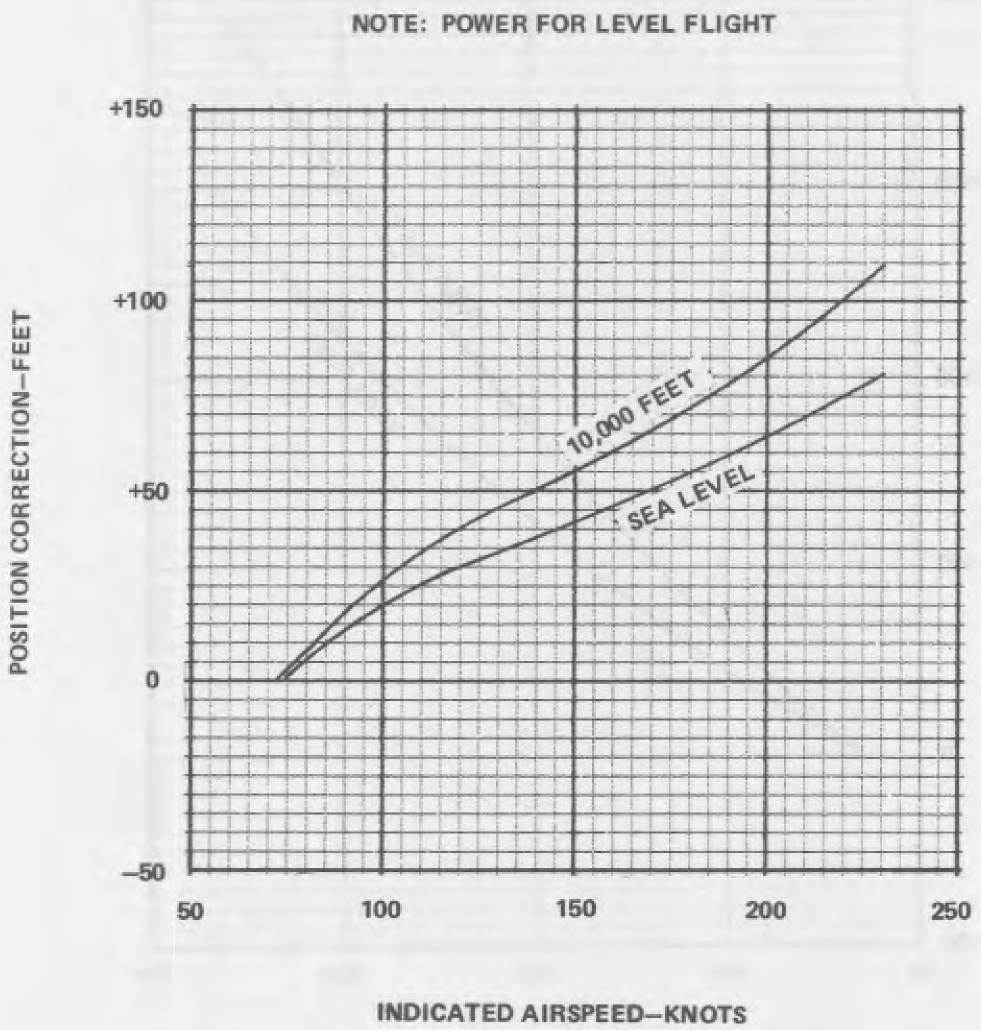


Figure A1-9

POSITION ERROR CORRECTION TO COPILOTS ALTIMETER
ALL AIRCRAFT WEIGHTS – CLEAN CONFIGURATION

MODEL: C-7A
DATE: APRIL 1971
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTE: POWER FOR LEVEL FLIGHT

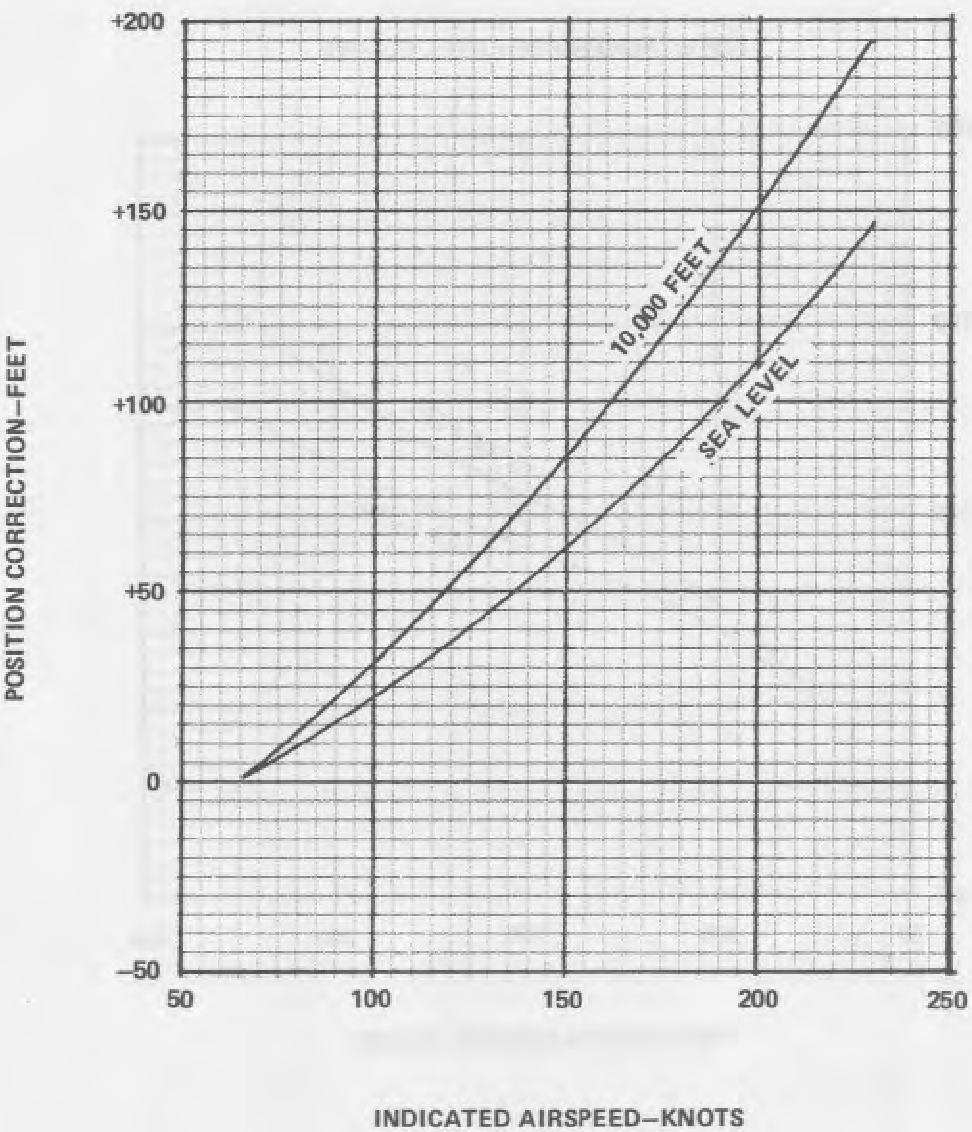


Figure A1-10

POSITION ERROR CORRECTION TO PILOTS AND COPILOTS ALTIMETER
ALL AIRCRAFT WEIGHTS – VARIOUS CONFIGURATIONS, GEAR UP OR DOWN

MODEL: C-7A
DATE: APRIL 1971
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL.

NOTE: POWER FOR LEVEL FLIGHT

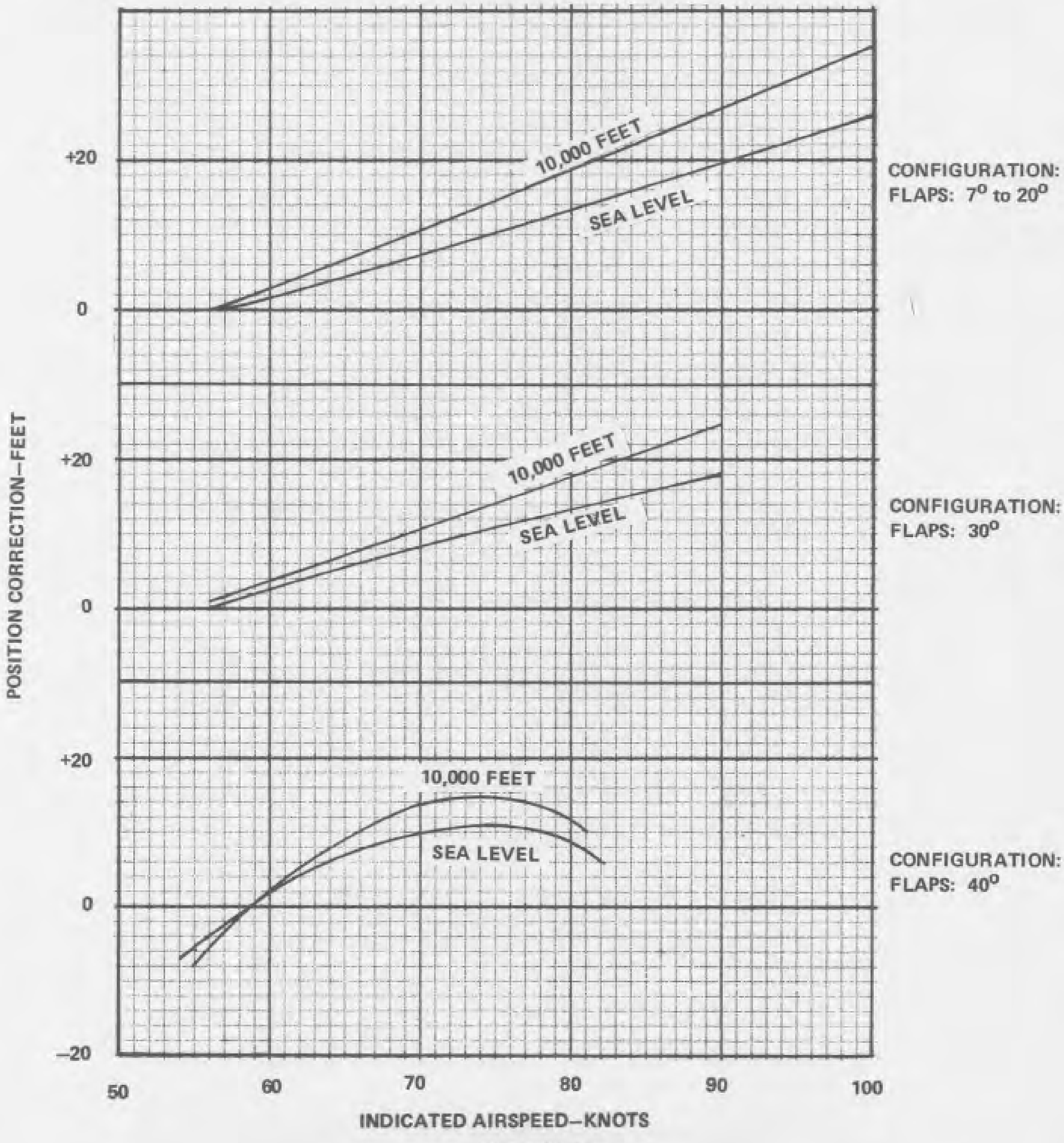


Figure A1-11

Figure A1-12 deleted.

PART 2

ENGINE DATA

TABLE OF CONTENTS.

ENGINE OPERATING LIMITS.

The Engine Operating Limits charts (figures A2-1 and A2-2) provide the necessary information to calculate critical altitude for STANDARD DAY conditions. These charts cover auto rich and auto lean conditions.

These charts are the basis for take-off, climb, and cruise data shown throughout this manual. They are intended to provide a graphic presentation of the two types of engine power limitations; those imposed by the engine manufacturer to prevent detonation and other effects of overboosting, and those due to the decreasing density of air with increasing altitude. From these charts, power and altitude conditions, not covered in Part 4 or Part 5, may be found.

The sea level calibration chart shows the variation of BHP with manifold pressure for the range of operating RPM at sea level.

The altitude calibration chart shows the variation of BHP and manifold pressure with altitude for the operating RPM when maintaining full throttle. On both charts, the upper end of each RPM line is terminated at the BHP limit for that RPM.

The problems which involve the use of operating curves fall generally into one of two types; the calculation of BHP, when manifold pressure, RPM, and altitude are known; and the calculation of manifold pressure, when BHP, RPM, and altitude are known.

NOTE

In the interest of clarity, example A is shown on figure A2-2 and example B is shown on figure A2-1. However, both examples can be applied to either chart.

EXAMPLE A

Given:	Manifold pressure	30 in. Hg
	RPM	2000
	Altitude	7000 ft
Find:	Brake horsepower	

Procedure: Enter the sea level calibration chart in figure A2-2 at 30 in. Hg and move vertically to intersect the 2000 RPM line (A). Move horizontally right to the BHP scale (B), 635 BHP. Enter the altitude calibration chart at 635 BHP (C). Locate the intersection of the 2000 RPM and 30 in. Hg lines (D). Join (C) and (D). Move horizontally left from the intersection of this line and the 7000-foot altitude line (E) to the BHP scale (F) and read the answer, 700 BHP.

Explanation:

The engine's sea level BHP at the given combination of RPM and manifold pressure is found from the sea level calibration chart at (B). The BHP at the full throttle critical altitude for the same combination is found from the altitude calibration chart at (D). The line CD is, therefore, the part throttle, constant RPM, constant manifold pressure line for the given combination of RPM and manifold pressure. The BHP for any altitude between sea level and critical altitude is determined by projecting the intersection of the altitude line and line CD horizontally left to the BHP scale.

EXAMPLE B

Given:	Brake horsepower	890
	RPM	2200
	Altitude	8000 ft

Find: Manifold pressure

Procedure: Enter the altitude calibration chart in figure A2-1 at 8000 feet and move vertically to intersect the 890 BHP line (A). Estimate a manifold pressure; eg, 33.9 in. Hg; and locate its intersection with the 2200 RPM line (B). Enter the sea level calibration chart at 33.9 in. Hg and move vertically to intersect the 2200 RPM line (C), then horizontally right to the BHP scale (D), 850 BHP. Enter the altitude calibration chart at 850 BHP (E). Join (B) and (E). Through (A) draw a line F G parallel to line B E and locate its intersection with the 2200 RPM line (H), which is the answer, 32.6 in. Hg.

Explanation:

All part throttle, constant RPM, constant manifold pressure lines are approximately parallel. If the slope of one such line B E is determined, a parallel line F G through the given BHP altitude point (A) can be drawn. Since manifold pressure is constant at all points on the line F G , the desired manifold pressure (H) can be read where the part throttle, constant RPM, constant manifold pressure line F G intersects the given RPM line. The more closely the desired manifold pressure is estimated, the more accurate will be the construction.

BRAKE HORSEPOWER AVAILABLE FOR TAKE-OFF.

Figure A2-3 is used to determine the maximum power available during take-off. The temperature lines (OAT) at the left of the reference line determine the maximum BHP in dry air for conditions of pressure altitude and ambient temperature. The reduction in BHP for various dew point temperatures can be determined from the guide lines to the right of the reference line. The solid guide lines denote sea level, and the broken guide lines, 10,000 feet. For other altitudes, the reduction in BHP must be determined by interpolation.

EXAMPLE

Given:	Pressure altitude	5000 ft
	Temperature	10°C
	Dew point	50°F

Find: Horsepower available

Procedure: Determine the allowable increase in MAP due to humidity from the minor chart on figure A2-3 by entering the bottom of the chart and moving vertically upward to intersect the curve and reading to the left 0.37 MAP increase allowable. Then enter the major chart at a pressure altitude of 5000 feet. Move vertically to intersect the 10°C line. Move horizontally right to the reference line and follow the guide line to 0.37 MAP increase intersection. Proceed horizontally to the next reference line. Move further right following the guide lines to the intersection of the dew point which is projected vertically from the scale at the base of the chart. From this intersection move horizontally right to the brake horsepower scale. Read: 1265 BHP.

NOTE

For take-offs in colder than standard conditions, avoid overpowering the engine beyond its rating. Reduce take-off manifold pressure 1 in. Hg for each 10°C below standard carburetor air temperature.

POWER SCHEDULES.

The Power Schedule tabulations are presented in figures A2-4 through A2-22. These tabulations provide information that will allow the pilot to set RPM and MAP to produce a BHP required for normal cruise operation. It should be noted that these figures are based on an engine that will develop 100% predicted power. Because of this requirement, the figures presented are only intended to allow the pilot to set power reasonably close to what is actually required for his particular engines. The pilot should make the final adjustments as required.

EXAMPLE

Given:	Brake horsepower	1200
	Pressure Altitude	5000 ft
	CAT	0°C
Find:	RPM, MAP, and fuel flow	

Procedure: Enter the Meto Power Schedule at 5000 feet and move horizontally to the 0° CAT column, read MAP 41.3 in. Hg. Also read the RPM, 2550, and the fuel flow for 2 engines, 1720.

ENGINE OPERATING LIMITS

AUTO RICH

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTE:
1. AVOID OPERATION BETWEEN 2310 AND 2510 RPM
2. OPERATION ABOVE 1200 BHP AT 2550 RPM IS PROHIBITED

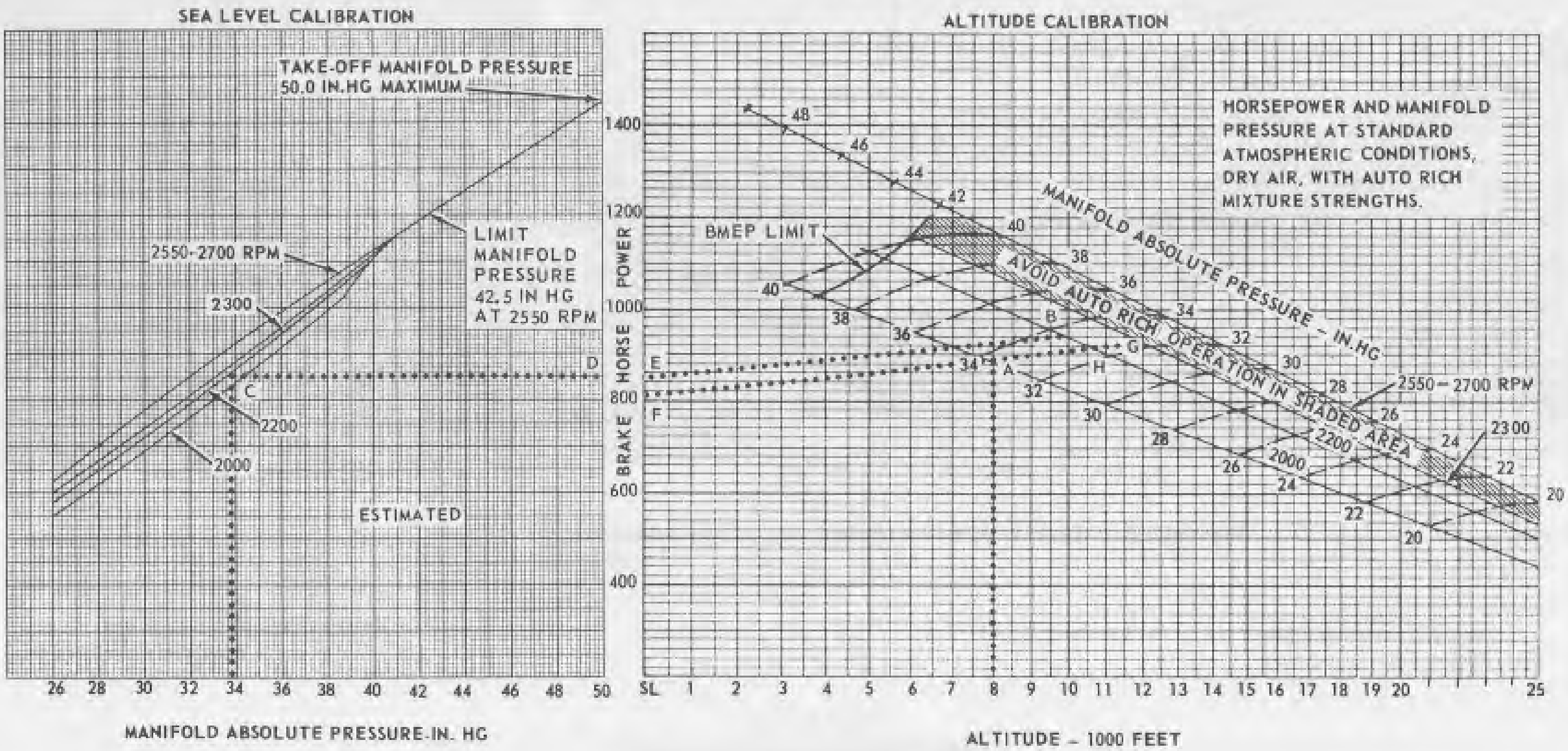


Figure A2-1

ENGINE OPERATING LIMITS

AUTO LEAN

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTE:
MAXIMUM AUTO LEAN OPERATION, MAP 33 IN. HG AND 2200 RPM

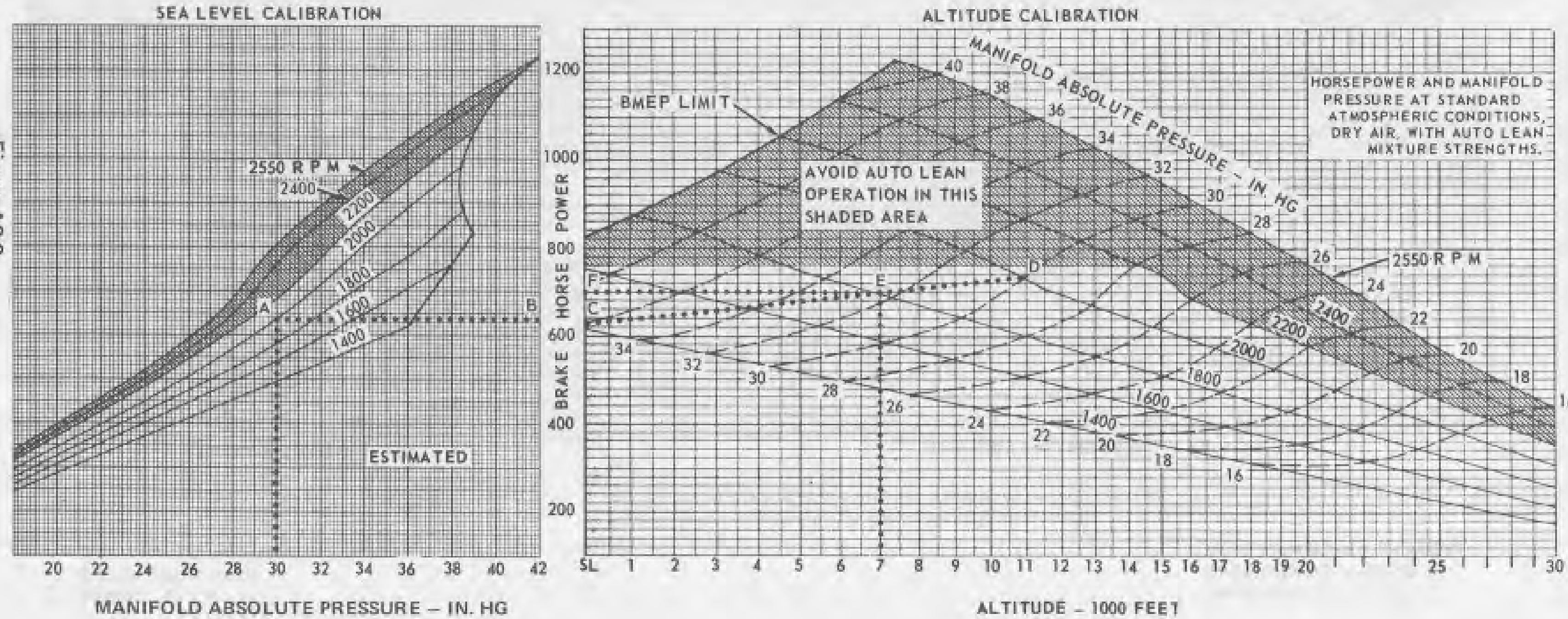


Figure A2-2

BRAKE HORSEPOWER AVAILABLE FOR TAKE-OFF

AUTO RICH – 2700 RPM

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

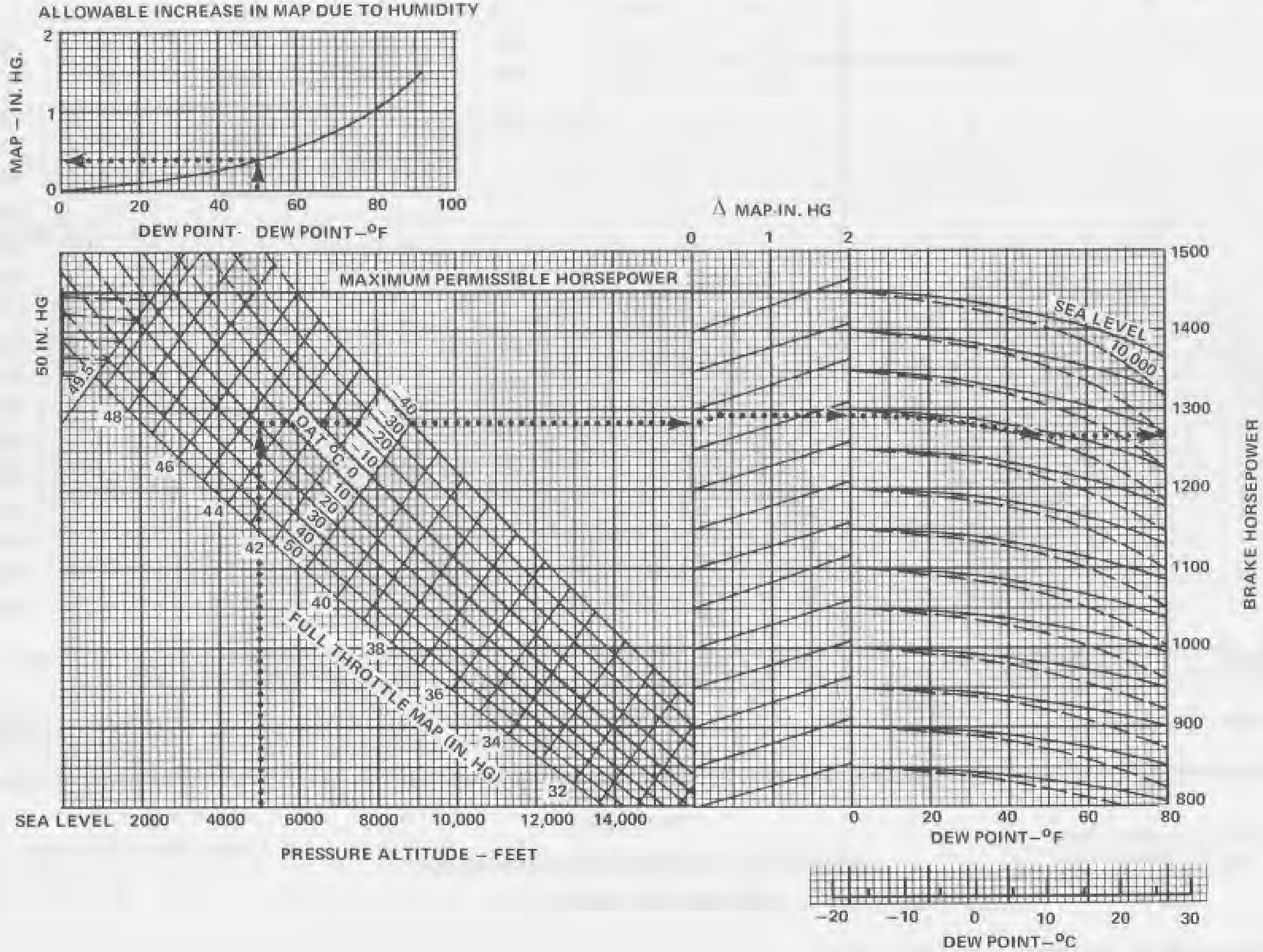


Figure A2-3

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

METO POWER SCHEDULE

1200 BRAKE HORSEPOWER PER ENGINE

AUTO RICH

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (^{o}C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000									
16,000									
15,000									
14,000									
13,000									
12,000									
11,000									
10,000									
9,000									
8,000	F.T.								
7,000	39.6	F.T.							
6,000	39.6	40.4	F.T.						
→ 5,000 •••	••• 39.6 •••	••• 40.5 ••• →	41.3	F.T.					
4,000	39.6	40.5	41.3	42.0	F.T.				
3,000	39.7	40.5	41.3	42.0	42.8	F.T.			
2,000	39.7	40.6	41.4	42.1	42.9	43.7			
1,000	39.7	40.6	41.4	42.1	42.9	43.7			
0	39.7	40.6	41.4	42.1	42.9	43.8	→ 2550	860	→ 1720

Figure A2-4

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE
1150 BRAKE HORSEPOWER PER ENGINE
AUTO RICH

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000									
16,000									
15,000									
14,000									
13,000									
12,000									
11,000									
10,000	F.T.								
9,000	38.1	F.T.							
8,000	38.1	38.9	F.T.						
7,000	38.1	38.9	39.7	F.T.					
6,000	38.1	39.0	39.7	40.4	F.T.				
5,000	38.1	39.0	39.8	40.4	41.2	F.T.			
4,000	38.1	39.0	39.8	40.5	41.2	42.0			
3,000	38.2	39.0	39.8	40.5	41.2	42.0			
2,000	38.2	39.1	39.8	40.5	41.3	42.0			
1,000	38.2	39.1	39.8	40.5	41.3	42.1			
0	38.2	39.1	39.8	40.5	41.3	42.1	2550	807	1614

Figure A2-5

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST(AFFTC)

CRUISE POWER SCHEDULE
1100 BRAKE HORSEPOWER PER ENGINE
AUTO RICH

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (^{o}C)						RPM	FUEL FLOW – LB/HR	
	−20^{o}	−10^{o}	0^{o}	+10^{o}	+20^{o}	+30^{o}		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000									
16,000									
15,000									
14,000									
13,000									
12,000									
11,000									
10,000									
9,000	F.T.								
8,000	36.8	F.T.							
7,000	36.8	37.5	F.T.						
6,000	36.8	37.6	38.3	F.T.					
5,000	36.9	37.6	38.3	39.0	F.T.				
4,000	36.9	37.7	38.4	39.1	39.8	F.T.			
3,000	36.9	37.8	38.5	39.1	39.9	40.6			
2,000	36.9	37.9	38.6	39.2	40.0	40.7			
1,000	37.0	37.9	38.6	39.2	40.0	40.8			
0	37.0	38.0	38.7	39.3	40.1	40.9	2300	700	1400

Figure A2-6

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE
1050 BRAKE HORSEPOWER PER ENGINE

AUTO RICH

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000									
16,000									
15,000									
14,000									
13,000									
12,000									
11,000									
10,000	F.T.								
9,000	36.0	F.T.							
8,000	36.0	36.6	F.T.						
7,000	36.6	36.7	37.2	F.T.					
6,000	36.6	37.4	37.3	38.0	F.T.				
5,000	36.6	37.4	38.1	38.1	38.6	F.T.	2300	650	1300
4,000	36.6	37.4	38.1	38.8	38.6	39.4			
3,000	36.6	37.4	38.1	38.8	39.5	39.5	2200	620	1240
2,000	36.6	37.4	38.1	38.8	39.5	40.3			
1,000	36.6	37.4	38.1	38.8	39.5	40.3			
0	36.6	37.4	38.1	38.8	39.5	40.3	2100	605	1210

Figure A2-7

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE
1000 BRAKE HORSEPOWER PER ENGINE
AUTO RICH

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000									
16,000									
15,000									
14,000									
13,000									
12,000									
11,000	F.T.								
10,000	34.1	F.T.							
9,000	34.2	34.9	F.T.						
8,000	35.0	35.0	35.6	F.T.					
7,000	35.0	35.7	35.7	36.2	F.T.				
6,000	35.1	35.8	36.5	36.1	37.2	F.T.	2300	600	1200
5,000	35.1	35.9	36.6	37.2	37.3	37.9	2200	586	1172
4,000	35.2	35.9	36.6	37.3	38.0	38.6			
3,000	35.3	36.0	36.7	37.4	38.1	38.7			
2,000	35.4	36.1	36.8	37.4	38.1	38.8			
1,000	35.4	36.1	36.8	37.5	38.2	38.9			
0	35.5	36.2	36.9	37.6	38.3	39.0	2100	568	1136

Figure A2-8

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE

950 BRAKE HORSEPOWER PER ENGINE

AUTO RICH

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000									
16,000									
15,000									
14,000									
13,000									
12,000	F.T.								
11,000	32.7	F.T.							
10,000	32.8	33.4	F.T.						
9,000	33.4	33.5	34.2	F.T.					
8,000	33.5	34.1	34.3	34.9	F.T.	F.T.			
7,000	33.6	34.2	34.9	35.1	35.7	35.8	2300	555	1110
6,000	33.7	34.3	35.0	35.6	36.2	36.4	2200	537	1074
5,000	33.8	34.4	35.1	35.7	36.3	36.0			
4,000	33.9	34.5	35.2	35.8	36.4	37.1			
3,000	33.9	34.6	35.3	35.9	36.6	37.2			
2,000	34.0	34.7	35.4	36.0	36.7	37.3			
1,000	34.1	34.8	35.5	36.1	36.8	37.5			
0	34.2	34.9	35.6	36.2	36.9	37.6	2100	517	1034

Figure A2-9

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE
900 BRAKE HORSEPOWER PER ENGINE
AUTO RICH

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000									
16,000									
15,000									
14,000	F.T.								
13,000	30.7	F.T.							
12,000	31.2	31.5	F.T.						
11,000	31.9	31.9	32.1	F.T.					
10,000	32.0	32.6	32.6	32.8	F.T.	F.T.			
9,000	32.8	32.7	33.3	33.3	33.5	34.0			
8,000	32.8	33.5	33.4	34.0	34.0	34.1	2300	523	1046
7,000	32.9	33.6	34.2	34.1	34.7	34.7	2200	503	1006
6,000	33.0	33.7	34.3	34.9	34.8	35.4			
5,000	33.0	33.7	34.4	35.0	35.1	35.5	2100	492	984
4,000	33.1	33.8	34.5	35.1	35.7	36.3			
3,000	33.1	33.9	34.5	35.1	35.8	36.5			
2,000	33.2	34.0	34.6	35.2	35.9	36.6			
1,000	33.2	34.0	34.7	35.3	36.0	36.7			
0	33.3	34.1	34.8	35.4	36.1	36.8	2000	477	954

Figure A2-10

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE
850 BRAKE HORSEPOWER PER ENGINE
AUTO RICH

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	–20°	–10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000									
16,000									
15,000									
14,000	F.T.								
13,000	29.6	F.T.	F.T.						
12,000	30.1	30.3	30.7	F.T.					
11,000	31.0	30.8	31.0	31.3	F.T.				
10,000	31.1	31.0	31.6	31.7	32.0	F.T.	2300	492	984
9,000	31.2	31.8	31.8	32.3	32.5	33.0			
8,000	31.3	31.9	32.5	32.5	33.1	33.1	2200	475	950
7,000	31.4	32.0	32.6	33.2	33.6	33.7	2100	462	924
6,000	31.4	32.1	32.7	33.3	33.8	34.5			
5,000	31.5	32.2	32.8	33.4	33.9	34.6			
4,000	31.6	32.3	32.9	33.5	34.0	34.8			
3,000	31.7	32.4	33.0	33.6	34.1	34.9			
2,000	31.7	32.5	33.1	33.7	34.3	35.0			
1,000	31.8	32.6	33.2	33.8	34.4	35.1			
0	31.9	32.7	33.3	33.9	34.5	35.2	2000	450	900

Figure A2-11

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE
800 BRAKE HORSEPOWER PER ENGINE
AUTO RICH

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000									
16,000	F.T.								
15,000	27.9	F.T.							
14,000	28.3	28.6	F.T.						
13,000	28.7	28.9	29.3	F.T.					
12,000	29.6	29.4	29.7	30.2	F.T.				
11,000	29.7	30.3	30.1	30.4	31.0	F.T.	2300	450	900
10,000	29.8	30.4	31.0	30.8	31.2	31.8			
9,000	29.9	30.5	31.1	31.6	31.4	31.9	2200	428	856
8,000	30.0	30.6	31.2	31.7	32.3	32.1	2100	413	826
7,000	30.1	30.7	31.3	31.9	32.5	33.0			
6,000	30.2	30.8	31.4	32.0	32.6	33.2			
5,000	30.3	31.0	31.6	32.1	32.7	33.3			
4,000	30.4	31.1	31.7	32.2	32.8	33.4			
3,000	30.5	31.2	31.8	32.3	32.9	33.6			
2,000	30.6	31.3	31.9	32.5	33.1	33.7			
1,000	30.7	31.4	32.0	32.6	33.2	33.9			
0	30.8	31.5	32.1	32.7	33.3	34.0	2000	404	808

Figure A2-12

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE

750 BRAKE HORSEPOWER PER ENGINE

AUTO RICH

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000	F.T.								
16,000	26.9	F.T.							
15,000	27.0	27.5	F.T.						
14,000	26.8	27.6	28.1	F.T.					
13,000	27.9	27.5	28.2	28.7	F.T.				
12,000	28.0	28.6	28.1	28.8	29.3		2300	403	806
11,000	28.1	28.7	29.3	28.7	29.2	F.T.	2200	395	790
10,000	28.3	28.9	29.4	29.9	29.4	29.9			
9,000	28.4	29.0	29.6	30.1	30.7	30.0	2100	387	774
8,000	28.6	29.2	29.7	30.2	30.8	31.4			
7,000	28.7	29.3	29.9	30.4	31.0	31.5			
6,000	28.8	29.4	30.0	30.5	31.1	31.7			
5,000	29.0	29.6	30.2	30.7	31.3	31.9			
4,000	29.1	29.7	30.3	30.8	31.4	32.0			
3,000	29.3	29.9	30.5	31.0	31.6	32.2			
2,000	29.4	30.0	30.6	31.1	31.7	32.4			
1,000	29.6	30.2	30.8	31.3	31.9	32.5			
0	29.7	30.3	30.9	31.4	32.0	32.7	2000	375	750

Figure A2-13

Model: C-7A
Date: Feb 1972
Date Basis: Flight Test (AFFTC)

CRUISE POWER SCHEDULE
750 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

Engine(s) R-2000
Fuel Grade: 115/145
Fuel Density: 6.0lb/gal

Press Alt Feet	Manifold pressure (in. Hg) at Carburetor Air Temperature (°C)						RPM	Fuel Flow lb/hr	
	-20°	-10°	0°	10°	20°	-30°		Per Eng	2 Eng
15000									
14000	28.1								
13000	28.2	28.8							
12000	28.3	28.9	29.4						
11000	29.6	29.0	29.6	30.1	30.6				
10000	29.7	30.3	30.9	30.2	30.8	31.3	2150	350	700
9000	29.8	30.4	31.0	31.5	30.9	31.4			
8000	29.9	30.5	31.1	31.7	32.2	32.8	2000	334	668
7000	30.0	30.6	31.2	31.8	32.3	32.9			
6000	30.1	30.7	31.3	31.9	32.4	33.0			
5000	30.2	30.8	31.4	32.0	32.5	33.1			
4000	30.3	30.9	31.5	32.1	32.6	33.2			
3000	30.4	31.0	31.6	32.2	32.8	33.3			
2000	30.5	31.1	31.7	32.3	32.9	33.4			
1000	30.6	31.2	31.8	32.4	33.0	33.5			
S. L.	30.7	31.3	31.9	32.5	33.1	33.6			

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE

700 BRAKE HORSEPOWER PER ENGINE

AUTO LEAN

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	–20°	–10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000									
16,000	F.T.								
15,000	26.2	F.T.							
14,000	27.0	27.5	F.T.						
13,000	27.2	27.7	28.2	F.T.					
12,000	28.5	29.0	28.3	28.9	F.T.				
11,000	29.4	29.1	29.7	29.1	29.6	F.T.	2200	320	640
10,000	29.5	30.1	29.8	30.3	29.8	30.2			
9,000	29.6	30.2	30.7	30.4	30.9	30.4	2100	313	626
8,000	29.7	30.3	30.8	31.4	31.0	31.5			
7,000	29.8	30.4	30.9	31.5	32.0	31.6	2000	303	606
6,000	29.9	30.5	31.0	31.6	32.2	32.8			
5,000	30.0	30.6	31.1	31.7	32.9	32.9			
4,000	30.1	30.8	31.2	31.9	32.4	33.1			
3,000	30.2	30.9	31.3	32.0	32.5	33.2			
2,000	30.3	31.0	31.4	32.1	32.7	33.3			
1,000	30.4	31.1	31.5	32.2	32.8	33.5			
0	30.5	31.2	31.6	32.3	32.9	33.6	1900	297	594

Figure A2-14

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE
650 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000	F.T.								
16,000	25.1	F.T.							
15,000	25.8	26.3	F.T.						
14,000	26.8	26.4	26.9	F.T.					
13,000	26.9	27.4	27.1	27.6	F.T.				
12,000	27.9	27.5	28.0	27.7	28.2	F.T.	2200	296	592
11,000	28.0	28.5	28.2	28.7	28.4	28.8			
10,000	29.4	28.6	29.2	28.8	29.3	29.0	2100	293	586
9,000	29.4	29.9	29.3	29.8	29.4	29.9	2000	288	576
8,000	29.5	30.0	30.6	29.9	30.4	30.9			
7,000	29.6	30.1	30.7	31.3	30.6	31.1			
6,000	29.7	30.2	30.8	31.4	31.9	31.2	1900	283	566
5,000	29.7	30.3	30.9	31.4	32.0	32.5			
4,000	29.8	30.4	31.0	31.5	32.1	32.7			
3,000	29.9	30.4	31.0	31.6	32.1	32.8			
2,000	30.0	30.5	31.1	31.7	32.2	32.9			
1,000	30.0	30.6	31.2	31.7	32.3	33.0			
0	30.1	30.7	31.3	31.8	32.4	33.1	1800	280	560

Figure A2-15

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE
600 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000	F.T.								
16,000	24.9	F.T.							
15,000	25.0	25.5	F.T.						
14,000	26.0	25.6	26.1	F.T.	F.T.				
13,000	26.1	26.7	26.3	26.8	26.4	F.T.			
12,000	27.2	26.8	27.3	26.9	27.5	27.1	2100	277	554
11,000	27.3	27.8	27.5	28.0	27.6	28.2			
10,000	28.2	27.9	28.5	28.1	28.6	28.3	2000	270	540
9,000	28.3	29.5	28.7	29.2	28.8	29.3			
8,000	29.4	29.0	28.5	29.3	29.8	29.5	1900	264	528
7,000	29.5	30.1	29.6	30.2	29.9	30.5			
6,000	29.6	30.2	30.9	30.4	30.9	30.6	1800	262	524
5,000	29.7	30.3	31.0	31.4	31.0	31.5	1700	258	516
4,000	29.8	30.4	31.1	31.5	32.0	32.7			
3,000	29.9	30.5	31.2	31.6	32.1	32.8			
2,000	30.0	30.6	31.2	31.7	32.2	32.9			
1,000	30.1	30.7	31.3	31.8	32.4	33.1			
0	30.2	30.8	31.4	31.9	32.5	33.2	1600	254	508

Figure A2-16

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE

550 BRAKE HORSEPOWER PER ENGINE

AUTO LEAN

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000	F.T.								
16,000	24.1	F.T.							
15,000	24.2	24.7	F.T.	F.T.					
14,000	25.2	24.9	25.4	24.8	F.T.				
13,000	25.3	25.8	25.5	25.9	25.3	F.T.			
12,000	25.9	25.9	26.4	26.0	26.5	25.9	2000	252	504
11,000	26.1	26.6	26.6	27.1	26.7	27.1			
10,000	26.9	26.7	27.2	27.2	27.6	27.2	1900	246	492
9,000	27.1	27.6	27.4	27.9	27.8	28.3			
8,000	27.3	27.8	28.3	28.0	28.5	28.4	1800	243	486
7,000	27.4	27.9	28.4	28.9	28.7	29.2	1700	240	480
6,000	27.6	28.1	28.6	29.1	29.7	30.2			
5,000	27.7	28.3	28.8	29.3	29.9	30.4			
4,000	27.9	28.4	28.9	29.4	30.0	30.6			
3,000	28.0	28.6	29.1	29.6	30.2	30.8			
2,000	28.2	28.8	29.3	29.8	30.4	30.9			
1,000	28.3	28.9	29.4	29.9	30.5	31.1			
0	28.5	29.1	29.6	30.1	30.7	31.3	1600	236	472

Figure A2-17

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE

500 BRAKE HORSEPOWER PER ENGINE

AUTO LEAN

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	–20°	–10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000	F.T.								
18,000	21.7	F.T.							
17,000	21.9	22.4	F.T.						
16,000	22.0	22.5	23.0	F.T.	F.T.				
15,000	23.4	23.8	23.1	23.5	22.4	F.T.			
14,000	24.3	23.9	24.4	23.6	24.1	24.2	2000	236	472
13,000	24.4	24.8	24.6	25.1	24.3	24.7			
12,000	25.1	25.0	25.5	25.2	25.7	24.9	1900	230	460
11,000	25.2	25.7	25.6	26.1	25.8	26.3			
10,000	25.3	25.8	26.3	26.2	26.7	26.5	1800	225	450
9,000	25.4	25.9	26.4	26.8	26.9	27.4			
8,000	25.5	26.1	26.6	27.0	27.5	27.5	1700	220	440
7,000	25.6	26.2	26.7	27.1	27.6	28.1			
6,000	25.7	26.3	26.8	27.2	27.7	28.2			
5,000	25.9	26.4	26.9	27.3	27.9	28.4			
4,000	26.0	26.5	27.0	27.4	28.0	28.5			
3,000	26.1	26.6	27.1	27.5	28.1	28.6			
2,000	26.2	26.8	27.3	27.7	28.2	28.7			
1,000	26.3	26.9	27.4	27.8	28.4	28.9			
0	26.4	27.0	27.5	27.9	28.5	29.0	1600	217	434

Figure A2-18

MODEL: C–7A DATE: APRIL 1970 DATA BASIS: FLIGHT TEST (AFFTC)	**CRUISE POWER SCHEDULE** **450 BRAKE HORSEPOWER PER ENGINE** AUTO LEAN	ENGINE(S): R–2000 FUEL GRADE: 115/145 FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000	F.T.	F.T.							
17,000	21.3	21.7	F.T.	F.T.					
16,000	21.8	21.9	22.3	21.8	F.T.				
15,000	21.9	22.3	22.4	22.8	22.0	F.T.			
14,000	22.8	22.5	23.0	22.9	23.3	22.2	1900	210	420
13,000	22.9	23.3	23.1	23.5	23.4	23.8	1800	206	412
12,000	23.0	23.5	24.0	23.7	24.1	24.5			
11,000	23.2	23.6	24.1	24.5	24.9	24.7	1700	201	402
10,000	23.3	23.7	24.2	24.6	25.1	25.5			
9,000	23.4	23.8	24.3	24.8	25.2	25.7			
8,000	23.5	24.0	24.5	24.9	25.4	25.8			
7,000	23.7	24.1	24.6	25.1	25.5	26.0			
6,000	23.8	24.2	24.7	25.2	25.6	26.1			
5,000	23.9	24.4	24.9	25.3	25.8	26.3			
4,000	24.0	24.5	25.0	25.5	25.9	26.4			
3,000	24.1	24.6	25.1	25.6	26.1	26.6			
2,000	24.3	24.7	25.2	25.7	26.2	26.7			
1,000	24.4	24.9	25.4	25.9	26.4	26.9			
0	24.5	25.0	25.5	26.0	26.5	27.0	1600	198	396

Figure A2-19

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE
400 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000	F.T.								
17,000	20.3	F.T.	F.T.						
16,000	20.4	20.8	20.5	F.T.					
15,000	20.6	21.0	21.3	21.0	F.T.				
14,000	20.7	21.1	21.4	21.8	21.6	F.T.			
13,000	20.8	21.2	21.6	22.0	22.4	22.3	1700	193	386
12,000	20.9	21.3	21.7	22.1	22.5	22.9			
11,000	21.1	21.5	21.8	22.2	22.6	23.1			
10,000	21.2	21.6	22.0	22.4	22.8	23.2			
9,000	21.3	21.7	22.1	22.5	22.9	23.4			
8,000	21.5	21.9	22.3	22.7	23.1	23.5			
7,000	21.6	22.0	22.4	22.8	23.2	23.7			
6,000	21.7	22.1	22.6	23.0	23.4	23.8			
5,000	21.9	22.3	22.7	23.1	23.5	24.0			
4,000	22.0	22.4	22.8	23.2	23.6	24.1			
3,000	22.1	22.5	23.0	23.4	23.8	24.3			
2,000	22.2	22.6	23.1	23.5	23.9	24.4			
1,000	22.4	22.8	23.3	23.7	24.1	24.6			
0,	22.5	22.9	23.4	23.8	24.2	24.7	1600	189	378

Figure A2-20

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE
350 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000									
16,000	17.8	18.1	18.5	18.8	19.1	19.5			
15,000	18.0	18.3	18.7	19.0	19.3	19.7			
14,000	18.1	18.5	18.9	19.2	19.5	19.9			
13,000	18.3	18.6	19.0	19.3	19.7	20.1			
12,000	18.5	18.8	19.2	19.5	19.9	20.3			
11,000	18.6	19.0	19.4	19.7	20.0	20.5			
10,000	18.8	19.2	19.6	19.9	20.2	20.7			
9,000	19.0	19.3	19.7	20.1	20.4	20.9			
8,000	19.2	19.5	19.9	20.3	20.6	21.1			
7,000	19.3	19.7	20.1	20.4	20.8	21.2			
6,000	19.5	19.9	20.3	20.6	21.0	21.4			
5,000	19.7	20.0	20.4	20.8	21.2	21.6			
4,000	19.8	20.2	20.6	21.0	21.4	21.8			
3,000	20.0	20.4	20.8	21.2	21.5	22.0			
2,000	20.2	20.6	21.0	21.3	21.7	22.2			
1,000	20.3	20.7	21.1	21.5	21.9	22.4			
0	20.5	20.9	21.3	21.7	22.1	22.6	1600	180	360

Figure A2-21

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

CRUISE POWER SCHEDULE
300 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

ENGINE(S): R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW – LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000									
16,000									
15,000									
14,000									
13,000									
12,000	17.2	17.5	17.8	18.2	18.5	18.8			
11,000	17.3	17.6	17.9	18.3	18.6	18.9			
10,000	17.4	17.7	18.0	18.4	18.7	19.1			
9,000	17.5	17.8	18.1	18.5	18.8	19.2			
8,000	17.6	17.9	18.3	18.6	19.0	19.3			
7,000	17.7	18.0	18.4	18.7	19.1	19.4			
6,000	17.8	18.2	18.5	18.9	19.2	19.6			
5,000	17.9	18.3	18.6	19.0	19.3	19.7			
4,000	18.0	18.4	18.7	19.1	19.4	19.8			
3,000	18.1	18.5	18.8	19.2	19.5	19.9			
2,000	18.2	18.6	19.0	19.3	19.7	20.1			
1,000	18.3	18.7	19.1	19.4	19.8	20.2			
0	18.4	18.8	19.2	19.5	19.9	20.3	1600	165	330

Figure A2-22

PART 3

TAKE-OFF DATA

TABLE OF CONTENTS.

APPLICATION OF WIND TO TAKE-OFF DATA.

Winds are usually measured at some fixed point on the airfield and are valid for the time and geographical point where measured. If wind is measured at a point other than the runway, it is recommended that 50 percent of reported headwinds and 150 percent of reported tailwinds be used with the wind correction grids. (Refer to table A3-1.)

The take-off charts are based on the true wind speed at 50 feet above the runway and include the effects of a typical wind velocity variation with height, obtained over clear level ground.

TAKE-OFF FACTOR.

The Take-Off Factor chart (figure A3-1) is used to simplify the determination of take-off performance. The take-off factor is determined from the parameters of pressure altitude, outside air temperature, and specific humidity. The take-off factor is used for all flap settings.

EXAMPLE

Given:	Outside air temperature	120° F
	Pressure altitude	8000 ft
	Specific humidity	0.02

Find: Take-off factor

Procedure: Enter Take-Off Factor chart (figure A3-1) at an outside air temperature of 120° F (A) and read vertically to pressure altitude of 8000 feet (B). Correct for specific humidity by proceeding horizontally to the specific humidity grid at zero (C), following the guide line to 0.02 (D), and reading horizontally to find the take-off factor of 30 (E).

TAKE-OFF GROSS WEIGHT LIMITATION.

To provide a margin of safety in the event of an engine failure, gross weight limitations are imposed for take-off. By observing the recommended weight limitations, the pilot is guaranteed a positive rate of climb of 100 feet per minute, propeller feathered, gear, flaps, and climb-out speed as noted on figure A3-2. (Refer to Single-engine Best Climb Speeds, Section III, T.O. 1C-7A-1.) Since atmospheric conditions, available engine power, and aircraft configuration largely determine the performance of the aircraft, the Take-Off Gross Weight Limitation chart (figure A3-2) is constructed so that the effects of these variables may be introduced. Take-off factor, which combines the effects of pressure altitude, ambient temperature, and specific humidity is plotted vertically along the left side of the chart.

EXAMPLE

Given:	Take-off factor	12
	Configuration	flaps 0°, gear up

Find: Take-off gross weight limit

Procedure: Enter the left side of figure A3-2 with a take-off factor of 12. Proceed horizontally to the flaps 0°, gear up line and move vertically to the bottom of the chart and read the answer, 30,000 pounds gross weight limit.

CROSSWIND COMPONENT CHART.

The effective crosswind component and runway component can be determined from the Crosswind Component chart (figure A3-3). To find the crosswind component, enter the chart with the wind velocity (using maximum gust velocity) and the wind angle relative to the runway. The runway component is found by entering the chart with the steady wind velocity and wind angle relative to the runway.

EXAMPLE

Given:	Runway heading	270°
	Wind direction	200°
	Wind velocity	25 knots
	Gross weight	26,000 lb
	Flaps	15°

Find: If take-off speed for 15° flaps is recommended.

Procedure: From figure A3-4, the take-off indicated airspeed is 68.8 knots for 15° flaps at 26,000 pounds take-off gross weight.

Runway heading 270° minus 200° (reported wind) = 70° (crosswind).

Enter the Crosswind Component chart (figure A3-3) at a wind angle of 70°, proceed diagonally and intersect wind velocity of 25 knots, proceed downward and read the crosswind component (23.5 knots); then proceed vertically and intersect the 68.8 take-off speed line. This take-off airspeed falls in the not recommended area. Raising the flaps to 7° gives an airspeed of 78.7 knots which now falls in the recommended area of the chart.

NOTE

A take-off with 15° flaps can be made if the airplane could accelerate on the ground to a take-off airspeed of 78.5 knots, However, in fixed configuration acceleration, increasing take-off airspeed because of crosswind, is not advisable. Decreasing the flaps to the next lower setting to obtain the recommended take-off airspeed is desirable.

Table A3-1

WIND SUMMARY TABLE		
TYPE OF WIND	HOW TO OBTAIN COMPONENT	USE OF WIND COMPONENT
HEADWIND	Runway component Enter wind component chart with steady wind value.	Apply 100 percent of component to acceleration check. Apply 50 percent of component to all take-off distances. Apply 50 percent of component for obstacle clearance.
TAILWIND	Runway component Enter wind component chart with steady wind value plus gust increment	Apply 100 percent of component to acceleration check. Apply 150 percent of component to all take-off distances. Apply 150 percent of component for obstacle clearance.
CROSSWIND	Crosswind component Enter wind component chart with steady wind value plus gust increment.	Check necessity of increased take-off speeds.
GUSTS	Gust increment Reported wind in excess of steady wind value.	
Note: Winds reported at the runway may be used at full reported values.		

TAKE-OFF SPEED.

Take-off speed can be determined from the Take-Off Speed chart (figure A3-4). The chart is based on various conditions of flap angle and aircraft weight. Take-off speeds are shown for flap angles of 0°, 7°, 15°, and 25°.

EXAMPLE

Given:	Flaps	15°
	Gross weight	26,000 lb

Find: Take-off speed

Procedure: Enter the chart (figure A3-4) at 26,000 pounds gross weight and move vertically to intersect the 15° flap line. From the point of intersection move horizontally left and read the answer, 68.8 knots IAS.

NOTE

Take-off airspeed is based on flight test recommended airspeeds or minimum control speed, whichever is higher for flaps at 0°, 7°, and 15°. However, for short-field take-off with flaps at 25°, the take-off speed is based on flight test recommended airspeed and is below minimum control speed.

TAKE-OFF GROUND ROLL AND AIR RUN DISTANCE TO CLEAR 50-FOOT OBSTACLE.

These charts (figures A3-5, A3-6, A3-7, and A3-8) are provided to determine the ground roll distance required from brake release to the point of take-off, and the air distance required to clear the 50-foot obstacle. The charts are based on various conditions of take-off factor, rolling friction coefficient, runway slope, gross weight, and wind. Take-off configuration is with both engines operating at maximum power and flaps set at 0°, 7°, or 15° for normal take-off techniques or 25° for short-field take-off. The airspeed, used for the 50-foot climb segment, is at the recommended take-off speeds. To determine the additional ground roll required due to increasing take-off airspeed because of crosswind, refer to TAKE-OFF PERFORMANCE — DISTANCE AND TIME DURING GROUND ROLL.

EXAMPLE

Given:	Flaps	0°
	Take-off factor	20
	Gross weight	28,000 lb
	Reported headwind component	20 knots
	Runway condition	Dry turf
	Runway slope	1.5% uphill

Find: The corrected level ground run distance. The air run distance to a 50-foot obstacle. The total level ground distance to clear a 50-foot obstacle.

Procedure: Enter figure A3-5, Sheet 2 at the take-off factor of 20(A), move vertically upward to intercept the gross weight line at 28,000 pounds (B). From point (B) move horizontally to the left and read the uncorrected ground roll distance, 3210 feet (C). From point (B) move horizontally to the right to intercept the zero wind base line (D). Since the reported headwind was not recorded at the runway, apply 50 percent of component, 10 knots (table A3-1). Starting at the zero wind base proceed parallel to the headwind correction guide lines to intercept the 10-knot headwind line (E). From point (E) move horizontally to intercept the rolling friction coefficient reference line (F). Starting at this reference line proceed parallel to the rolling friction coefficient guide lines to intercept the dry turf line (G). Proceed horizontally to the 0 percent runway slope line (H). Follow the uphill runway slope guide lines parallel to intercept the 1.5% uphill slope line (I). Proceed horizontally to the right and read the corrected ground roll distance, 3530 feet (J).

Enter the Normal Take-Off Air Run chart (figure A3-5, Sheet 3) at the bottom with a take-off factor of 20. Proceed vertically upward to intercept the 28,000-pound gross weight line. From this point move horizontally to the right to the zero wind base line and follow parallel to the headwind guide lines to intersect the 10-knot line. Continue horizontally right and read the air distance to 50 feet, 2100 feet.

The total ground distance is the sum of the corrected ground roll distance and the air run distance, 3530 + 2100 = 5630 ft.

CRITICAL FIELD LENGTH.

The Critical Field Length charts (figures A3-9, A3-10, A3-11, A3-12) are used to determine the length of runway required to accelerate to critical engine failure speed and to either continue the take-off or stop within the available runway in the event of an engine failure for various combinations of take-off factor, wind, RCR, runway slope, rolling coefficient of friction, and gross weight. Separate charts are provided for flap settings of 0°, 7°, 15°, and 25°.

NOTE

If the runway length is less than the critical field length, the possibility of off-loading cargo or fuel to reduce the critical field length should be considered in the interest of safety.

NOTE

Critical engine failure speed is obtained from the Refusal Speed charts (figures A3-13, A3-14, A3-15, and A3-16 by substituting critical field length for available runway length.

The charts assume engine failure occuring on the most critical engine (No. 1 engine) at critical engine failure speed. For a continued take-off (flaps at 0°, 7°, or 15°) it is assumed that the aircraft leaves the runway at the take-off speed shown on the Take-Off Speed chart (figure A3-4).

NOTE

The short-field take-off with flaps at 25°, take-off airspeed is assumed to be minimum control speed or take-off speed, whichever is greater.

For an aborted take-off it is assumed that after engine failure, 3 seconds is allowed for reaction time (one engine acceleration) and 1 additional second in which the airplane is assumed coasting (power is reduced to zero); then brakes are applied, and the aircraft is decelerated with wheel braking only.

The following example illustrates the method of using the chart.

EXAMPLE

Given:	Take-off factor	10
	Gross weight	26,000 lb
	Effective headwind	10 knots
	Runway slope	1% uphill
	RCR	15
	Rolling friction coefficient	0.05
	Flaps	0°

Find: Critical field length

Procedure: Enter the chart (figure A3-9) with take-off factor of 10 (A), read vertically upward to a gross weight of 26,000 pounds (B). Then move horizontally to the right to the zero wind base line (C). Correct for headwind by following the headwind guide lines to 10 knots (D). Continue horizontally to the right to the zero slope base line (E). Correct for slope by following the slope guide lines to 1 percent uphill line. Then proceed horizontally to the right to the RCR base line (G). Correct for RCR by following the guide lines to an RCR of 15 (H). Again proceed horizontally to the right to the rolling friction coefficient base line (I). Correct for rolling friction coefficient by following the rolling friction guide lines to 0.05 (J). Continue horizontally right to find corrected critical field length, 2300 feet (K).

It should be noted that this example is below the TAKE-OFF GROSS WEIGHT LIMITATION LINE, gear down. This guarantees the pilot a 100 feet per minute rate of climb on one engine after lift-off at the take-off airspeed. For any single-engine take-off above this line a 100 feet per minute rate of climb is not guaranteed.

REFUSAL SPEED.

The Refusal Speed charts (figures A3-13, A3-14, A3-15, and A3-16) are provided to show the maximum speed to which the aircraft can accelerate and then stop in the available runway length for various conditions of take-off factor, runway slope, RCR, gross weight, and wind velocity. This chart assumes the same conditions as noted for the Critical Field Length chart (figures A3-9, A3-10, A3-11, and A3-12). Separate charts are provided for flap settings of 0°, 7°, 15°, and 25°.

If an engine failure should occur prior to reaching refusal speed, the take-off should be aborted; and conversely, if it occurs at or beyond refusal speed, the take-off should be continued (provided critical field length does not exceed runway length).

The following example illustrates the method of using the chart.

EXAMPLE

Given:	Take-off factor	20
	RCR	18
	Runway slope	1%
	Runway length available	2750 ft
	Flaps	0°
	Reported headwind	10 knots
	Gross weight	22,500 lb

Find: Refusal speed or critical engine failure speed.

Procedure: Enter the chart (figure A3-13) at a take-off factor of 20 (A), read up to the runway length of 2750 feet (B) and across to reference line (C). Correct for headwind by following the guide line to 10 knots (D) and across to the reference line (E). Follow the guide lines to (F), the intersection with the vertical line from 1% slope, then across to the reference line (G) and follow guide lines to the gross weight of 22,500 pounds (H). Continue right to base line (I). Follow guide line to RCR at 18 (J), continue right and read a refusal speed (K) of 60 knots IAS.

NOTE

To find critical engine failure speed, substitute critical field length for available runway length and ascertain the result in the same manner.

TAKE-OFF PERFORMANCE – DISTANCE AND TIME DURING GROUND ROLL.

The Distance — Time During Take-Off Ground Roll chart (figure A3-17) is based on the average acceleration characteristics of the airplane during the take-off ground roll with both engines operating at take-off power. The configuration of the airplane is accounted for by entering the chart with the take-off ground roll distance obtained from the appropriate chart, corrected for runway slope and runway condition. This chart is used to determine if the airplane acceleration is normal and can be expected to reach the refusal speed at the proper distance from start of roll. All refusal speeds and field lengths are valid only if acceleration is normal. Abort the take-off if acceleration check speed is not attained before the acceleration check distance (or time) is reached. This chart is also used to determine the additional distance required whenever the take-off speed is increased because of crosswind conditions.

EXAMPLE

Given:	Flaps	0°
	Take-off factor	30
	Gross weight	28,000 lb
	Runway length	5000 ft
	Runway slope	1.5% downhill
	Runway condition	Dry, hard surface
	Effective headwind component	10 knots
	Reciprocal square root of density ratio $\sqrt{\frac{1}{\sigma}}$	1.023

(1) Find: The indicated airspeed and the acceleration time at nearest 1000-foot marker below the refusal speed.

Procedure: From figure A3-5, Sheet 2 determine the ground roll distance, 4000 feet.

From figure A3-4 determine the take-off speed for 0° flaps, 87.5 knots.

Correct lift-off speed to ground speed using reported headwind, 87.5 — 10 = 77.5 knots.

From figure A3-14 determine the refusal speed, 70 KIAS. Correct for headwind, 70 — 10 = 60 knots.

Enter figure A3-17 at the bottom at 77.5 knots (A) and move vertically upward to intercept the 4000 corrected take-off ground roll distance (B) point.

Follow the guide lines to intercept the refusal speed, 60 knots (C), and continue following the guide lines to the next lowest 1000-foot marker, 2000 feet (D). Move vertically downward and read the ground speed, 56 knots (E). Correct for headwind 56 + 10 = 66 KIAS.

At point (D) visually interpolate the time, 41, and correct for density altitude 41 ÷ 1.023 = 40 seconds.

(2) Find: The corrected take-off distance if the take-off airspeed was increased 5 knots due to crosswind conditions (87.5 + 5.0 = 92.5 knots).

Procedure: From point (B) follow the guide line upward to intercept the 82.5-knot ground speed line (F) (92.5 — 10 = 82.5 knots). Move horizontally to the left and read the corrected take-off distance, 4500 feet.

RUNWAY CONDITION.

Runway condition reading (RCR) is a value which relates the average braking effectiveness of the particular runway surface to the braking capability of the aircraft. The measured RCR, therefore, becomes a factor in determining any performance which involves braking, such as critical field length and refusal speed. Many airfields will continue to report braking action in accordance with ICAO documents. This is the good, medium and poor categorization of braking action on unusual runway surface conditions. Table A3-2 will be used when correlating -RCR to Runway Conditions.

Table A3-2

RUNWAY CONDITIONS

RUNWAY SURFACE	RUNWAY CONDITION READING (RCR)	ICAO
DRY CONCRETE OR MACADAM	23	GOOD
DRY TURF	15	
WET CONCRETE OR MACADAM	12	MEDIUM
SNOW OR WET GRASS	08	
ICE	05	POOR

TAKE-OFF FACTOR

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST

CONDITIONS:
MAXIMUM POWER

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

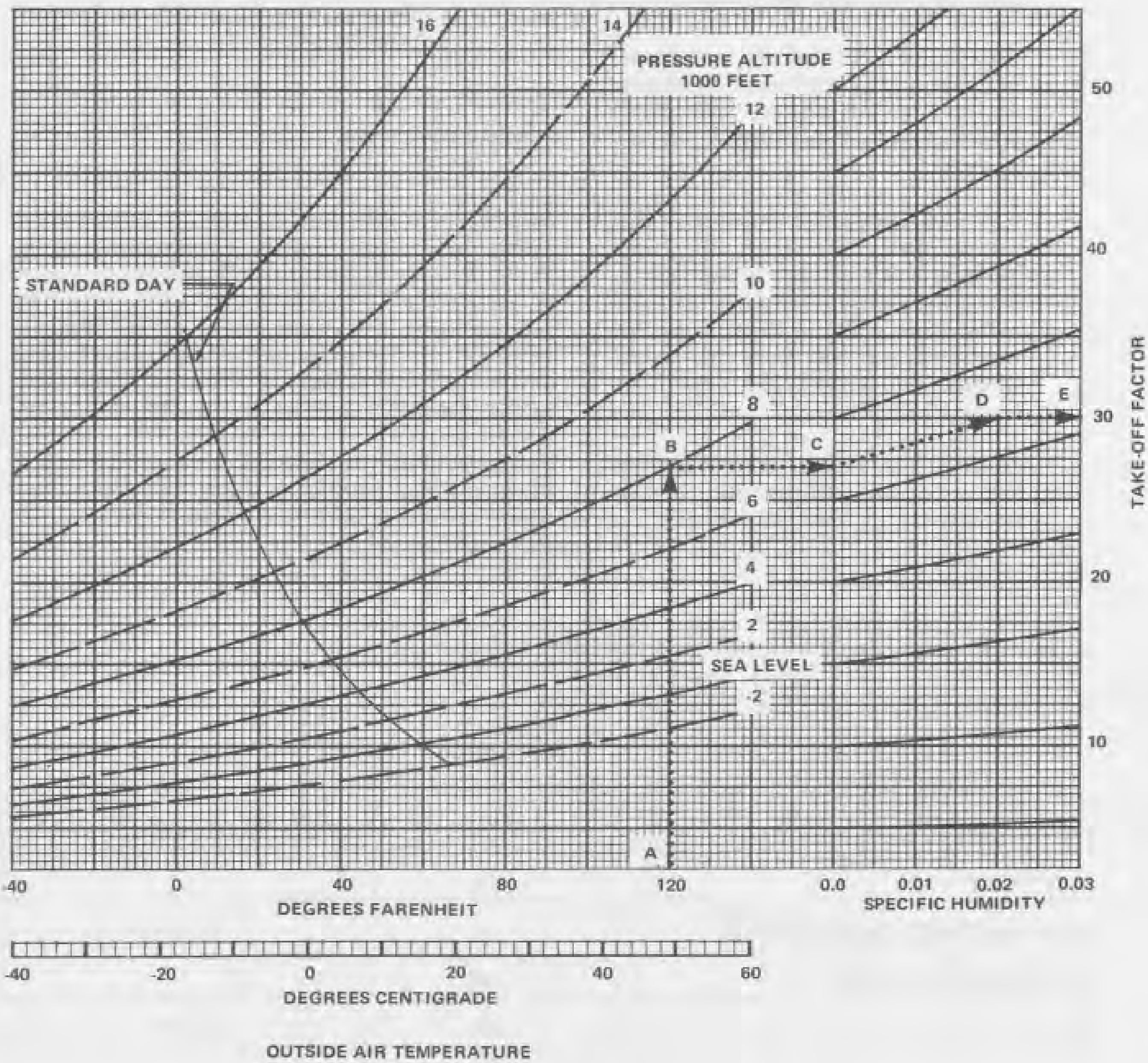


Figure A3-1

TAKE-OFF GROSS WEIGHT LIMITATION

MODEL: C-7A
DATE: AUGUST 1971
DATA BASIS: FLIGHT TEST

ENGINES: (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTES:

1. LIMIT BASED ON RATE OF CLIMB OF 100 FPM FOLLOWING NORMAL TAKE-OFF.
2. OPERATING ENGINE AT MAXIMUM POWER, PROPELLER OF INOPERATIVE ENGINE FEATHERED.
3. GEAR DOWN CLIMB SPEED BASIS: CLIMB SPEED = TAKE-OFF SPEED (0°, 7°, 15° FLAPS) CLIMB SPEED = TAKE-OFF SPEED OR VMC, WHICHEVER IS HIGHER (20°, 25° FLAPS)
4. GEAR UP CLIMB SPEED BASIS: CLIMB SPEED = SINGLE ENGINE BEST CLIMB SPEED.

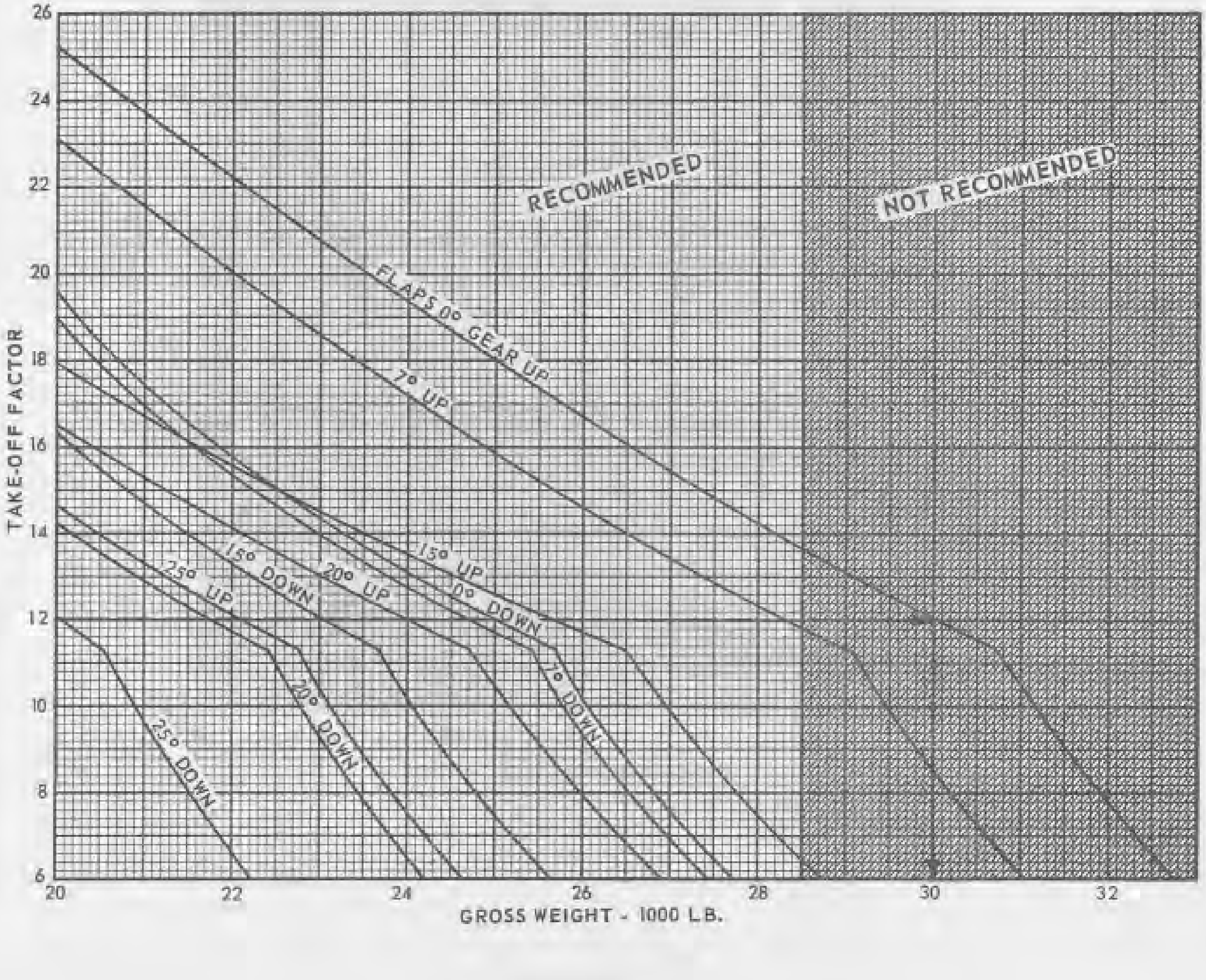


Figure A3-2

CROSSWIND COMPONENT

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTE:
KEEP NOSEWHEEL ON GROUND UNTIL RUDDER BECOMES EFFECTIVE DURING TAKE-OFF

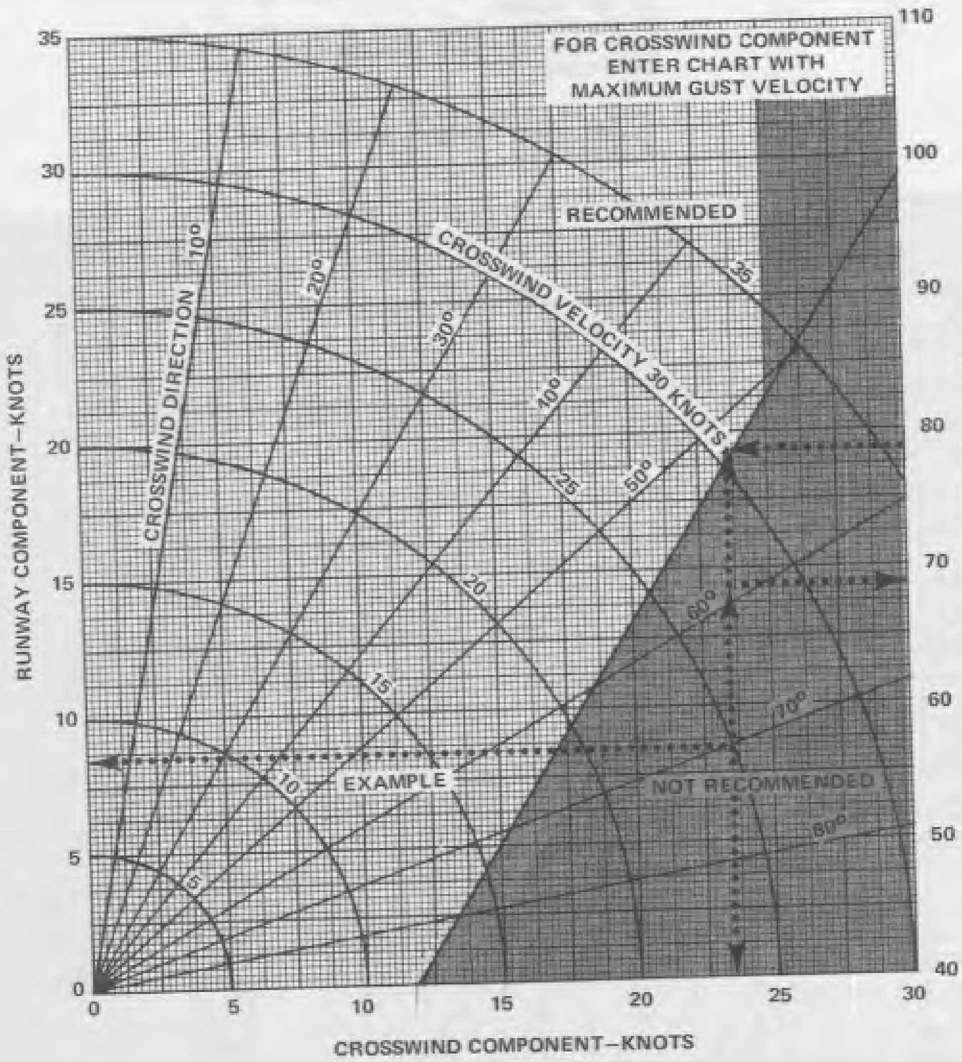


Figure A3-3

TAKE-OFF SPEED

MODEL: C-7A
DATE: JULY 1971
DATA BASIS: ESTIMATED

ENGINES: (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

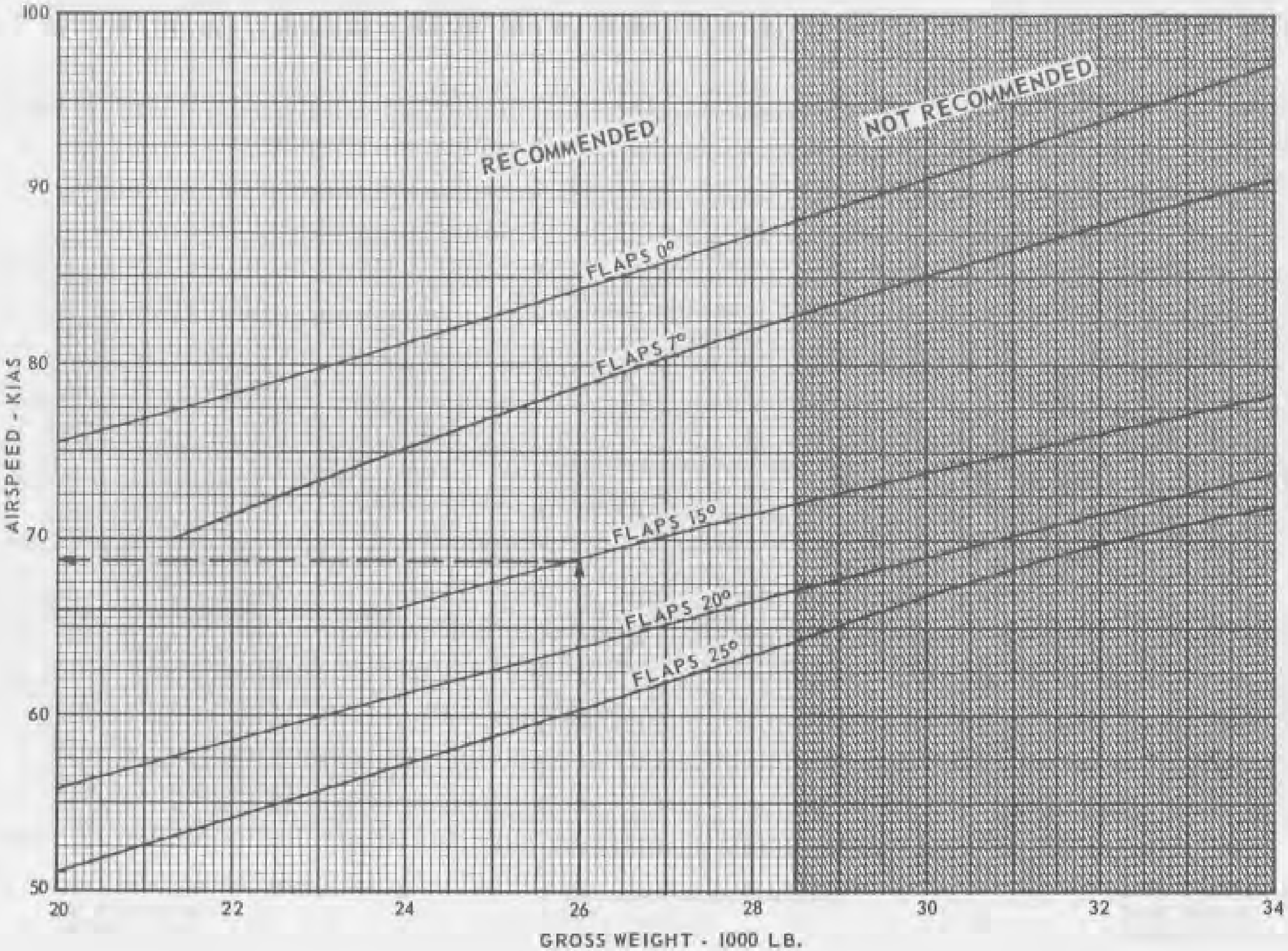


Figure A3-4

NORMAL TAKE-OFF GROUND ROLL DISTANCE

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST

CONDITIONS:
1. FLAP - 0°
2. 2700 RPM AND RICH MIXTURE

ENGINE(S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTE:
FOR TAKE-OFF SPEEDS SEE FIGURE A3-4

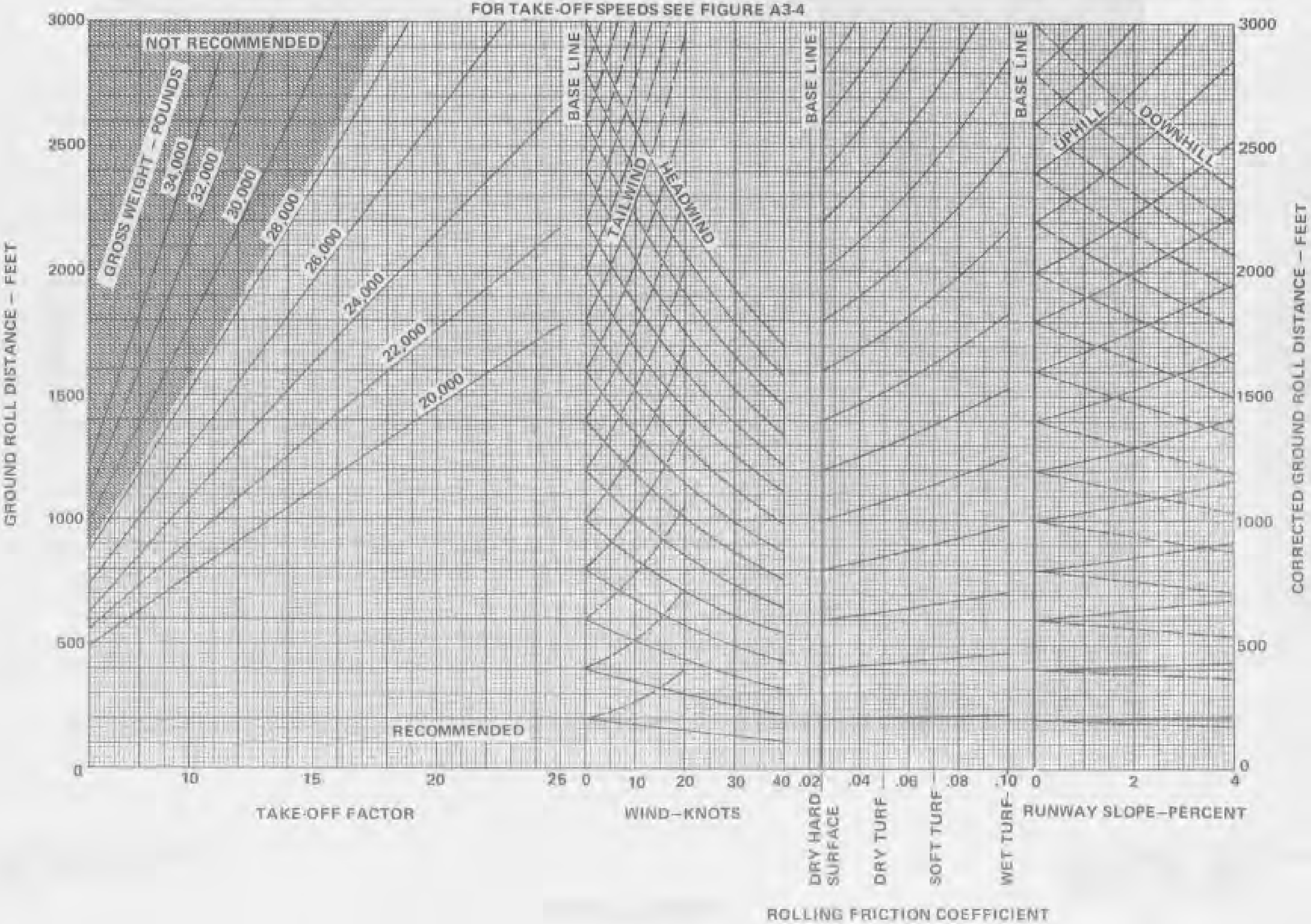


Figure A3-5 (Sheet 1 of 3)

NORMAL TAKE-OFF GROUND ROLL DISTANCE

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. FLAPS - 0°
2. 2700 RPM AND RICH MIXTURE

NOTE:
FOR TAKE-OFF SPEEDS SEE FIGURE A3-4

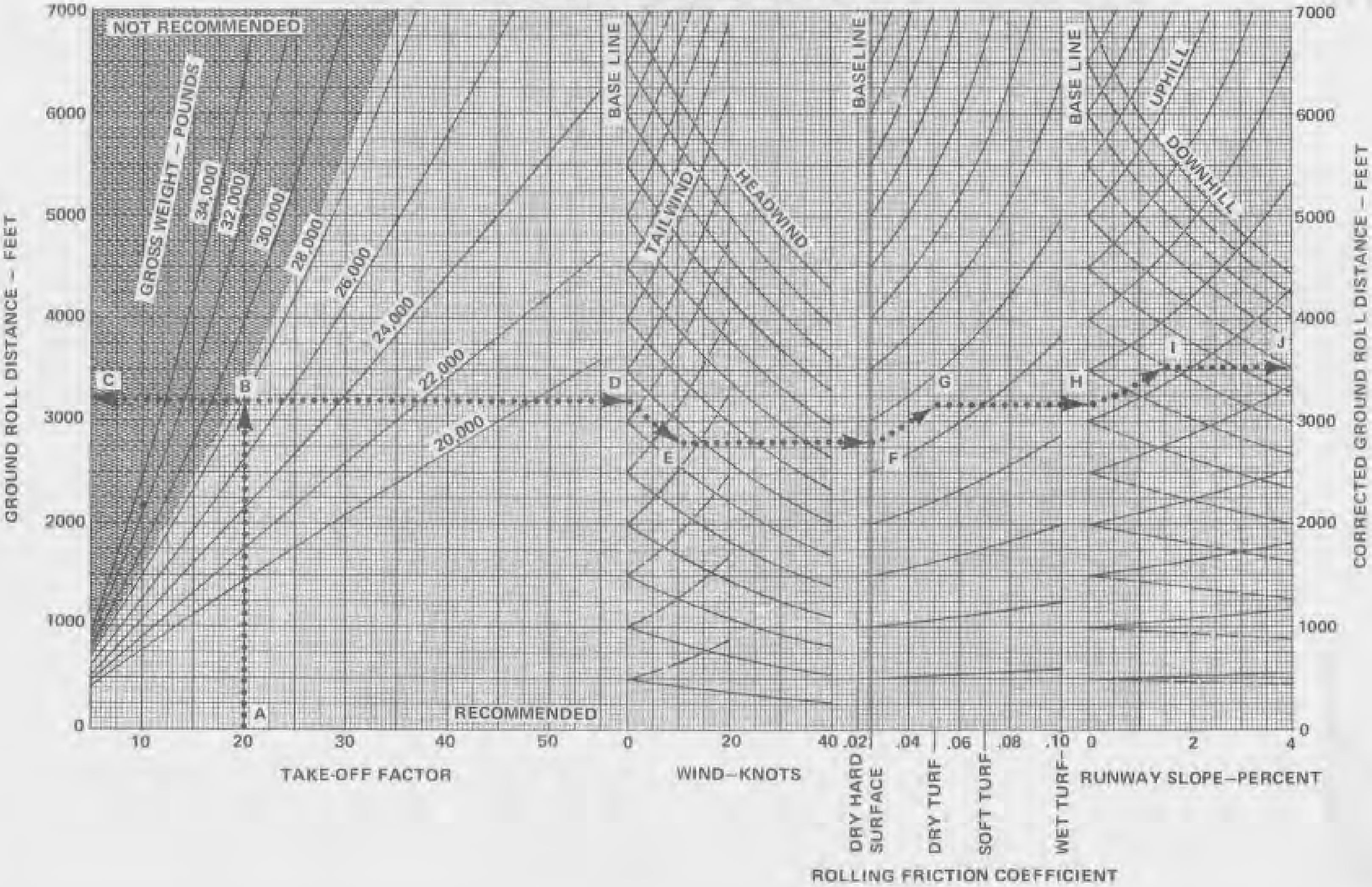


Figure A3-5 (Sheet 2 of 3)

NORMAL TAKE-OFF

AIR RUN DISTANCE TO CLEAR 50-FOOT OBSTACLE

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LG/GAL

CONDITIONS:
1. FLAPS 0°
2. LEVEL HARD SURFACE RUNWAY
3. 2700 RPM AND RICH MIXTURE
4. $V_{CLIMB} = V_{TO}$

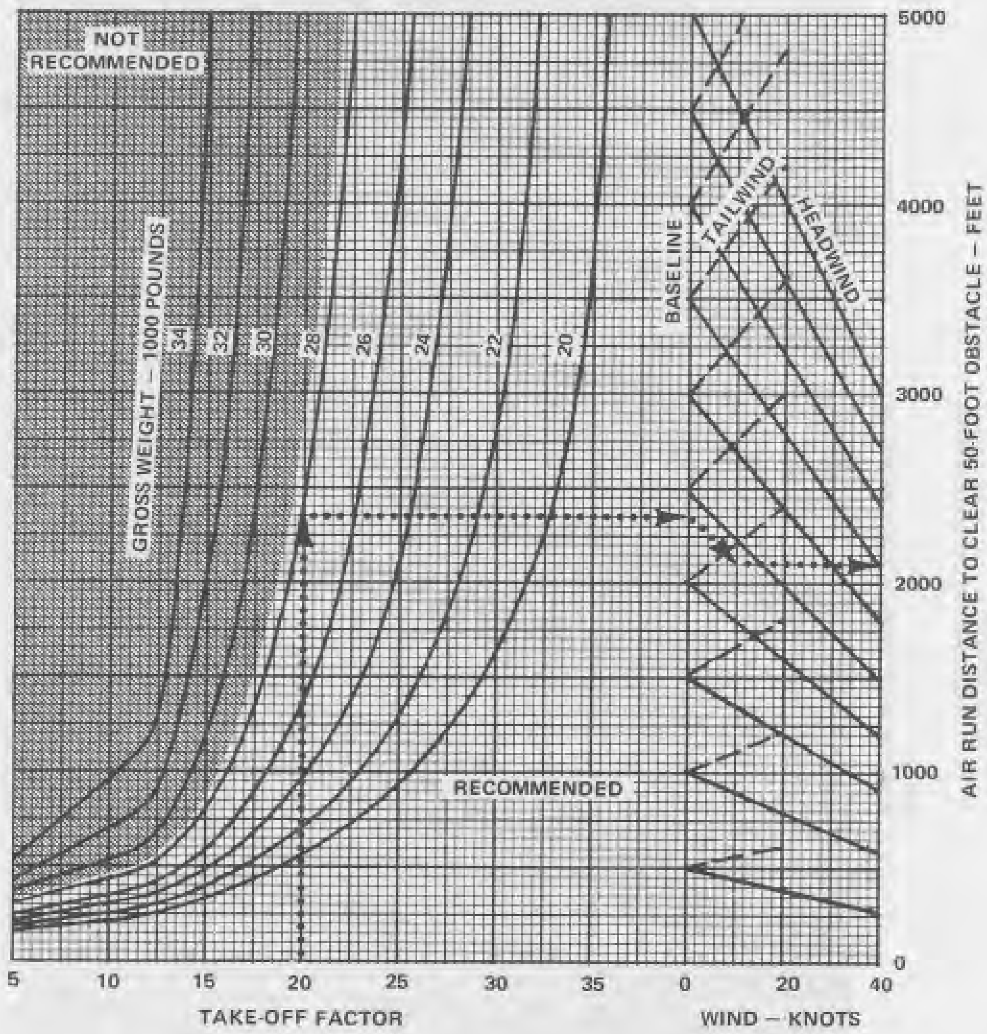


Figure A3-5 (Sheet 3 of 3)

NORMAL TAKE-OFF GROUND ROLL DISTANCE

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. FLAPS - 7°
2. 2700 RPM AND RICH MIXTURE

NOTE:
FOR TAKE-OFF SPEEDS SEE FIGURE A3-4

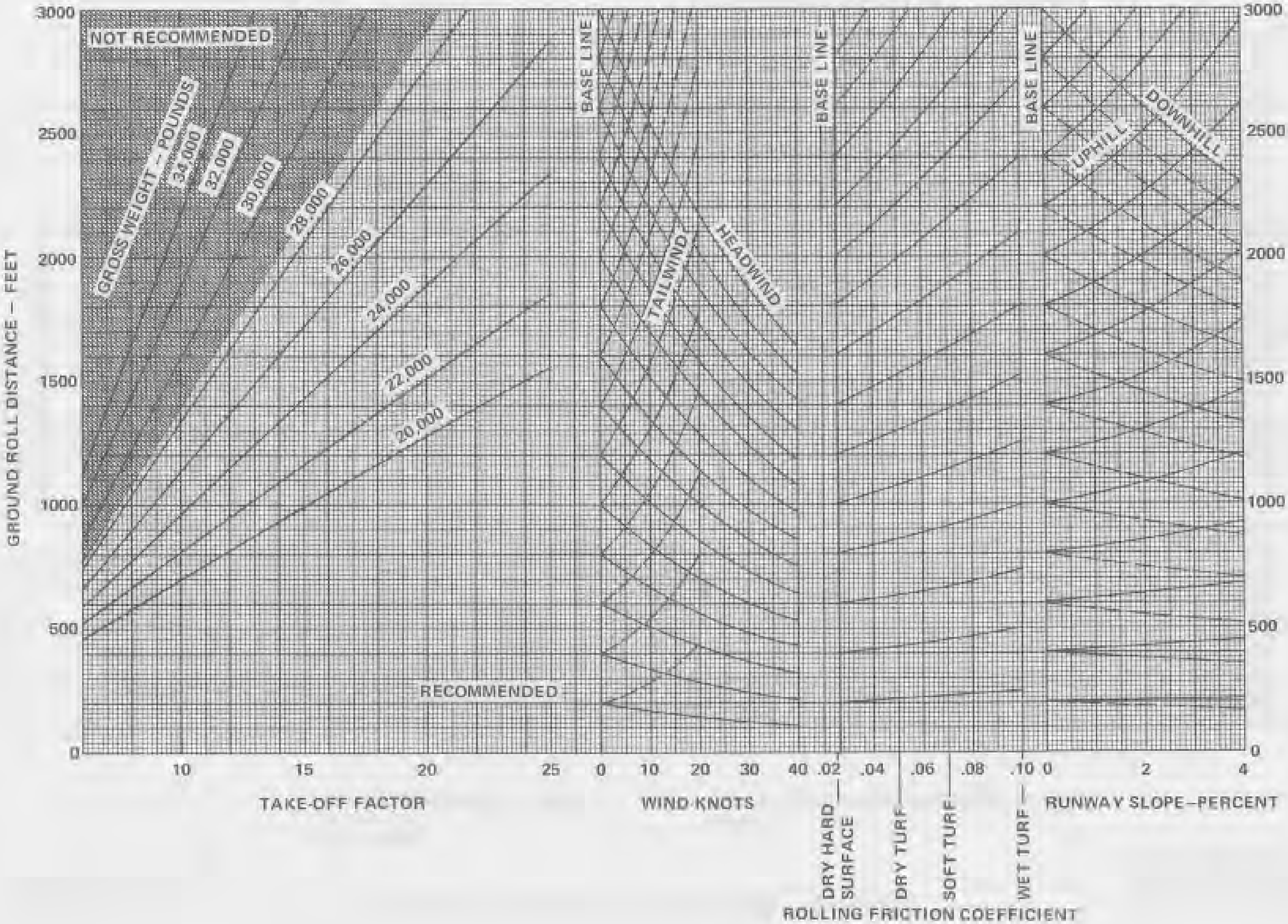


Figure A3-6 (Sheet 1 of 3)

MODEL: C–7A
DATE APRIL 1970
DATA BASIS: FLIGHT TEST

NORMAL TAKE-OFF GROUND ROLL DISTANCE

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. FLAPS - 7°
2. 2700 RPM AND RICH MIXTURE

NOTE:
FOR TAKE-OFF SPEEDS SEE FIGURE A3-4

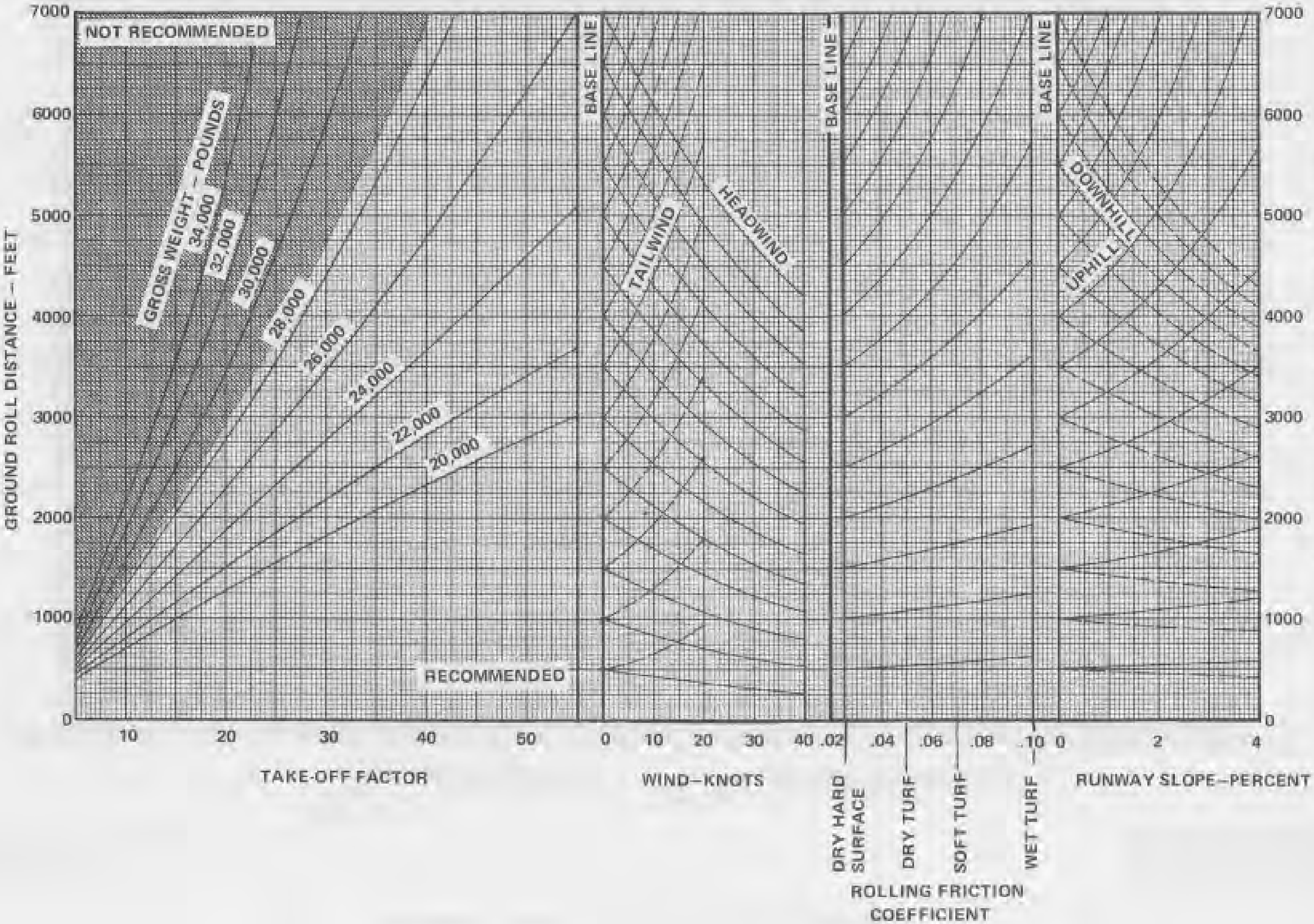


Figure A3-6 (Sheet 2 of 3)

NORMAL TAKE-OFF

AIR RUN DISTANCE TO CLEAR 50-FOOT OBSTACLE

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. FLAP 7°
2. LEVEL HARD SURFACE RUNWAY
3. 2700 RPM AND RICH MIXTURE
4. $V_{CLIMB} = V_{TO}$

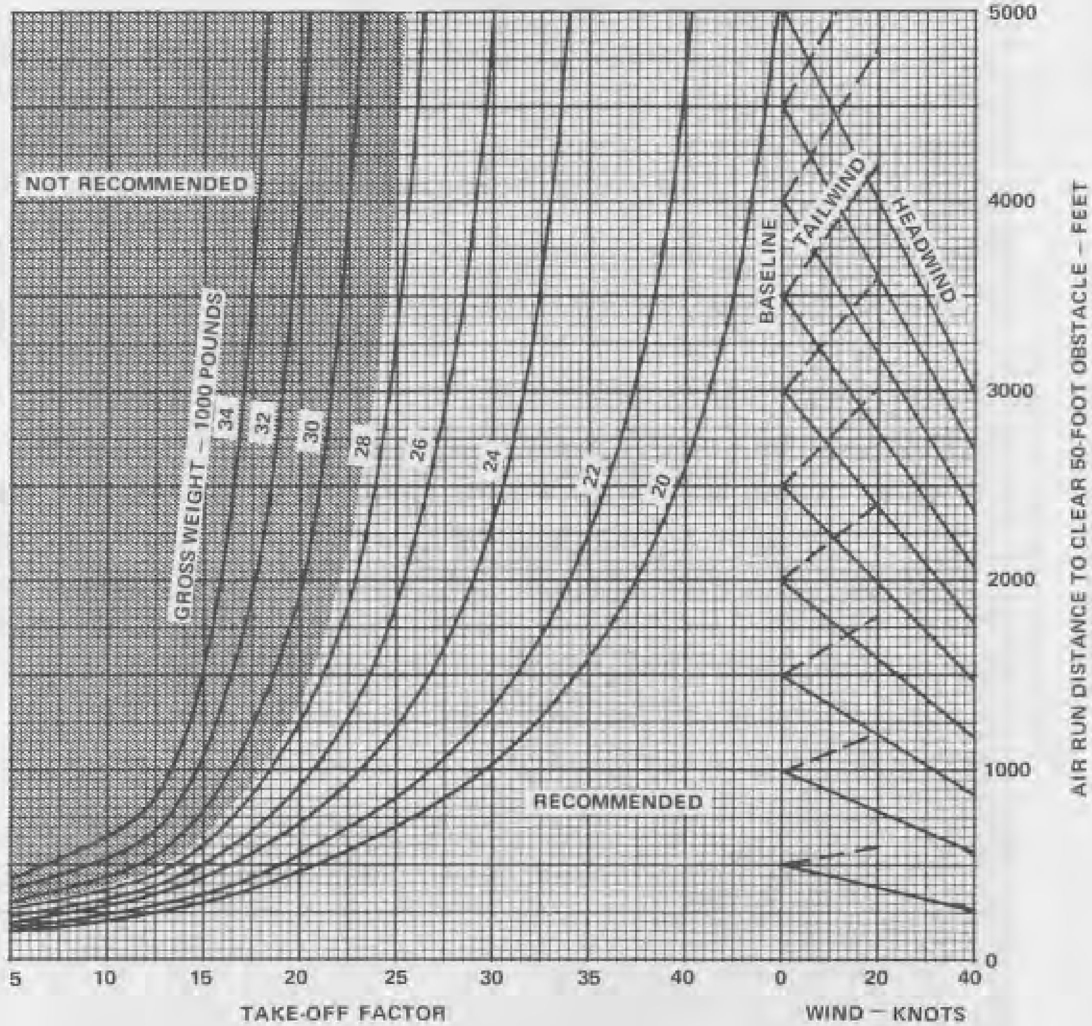


Figure A3-6 (Sheet 3 of 3)

NORMAL TAKE-OFF GROUND ROLL DISTANCE

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST

CONDITIONS:
1. FLAPS - 15°
2. 2700 RPM AND RICH MIXTURE

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTE:
FOR TAKE-OFF SPEEDS SEE FIGURE A3-4

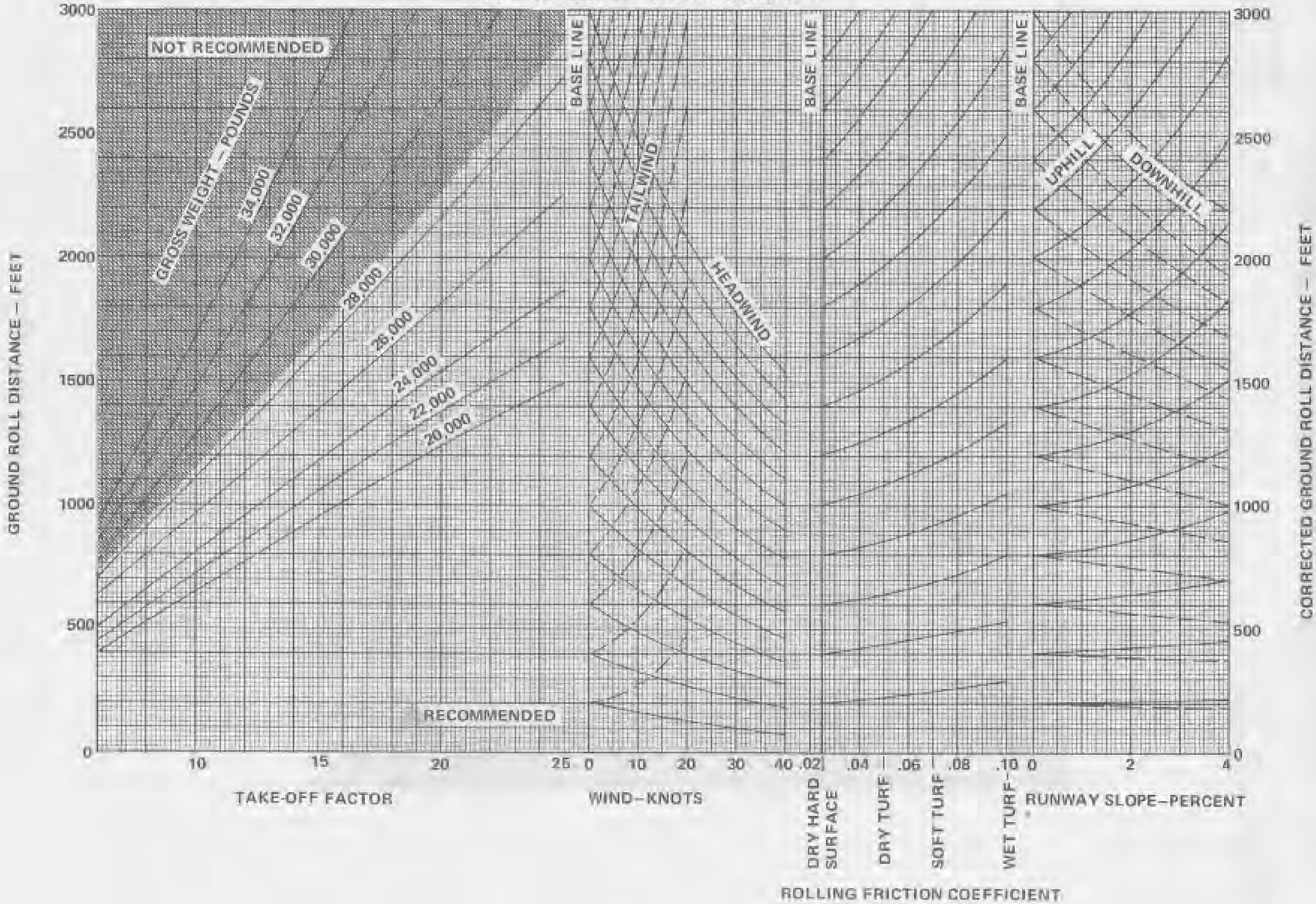


Figure A3-7 (Sheet 1 of 3)

NORMAL TAKE-OFF GROUND ROLL DISTANCE

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. FLAPS - 15°
2. 2700 RPM AND RICH MIXTURE

NOTE:
FOR TAKE-OFF SPEEDS SEE FIGURE A3-4

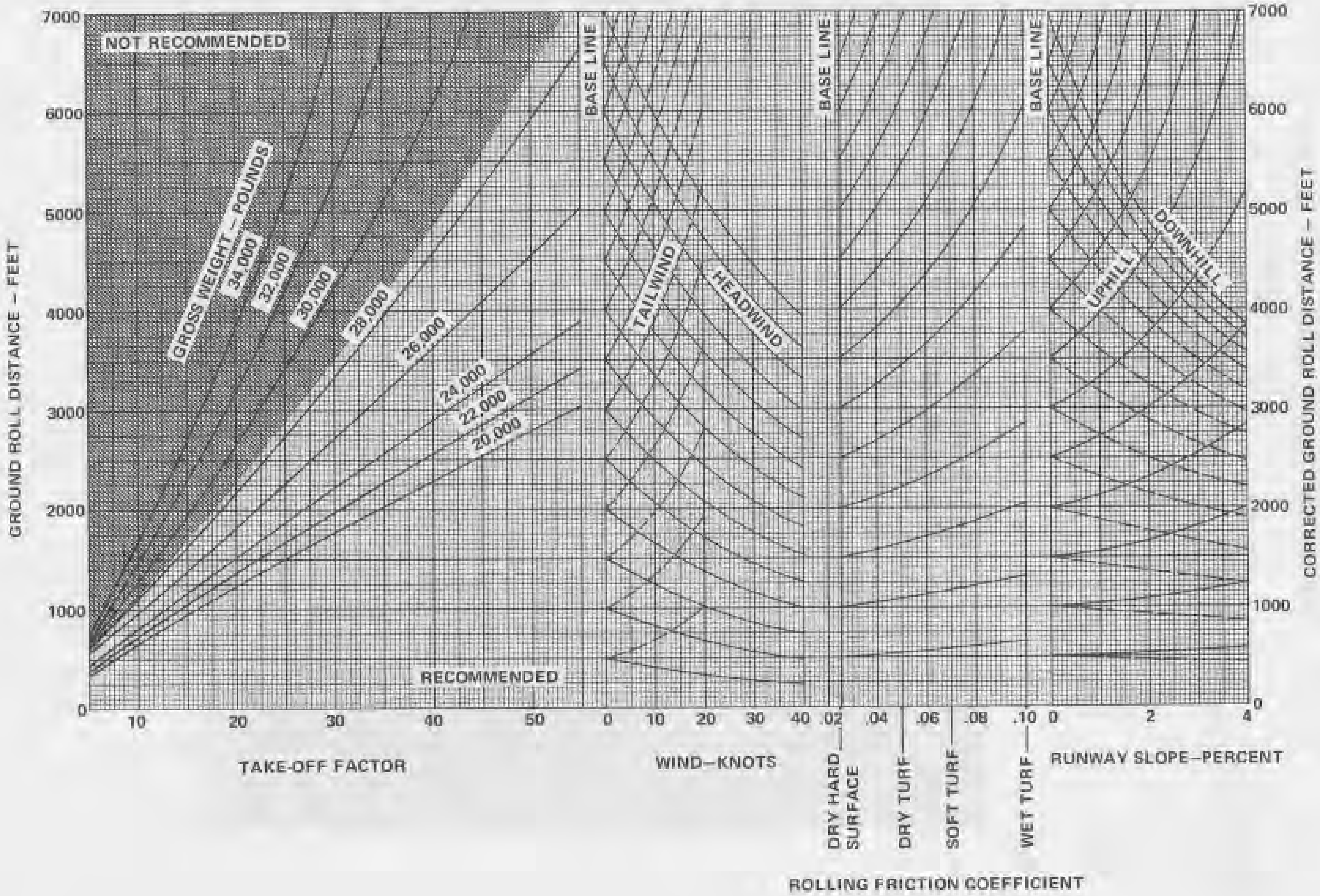


Figure A3-7 (Sheet 2 of 3)

NORMAL TAKE-OFF
AIR RUN DISTANCE TO CLEAR 50-FOOT OBSTACLE

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS
1. FLAPS 15°
2. LEVEL HARD SURFACE RUNWAY
3. 2700 RPM AND RICH MIXTURE
4. V CLIMB = VTO

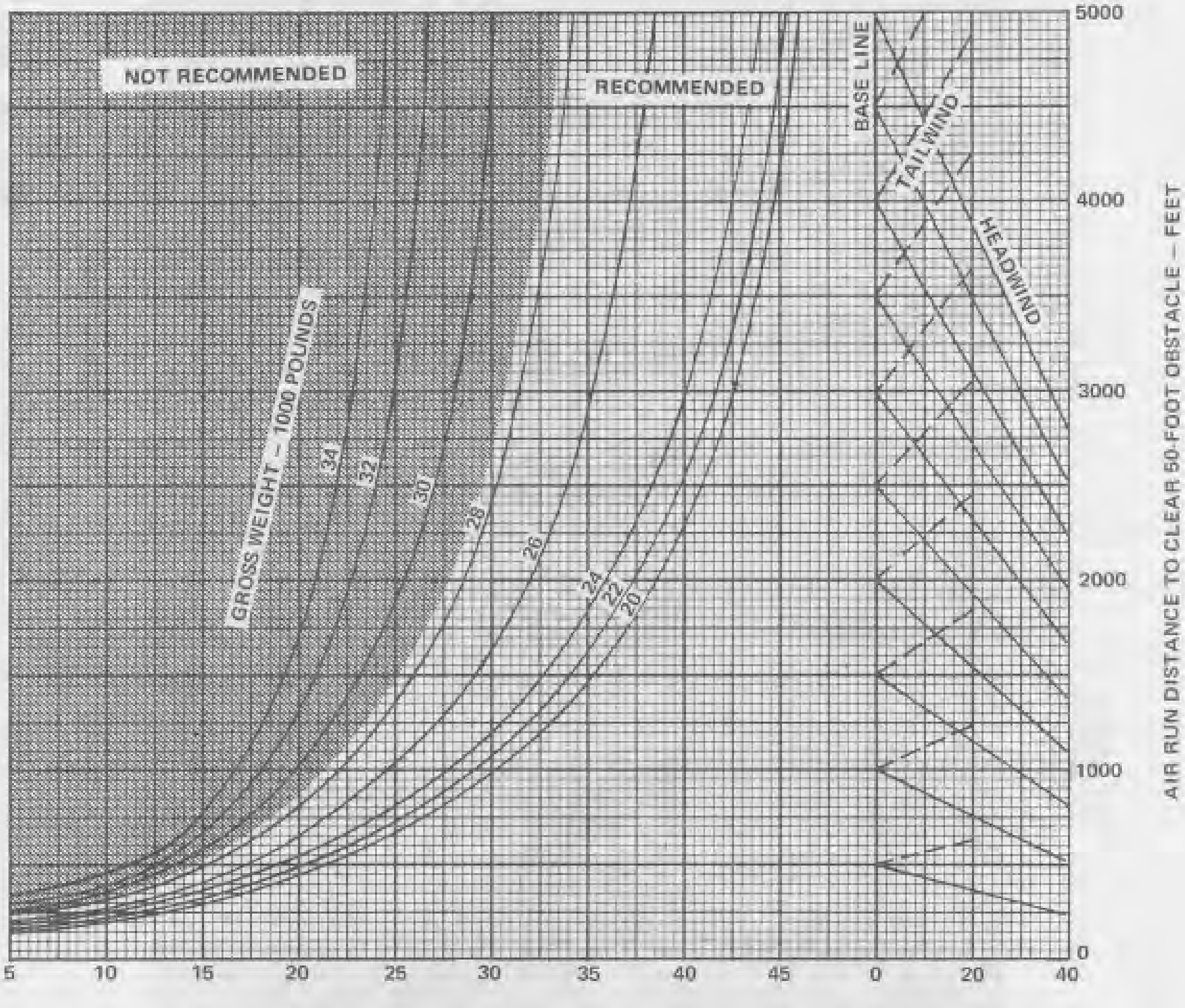


Figure A3-7 (Sheet 3 of 3)

NORMAL TAKE-OFF GROUND ROLL DISTANCE

MODEL: C-7A
DATE: JULY 1971
DATA BASIS: FLIGHT TEST

CONDITIONS:
1. FLAPS: 20°
2. 2700 RPM RICH MIXTURE

NOTE:
FOR TAKE-OFF SPEEDS SEE FIG. A3-4

ENGINES: (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

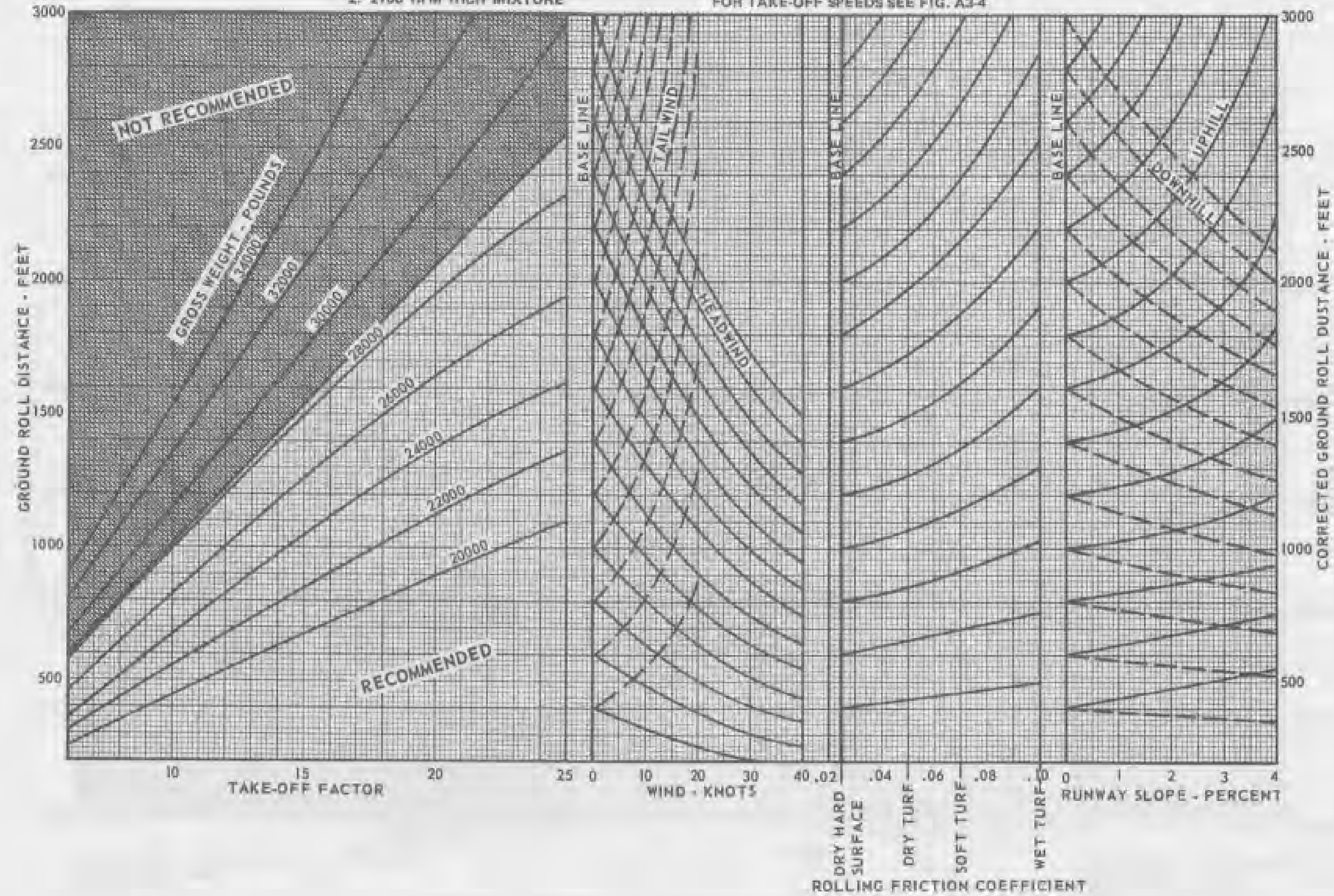


Figure A3-7A (Sheet 1 of 2)

NORMAL TAKE-OFF GROUND ROLL DISTANCE

MODEL: C-7A
DATE: JULY 1971
DATA BASIS: FLIGHT TEST

CONDITIONS:
1. FLAPS: 20°
2. 2700 RPM RICH MIXTURE

NOTE:
FOR TAKE-OFF SPEEDS SEE FIG. A3-4

ENGINES: (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

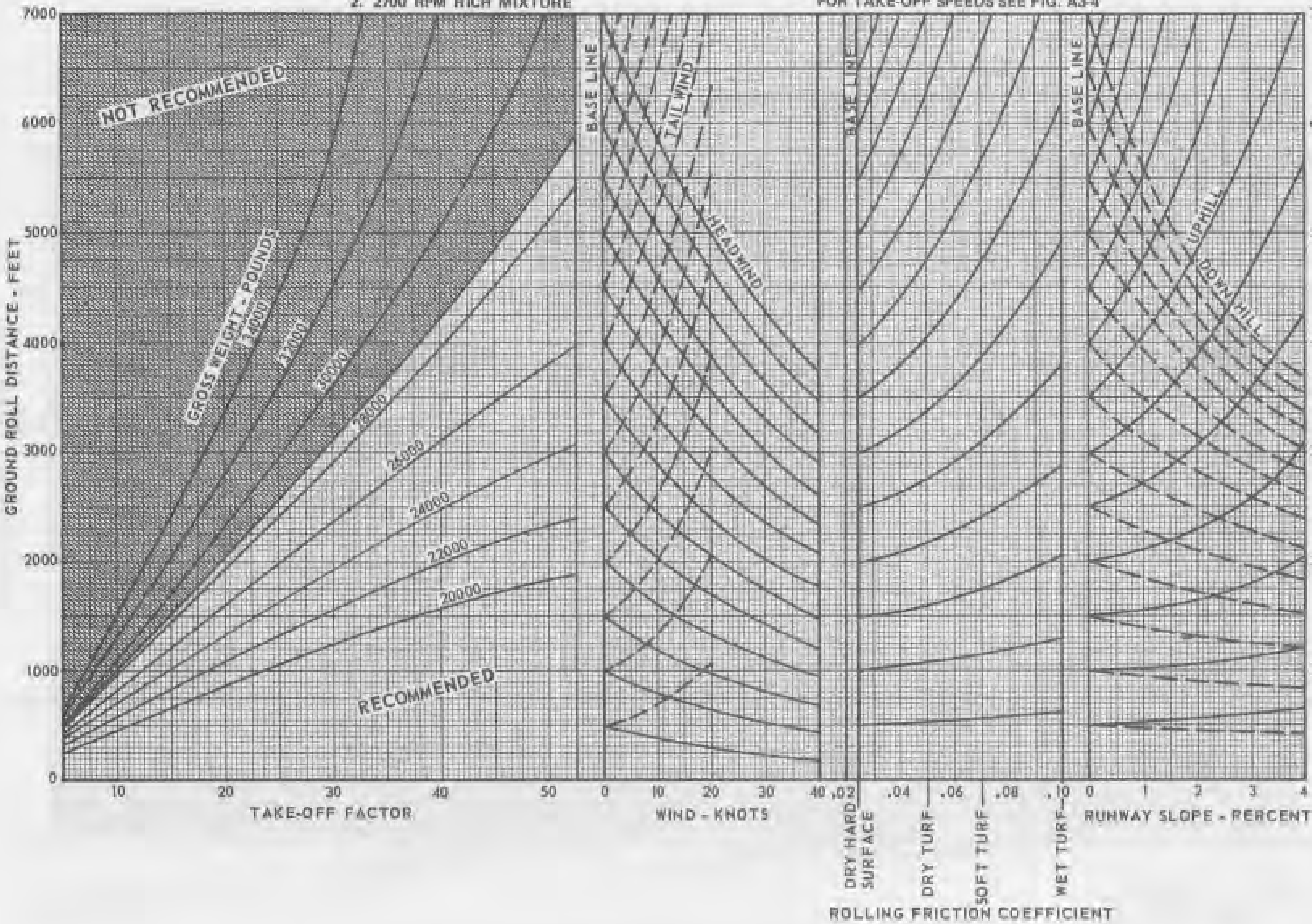


Figure A3-7A (Sheet 2 of 2)

NORMAL TAKE-OFF

AIR RUN DISTANCE TO CLEAR 50-FOOT OBSTACLE

MODEL: C-7A
DATE: AUGUST 1971
DATA BASIS: FLIGHT TEST

ENGINES: (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. FLAPS 20°
2. LEVEL HARD SURFACE RUNWAY
3. 2700 RPM AND RICH MIXTURE
4. V CLIMB = VTO

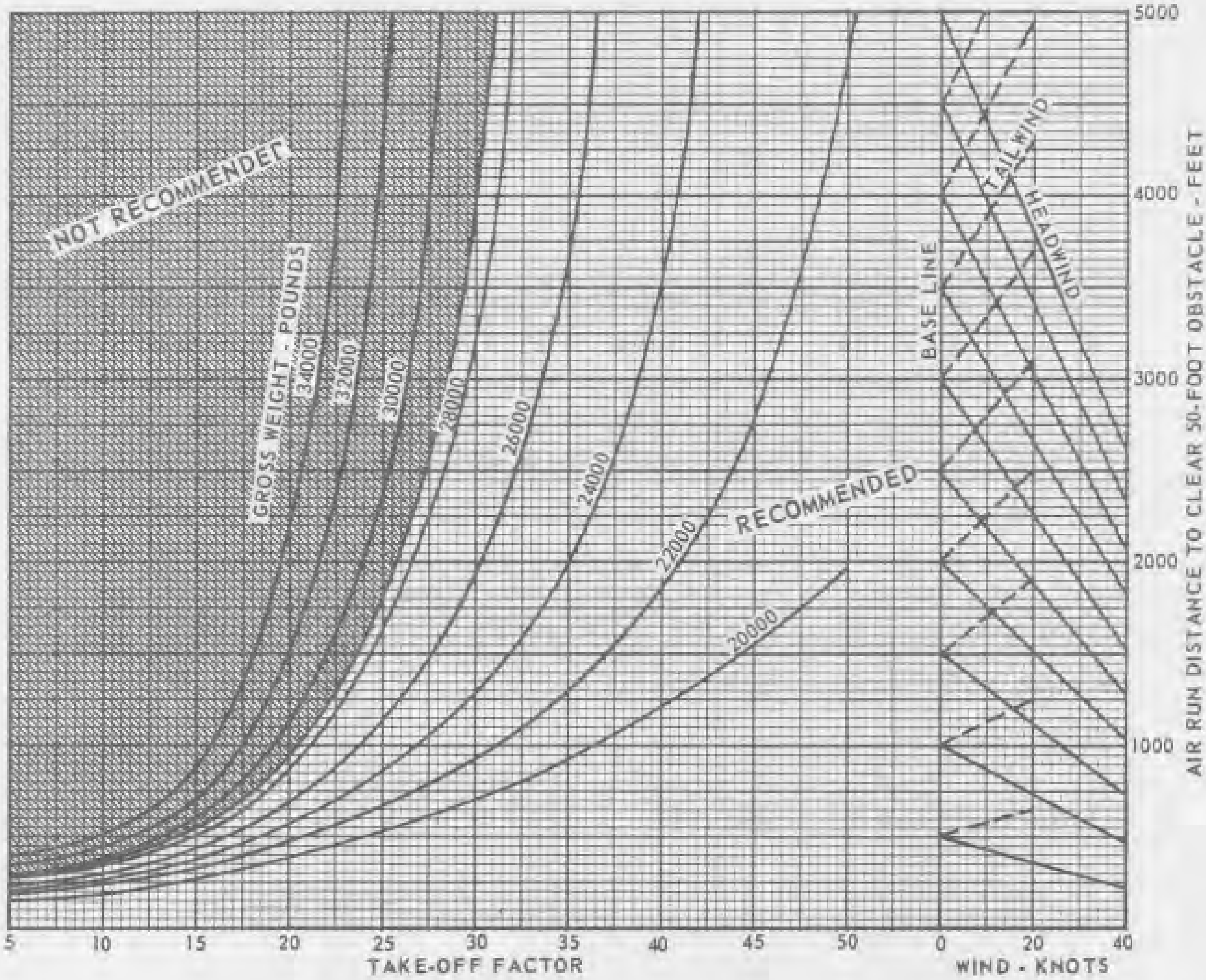


Figure A3-7B

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST

SHORT-FIELD TAKE-OFF GROUND ROLL DISTANCE

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. FLAPS - 25°
2. 2700 RPM RICH MIXTURE

NOTE:
FOR TAKE-OFF SPEEDS SEE FIGURE A3-4

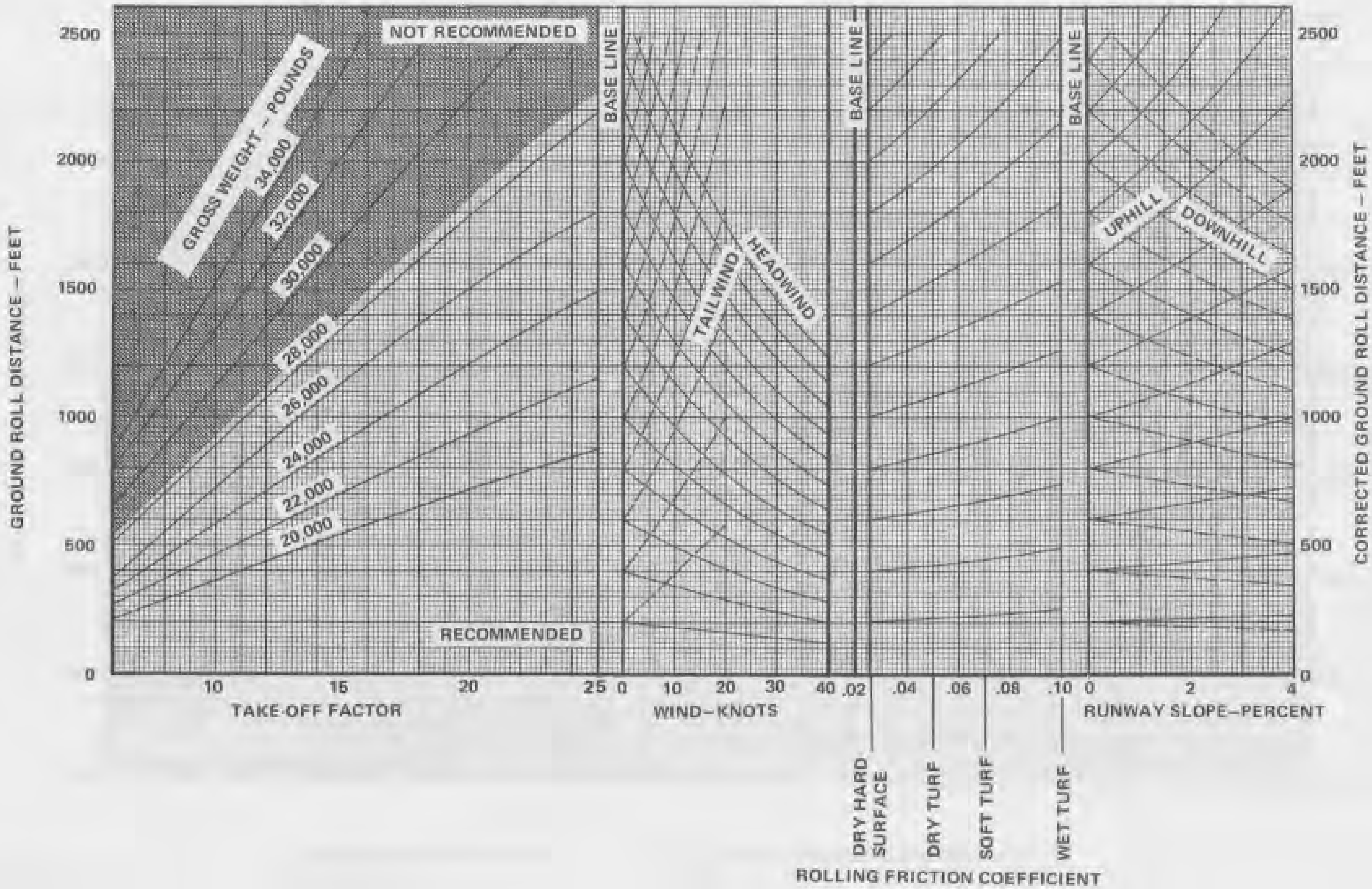


Figure A3-8 (Sheet 1 of 3)

SHORT-FIELD TAKE-OFF GROUND ROLL DISTANCE

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST

CONDITIONS:
1. FLAPS - 25°
2. 2700 RPM RICH MIXTURE

NOTE:
FOR TAKE-OFF SPEEDS SEE FIGURE A3-4

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

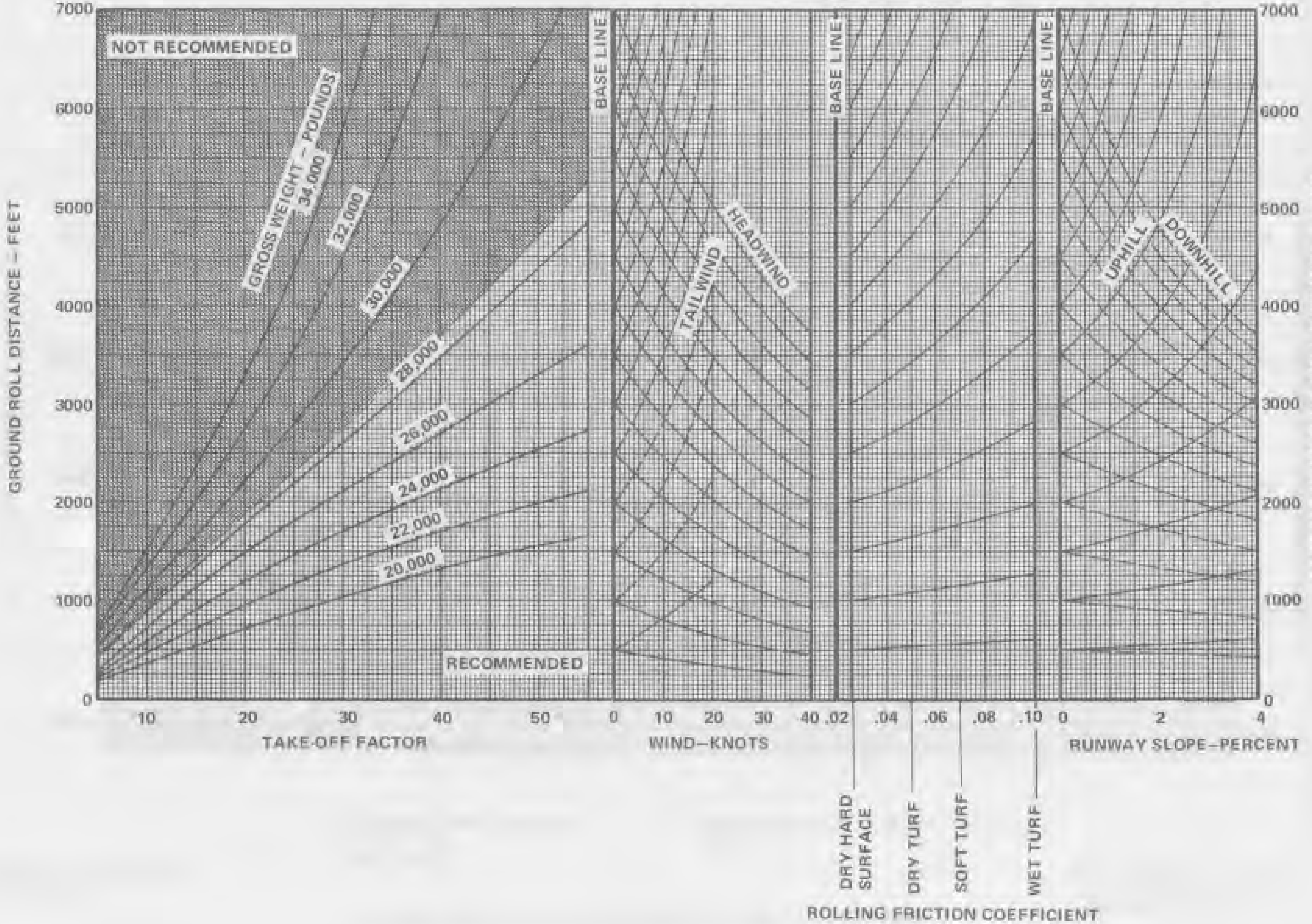


Figure A3-8 (Sheet 2 of 3)

SHORT FIELD TAKE-OFF

AIR RUN DISTANCE TO CLEAR 50-FOOT OBSTACLE

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST

ENGINE(S): (2) R–2000
FUEL GRADE 115/145
FUEL DENSITY 6.0 LB/GAL

CONDITIONS:
1. FLAPS 25°
2. LEVEL HARD SURFACE RUNWAY
3. 2700 RPM AND RICH MIXTURE
4. $V_{CLIMB} = V_{TO}$

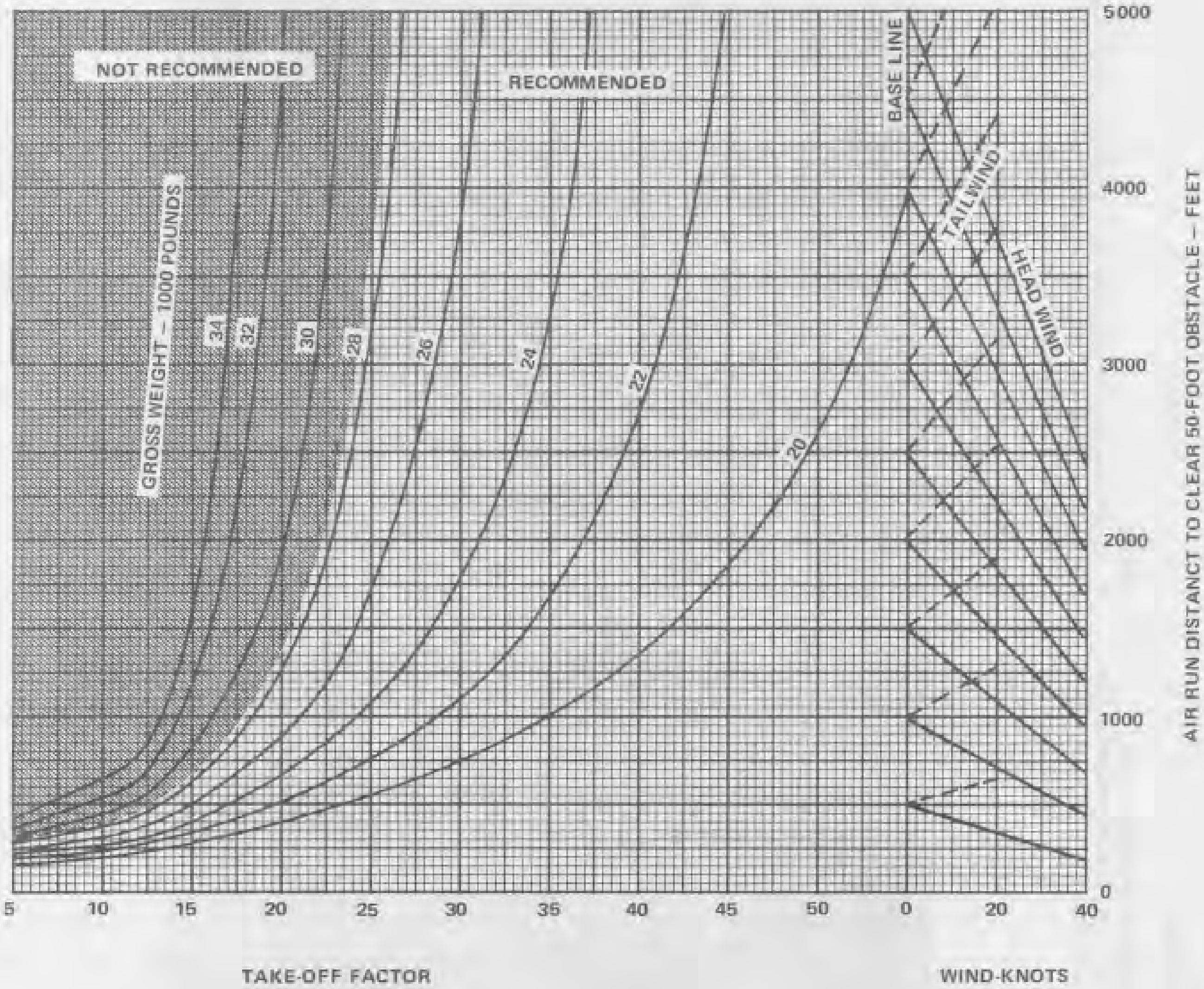


Figure A3-8 (Sheet 3 of 3)

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

CRITICAL FIELD LENGTH

FLAPS 0°

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

DECELERATION CONDITIONS:
1. BOTH PROPELLERS WINDMILLING
2. BRAKES ONLY

NOTES:
1. TO OBTAIN CRITICAL ENGINE FAILURE SPEED ENTER REFUSAL SPEED CHART (FIGURE A3–13) USING CRITICAL FIELD LENGTH IN PLACE OF AVAILABLE RUNWAY LENGTH
2. TAKE-OFF AT RECOMMENDED AIRSPEED

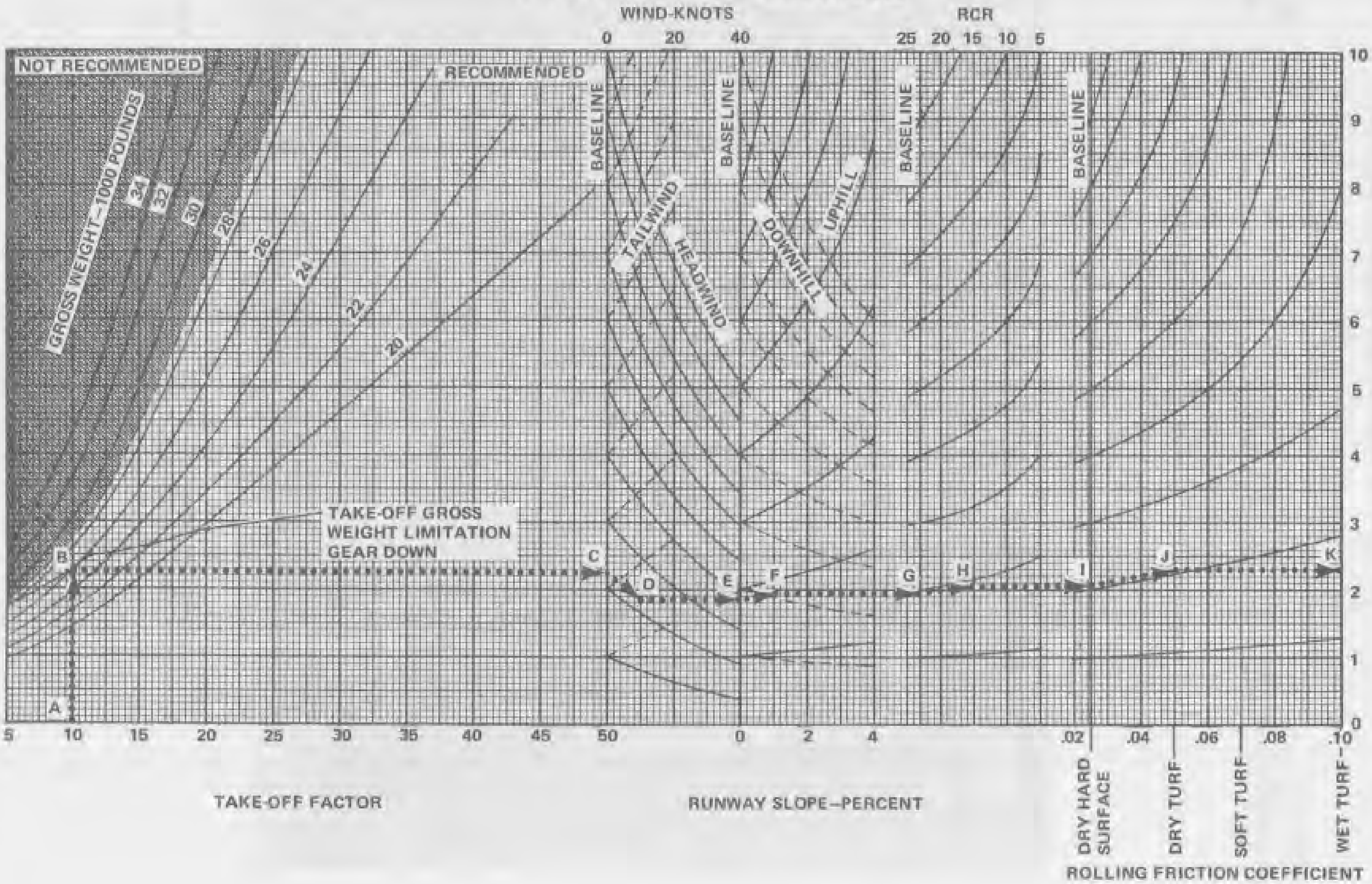


Figure A3-9

CRITICAL FIELD LENGTH

FLAPS 7°

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

DECELERATION CONDITIONS:
1. BOTH PROPELLERS WINDMILLING
2. BRAKES ONLY

NOTES:
1. TO OBTAIN CRITICAL ENGINE FAILURE SPEED ENTER REFUSAL SPEED CHART (FIGURE A3–14) WITH CRITICAL FIELD LENGTH IN PLACE OF AVAILABLE RUNWAY LENGTH
2. TAKE-OFF AT RECOMMENDED AIRSPEED

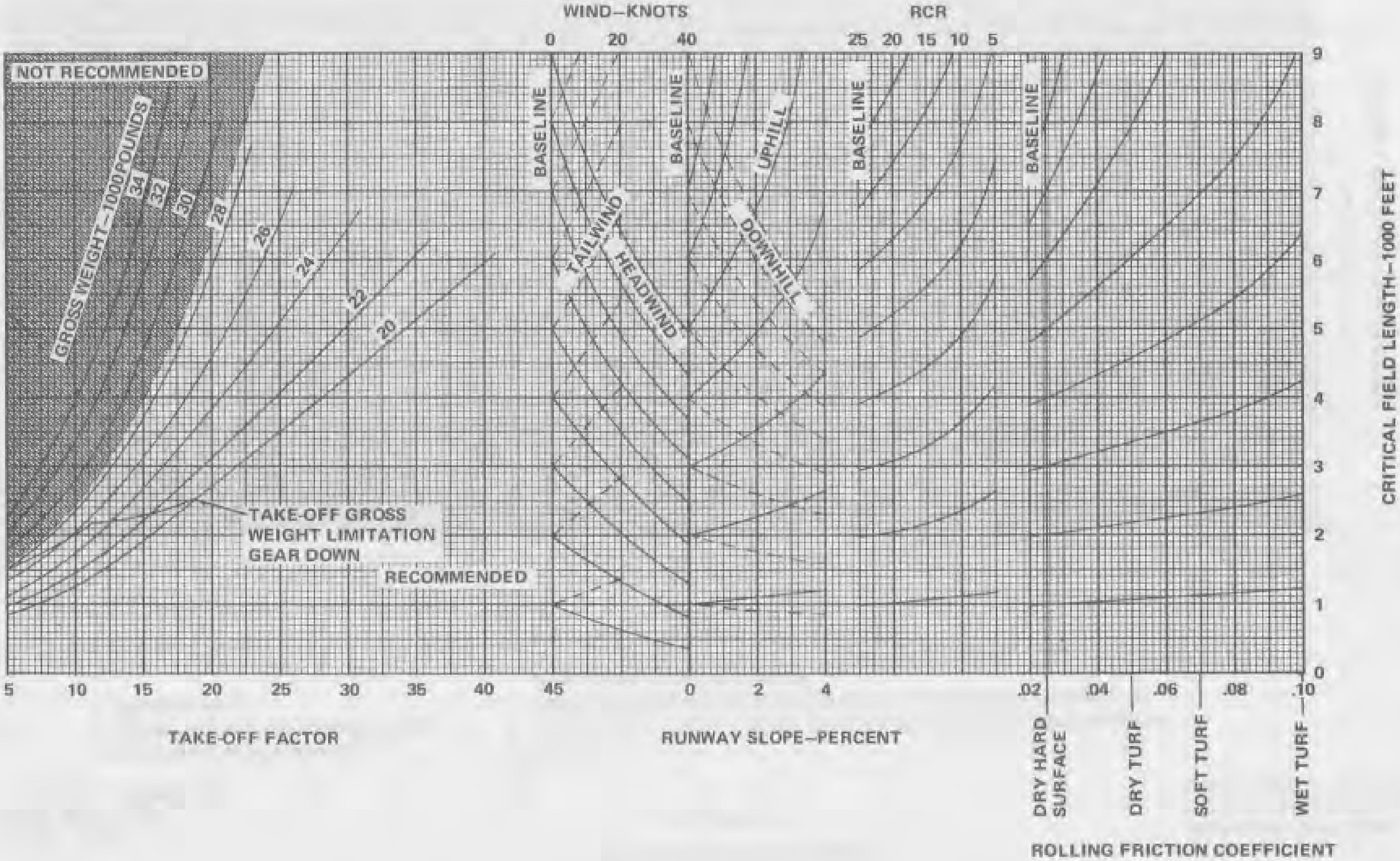


Figure A3-10

CRITICAL FIELD LENGTH

FLAPS 15°

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

DECELERATION CONDITIONS:
1. BOTH PROPELLERS WINDMILLING
2. BRAKES ONLY

NOTES:
1. TO OBTAIN CRITICAL ENGINE FAILURE SPEED ENTER REFUSAL SPEED CHART (FIGURE A3–15) WITH CRITICAL FIELD LENGTH IN PLACE OF AVAILABLE RUNWAY LENGTH
2. TAKE-OFF AT RECOMMENDED AIRSPEED

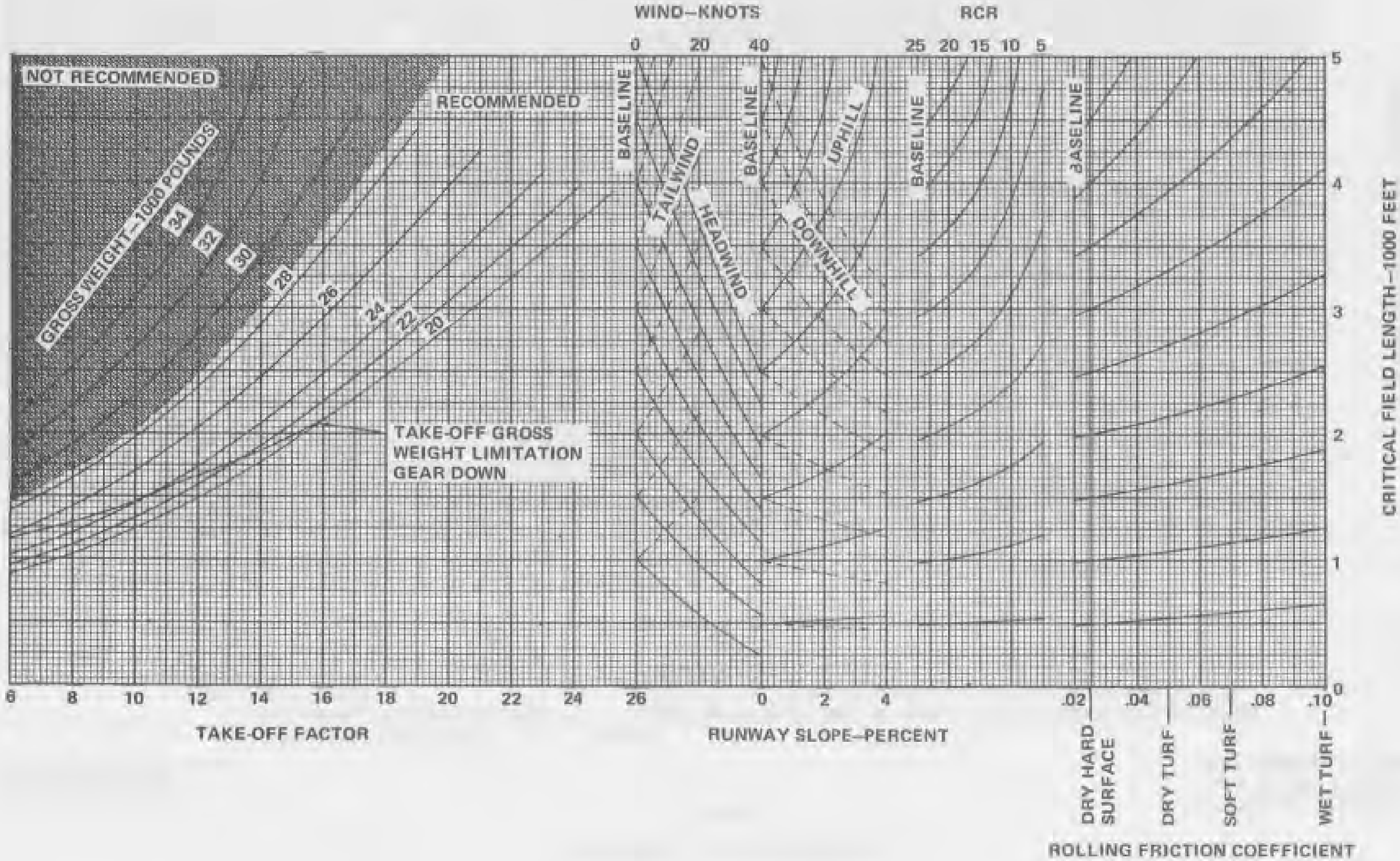


Figure A3-11

CRITICAL FIELD LENGTH

FLAPS 20°

MODEL: C-7A
DATE: AUGUST 1971
DATA BASIS: ESTIMATED

NOTES:

1. TO OBTAIN ENGINE FAILURE SPEED ENTER REFUSAL SPEED CHART (FIGURE A3-15A) WITH CRITICAL FIELD LENGTH IN PLACE OF AVAILABLE RUNWAY LENGTH.
2. TAKE-OFF AT RECOMMENDED AIRSPEED OR MINIMUM CONTROL SPEED, WHICHEVER IS GREATER.

ENGINES: (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

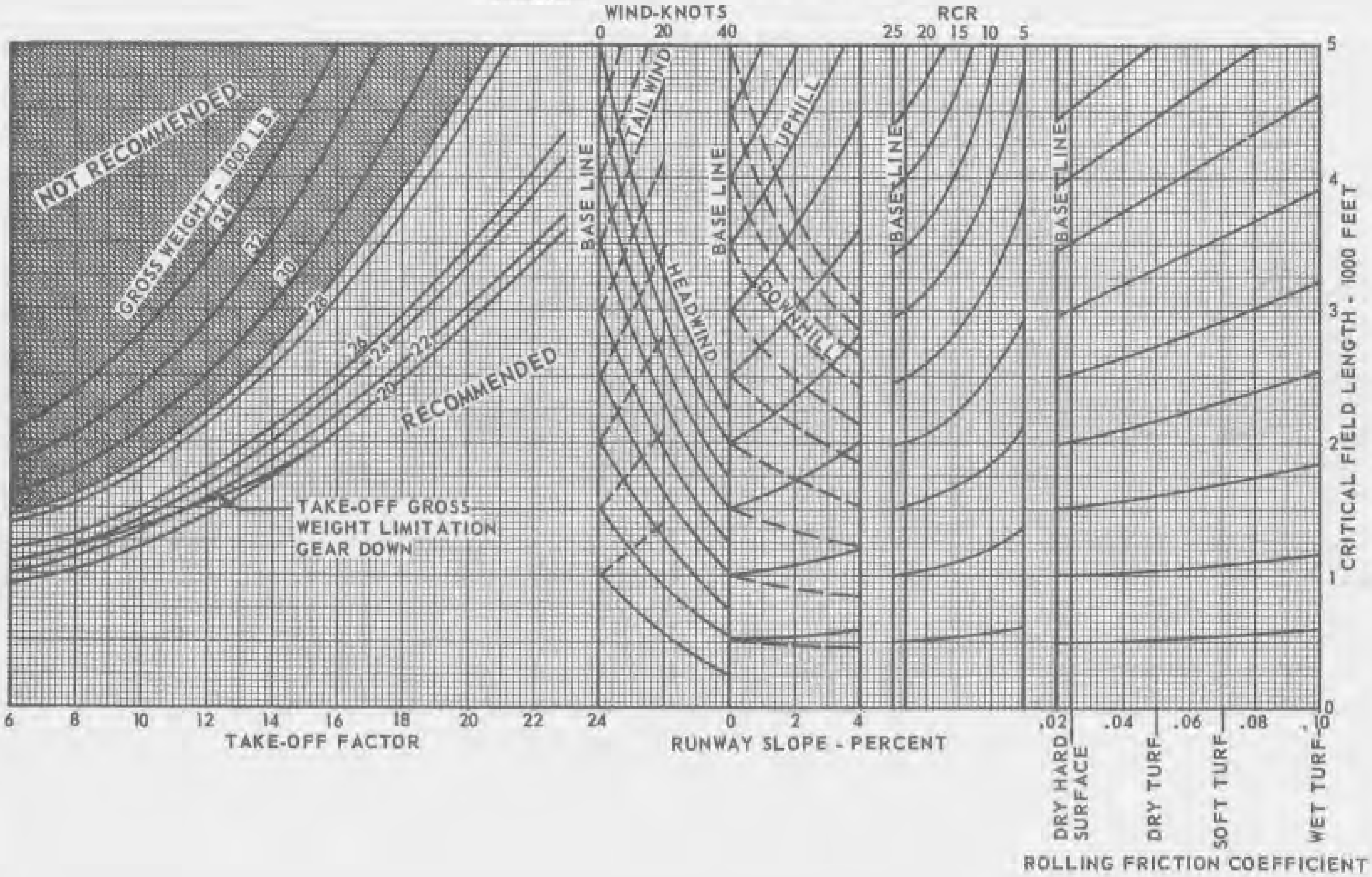


Figure A3-11A

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

CRITICAL FIELD LENGTH

FLAPS 25°

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

DECELERATION CONDITIONS:
1. BOTH PROPELLERS WINDMILLING
2. BRAKES ONLY

NOTES:
1. TO OBTAIN CRITICAL ENGINE FAILURE SPEED ENTER REFUSAL SPEED CHART (FIGURE A3-16) WITH CRITICAL FIELD LENGTH IN PLACE OF AVAILABLE RUNWAY LENGTH.
2. TAKE-OFF AT RECOMMENDED AIRSPEED OR MINIMUM CONTROL SPEED, WHICHEVER IS GREATER.

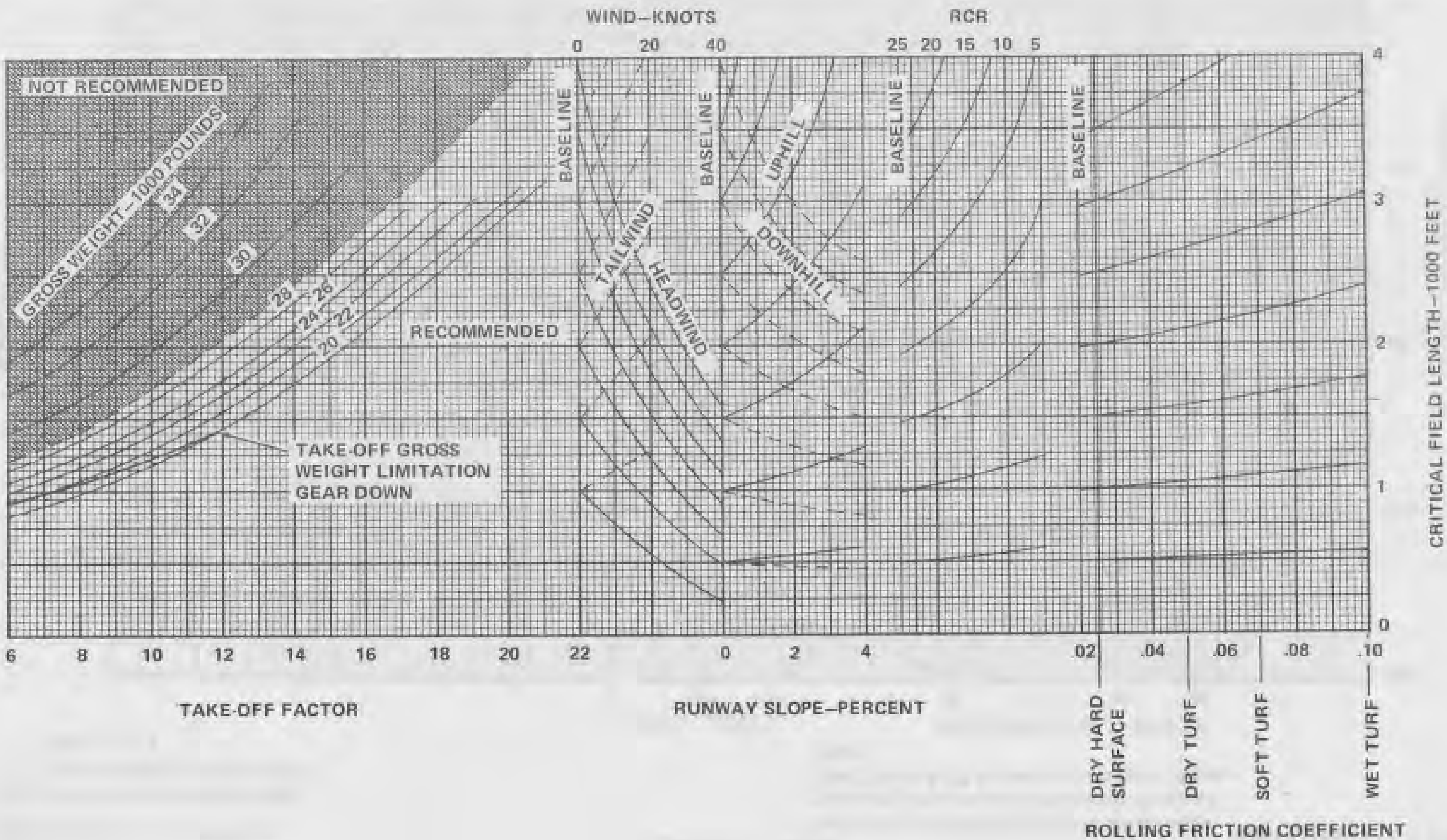


Figure A3-12

MODEL: C-7A
DATE: JULY 1972
DATA BASIS: FLIGHT TEST

DECELERATION CONDITIONS:
1. Both propellers windmilling
2. Brakes only

REFUSAL SPEED

FLAPS 0°

NOTE:
To obtain critical engine failure speed enter this chart with critical field length obtained from Figure A3-9 in place of available runway length.

ENGINE(S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

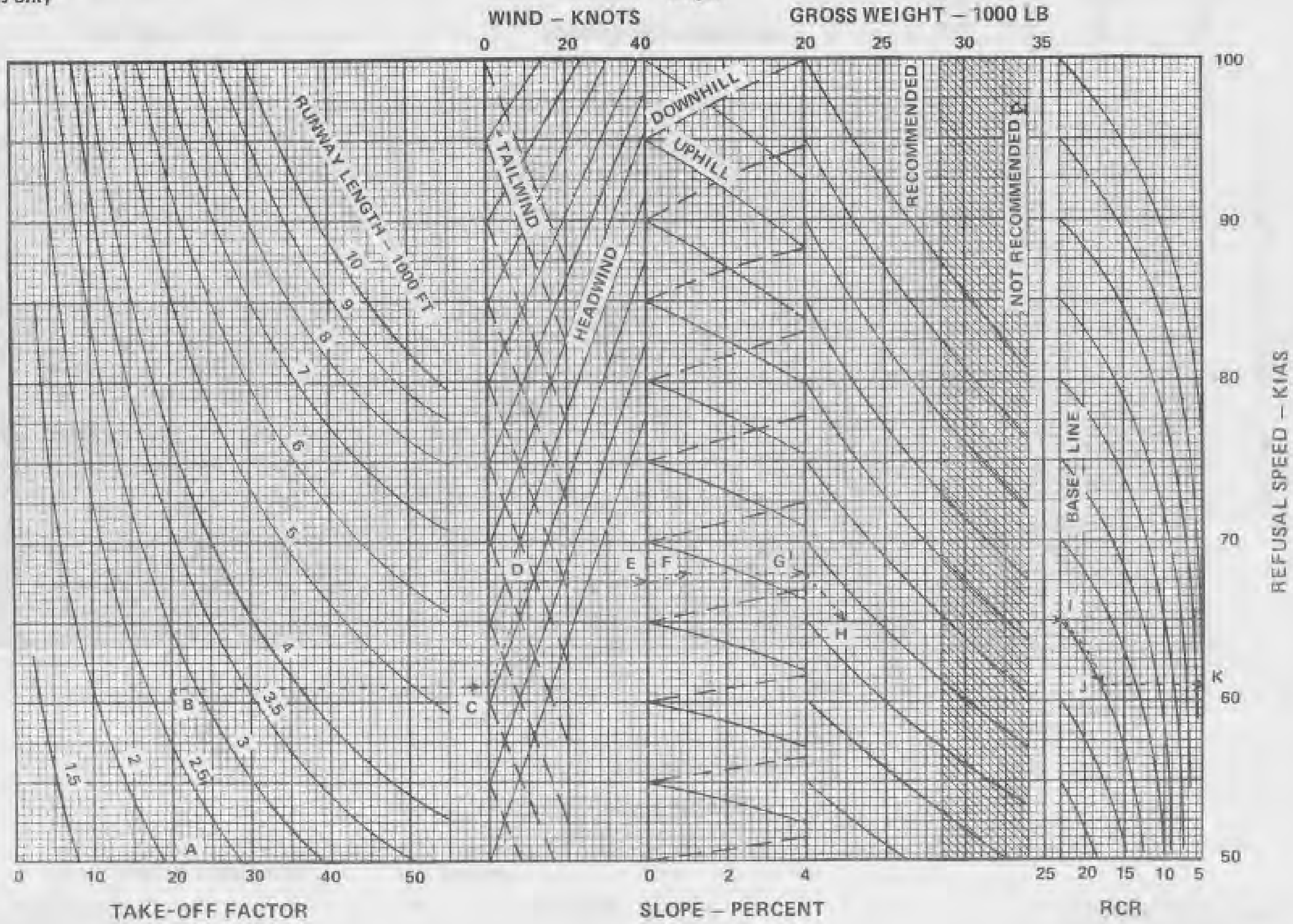


Figure A3-13

MODEL: C-7A
DATE: JULY 1972
DATA BASIS: FLIGHT TEST

REFUSAL SPEED

FLAPS 7°

ENGINE(S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTE:
To obtain critical engine failure speed enter this chart with critical field length obtained from Figure A3-10 in place of available runway length.

DECELERATION CONDITIONS:
1. Both propellers windmilling
2. Brakes only

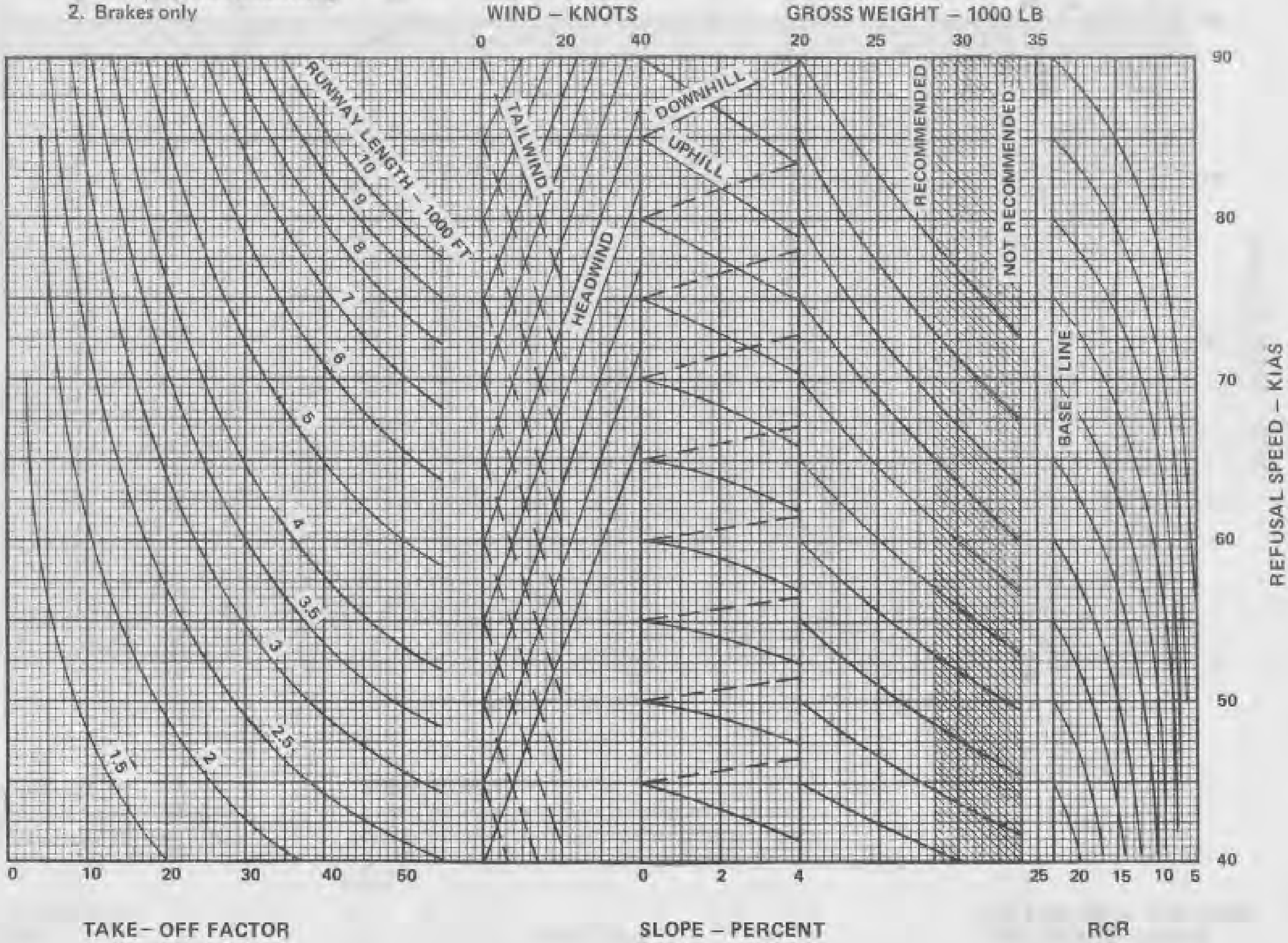


Figure A3-14

MODEL: C-7A
DATE: JULY 1972
DATA BASIS: FLIGHT TEST

REFUSAL SPEED

FLAPS 15°

ENGINE(S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

DECELERATION CONDITIONS:

1. Both propellers windmilling
2. Brakes only

NOTE:
To obtain critical engine failure speed enter this chart with critical field length obtained from Figure A3-11 in place of available runway length.

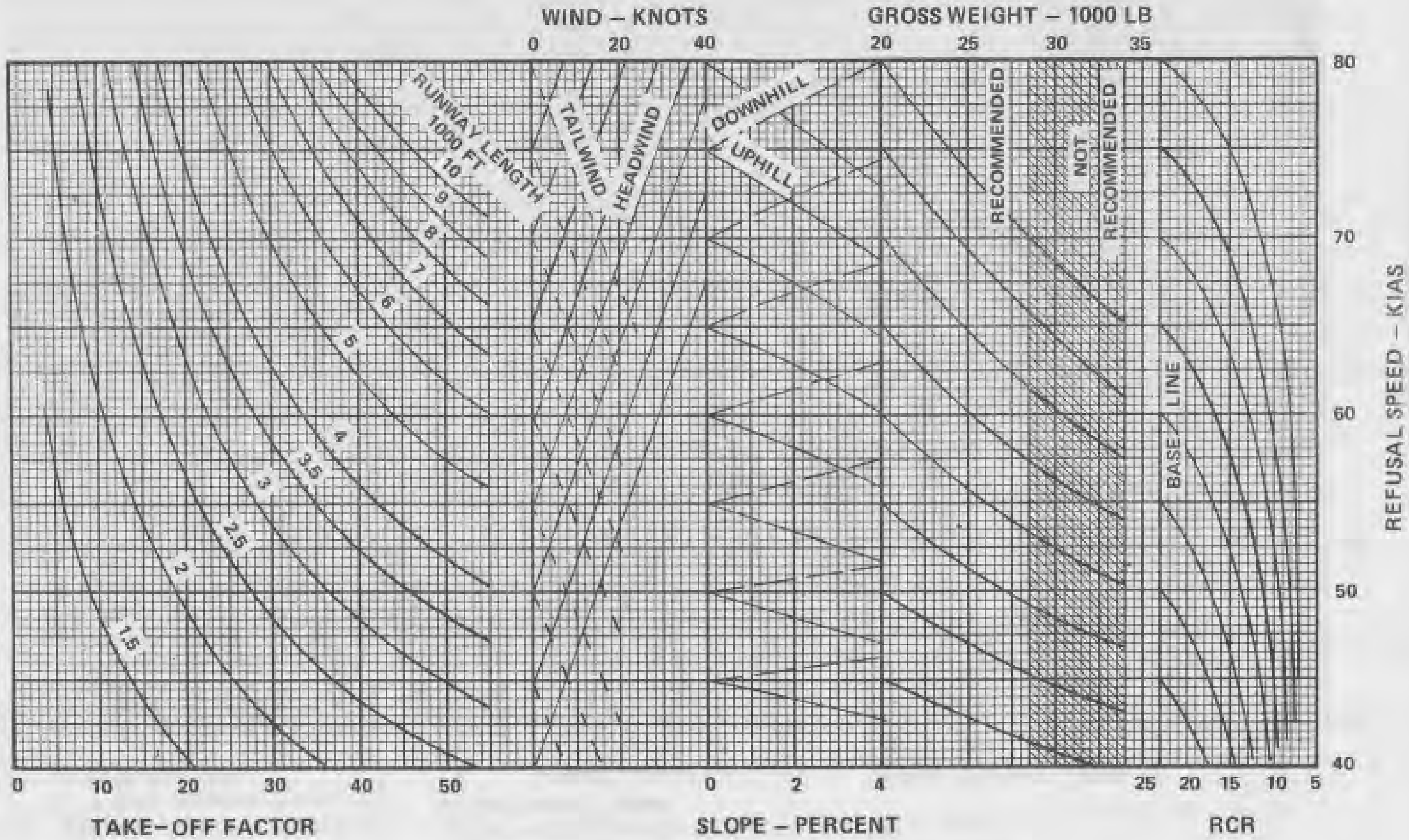


Figure A3-15

REFUSAL SPEED

FLAPS 20°

MODEL: C-7A
DATE: JULY 1972
DATA BASIS: FLIGHT TEST

DECELERATION CONDITIONS:
1. Both propellers windmilling
2. Brakes only

NOTE:
To obtain critical engine failure speed enter this chart with critical field length obtained from Figure A3-11 in place of available runway length.

ENGINES: (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

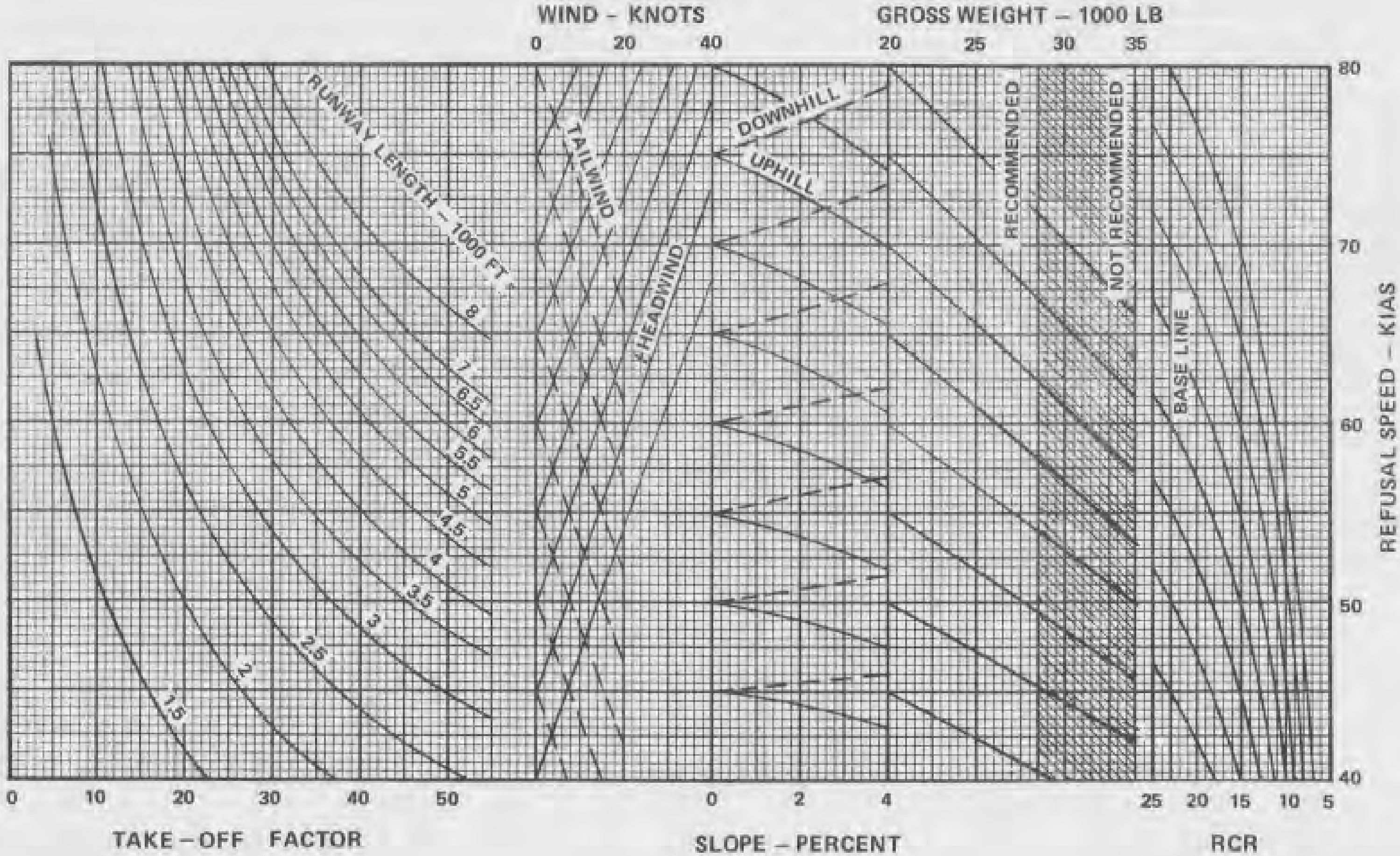


Figure A3-15A

MODEL: C-7A
DATE: JULY 1972
DATA BASIS: FLIGHT TEST

REFUSAL SPEED
FLAPS 25°

ENGINE(S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

DECELERATION CONDITIONS:
1. Both propellers windmilling
2. Brakes only

NOTE:
To obtain critical engine failure speed enter this chart with critical field length obtained from Figure A3-12 in place of available runway length.

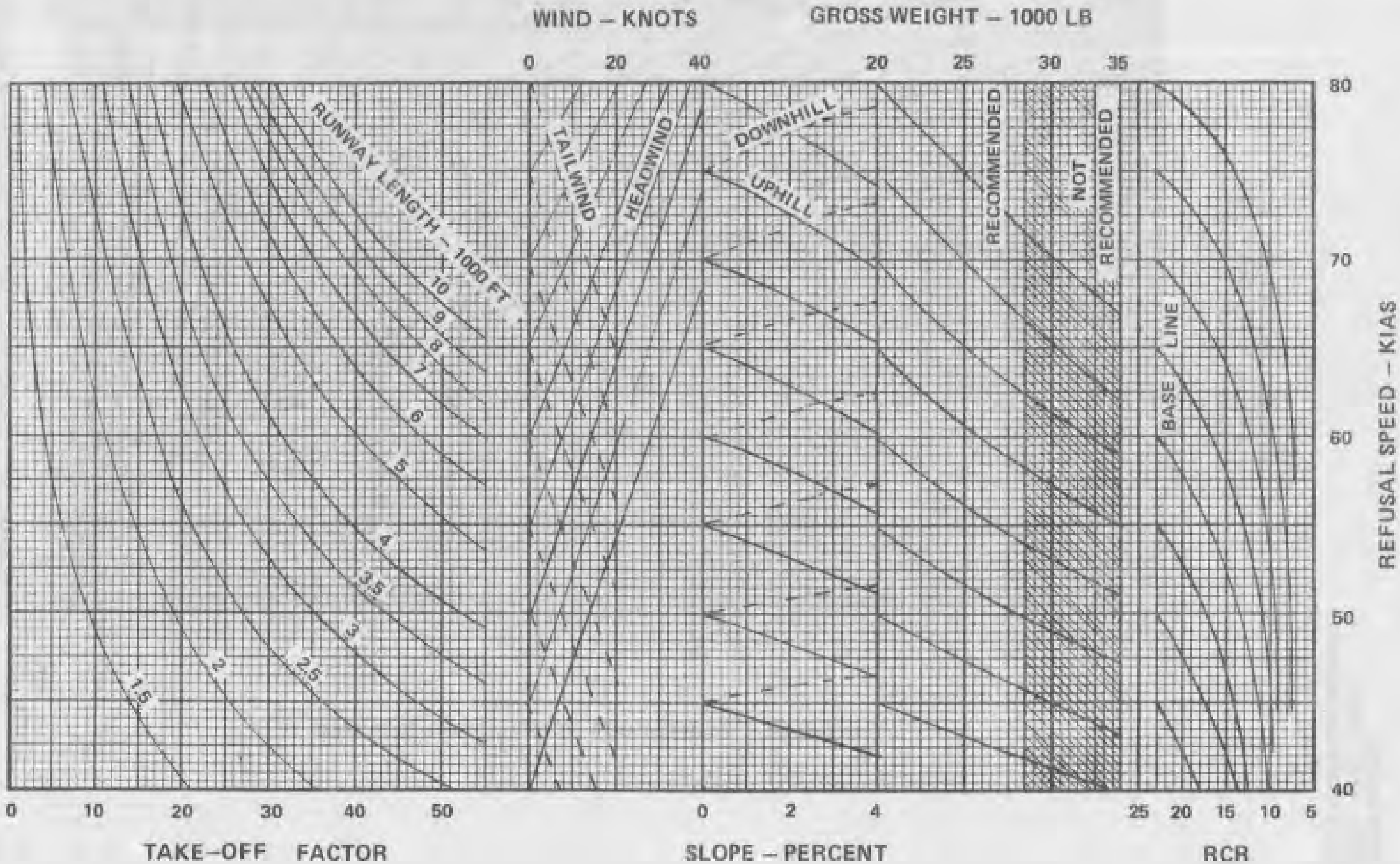


Figure A3-16

DISTANCE–TIME DURING TAKE-OFF GROUND ROLL

TWO ENGINE ACCELERATION

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTE:
TIMES ARE CORRECT FOR SEA LEVEL DENSITY ONLY. FOR ALL OTHER DENSITY ALTITUDES DIVIDE BY $1/\sqrt{\sigma}$ TO OBTAIN TRUE TIME.

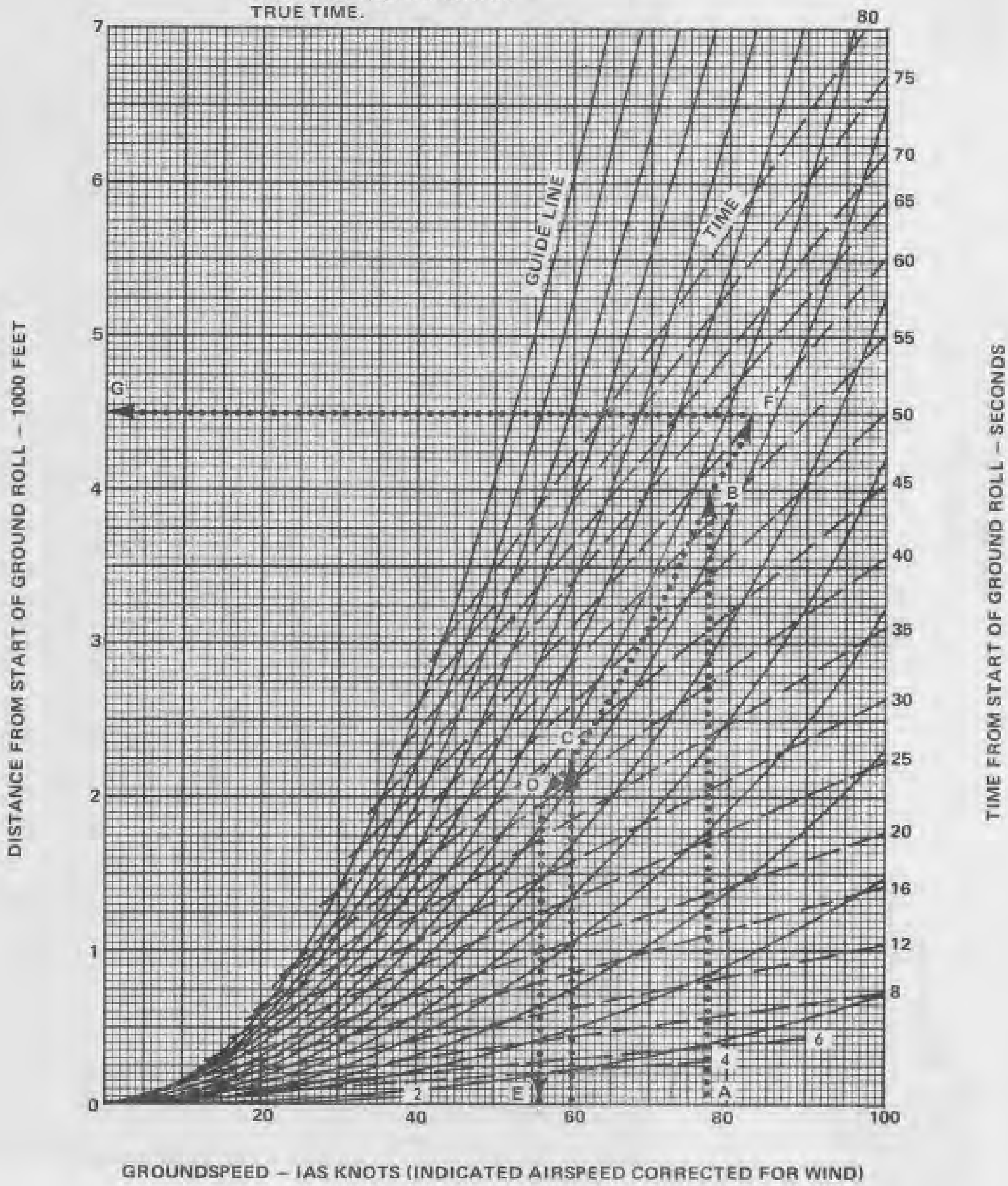


Figure A3-17

PART 4

CLIMB DATA

TABLE OF CONTENTS.

CLIMB CURVES - DISTANCE AND FUEL.

The Climb Curve charts for Distance and Fuel (figures A4-1 and A4-3) are used to determine the distance travelled and the fuel used in climb, for both engines at METO power, and one engine inoperative (propeller feathered, other engine METO power), when temperature, gross weight, density altitude at start of climb and density altitude at completion of climb are known. The 100 foot per minute reference rate of climb or service ceiling is marked on each chart. The distance in climb is given in nautical miles.

To determine distance to climb and fuel used, enter with the gross weight at the bottom of the chart and read vertically upward to the density altitude at the start of the climb. Move horizontally to the right and mark the distance scale at the right edge of the chart. Starting again at the point of intersection of gross weight and density altitude at the start of climb proceed upwards and parallel to the weight reduction grid lines. At the intersection of the density altitude for end of climb proceed horizontally to the right and mark the distance scale the second time. From the point where the line paralleling the weight reduction grid line intersects the end of climb density altitude, drop vertically and mark the gross weight scale.

The difference between the first and second marks on the distance scale is the nautical miles required to climb.

The difference between the starting gross weight and the final mark on the gross weight scale is the fuel required for climb in pounds.

EXAMPLE

Given: Climb from 3000 ft to 11,000 ft under Standard Day temperatures, starting climb at 25,000 lb gross weight, gear and flaps up, METO power on both engines.

Find: Fuel used during climb; distance covered during climb.

Procedure: Enter the gross weight scale at the bottom of Figure A4-1 with 25,000 pounds and read vertically upward to the point of intersection with the 3000-foot density altitude line (interpolation is required).

From this point of intersection move horizontally right and note the distance scale on the right of the chart.

Starting again from the point of intersection of the gross weight line and 3000-foot density altitude line, follow along or parallel to the weight reduction guide lines upward and to the right until the 11,000-foot density altitude line is intersected (interpolation is required).

From this point of intersection of the decreasing gross weight line and the density altitude line at the completion of climb, again mark the distance for reference. Also drop a vertical line to the gross weight scale and mark for reference.

Compute the fuel consumed during the climb by subtracting the gross weight at the end of climb from start of climb (25,000 - 24,850 = 150 pounds).

Compute the distance travelled during the climb by subtracting the distance marked for reference at the beginning of climb from the distance marked for reference at the end of climb (13.2 - 3.0 = 10.2).

CLIMB CURVES - TIME.

The Climb Curve charts for Time (figures A4-2 and A4-4) are used to determine time required in climb, for both engines at METO power, and one engine inoperative (propeller feathered, other engine METO power), when temperature, gross weight, density altitude at the start of the climb, and the density altitude at the completion of climb are known. The 100 foot per minute reference rate of climb or service ceiling is marked on each chart.

To determine the time required to climb, enter with the gross weight and read vertically upward to the density altitude at the start of the climb. Move horizontally to the right and mark the time scale at the right edge of the chart. Starting again at the point of intersection of gross weight and density altitude at the start of climb proceed upwards and parallel to the weight reduction grid lines. At the intersection of the density altitude for end of climb proceed horizontally to the right and mark the time scale the second time.

The difference between the first and second marks on the time scale is the time required to climb.

EMERGENCY CLIMB - ONE ENGINE INOPERATIVE.

The Emergency Climb chart (figure A4-5) enables the airspeed and rate of climb to be determined with one engine inoperative and the propeller feathered, for various gross weights and configurations. Also the reduction in rate of climb due to a windmilling propeller is illustrated for various gross weights and airspeeds. To determine the rate of climb versus the desired IAS, enter the appropriate curve for the aircraft configuration. The desired airspeed for a given set of conditions can be found by locating the peak of the curve and reading the airspeed on the airspeed scale at the base of the chart. The maximum rate of climb for the desired airspeed is then found by reading the scale on the side of the chart.

EXAMPLE

Given:	Flaps	0°
	Gear	Up
	Gross weight	28,500 lb

Find: Desired airspeed and maximum rate of climb.

Procedure: On the 28,500 lb chart, find the curve that corresponds to the aircraft configuration. Determine the peak of the curve and plot a vertical line down to the airspeed scale, read 91 knots IAS. From the intersection of the curve and the vertical line to the airspeed scale follow a horizontal line to the left to the rate of climb scale, read 295 FPM maximum rate of climb.

EMERGENCY CEILING - ONE ENGINE INOPERATIVE.

The emergency ceiling chart (figure A4-6) enables the service and absolute ceilings to be determined at various gross weights with MAX power on the operating engine. The ceiling is effected by gross weight, which is plotted along the bottom edge of the chart. By limiting the gross weight of the aircraft, the emergency ceiling can be raised to exceed terrain elevations by a reasonably safe margin. When the gross weight of the aircraft is known, the chart may be used to determine the emergency ceiling for maximum power. Use the chart by reading vertically upward from the gross weight scale until the line is reached. From this point project a line horizontally to the left to the density altitude scale. In some cases, operational requirements will include take-off from field elevations well above sea level and require passage over higher terrain enroute. This may necessitate limiting the gross weight to provide a safe operating margin. To read the chart for this purpose, enter the altitude scale at the left edge and read horizontally to the right until the appropriate line is reached. Vertically below, read the gross weight limit which should be met at the point in the flight plan where the highest enroute obstacle exists.

EXAMPLE

Given: Minimum enroute cruising altitude 10,000 ft.

Find: Maximum permissible weight at maximum power.

Procedure: Enter the density altitude scale at the 10,000-foot mark and read horizontally to the right to the line marked SERVICE CEILING. From this point, project a vertical line to the bottom of the chart and read the maximum permissible gross weight of 23,670.

CLIMB CURVE - DISTANCE AND FUEL

BOTH ENGINES METO POWER

MODEL: C–7A
DATE: MARCH 1972
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. STANDARD DAY
2. FLAPS AND GEAR RETRACTED
3. CLIMB SPEED = 95 KIAS FOR ALL WEIGHTS AND ALTITUDES

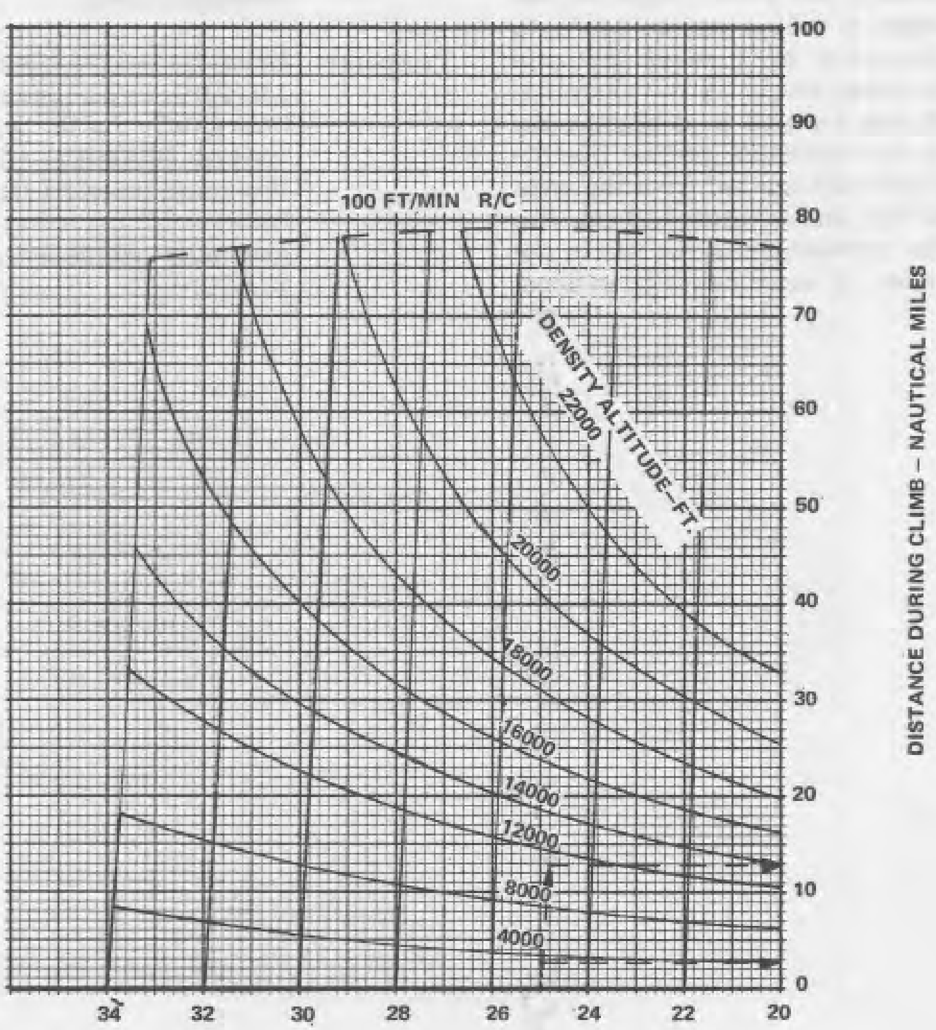


Figure A4-1.

CLIMB CURVE – TIME

BOTH ENGINES METO POWER

MODEL: C-7A
DATE: MARCH 1972
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. STANDARD DAY
2. FLAPS AND GEAR RETRACTED
3. CLIMB SPEED = 95 KIAS FOR ALL WEIGHTS AND ALTITUDES

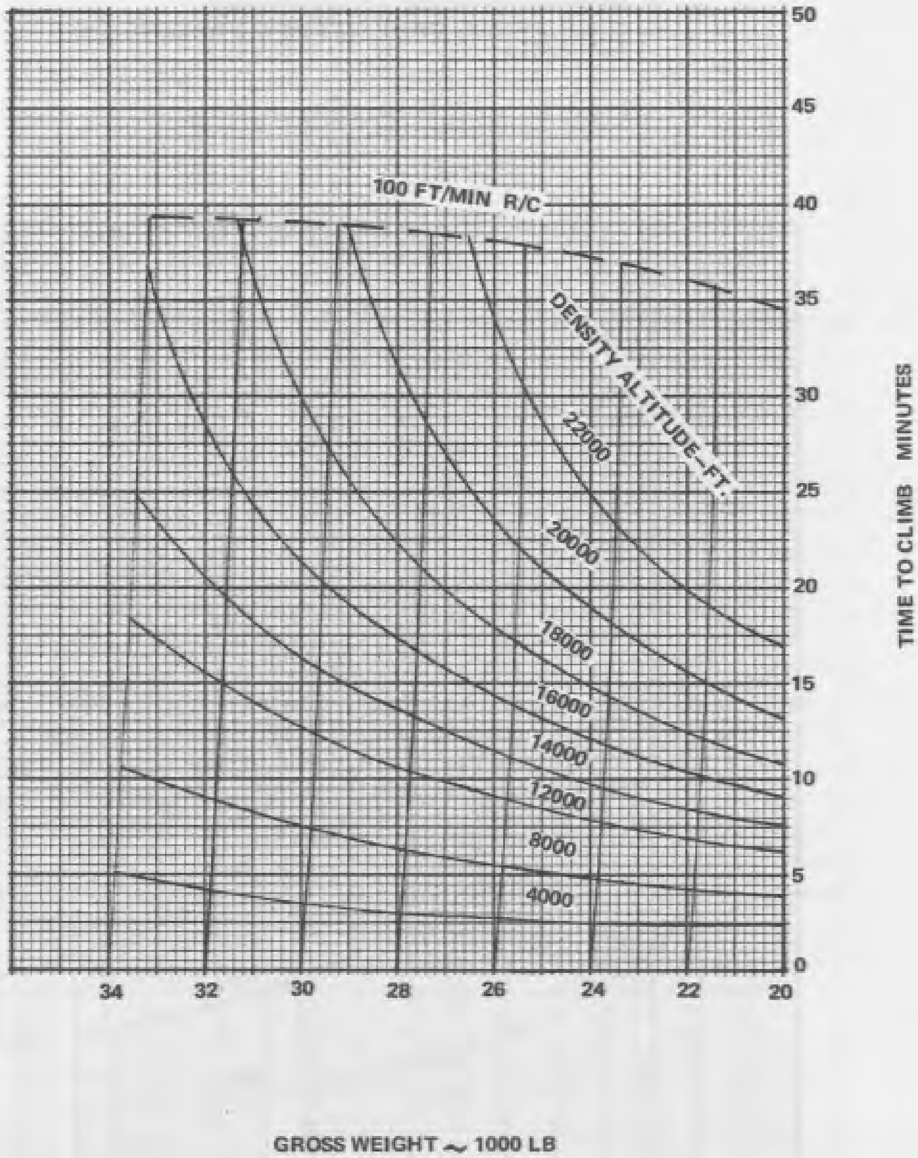


FIGURE A4-2

CLIMB CURVE - DISTANCE AND FUEL

ONE ENGINE INOPERATIVE – PROPELLER FEATHERED

MODEL: C-7A
DATE: MARCH 1972
DATA BASIS: FLIGHT TEST (AFFTC)

OTHER ENGINE METO POWER

ENGINE(S): (1) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. STANDARD DAY
2. FLAPS AND GEAR RETRACTED
3. INOPERATIVE PROPELLER FEATHERED
4. CLIMB SPEED 95 KNOTS IAS FOR ALL WEIGHTS AND ALTITUDES

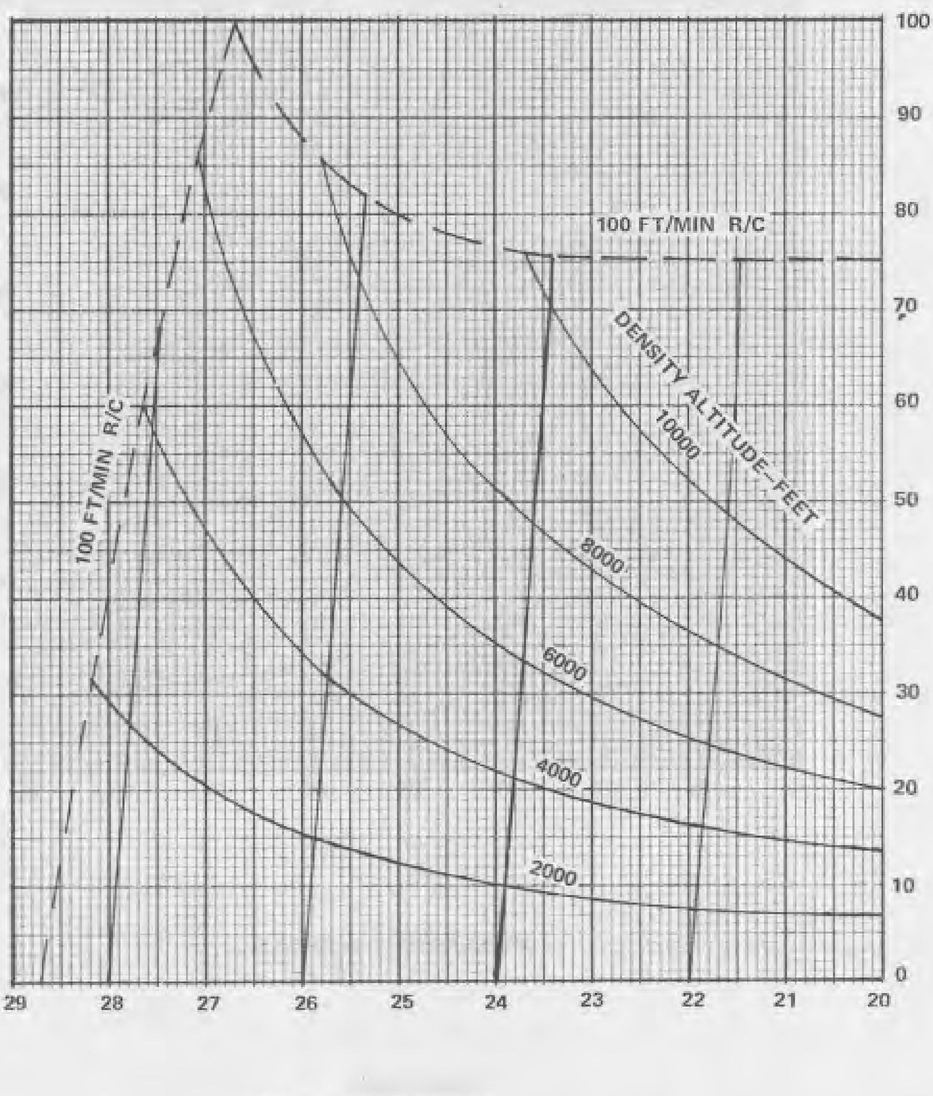


Figure A4-3.

CLIMB CURVE – TIME

ONE ENGINE INOPERATIVE – PROPELLER FEATHERED
OTHER ENGINE METO POWER

MODEL: C-7A
DATE: MARCH 1972
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (1) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. STANDARD DAY
2. FLAPS AND GEAR RETRACTED
3. INOPERATIVE PROPELLER FEATHERED
4. CLIMB SPEED 95 KIAS FOR ALL WEIGHTS AND ALTITUDES

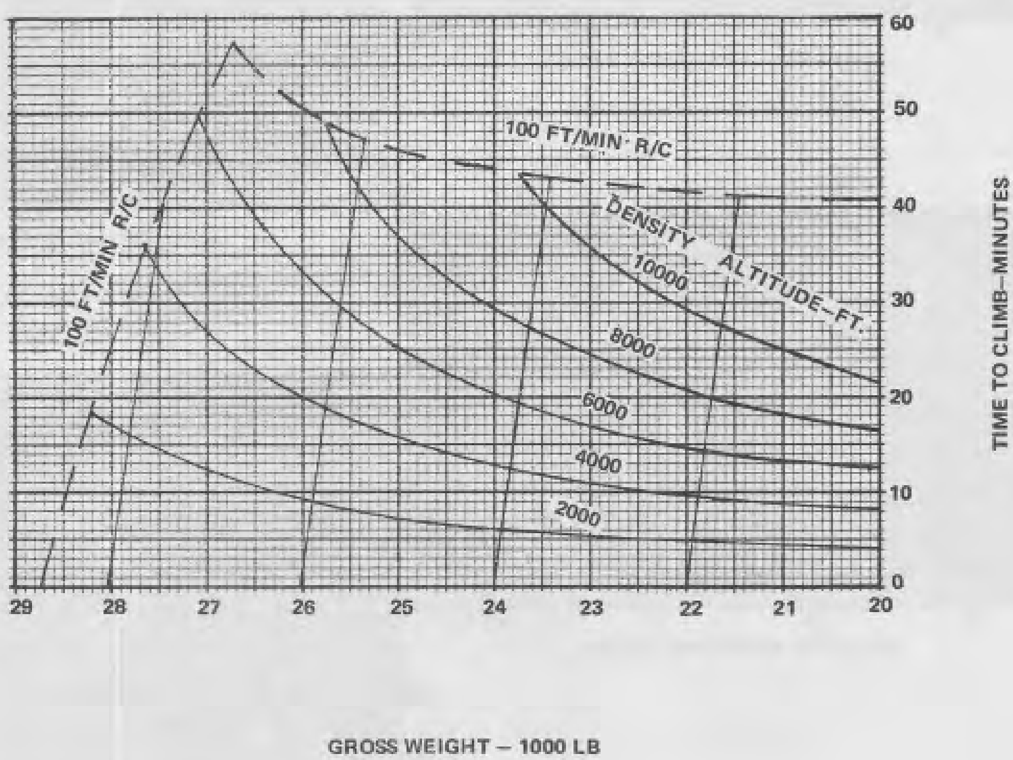


FIGURE A4-4

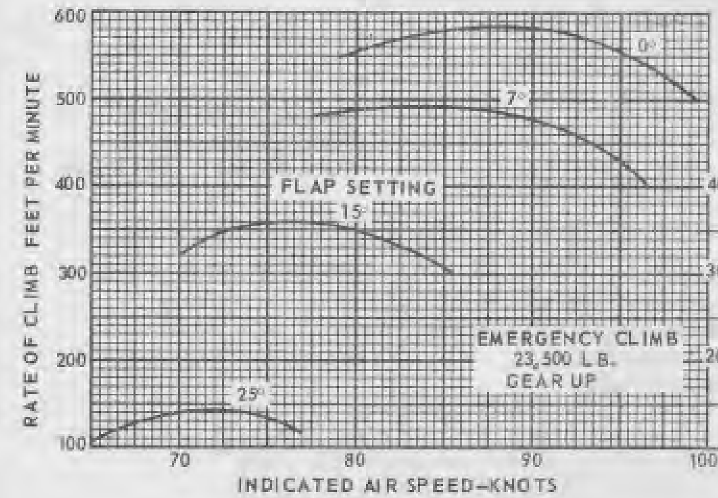
EMERGENCY CLIMB

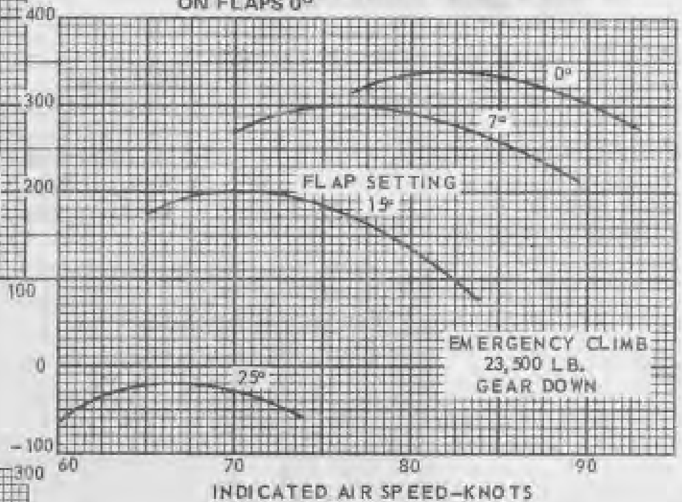
MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

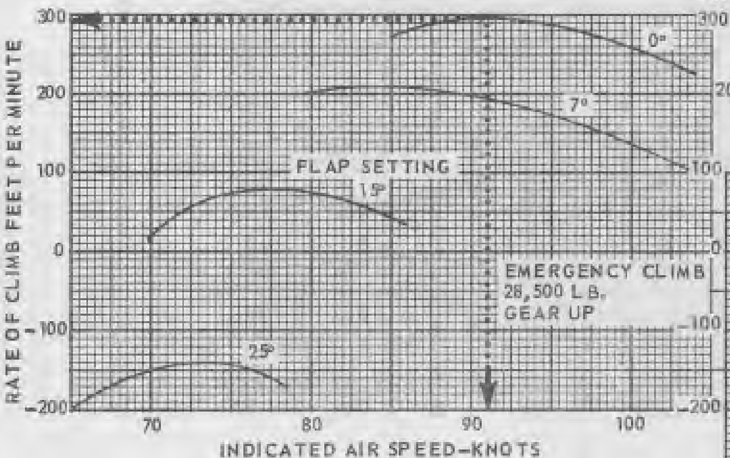
ONE ENGINE INOPERATIVE

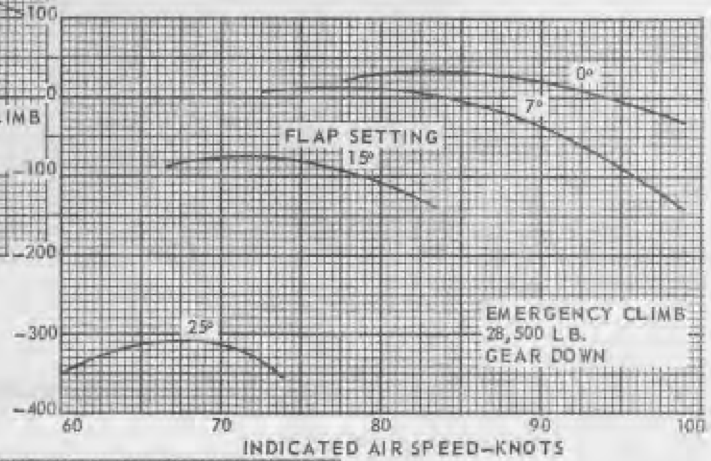
ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

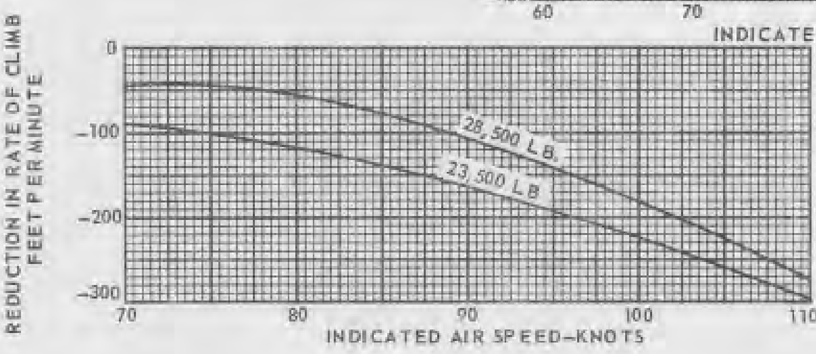
NOTES:
1. SEA LEVEL, STANDARD DAY
2. OPERATING ENGINE AT MAXIMUM POWER
3. UNLESS OTHERWISE STATED THE INOPERATIVE PROPELLER IS FEATHERED
4. WINDMILLING PROPELLER DATA IS BASED ON FLAPS 0°











REDUCTION IN RATE OF CLIMB DUE TO WINDMILLING PROPELLER

Figure A4-5.

MODEL: C-7A
DATE: MARCH 1972
DATA BASIS: FLIGHT TEST (AFFTC)

EMERGENCY CEILING
ONE ENGINE INOPERATIVE

ENGINE(S): (1) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:

1. STANDARD DAY
2. FLAPS AND GEAR RETRACTED
3. INOPERATIVE PROPELLER FEATHERED

NOTES:

1. SERVICE CEILING RATE OF CLIMB–100 FPM
2. ABSOLUTE CEILING RATE OF CLIMB -0 FPM
3. BASED ON CLIMB SPEED = 95 KIAS

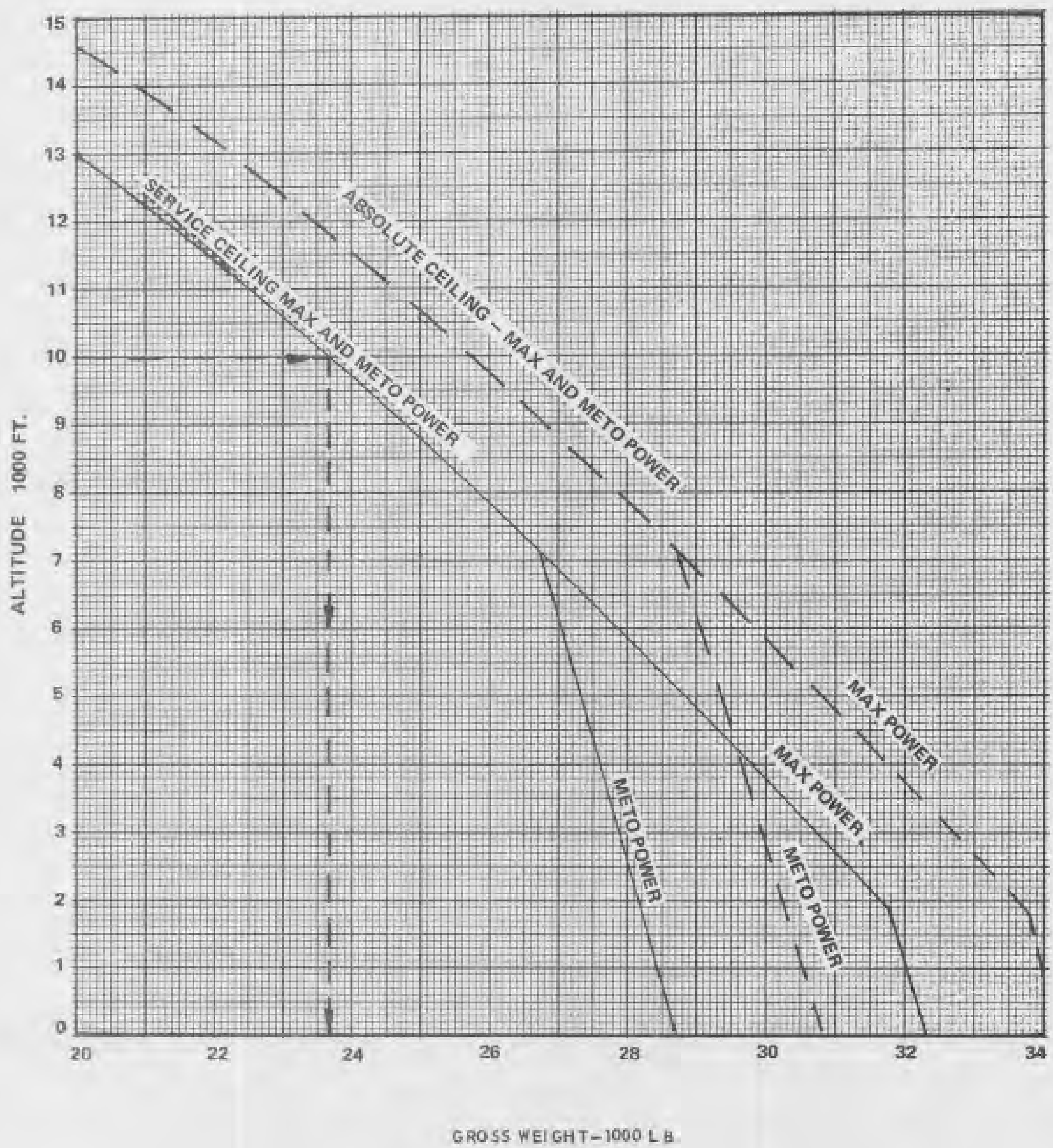


Figure A4-6

PART 5
CRUISE DATA

TABLE OF CONTENTS.

LEVEL FLIGHT PERFORMANCE.

The Level Flight Performance charts (figure A5-1 and A5-2) are used to determine the equivalent and true airspeeds and the brake horsepower required per engine for level flight performance at various combinations of gross weight and density altitude.

NOTE

Increase computed BHP by approximately 5 percent on aircraft which are generally in poor condition (nicks in props, etc) due to operation in an austere environment.

EXAMPLE

Given:	Altitude	5000 ft
	Gross Weight	23,000 lb
Find:	BHP required	
	CAS	
	TAS	

Procedure: Enter the chart at the maximum range, no wind line and proceed to the known gross weight, 23,000 pounds. From this intersection proceed horizontally to the known density altitude and read 500 BHP, the required brake horsepower per engine for two-engine operation. To determine the correct calibrated airspeed, proceed vertically downward to the calibrated airspeed scale and read 116 knots. The true airspeed may be determined by continuing vertically downward to the known density altitude, 5000 feet, and interpolate true airspeed, 124 knots.

LONG-RANGE PREDICTION.

The long-range cruise performance of the aircraft is expressed in two forms: distance covered and time required. Both forms are useful in the flight planning stage, and may be read from a series of two Long-Range Prediction charts when the amount of fuel (pounds) available for cruise is known. Figure A5-3 is for twin-engine performance and Figure A5-4 is for single-engine performance. Each chart specifies the distance covered (air nautical miles) and the time required (hours) as functions of fuel consumed. If the distance or time available is the known factor in the problem, the charts may also be read in reverse to determine the amount of fuel required. Notice that the distance and time may not be read directly from the scale at the left, but are represented by the difference between two readings which correspond to the initial and final cruising weights. Fuel quantity is read in a similar manner from the scale at the bottom when time or distance is known. It should be noted that the performance specified on the charts is obtained only when the recommended power setting for long range is used; ie, setting power each hour. The effect of pressure altitude is shown on each chart by pressure altitude lines ranging from sea level to 20,000 feet on the two-engine charts, and from sea level to 14,000 feet on the single-engine charts.

EXAMPLE

Given:	Pressure altitude	20,000 ft
	Gross weight	25,000 lb
	Distance	1100 miles
	Engines operating	Two
Find:	Fuel used for long range cruise.	

Procedure: Enter the gross weight scale at the bottom of the chart (figure A5-3) with 25,000 pounds and read vertically upward to the 20,000 foot pressure altitude line. Move horizontally left and read 5100 miles on the distance scale. Move up the NAUTICAL MILES scale 1100 miles to the 6200-mile point. Re-enter the chart from the 6200-mile point and move to the right until the 20,000-foot altitude line is intersected. Drop vertically from the point of intersection and read 21,200 pounds from the GROSS WEIGHT scale at the bottom of the chart. Fuel consumed in the 1100-mile cruise is computed by subtracting the gross weight at the end of cruise from the gross weight at the start of cruise, in this case 3,800 pounds. Correct for nonstandard OAT using the data noted on the chart. To determine the time required, proceed vertically from 25,000 pounds and 21,200 pounds until the 20,000 foot line on the upper grid is intersected. Move horizontally left and read the corresponding Times: 26 hours and 35 hours. Subtract the two times to determine the total time required: 35 - 26 = 9 hours.

EFFECT OF CARGO/RAMP DOORS ON CRUISE AND RANGE.

The effect of cargo/ramp doors on cruise speed and range is presented in tabular form (figure A5-7).

LEVEL FLIGHT PERFORMANCE

TWO ENGINE

MODEL: C-7A
DATE: APRIL 1972
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONFIGURATION: FLAPS AND GEAR RETRACTED

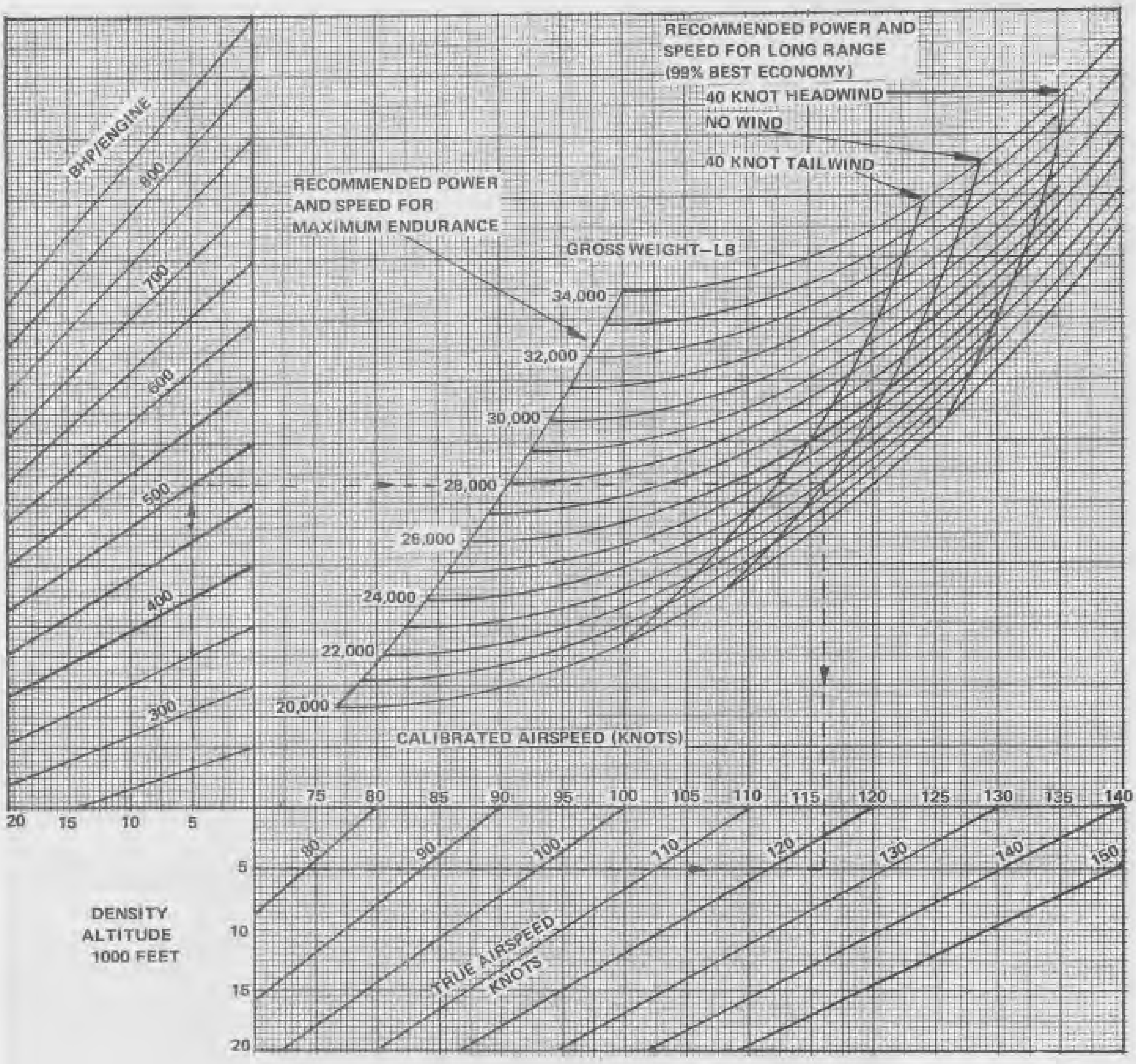


FIGURE A5-1 (SHEET 1 OF 2)

LEVEL FLIGHT PERFORMANCE
TWO ENGINE

MODEL: C-7A
DATE: APRIL 1972
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONFIGURATION: FLAPS AND GEAR RETRACTED

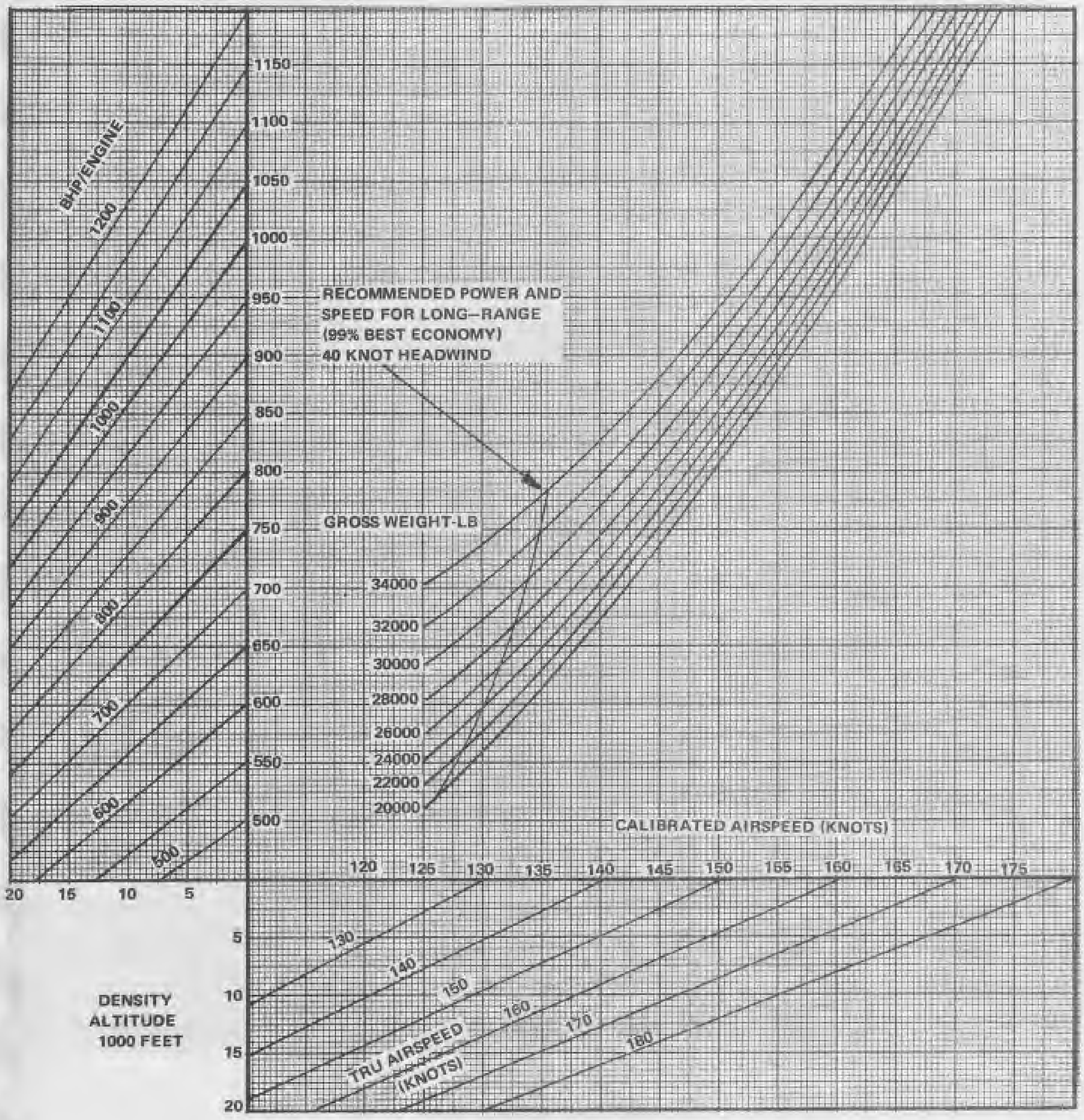


FIGURE A5-1 (SHEET 2 OF 2)

LEVEL FLIGHT PERFORMANCE

SINGLE ENGINE

MODEL: C-7A
DATE: APRIL 1972
DATA BASIS: FLIGHT TEST (AFFTC)
CONFIGURATION:
FLAPS AND GEAR RETRACTED
PROP FEATHERED ON INOPERATIVE ENGINE

ENGINE(S): (1) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

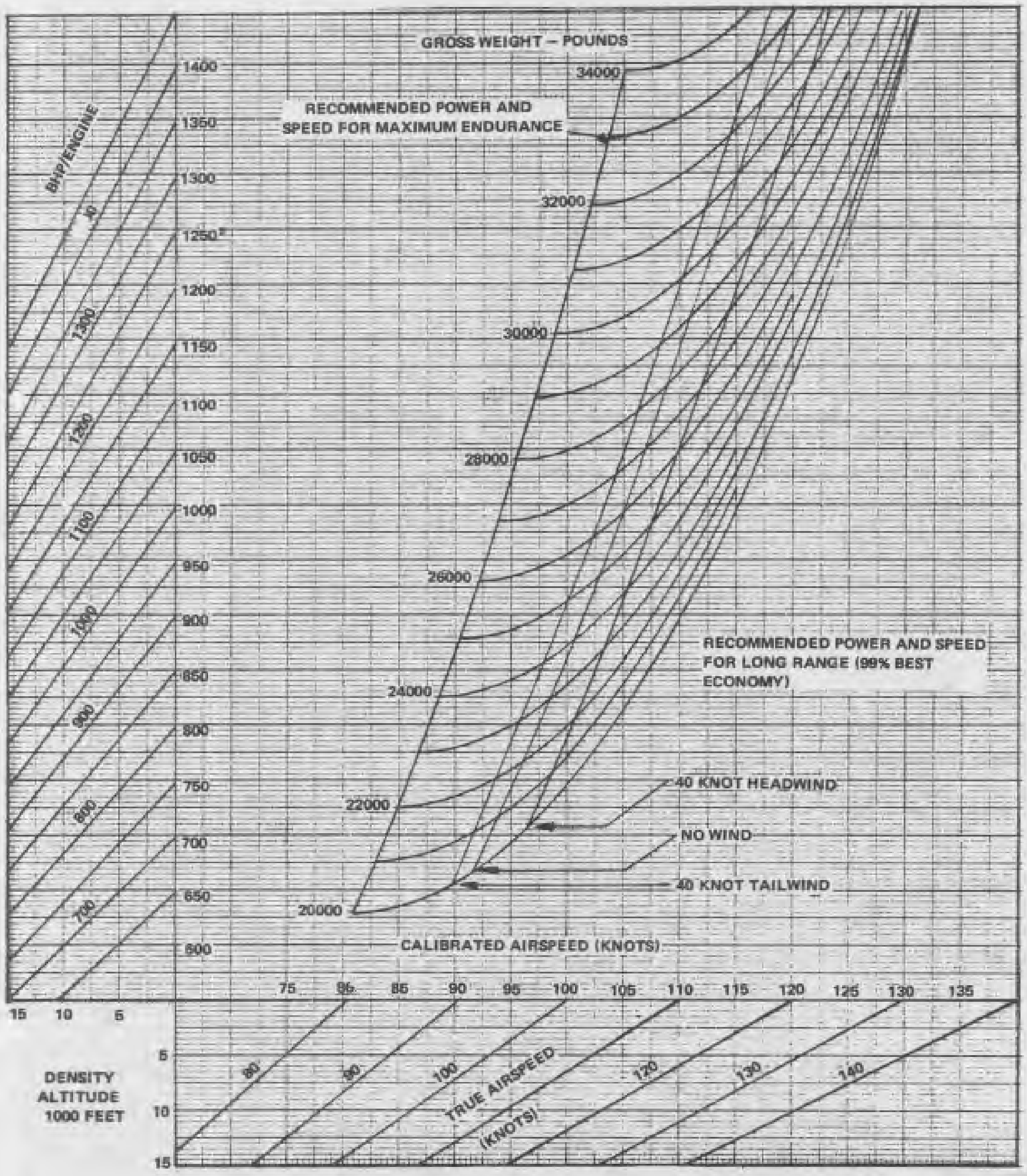


Figure A5-2

LONG–RANGE PREDICTION – TIME AND DISTANCE

BOTH ENGINES OPERATING

MODEL: C-7A
DATE: APRIL 1972
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTES:

1. STANDARD DAY, NO WIND.
2. BASED ON SETTING POWER EACH HOUR.
3. LONG RANGE CRUISING SPEED.
4. AMBIENT TEMPERATURE EFFECTS ARE NEGLIGIBLE FOR A TEMPERATURE RANGE OF ± 30°C FROM STANDARD

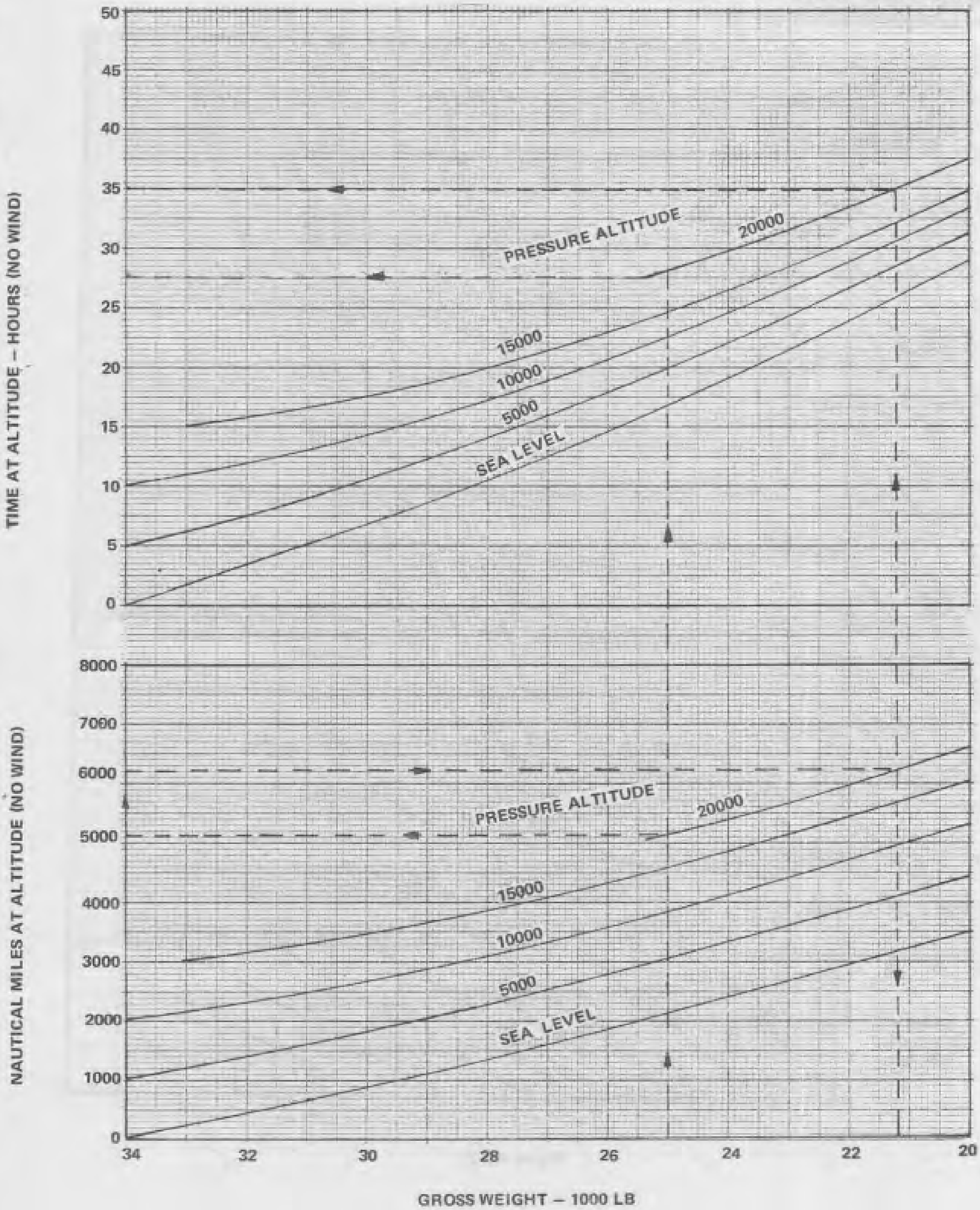


Figure A5-3

LONG – RANGE PREDICTION – TIME AND DISTANCE

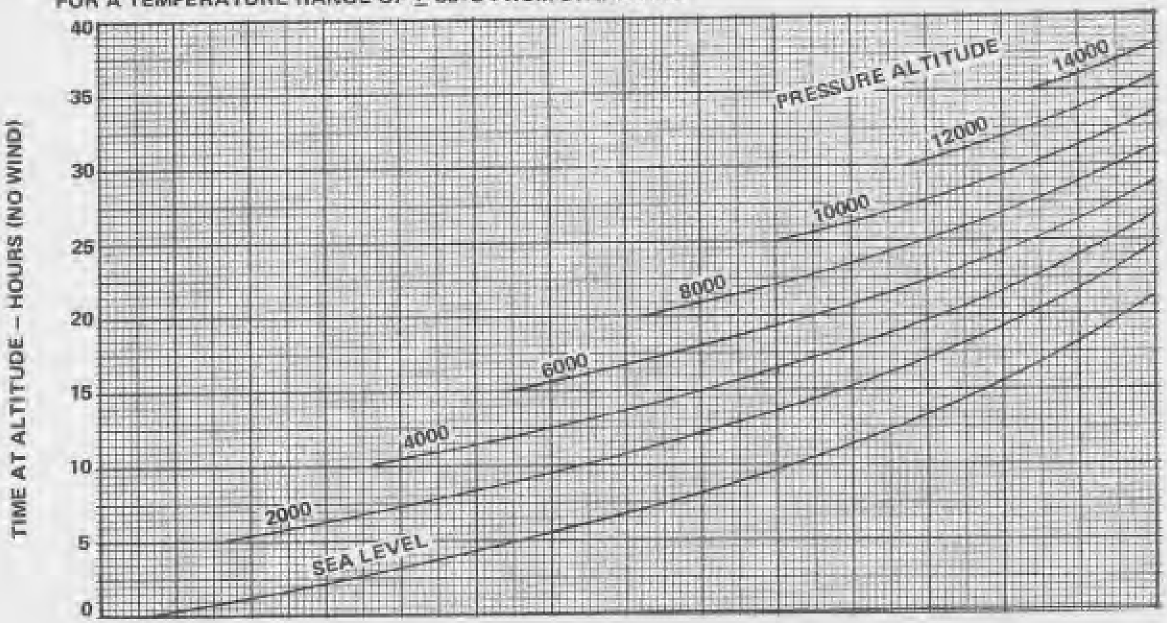
ONE ENGINE INOPERATIVE–PROPELLER FEATHERED

ENGINE(S): (1) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

MODEL: C-7A
DATE: APRIL 1972
DATA BASIS: FLIGHT TEST (AFFTC)

NOTES:

1. STANDARD DAY, NO WIND.
2. BASED ON SETTING POWER EACH HOUR.
3. LONG RANGE CRUISING SPEED.
4. AMBIENT TEMPERATURE EFFECTS ARE NEGLIGIBLE FOR A TEMPERATURE RANGE OF ± 30ºC FROM STANDARD.



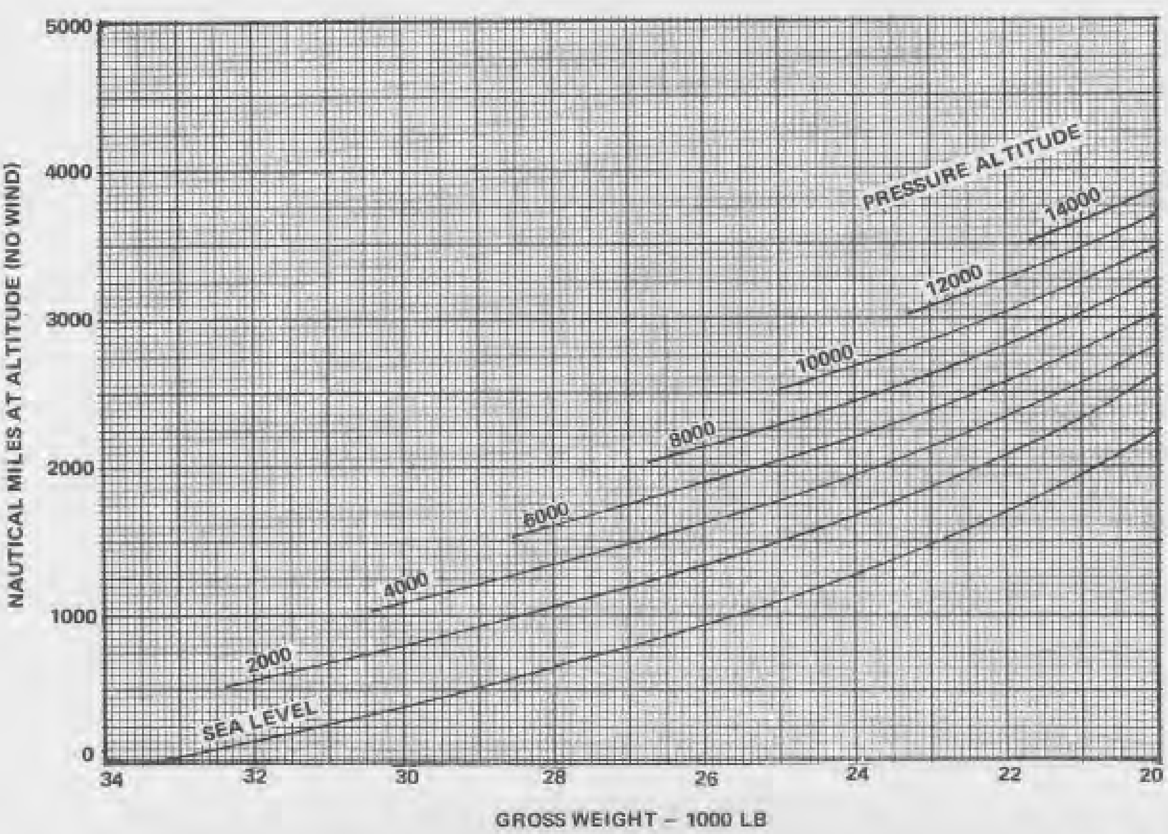


Figure A5-4

EFFECT OF CARGO/RAMP DOORS ON CRUISE AND RANGE

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

RAMP DOOR POSITION	CARGO DOOR POSITION	INCREASE IN POWER REQUIRED PERCENT
UP	OPEN	4.9
DOWN 15°	OPEN	9.6
DOWN 30°	OPEN	18.7

NOTE:
CRUISE POWER RATING (725 BHP) THE DECREASE IN CRUISE SPEED WILL BE AS FOLLOWS:

RAMP DOOR POSITION	CARGO DOOR POSITION	DECREASE IN SPEED - KTS	DECREASE IN RANGE PERCENT
UP	OPEN	2.5	4.4
DOWN 15°	OPEN	5.9	9.2
DOWN 30°	OPEN	10.2	12.0

Figure A5-5

EFFECT OF CARGO/RAMP DOORS ON CRUISE AND RANGE

MODEL: C–7A
DATE: APRIL 1970
DATA BASIS: FLIGHT TEST (AFFTC)

ENGINE(S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

RAMP DOOR POSITION	CARGO DOOR POSITION	INCREASE IN POWER REQUIRED PERCENT
UP	OPEN	4.9
DOWN 15°	OPEN	9.6
DOWN 30°	OPEN	18.7

NOTE:
CRUISE POWER RATING (725 BHP) THE DECREASE IN CRUISE SPEED WILL BE AS FOLLOWS:

RAMP DOOR POSITION	CARGO DOOR POSITION	DECREASE IN SPEED - KTS	DECREASE IN RANGE PERCENT
UP	OPEN	2.5	4.4
DOWN 15°	OPEN	5.9	9.2
DOWN 30°	OPEN	10.2	12.0

Figure A5-7

PART 6

LANDING DATA

TABLE OF CONTENTS.

APPLICATION OF WIND TO LANDING DATA.

Winds are usually measured at some fixed point on the airfield and are valid for the time and geographical point where measured. If wind is measured at a point other than the runway, it is recommended that 50 percent of reported headwinds and 150 percent of reported tailwinds be used with the wind correction grids. (Refer to Table A6-1.)

The landing charts are based on the true wind speed at 50 feet above the runway and include the effects of a typical wind velocity variation with height, obtained over clear, level ground.

THRESHOLD SPEED.

The Threshold Speed chart (figure A6-1) provides threshold speed as a function of weight and aircraft configuration. It is based on flight test recommended threshold speeds.

EXAMPLE

Given:	Gross weight	26,000 lb
	Flaps	30°
Find:	Threshold speed for a normal landing.	
Procedure:	Enter the threshold speed chart at the bottom of 26,000 pounds. Proceed vertically to intersect the 30° flaps line, move horizontally to the left and read the indicated airspeed, 70.9 knots.	

CROSSWIND COMPONENT.

The effective crosswind component and headwind component can be determined from the Crosswind Component chart (figure A6-2).

EXAMPLE

Given:	Runway	120°
	Wind direction	180°
	Wind velocity	25 knots
	Landing weight	22,000 lb
Find:	Is landing recommended at 30° flaps?	

Procedure: From the Threshold Speed chart (figure A6-1) determine the threshold speed for 30° flaps and 22,000-pound landing weight. Solution 68.3 knots.

Wind direction 180° minus 120° (runway heading) = 60° (crosswind).

Enter the crosswind component, normal landing, at a wind angle of 60° and a maximum wind velocity of 25 knots, determine the crosswind component to be 21.6 knots.

Proceed vertically to threshold speed of 68.3 knots and determine that the landing would be in the not recommended area. Thus a 30° flap landing is not recommended. From A6-1 determine the threshold speed for 20° flaps. Solution, 73 knots again proceed vertically from the 21.6 knot crosswind component and determine that the 20° flap threshold speed, 73 knots, is in the recommended area and is satisfactory for landing.

LANDING DISTANCE.

Landing Distance charts (figures A6-3 through A6-9) depict the expected level ground roll distance on a dry, hard-surface runway for 0°, 15°, 20°, 30°, and 40° flaps (normal technique with brakes only) and 30° and 40° flaps (short-field technique with brakes and reverse thrust). Landing distances are computed for various conditions of temperature, pressure altitude, gross weight, headwind, runway slope, RCR, and obstacle clearance. The landing distance normal technique charts are based on brakes only; however, the landing ground roll can be shortened by 30% with proper use of reverse thrust.

EXAMPLE

Given:	Temperature	40°C
	Pressure altitude	2000 ft
	Gross weight	24,000 lb
	Runway slope	+1.6%
	Effective headwind component	10 knots
	RCR	12
	Landing flap setting	0°

Find: Ground roll (no wind)
Ground roll corrected for wind
Total distance to clear a 50-foot obstacle

Procedure: Enter the chart (figure A6-3, Sheet 1) at 40°C OAT and project vertically up to intersect the 2000-foot pressure altitude curve and move horizontally right to intersect the 24,000-pound gross weight curve.

From this intersection project vertically down through the base line and read the landing ground roll (no wind) 1680 feet.

From the vertical line intersection with the base line follow the head-wind guide lines to intersect a line projected horizontally from 10 knots on the wind scale, then vertically down and read the corrected ground roll 1420 feet.

To determine the air run distance to clear a 50-foot obstacle enter figure A6-3, Sheet 2, with the corrected ground roll of 1420 feet at the bottom of the chart. Move vertically upward to intersect the 50-foot obstacle height line, then horizontally left and read the answer 1020 feet.

To determine the corrected ground run distance to include runway slope and RCR proceed vertically downward from the 10-knot headwind intersection to the slope base line on figure A6-3, Sheet 1. Follow the slope guide line to intercept the 1.6% gradient. Continue vertically downward to the RCR base line (RCR = 23), then follow the RCR guide line to intercept RCR at 12. Proceed vertically downward from this intersection and read the corrected ground run distance, 2240 feet. Add air distance to corrected ground roll to obtain the total distance to clear obstacle on other than a dry, hard surface (2240 +1020 =3260 ft).

Table A6-1

WIND SUMMARY TABLE		
Type of Wind	How to Obtain Component	Use of Wind Component
HEADWIND	Runway component Enter wind component chart with steady wind value.	Apply 50 percent of component to all landing distances. Apply 50 percent headwinds for obstacle clearance.
TAILWIND	Runway component Enter wind component chart with steady wind value plus gust increment.	Apply 150 percent of component to all landing distances. Apply 150 percent of component for obstacle clearance.
CROSSWIND	Crosswind component Enter wind component chart with steady wind value plus gust increment.	Check necessity of increased threshold speeds.
GUSTS	Gust increment Reported wind in excess of steady wind value.	
NOTE: Winds reported at the runway may be used at full reported values.		

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

THRESHOLD SPEED

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTE
INCREASE THRESHOLD SPEED BY ONE HALF THE GUST FACTOR UNDER GUSTY CONDITIONS.

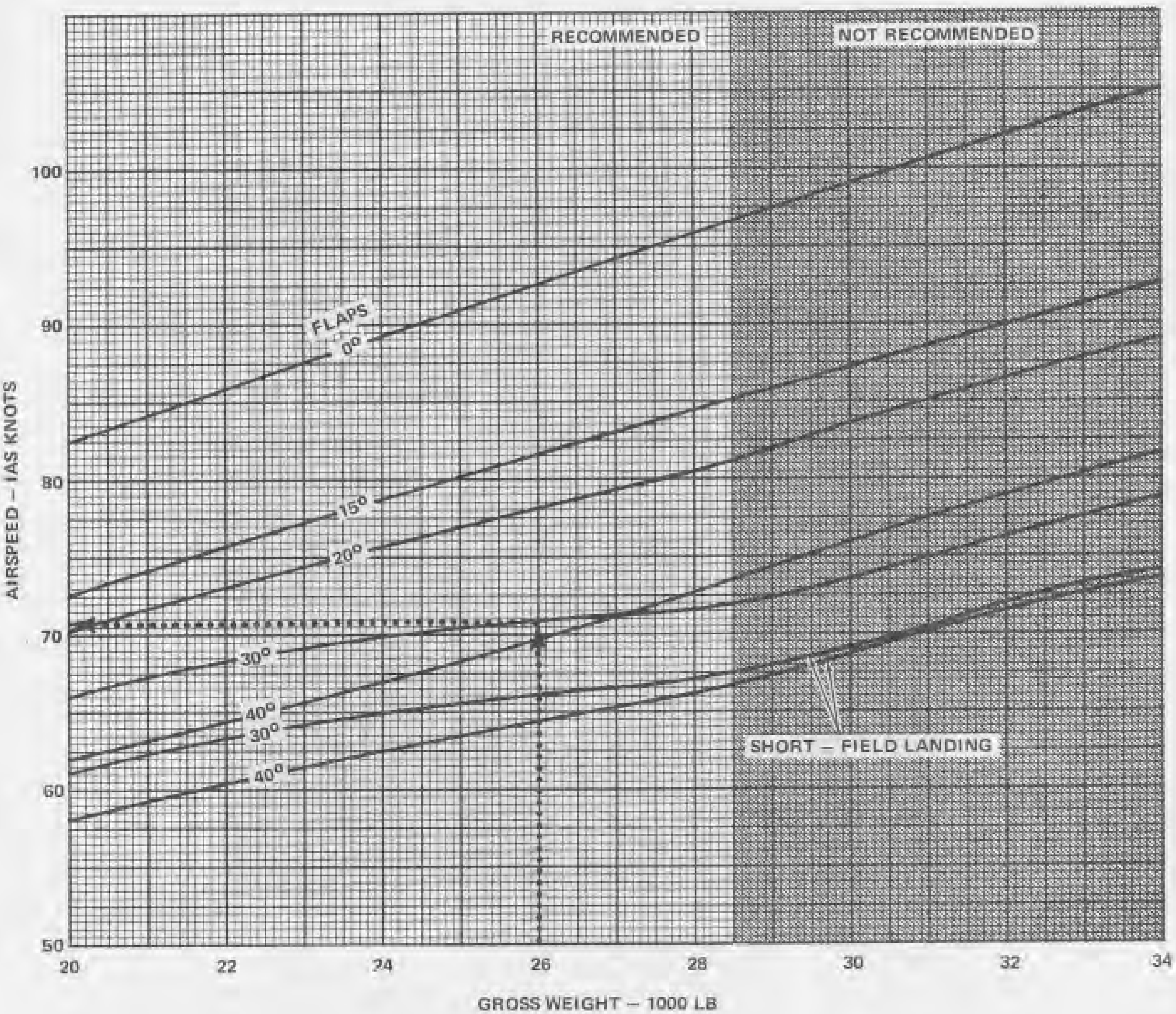


Figure A6-1

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

CROSSWIND COMPONENT

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

NOTE:
INCREASE THE THRESHOLD SPEED BY ONE-HALF THE GUST FACTOR DURING GUSTY WIND CONDITIONS.

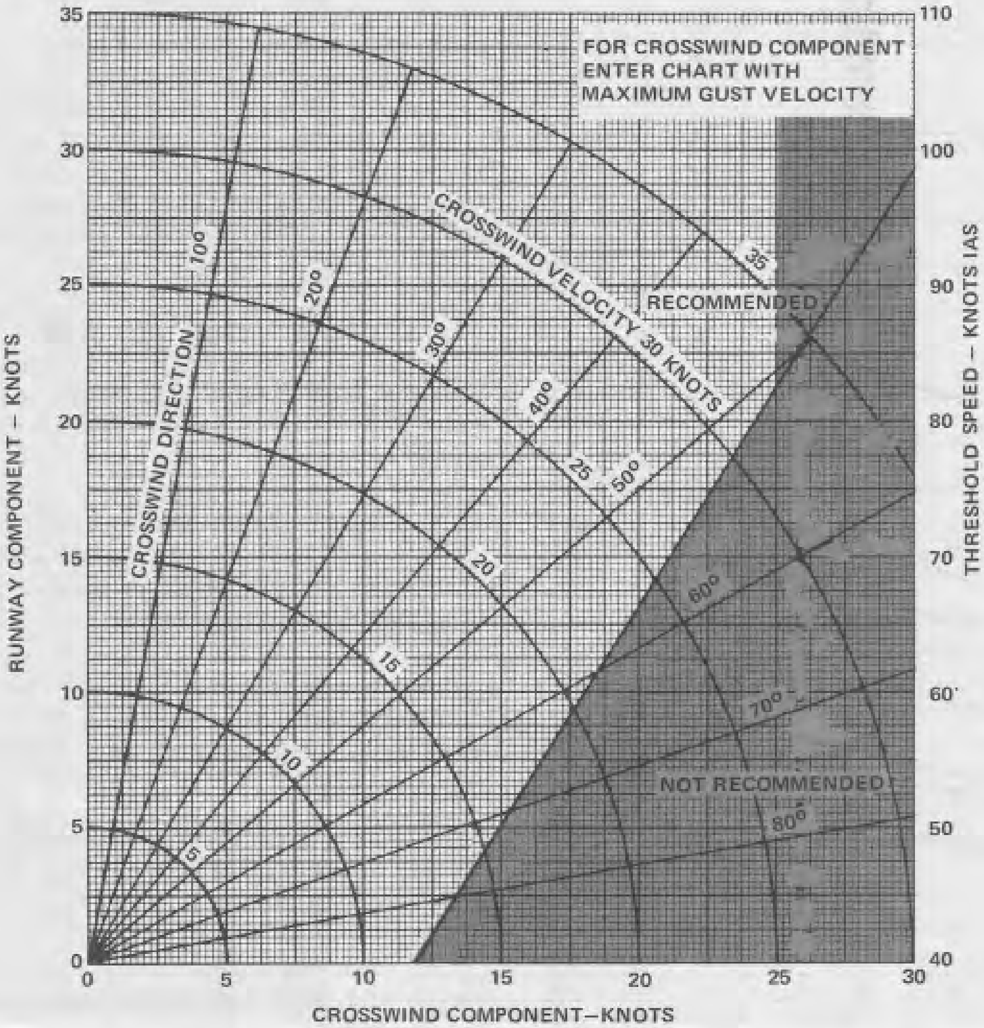


Figure A6-2

NORMAL LANDING DISTANCE

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

CONDITIONS:
1. WHEEL BRAKES ONLY
2. FLAPS 0°

ENGINE (S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

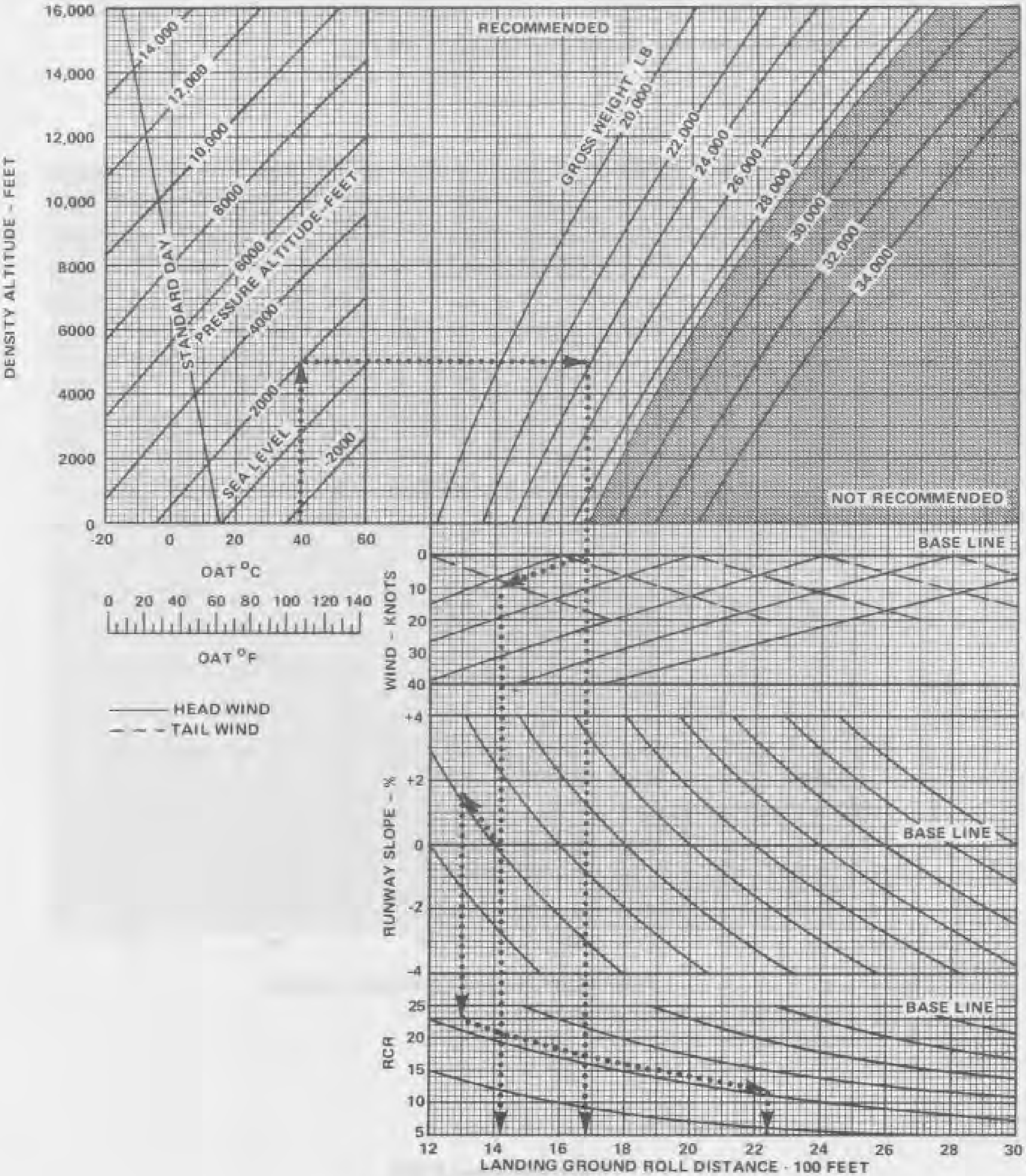


Figure A6-3 (Sheet 1 of 2)

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

NORMAL LANDING DISTANCE

AIR RUN DISTANCE TO CLEAR OBSTACLE HEIGHT

ENGINE (S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. WHEEL BRAKES ONLY
2. FLAPS 0°
3. LANDING GROUND ROLL DISTANCE DETERMINED AT RCR =23

NOTE: ENTER CHART WITH GROUND ROLL OBTAINED FROM FIGURE A6-3 (SHEET 1)

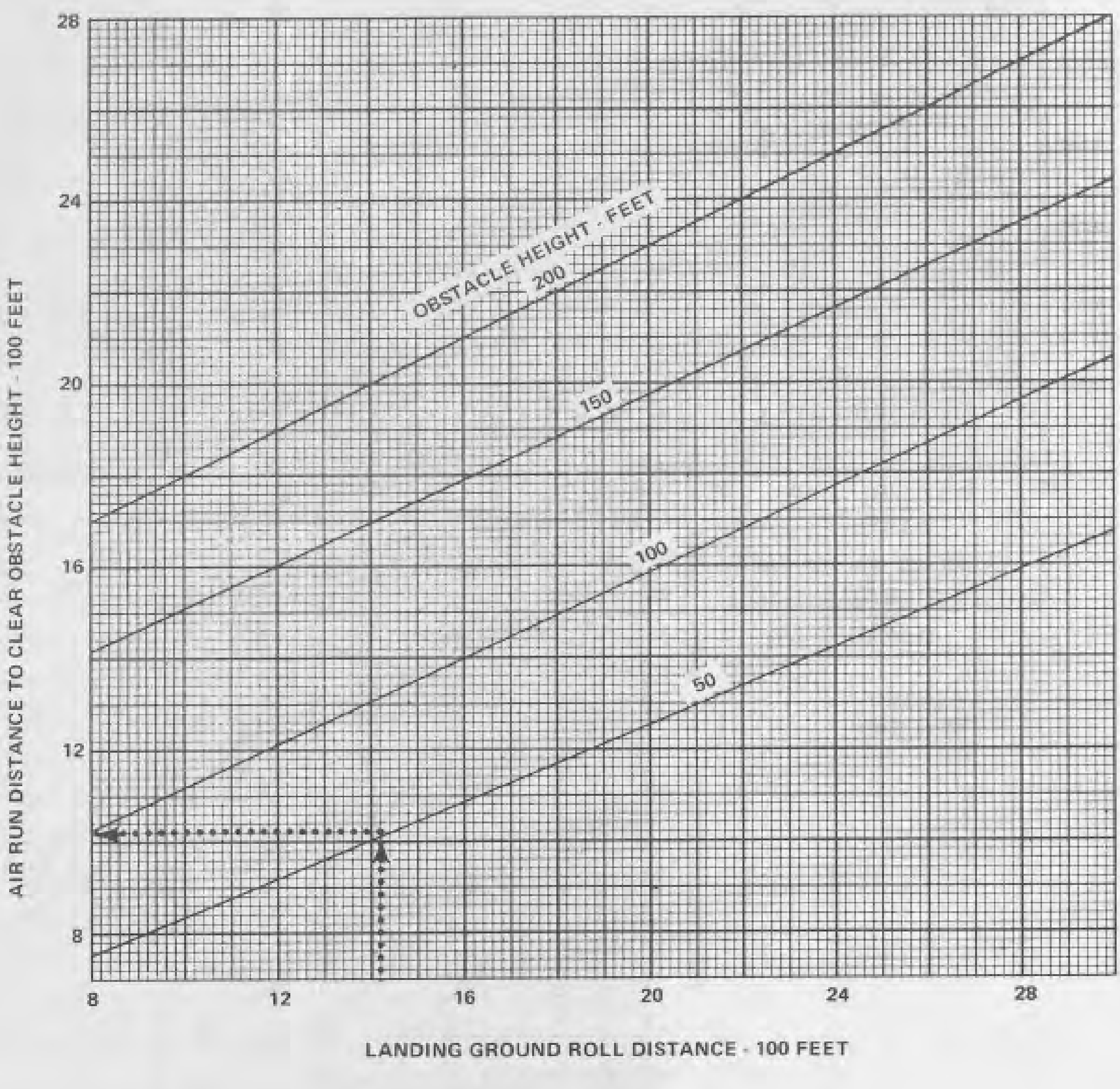


Figure A6-3 (Sheet 2 of 2)

NORMAL LANDING DISTANCE

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

CONDITIONS:
1. WHEEL BRAKES ONLY
2. FLAPS 15°

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

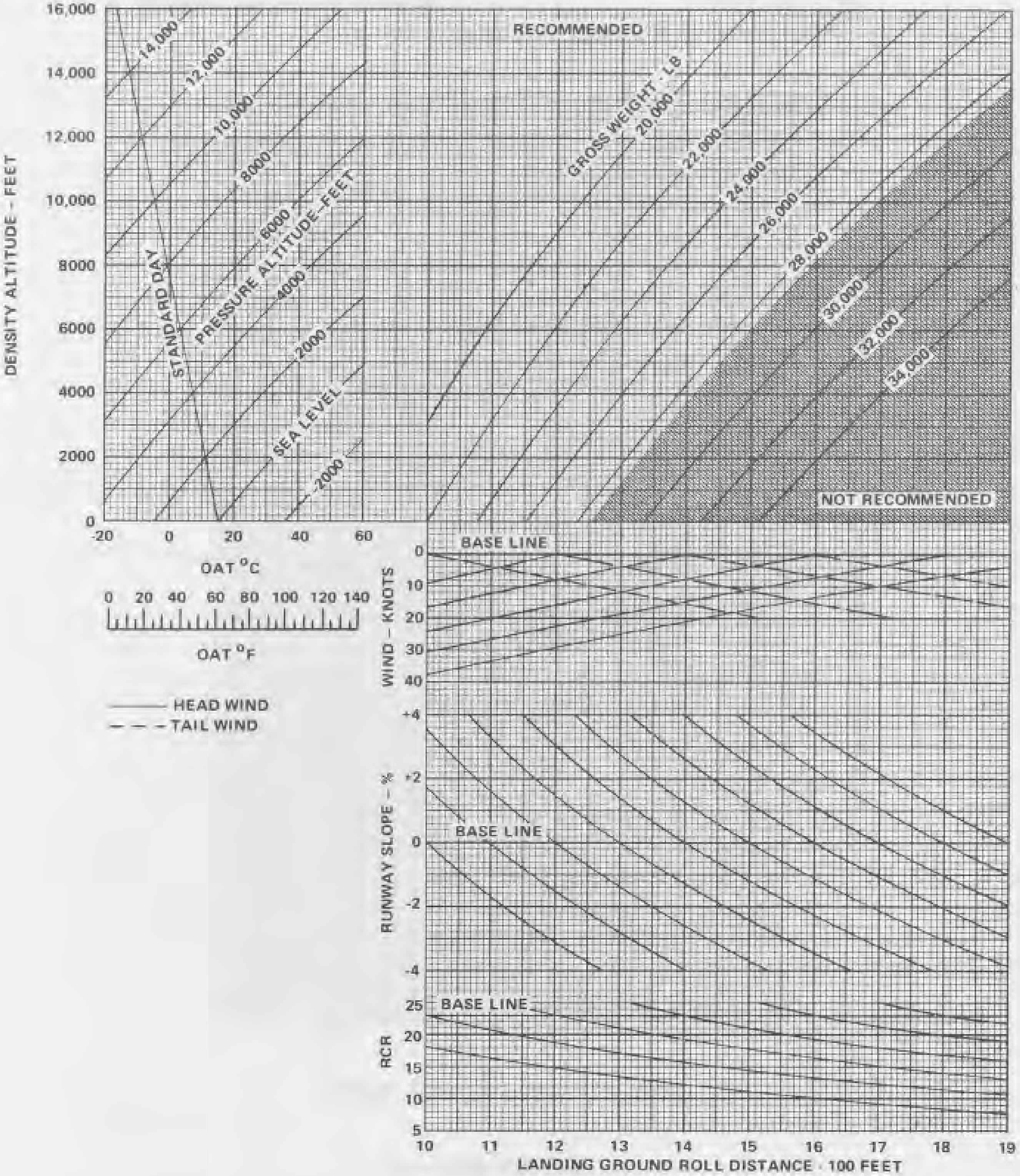


Figure A6-4 (Sheet 1 of 2)

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

NORMAL LANDING DISTANCE
AIR RUN DISTANCE TO CLEAR OBSTACLE HEIGHT

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. WHEEL BRAKES ONLY
2. FLAPS 15°
3. LANDING GROUND ROLL DISTANCE DETERMINED AT RCR =23

NOTE: ENTER CHART WITH GROUND ROLL OBTAINED FROM FIGURE A6-4 (SHEET 1)

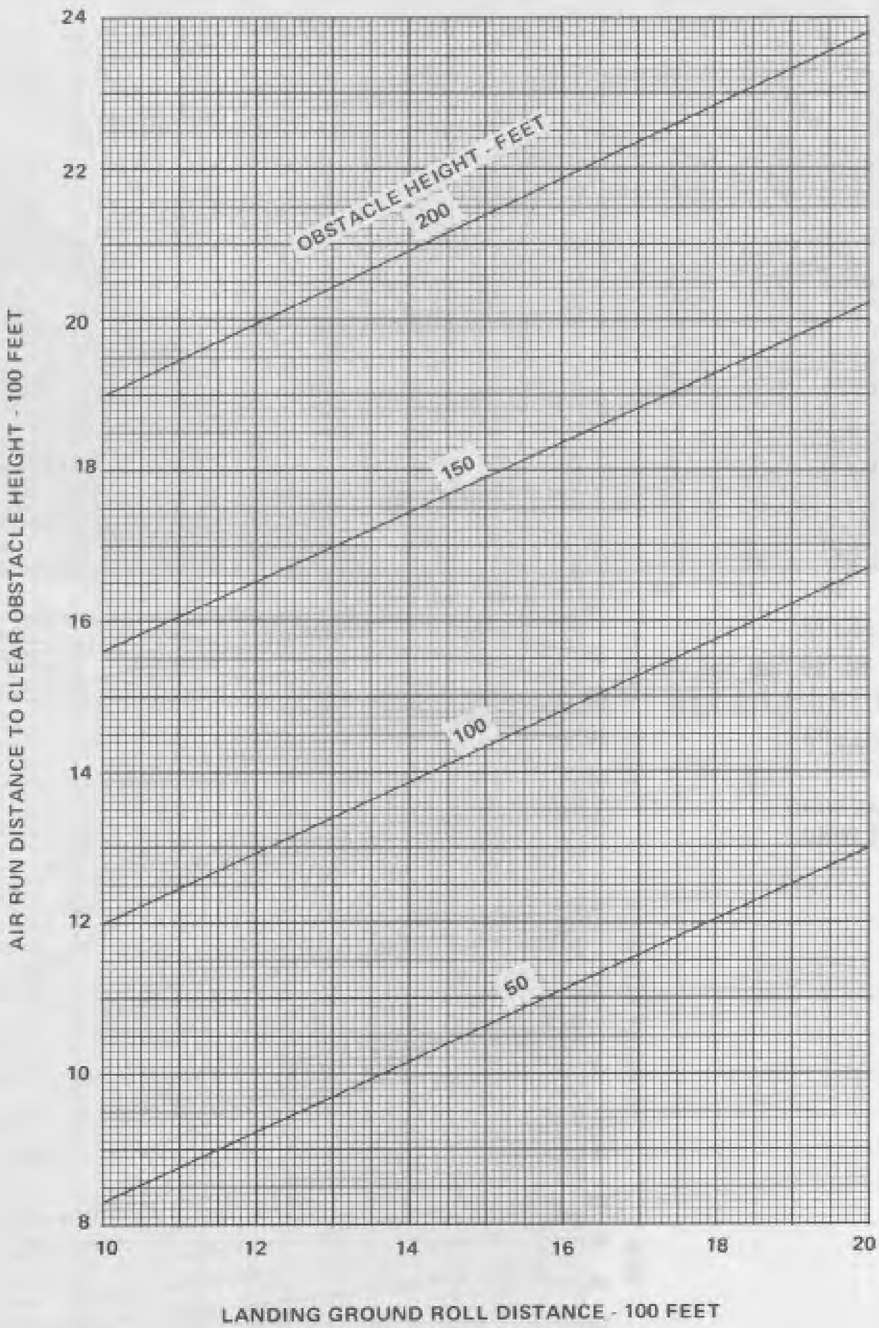


Figure A6-4 (Sheet 2 of 2)

NORMAL LANDING DISTANCE

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

CONDITIONS:
1. WHEEL BRAKES ONLY
2. FLAPS 20°

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

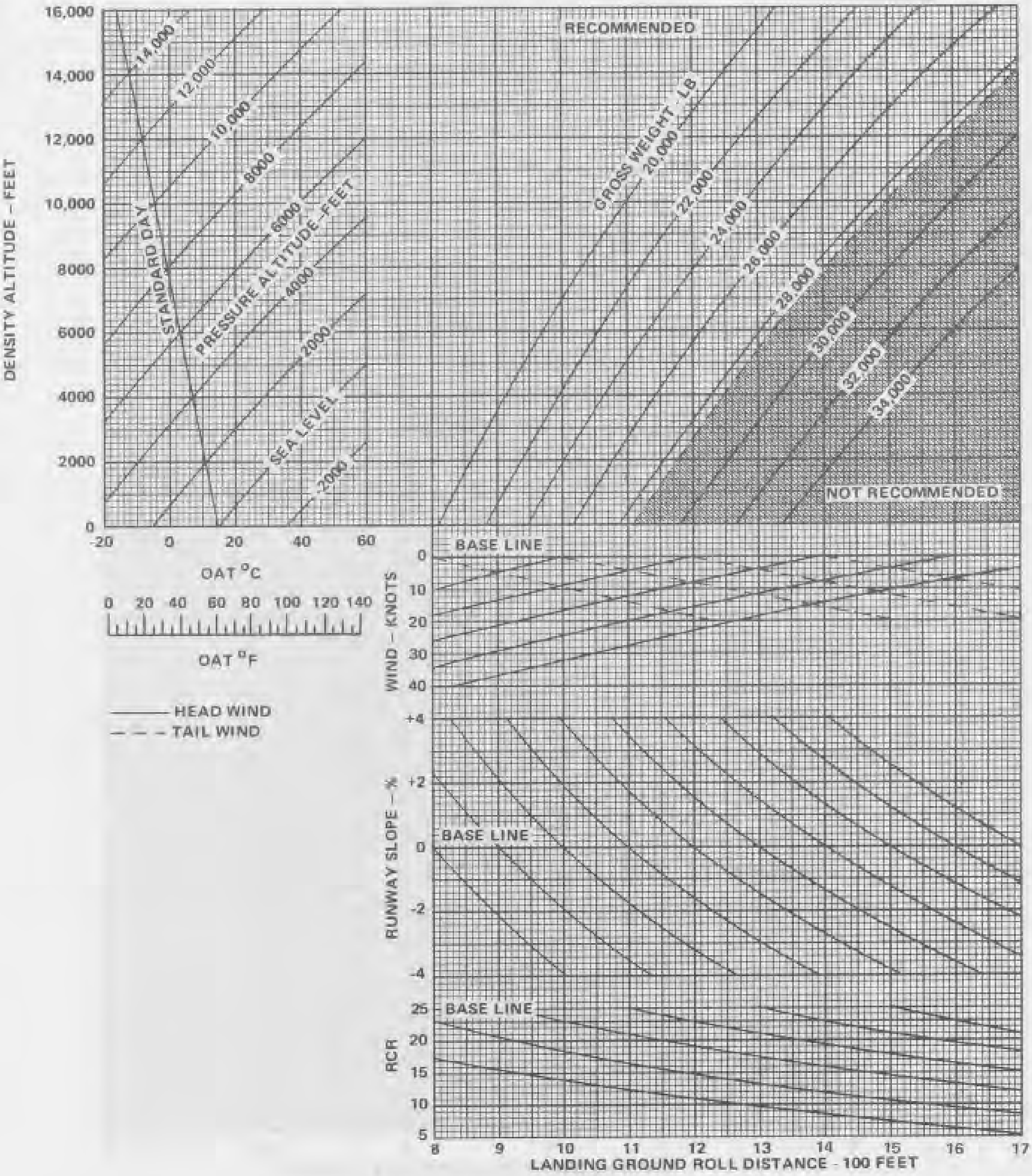


Figure A6-5 (Sheet 1 of 2)

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

NORMAL LANDING DISTANCE

AIR RUN DISTANCE TO CLEAR OBSTACLE HEIGHT

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. WHEEL BRAKES ONLY
2. FLAPS 20°
3. LANDING GROUND ROLL DISTANCE DETERMINED AT RCR =23

NOTE: ENTER CHART WITH GROUND ROLL OBTAINED FROM FIGURE A6-5 (SHEET 1)

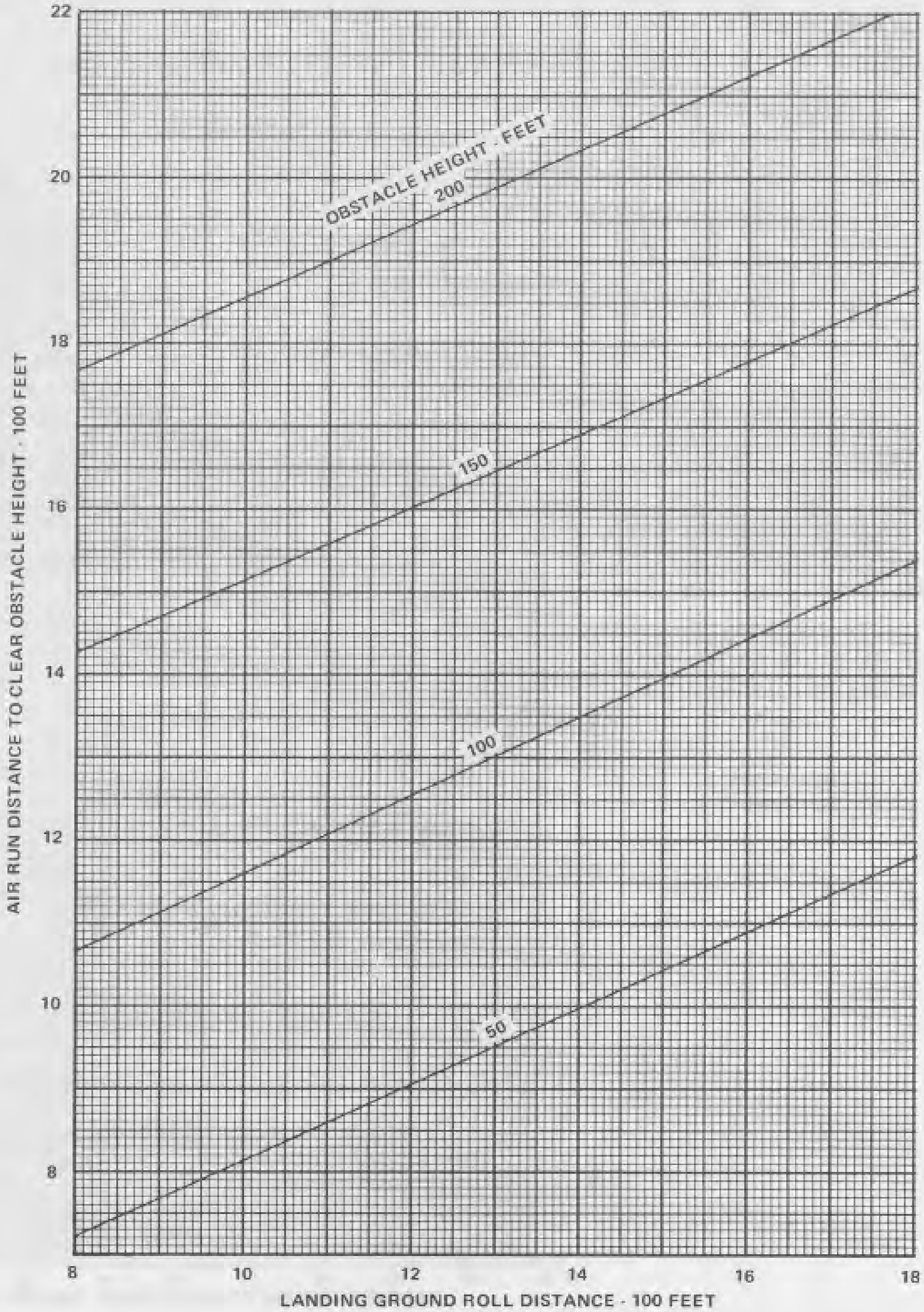


Figure A6-5 (Sheet 2 of 2)

NORMAL LANDING DISTANCE

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

CONDITIONS:
1. WHEEL BRAKES ONLY
2. FLAPS 30°

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

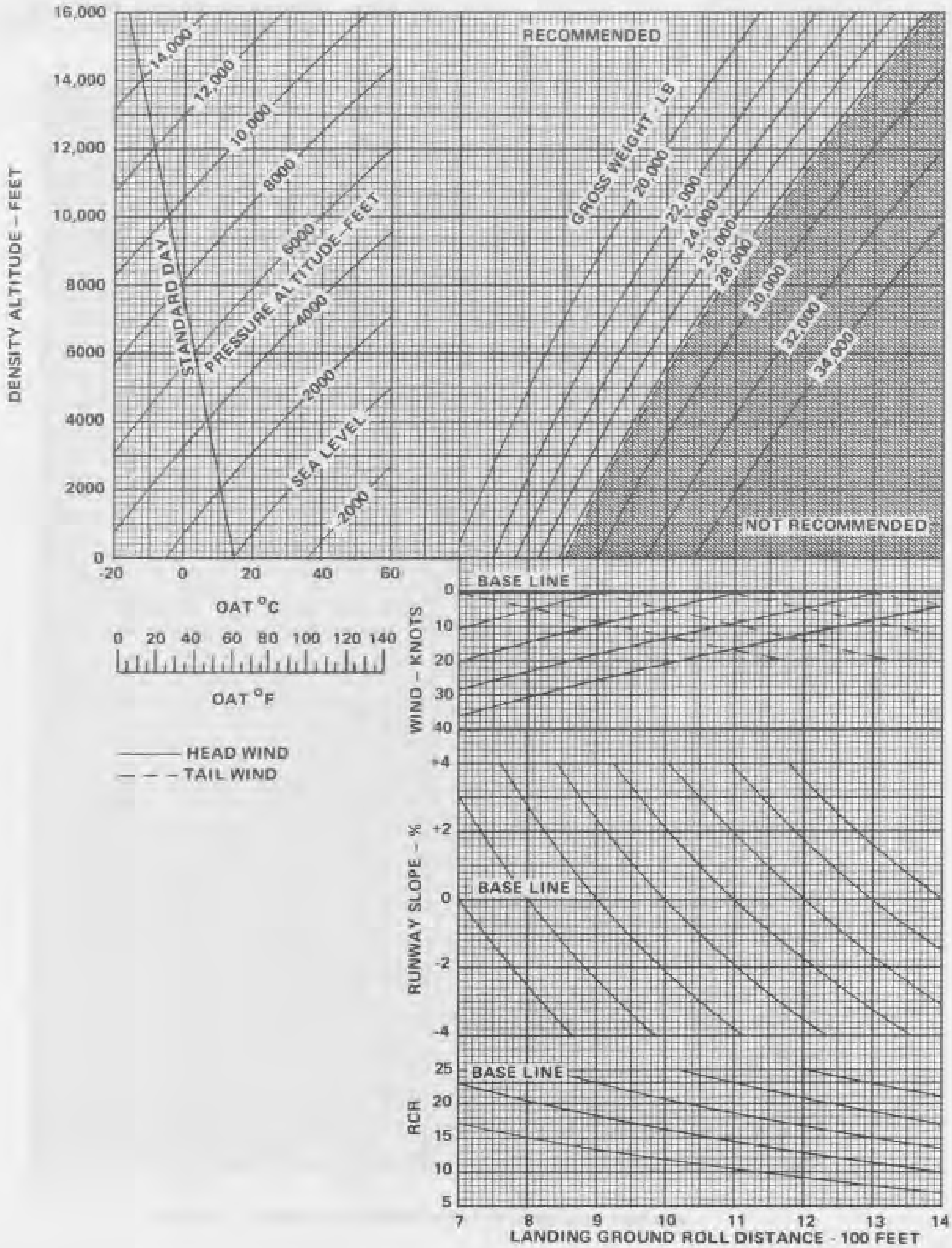


Figure A6-6 (Sheet 1 of 2)

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

NORMAL LANDING DISTANCE
AIR RUN DISTANCE TO CLEAR OBSTACLE HEIGHT

ENGINE (S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. WHEEL BRAKES ONLY
2. FLAPS 30°
3. LANDING GROUND ROLL DISTANCE DETERMINED AT RCR =23

NOTE: ENTER CHART WITH GROUND ROLL OBTAINED FROM FIGURE A6-6 (SHEET 1)

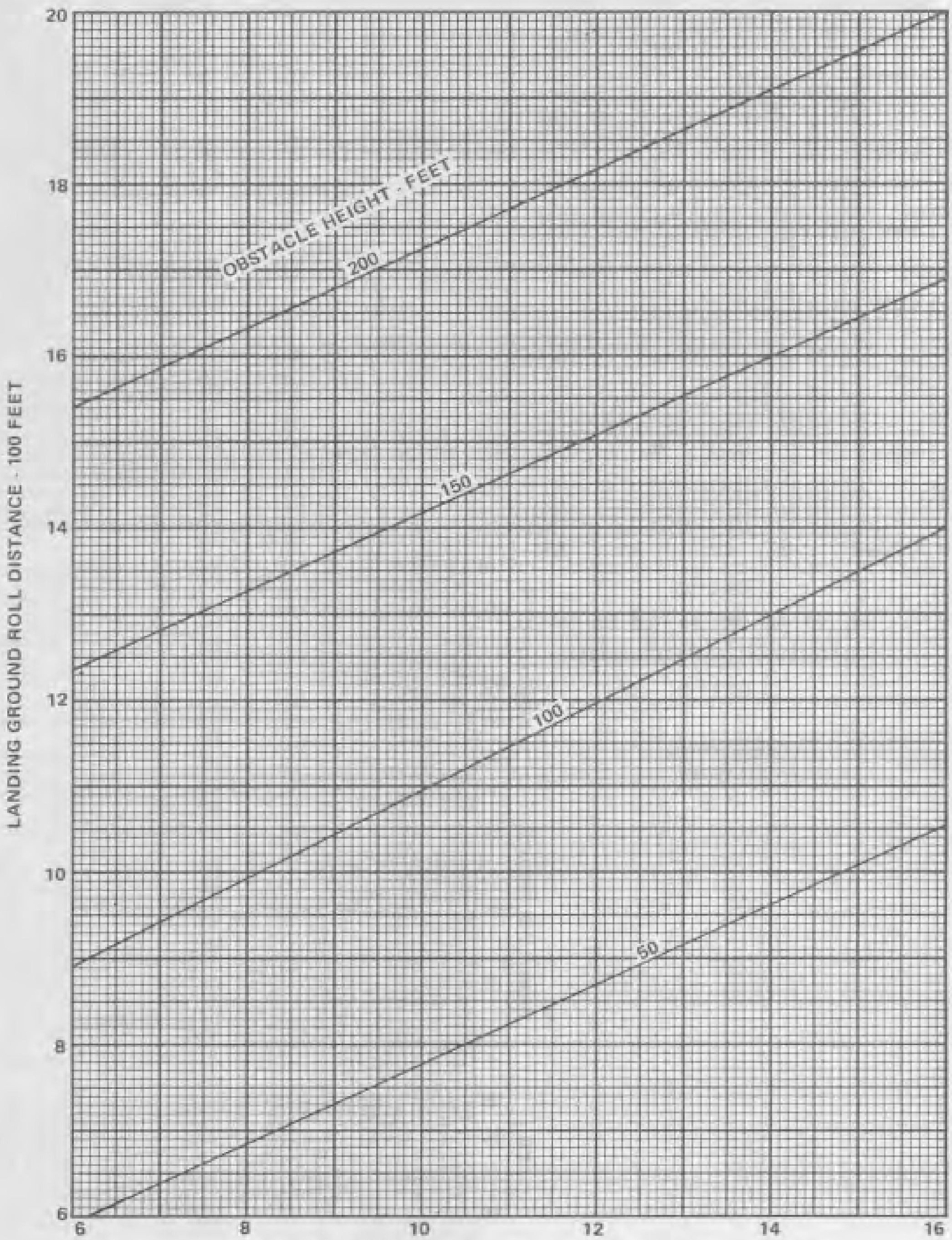


Figure A6-6 (Sheet 2 of 2)

NORMAL LANDING DISTANCE

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

CONDITIONS:
1. WHEEL BRAKES ONLY
2. FLAPS 40°

ENGINE (S): (2) R-2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

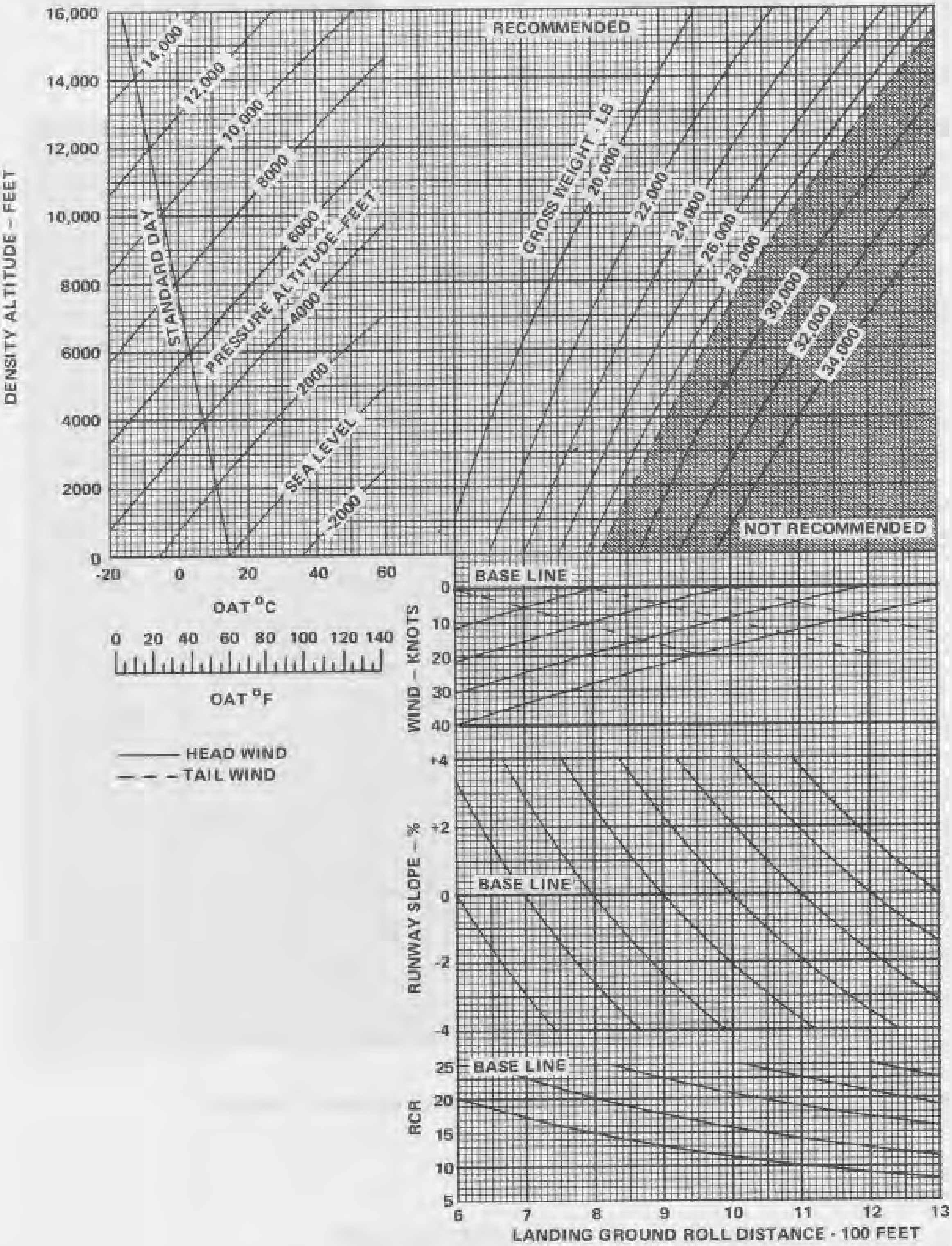


Figure A6-7 (Sheet 1 of 2)

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

NORMAL LANDING DISTANCE

AIR RUN DISTANCE TO CLEAR OBSTACLE HEIGHT

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. WHEEL BRAKES ONLY
2. FLAPS 40°
3. LANDING GROUND ROLL DISTANCE DETERMINED AT RCR =23

NOTE: ENTER CHART WITH GROUND ROLL OBTAINED FROM FIGURE A6-7 (SHEET 1)

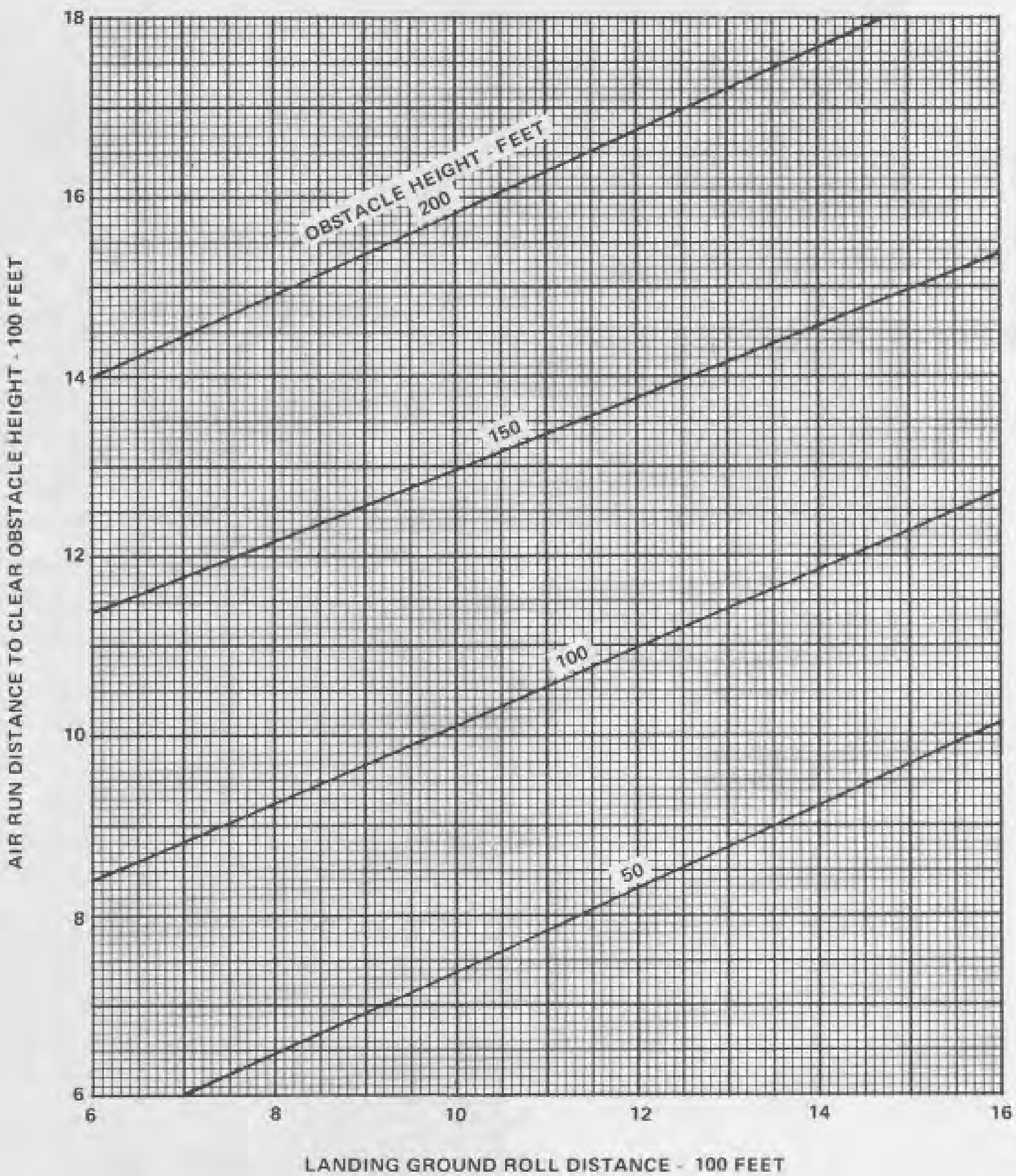


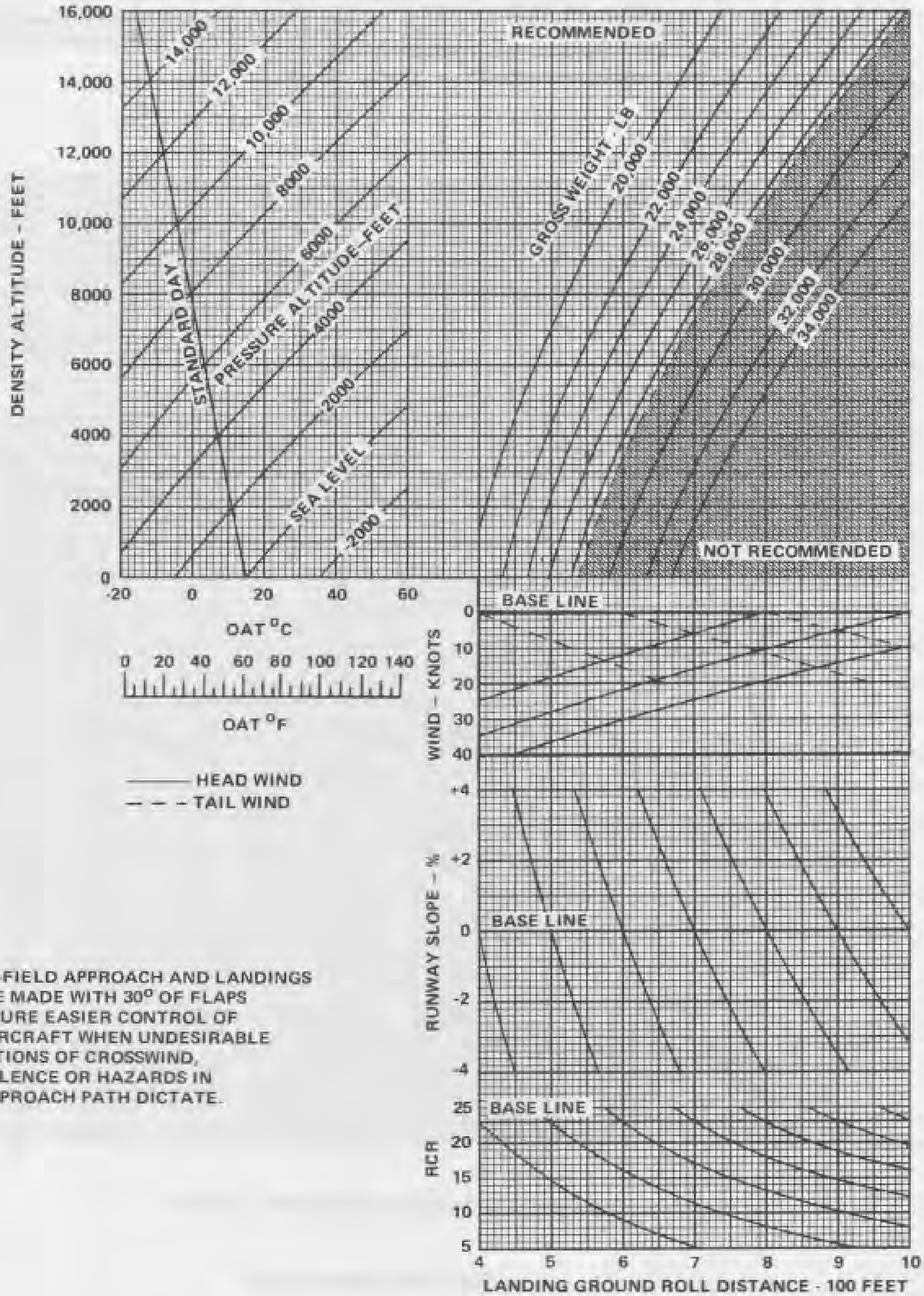
Figure A6-7 (Sheet 2 of 2)

SHORT – FIELD LANDING DISTANCE

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

CONDITIONS:
1. WHEEL BRAKES AND REVERSE PROPELLER THRUST
2. FLAPS 30°

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL



NOTE:
SHORT-FIELD APPROACH AND LANDINGS MAY BE MADE WITH 30° OF FLAPS TO ENSURE EASIER CONTROL OF THE AIRCRAFT WHEN UNDESIRABLE CONDITIONS OF CROSSWIND, TURBULENCE OR HAZARDS IN THE APPROACH PATH DICTATE.

Figure A6-8 (Sheet 1 of 2)

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

SHORT – FIELD LANDING DISTANCE

AIR RUN DISTANCE TO CLEAR OBSTACLE HEIGHT

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. WHEEL BRAKES AND REVERSE PROPELLER THRUST
2. FLAPS 30°
3. LANDING GROUND ROLL DISTANCE DETERMINED AT RCR =23

NOTE: ENTER CHART WITH GROUND ROLL OBTAINED FROM FIGURE A6-8 (SHEET 1)

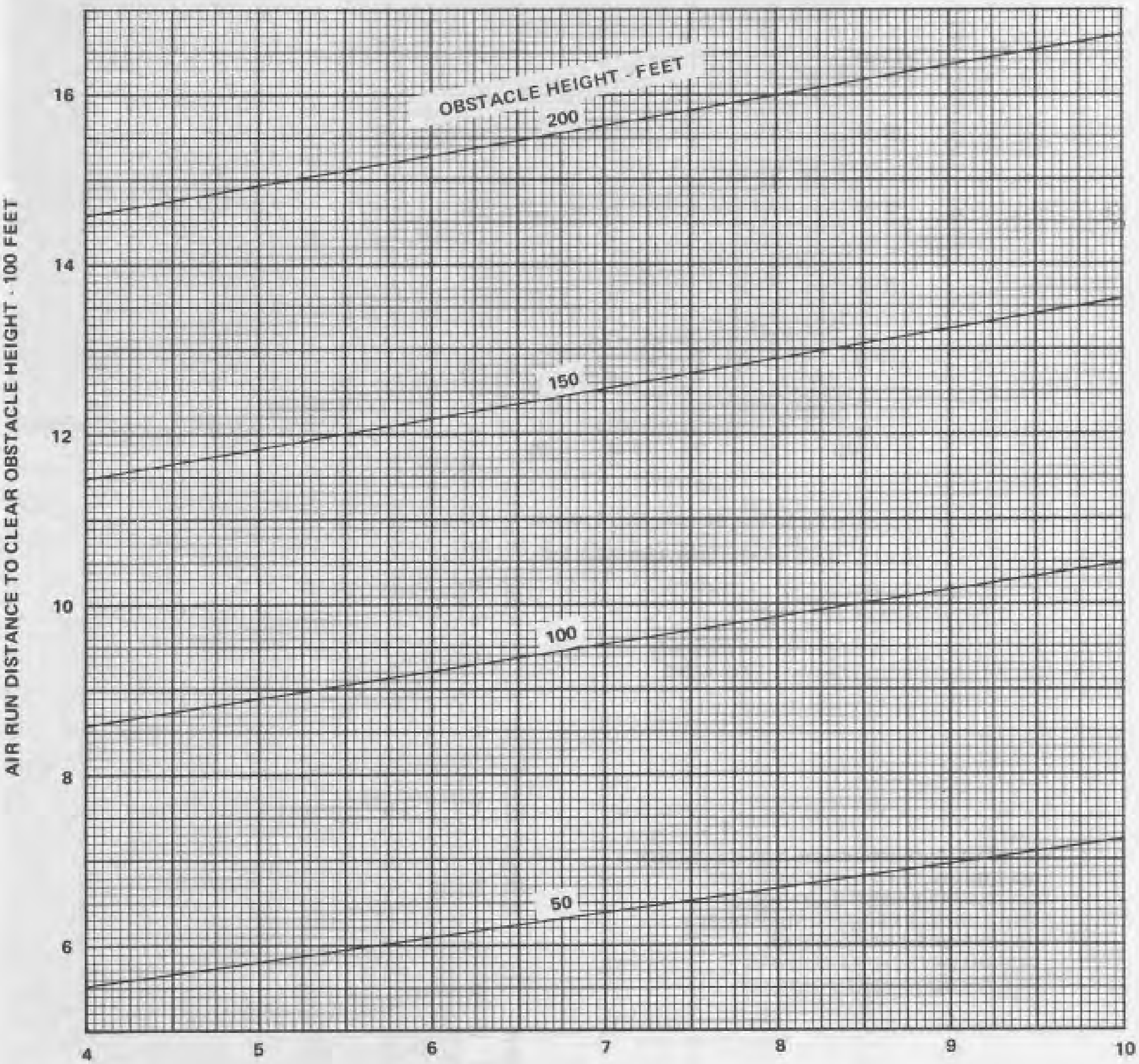


Figure A6-8 (Sheet 2 of 2)

SHORT – FIELD LANDING DISTANCE

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

CONDITIONS:
1. WHEEL BRAKES AND REVERSE PROPELLER THRUST
2. FLAPS 40°

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

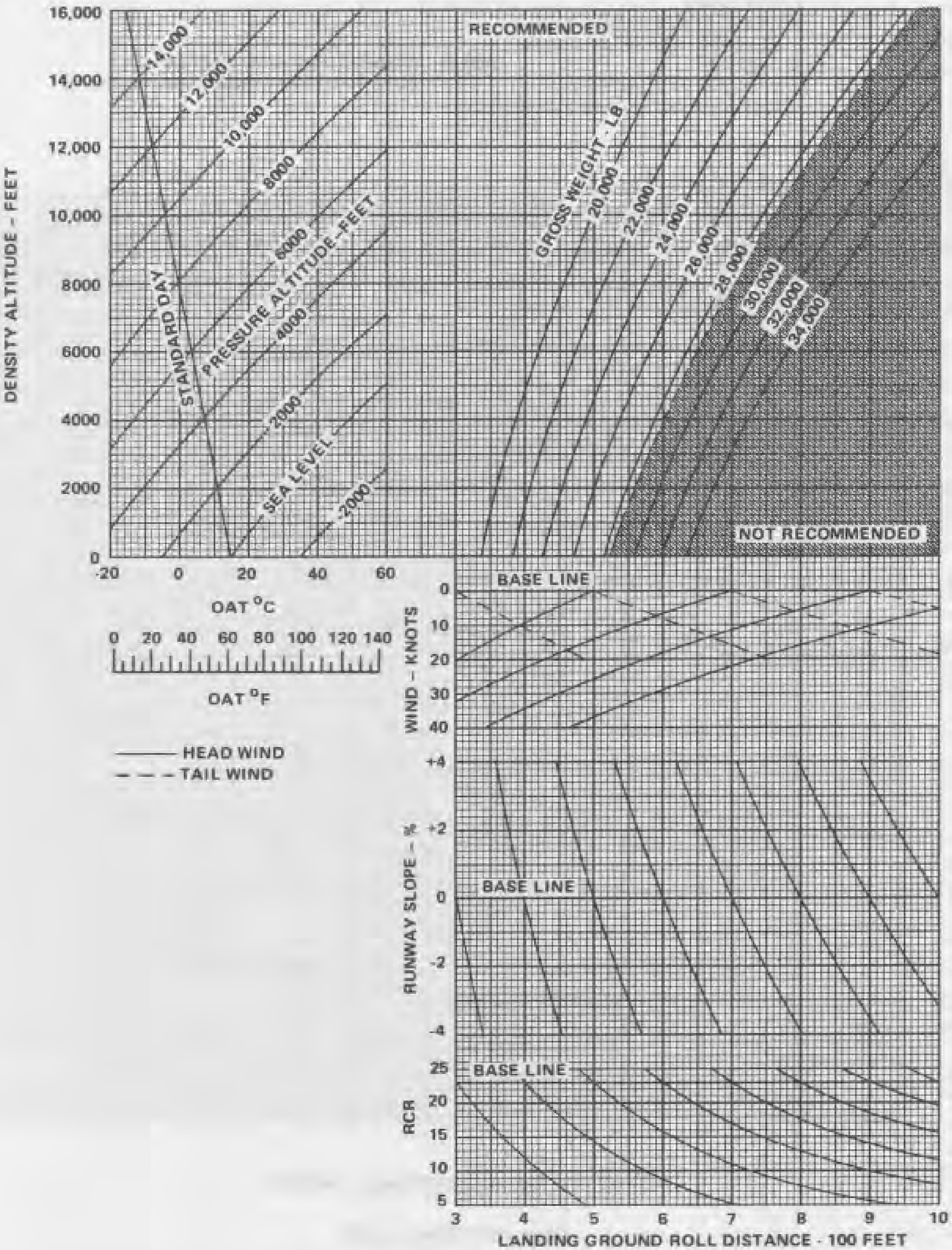


Figure A6-9 (Sheet 1 of 2)

MODEL: C-7A
DATE: APRIL 1970
DATA BASIS: ESTIMATED

SHORT – FIELD LANDING DISTANCE

AIR RUN DISTANCE TO CLEAR OBSTACLE HEIGHT

ENGINE (S): (2) R–2000
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

CONDITIONS:
1. WHEEL BRAKES AND REVERSE PROPELLER THRUST
2. FLAPS 40°
3. LANDING GROUND ROLL DISTANCE DETERMINED AT RCR =23

NOTE: ENTER CHART WITH GROUND ROLL OBTAINED FROM FIGURE A6-9 (SHEET 1)

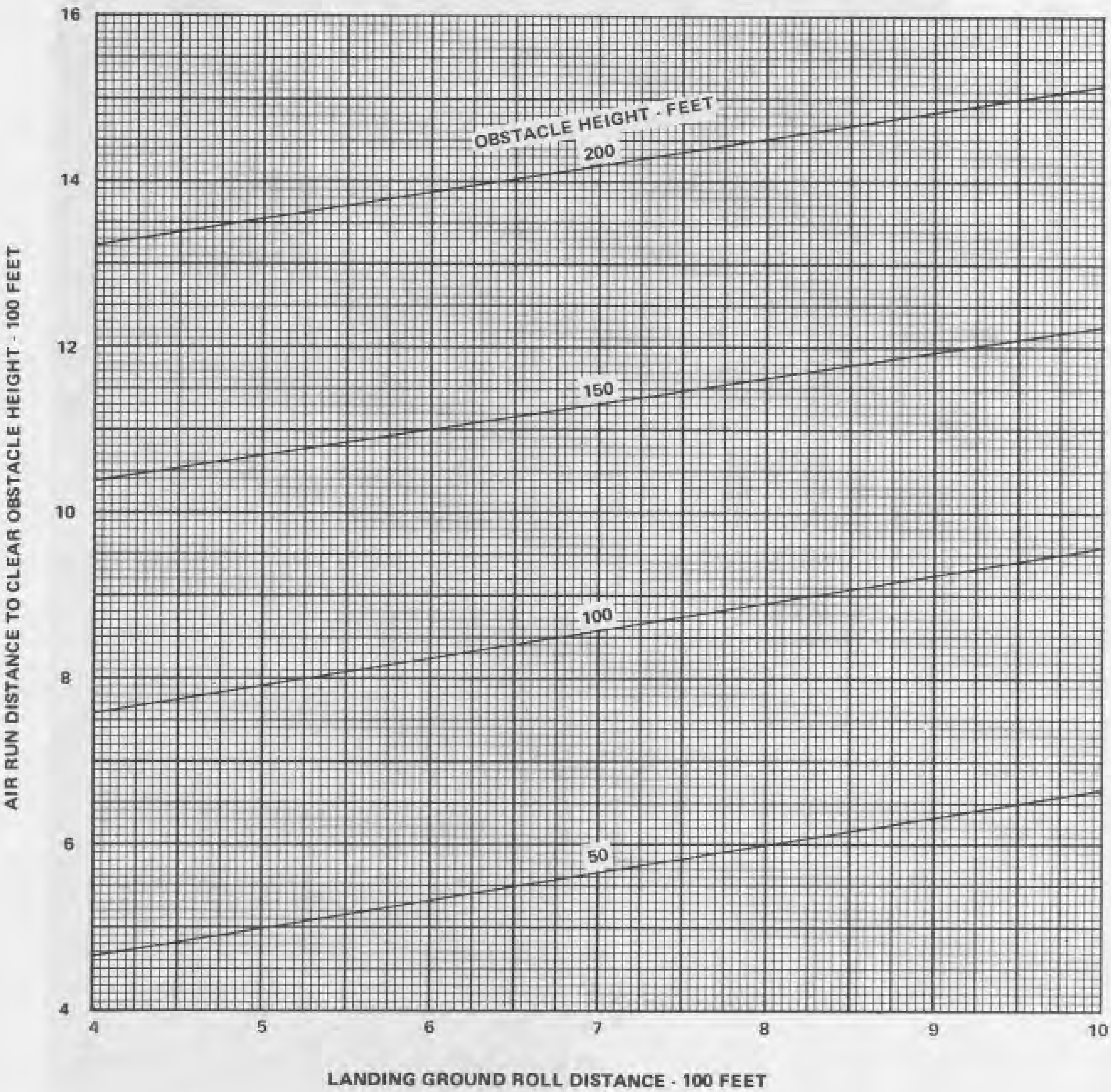


Figure A6-9 (Sheet 2 of 2)

PART 7

MISSION PLANNING

TABLE OF CONTENTS.

LONG RANGE MISSION.

NOTE

On aircraft with T.O. 1C-7A-589 incorporated, polyurethane baffles have been added to the fuel tank to act as an explosion suppressant. These baffles reduce usable fuel capacity approximately 5 percent.

The following hypothetical mission planning problem is provided to illustrate the use of the performance data charts.

OBJECT OF MISSION.

A payload of 4500 pounds is to be transported a distance of 220 nautical miles. Mountainous terrain must be flown over which commences at the 95-mile point. Adequate clearance of the mountainous area can be assured by the choice of a cruise pressure altitude of 7500 feet.

KNOWN DATA.

1. Departure point is at an elevation of 36 feet above mean sea level, with a 3500-foot hard surface runway oriented 090° - 270° magnetic. Runway gradient is 1% uphill to the east.

2. Destination is at an elevation of 2692 feet above mean sea level, with a 1300-foot runway oriented 020° - 200°. Runway gradient is zero. There are obstacles on the southern approaches consisting of a line of 50-foot tall trees, 300 feet from the paved edge of the runway.

3. Weather at departure point is VFR, temperature is 35°C, dew point 70°F, and altimeter setting is 29.96. Reported wind is from 130° magnetic at 8 knots, gusting to 13 knots (measured at the runway).

4. Weather at destination is VFR, temperature is 28°C, dew point 73°F, and altimeter setting is 30.13. Reported wind is from the east at 10 knots with gusts to 15 knots (not measured at the runway).

5. For the first 95 miles, prior to reaching the mountain foothill area, minimum pressure altitude is 3500 feet. At this altitude temperature is 26°C, and the headwind is 5 knots.

6. The second stage of 125 miles required a climb on the cruise heading up to a pressure altitude of 7500 feet, where a 10-knot headwind and a mean OAT of 18°C is present.

7. For this particular mission, the basic operating weight of the aircraft (less fuel and cargo) is 21,200 pounds.

8. For the cruise phases of the flight, the speed and power settings corresponding to long range conditions will be selected.

GENERAL CONSIDERATIONS.

A preliminary examination of the mission should be made to determine which aspects may be critical with regard to safety. For the hypothetical mission this could be a possible engine failure while crossing the mountains, or the ability to land on the short runway at the destination.

Alternation of some of the primary assumptions may be necessary to allow a better compromise with desirable alternatives, such as increased safety, expenditure of minimum time or fuel, higher payload, alternative destinations in case of weather changes, etc.

DETAILED FLIGHT PLAN.

Warmup, Taxi, Take-Off, and Climb to 3500 Feet.

PRESSURE ALTITUDE. The corrected pressure altitude is found by entering figure A1-5 with the given altimeter setting of 29.96 in. Hg, and the field elevation of 36 feet. The pressure altitude is sea level.

DENSITY ALTITUDE AND DENSITY RATIO. Density altitude and corresponding reciprocal square root of the density ratio is found by using figure A1-3. The chart is entered with a temperature of 35°C and pressure altitude of sea level. Density altitude is 2400 feet and the reciprocal square root of the density ratio is 1.038.

SPECIFIC HUMIDITY. A specific humidity of 0.0100 is found in figure A1-4 by reading in a dew point temperature of 70°F, which was converted to 21°C using figure A1-1. At 35°C the horsepower is corrected to a dew point of 70°F. Brake horsepower available is 1428 (figure A2-3).

HEADWIND AND CROSSWIND COMPONENT. In finding the headwind component for take-off, the value of the steady wind is used. From figure A3-3 the headwind component is 6 knots and the crosswind component is 8.5 knots (using the maximum gust velocity).

TAKE-OFF SPEED. From figure A3-4 the take-off speed for flaps 7° at the gross weight of 28,500 pounds is 83 knots indicated.

TAKE-OFF GROUND ROLL. A take-off factor of 12.5 was determined from figure A3-1. Figure A3-6, Sheet 1, shows a corrected ground roll of 1680 feet. Air distance to clear a 50-foot obstacle corrected for wind is 450 feet, obtained from figure A3-6, Sheet 3. The total distance to clear a 50-foot obstacle is 1680 + 450 = 2130.

GROSS WEIGHT LIMITATION. In figure A3-2 using a take-off factor of 12.5, the take-off gross weight limitation with gear down and one engine inoperative is 24,200 pounds; with gear up the weight is approximately 27,800 pounds. The gross weight intended for take-off is greater than the limiting weight with gear up. It should be noted that if an engine failed before take-off, it would be extremely unlikely that take-off would be possible, since the aircraft would be approximately 3500 to 4000 pounds over the take-off gross weight limitation (guaranteed 100 fpm rate of climb) for 7° flaps and gear down.

CRITICAL FIELD LENGTH. The critical field length is obtained to check that the runway length is long enough for the aircraft to decelerate to a stop after an engine failure. Figure A3-10 shows that the critical field length is 3000 feet corrected for headwind and slope, which is well short of the available 3500-foot runway.

REFUSAL SPEED. Entering the chart in figure A3-14, with a runway of 3500 feet available, wind at 6 knots, take-off factor of 12.5, and a 1% slope gives a refusal speed of approximately 75 knots indicated.

DISTANCE-TIME DURING TAKE-OFF GROUND ROLL. Enter the chart in figure A3-17 with the ground velocity and corrected ground roll distance. Ground velocity is indicated take-off airspeed corrected for wind (headwind minus, tailwind positive), 83 - 6 = 77 knots. Using the 1000-foot marker as the distance check marker, the indicated airspeed is 61 + 6.0 = 67 knots. The correct time to accelerate is the reading divided by the reciprocal of the density ratio, 18 ÷ 1.038 = 17+ seconds.

FUEL FOR WARMUP, TAXI, AND TAKE-OFF. Fuel required to warm up, taxi, and take off is determined by the general rule of thumb of allowing 10 minutes at METO power. Figure A2-4 shows that METO power is 1200 HP and fuel flow is 860 pounds per hour for each engine. To determine the total fuel required:

Fuel required =

$$860 \times 2 \text{ engines} \times \frac{10 \text{ minutes}}{60} = 287 \text{ pounds.}$$

CLIMB TO FIRST STAGE CRUISE ALTITUDE OF 3500 FEET. The method and data required for calculation of time, distance, and fuel to climb to 3500 feet are as follows:

The density altitude at cruise altitude is obtained from figure A1-3 at a pressure altitude of 3500 feet and an ambient temperature of 26°C. The cruise density altitude is 5500 feet.

Weight at start of climb (28,500-287) = 28,213 pounds

Distance covered during climb (figure A4-1) = 4.0 nautical miles

Fuel used in climb (figure A4-1) = 150 pounds

Time required to climb (figure A4-2) = 2.5 minutes

Weight at end of climb (28,213-150) = 28,063 pounds

Cruise First Stage.

BHP REQUIRED AND CRUISE SPEED. Brake horsepower per engine and the corresponding cruise speed are obtained from the Level Flight Performance chart (figure A5-1). TAS is 134 knots and BHP is 645.

TRUE GROUND SPEED. The ground speed is the true airspeed (TAS) minus the 5-knot headwind, which is 129 knots.

TIME. The cruise time in minutes is computed by dividing the ground distance covered by the ground speed and multiplying by 60.

$$\text{Time} = \frac{(95\text{-}4) \times 60}{129} \qquad = 42.3 \text{ minutes}$$

FUEL USED. Fuel used in cruise is found by interpolating the fuel flow at 645 BHP, 3500 feet pressure altitude, from figures A2-15 and A2-16. From figure A2-15 fuel flow at 650 BHP, 26° CAT, is 280 pounds per hour. From figure A2-16 fuel flow at 600 BHP, 26° CAT, is 254 pounds per hour. By interpolation the fuel flow at 645 BHP is 277 pounds per hour. Fuel used in cruise equals fuel flow multiplied by cruise time.

$$\text{Fuel used} = 277 \times 2 \times \frac{42.3}{60} \qquad = 391 \text{ pounds}$$

WEIGHT AT END OF CRUISE. The weight at the end of each stage of the cruise is required as an input for the calculation of the data for the succeeding stage.

Weight = 28,063 − 391 = 27,672 pounds

CLIMB TO SECOND STAGE CRUISE ALTITUDE. Data for the second climb of the mission is determined in the same manner as for the first climb. Note that time, distance, and fuel are obtained by subtracting the amounts required to climb from sea level to the altitude specified for the start of the climb, from the amounts required to climb from sea level to the altitude specified for the completion of the climb. Data obtained for the climb to the second stage cruise altitude is as follows:

Cruise altitude of 7500 feet and temperature of 18°C results in a density altitude of 9600 feet.

Weight at start of climb = 27,672 pounds

Distance covered during climb (figure A4-1) = 6.0 nautical miles

Fuel used in climb (figure A4-1) = 100 pounds

Time required to climb (figure A4-2) = 3.7 minutes

Weight at end of climb (27,672-100) = 27,572 pounds

Additional Considerations.

SINGLE ENGINE OPERATION. Because of the relatively large changes involved in airspeed, fuel consumption, and ability to maintain ceilings, engine failure represents one of the most important variations to the flight plan that may occur enroute. Accordingly, it is advisable that preflight study of the single engine performance be made to allow the pilot to decide whether to proceed or return when engine failure occurs at any point in the mission.

SINGLE ENGINE SERVICE CEILING. From figure A4-6 the single engine service ceiling at a gross weight of 27,599 pounds is found to be 6300 feet density altitude at maximum power and 4000 feet at METO power. Since some mountain peaks are near the 9600-foot cruise density altitude, an element of risk is involved if weather is not adequate to allow skirting of the higher peaks under single-engine operation.

SINGLE ENGINE ABSOLUTE CEILING. Figure A4-6 depicts an absolute ceiling of 8250 feet density altitude. Therefore, should an engine failure occur during cruise at 9600 feet density altitude, it will be necessary to jettison approximately 1422 pounds to reduce the gross weight to 26,150 pounds.

SINGLE ENGINE CRUISE. Using figures A5-3 and A5-4, it is possible to estimate the maximum distance the aircraft can fly on one engine. The gross weight of the aircraft is 26,150 pounds. Fuel available is the total amount minus the total amount used (2800 - 928) = 1872 pounds. The long range distance is calculated to be 300 nautical miles and the time required is 3.2 hours. This indicates that the mission could be completed if engine failure occurs at the start of the second stage cruise.

Cruise Second Stage.

The brake horsepower per engine and cruise speed may be obtained from figure A5-1. Weight at the start of the cruise is 27,572 pounds and density altitude is 9600 feet. Using the chart (figure A5-1), data of 146 knots TAS and 700 BHP and accounting for a 10-knot headwind the following is obtained:

$$\text{Time} = \frac{125 - 6.0}{136} \times 60 = 52.5 \text{ minutes}$$

FUEL USED. Referring to figure A2-14, the fuel flow is 606 pounds per hour at 700 BHP.

$$\text{Fuel used} = \frac{606 \times 52.5}{60} = 530 \text{ pounds}$$

Disregarding the time and fuel used in descent if the cruise is continued to the destination point, total time to fly the mission is:

$$2.5 + 42.3 + 3.7 + 52.5 = 101.0 \text{ minutes}$$

Total fuel for the mission is:

$$287 + 150 + 391 + 100 + 530 = 1458 \text{ pounds}$$

Landing Data.

LANDING WEIGHT. The aircraft weight at the destination is:

$$28{,}500 - 1458 = 27{,}042 \text{ pounds}$$

THRESHOLD SPEED. For a normal landing using 40° flaps, the threshold speed is given in figure A6-1 as 71.4 knots indicated.

CROSSWIND AND HEADWIND COMPONENT. Using figure A6-2 with 50% of the 10-knot wind at 90° magnetic and the runway heading at 20° magnetic, the headwind component is calculated at 2 knots. Using 50% of the 15-knot gust velocity, the crosswind component is calculated at 7.5 knots, which is in the recommended area.

PRESSURE ALTITUDE AT DESTINATION. Using figure A1-5, with an elevation of 2692 feet and an altimeter setting of 30.13, the pressure altitude is 2500 feet.

LANDING GROUND ROLL. Assuming a normal landing with 40° flaps, figure A6-7, Sheet 1, is used to obtain landing ground roll. Applying to the chart 28°C OAT, pressure altitude 2500 feet, weight 27,042 pounds, and headwind component 2 knots, results in a ground roll distance of 845 feet. Figure A6-7, Sheet 2, is then used to obtain the air distance to clear a 50-foot obstacle, 665 feet. The total landing distance is 845 + 665 = 1510 feet.

The total distance available for landing from the 50-foot trees is 1600 feet. Since 845 feet is the landing ground roll, there is 755 feet (1600-845) available for air distance. Entering figure A6-7 with an air distance of 755 feet and a ground roll of 845 feet reveals that approximately a 70-foot obstacle could be cleared and the landing safely made in the space available. Therefore, a safe landing could be made with a maximum of 20 feet of vertical clearance over the 50-foot trees.

SHORT RANGE MISSION.

OBJECT OF MISSION.

A payload of 3300 pounds is to be transported a distance of 75 nautical miles at 5000 feet over jungle terrain, unload, and return.

KNOWN DATA.

1. Departure point is at an elevation of 71 feet above mean sea level, with a 5700-foot hard surface runway oriented 40° - 200° magnetic. Runway gradient is 2% uphill to the northeast.

2. Destination is at an elevation of 1825 feet above mean sea level, with a 1250-foot turf runway (RCR 19) oriented 140° - 320°. Runway gradient is 1% northwest. There are obstacles on each end of the runway consisting of 50-foot trees located 300 feet from the ends of the turf runway.

3. Weather at departure point is VFR, temperature is 95°F, dew point 80°F, and altimeter setting is 29.78. Reported wind is from 160° magnetic at 10 knots steady.

4. Weather at destination is VFR, temperature is 90°F (32.2°C), dew point 65°F, and altimeter setting is 30.09. Reported wind is from 180° magnetic at 15 knots, gusting to 20 knots.

5. The cruise altitude to the destination and return will be at 5000 feet. There is a tailwind of 20 knots on route to destination and the temperature is 65°F.

6. The basic operating weight for this mission is 21,100 pounds, 3300 pounds of cargo, and fuel. An estimate of the fuel required for the mission can be obtained by the following procedure.

Fuel for two take-offs (10 minutes at Meto Power, figure A2-4)

$1720 \times \frac{10}{60} \times 2$ = 573 pounds

Fuel used for two climbs (SL to 5000 feet, figure A4-1)

125 x 2 = 250 pounds

Fuel used during cruise at 5000 feet (150 nautical miles, figure A5-3)

600 pounds

Total fuel without reserve

573 + 250 + 600 = 1423 pounds

Thirty minutes at maximum endurance at SL. Assume cruise at SL at 350 BHP.

$360 \times \frac{30}{60}$ =180 pounds (figure A2-21)

Reserve of 5 percent of total

0.05 x (1423 + 180) = 80 pounds

Total fuel required

1423 + 180 + 80 = 1683 pounds

Therefore, assume the fuel required for the mission is 1700 pounds. The take-off gross weight is 26,100 pounds.

7. For the cruise phase of the flight, the speed and power setting corresponding to long range conditions will be selected.

DETAILED FLIGHT PLAN.

Warmup, Taxi, Take-Off, and Climb to 5000 Feet.

PRESSURE ALTITUDE. The corrected pressure altitude found from figure A1-5 is 202 feet.

DENSITY ALTITUDE AND DENSITY RATIO. Density altitude and corresponding reciprocal square root of the density ratio is found by using figure A1-3. The chart is entered with a temperature of 95°F (35°C) and a pressure altitude of 202 feet. Density altitude is 2800 feet and the reciprocal square root of the density ratio is 1.042.

SPECIFIC HUMIDITY. A specific humidity of 0.019 is found in figure A1-4. At 95°F (35°C) the brake horsepower is corrected to a dew point of 80°F (27°C). Brake horsepower available is 1350 (figure A2-3).

HEADWIND AND CROSSWIND COMPONENT. From figure A3-3 the headwind component is found to be 8 knots and the crosswind component is 6 knots.

TAKE-OFF SPEED. From figure A3-4 the take-off speed for flaps 7° at the gross weight of 26,100 pounds is 79.0 knots indicated.

TAKE-OFF GROUND ROLL. Figure A3-1 shows a take-off factor of 13.4 for the take-off conditions. Using 7° flaps for the take-off, figure A3-6, Sheet 1, shows a corrected ground roll of 1220 feet. The air distance to clear a 50-foot obstacle is 390 feet (figure A3-6, Sheet 3). The total distance to clear a 50-foot obstacle is 1220 + 390 = 1610.

GROSS WEIGHT LIMITATION. In figure A3-2 the take-off gross weight limitation with gear down and one engine inoperative is 23,450 pounds; with gear up the weight is approximately 26,950 pounds. Since the gross weight intended for take-off is less than the limiting weight with gear up, it will be possible to either maintain altitude after engine failure on take-off or reduce any altitude loss to a minimum by selecting gear up when clear of the runway.

CRITICAL FIELD LENGTH. The critical field length is obtained to check that the runway length is long enough for the aircraft to decelerate to a stop after an engine failure. Figure A3-10 shows that the critical field length is 2000 feet, which is well short of the available 5700-foot runway.

REFUSAL SPEED. Entering the chart in figure A3-14, with a runway of 5700 feet, wind at 9 knots, take-off factor of 13.4, and a 2% slope gives a refusal speed of 90 knots indicated. Extrapolation of chart data is required to obtain this figure.

DISTANCE-TIME DURING TAKE-OFF GROUND ROLL. Enter the chart (figure A3-17) with ground velocity and corrected ground roll distance. Ground velocity is indicated take-off airspeed corrected for wind (79 - 8 = 71 knots). Using the 1000-foot marker as the check marker, the indicated airspeed should be (56 + 8) 64 knots, and the acceleration time (20 ÷ 1.042) is 19 seconds.

FUEL FOR WARMUP, TAXI, AND TAKE-OFF. Fuel required to warm up, taxi, and take off is determined by the general rule of thumb of allowing 10 minutes at METO power. Figure A2-4 shows that METO power is 1200 BHP and fuel flow is 860 pounds per hour for each engine. To determine the total fuel required:

Fuel required =

$$860 \times 2 \text{ engines} \times \frac{10 \text{ minutes}}{60} = 287 \text{ pounds.}$$

CLIMB TO CRUISE ALTITUDE OF 5000 FEET. The method and data required for calculation of time, distance, and fuel to climb to 5000 feet are as follows:

Density altitude, for a pressure altitude of 5000 feet, at 65°F (18.3°C) is 6500 feet.

Weight at start of climb (26,100-287)	= 25,813 pounds
Distance covered during climb with a 20-knot tailwind (figure A4-1)	= 5.5 nautical miles
Fuel used to climb (figure A4-1)	= 100 pounds
Time required to climb (figure A4-2)	= 3.2 minutes
Weight at end of climb (25,813-100)	= 25,713 pounds

Cruise First Stage

BHP REQUIRED AND CRUISE SPEED. Brake horsepower per engine and the corresponding cruise speed are obtained from the Level Flight Performance chart (figure A5-1). TAS is 133 knots and BHP is 590.

TRUE GROUND SPEED. The ground speed is the true airspeed (TAS) plus the 20-knot tailwind, which is 153 knots.

TIME. The cruise time in minutes is computed by dividing the ground distance covered by the ground speed and multiplying by 60.

$$\text{Time} = \frac{(75 - 5.5) \times 60}{153} = 27.3 \text{ minutes}$$

FUEL USED. The fuel used from figures A2-16 and A2-17 is:

$$\text{Fuel used} = \frac{507 \times 27.3}{60} = 231 \text{ pounds}$$

Disregarding the time and fuel used in descent if the cruise is continued to the destination point, total time for the first leg is:

Time = 3.2 + 27.3 = 30.5 minutes

Landing Data.

LANDING WEIGHT. The aircraft weight at the destination is:

25,713 - 231 = 25,482 pounds

THRESHOLD SPEED. For a short-field landing using 40° flaps, the threshold speed is given in figure A6-1 as 64 knots indicated.

CROSSWIND AND HEADWIND COMPONENT. Using figure A6-2 with 50% of the 15-knot wind at 180° magnetic and a runway heading of 140° magnetic, the headwind component is 6 knots. Using 50% of the 20-knot gust velocity, the crosswind component is 6.5 knots.

PRESSURE ALTITUDE AT DESTINATION. Using figure A1-5, with an elevation of 1825 feet and an altimeter setting of 30.09, the pressure altitude is 1669 feet.

LANDING GROUND ROLL. Assuming a short-field landing with 40° flaps, figure A6-9, Sheet 1, is used to obtain landing ground roll. Applying to the chart 32.2°C (90°F) OAT, pressure altitude 1669 feet, weight 25,482 pounds, headwind component 6 knots, runway slope 1% uphill, and RCR of 19, the landing ground roll is 490 feet. Figure A6-9, Sheet 2, shows that an air distance of 495 feet is required to clear a 50-foot obstacle. The total landing distance is 490 + 495 = 985 feet.

Return Flight.

CONDITIONS:

Take-off gross weight	25,482 - 3,300 = 22,182 pounds
Headwind component	= 6 knots
Runway gradient	= 1%
RCR (turf runway)	= 19
OAT	= 90°F (32°C)
Dew point temperature	= 65°F (19°C)
Pressure altitude	= 1669 feet

DENSITY ALTITUDE AND DENSITY RATIO. From figure A1-3 density altitude is 4200 feet and the corresponding reciprocal square root of the density ratio is 1.065.

SPECIFIC HUMIDITY. From figure A1-4 the specific humidity is found to be 0.009.

TAKE-OFF SPEED. From figure A3-4 the take-off speed with 15° flaps is 66 knots.

TAKE-OFF GROUND ROLL. Figure A3-1 depicts a take-off factor of 14.0. The air run distance is 275 feet. The corrected ground run distance is 1000 feet. The total take-off run is 1000 + 275 = 1275 feet.

CRITICAL FIELD LENGTH. The critical field length (figure A3-11) shows a distance of 2150 feet corrected for an RCR of 19, runway gradient at 1%, and a headwind of 6 knots. This distance is greater than the 1250 feet available. The refusal speed is dependent upon the runway length available.

REFUSAL SPEED. Refusal speed based on the available runway is 43.5 knots indicated.

DISTANCE-TIME DURING TAKE-OFF GROUND ROLL. Since there are no runway markers, airplane performance is checked using the time to accelerate to refusal speed. Using figure A3-17, enter the chart with the ground velocity (66-6) 60 knots and corrected ground roll distance, 1000 feet. At the refusal speed, corrected to ground velocity (43.5 - 6) 37.5 knots, the acceleration time is (10 ÷ 1.015) 9.8 pounds.

FUEL FOR WARMUP, TAXI, AND TAKE-OFF. Using the general rule of the thumb, allow 10 minutes at METO power (1200 BHP). Fuel required is 287 pounds.

CLIMB TO CRUISE ALTITUDE.

Weight at start of climb (22,182 - 287)	= 21,895 pounds
Distance covered during climb to 6500 feet density altitude (figure A4-1)	= 6.0 nautical miles
Fuel used in climb (figure A4-1)	= 100 pounds
Time required to climb (figure A4-2)	= 3.5 minutes
Weight at end of climb (21,895 - 100)	= 21,795 pounds

Cruise.

BHP REQUIRED AND CRUISE SPEED. Brake horsepower per engine and corresponding cruise speed are:

BHP per engine (figure A5-1)	= 480 BHP
TAS	= 125 knots

TIME. The cruise time is:

$$\text{Time} = \frac{(75 - 3.5) \times 60}{(125 - 20)} = 40.9 \text{ minutes}$$

FUEL USED. Fuel used is:

$$\text{Fuel used} = \frac{419 \times 40.9}{60} = 286 \text{ pounds}$$

Disregarding time and fuel required for descent, if the cruise is continued to the destination point, the total time for return is:

3.5 + 40.9 = 44.4 minutes

Landing Data.

LANDING WEIGHT. The aircraft landing weight at the destination is:

21,895 - 286 = 21,609 pounds

THRESHOLD SPEED. For a normal landing using 40° flaps, the threshold speed is given in figure A6-1 as 64 knots indicated.

LANDING GROUND ROLL. Assuming a normal landing with 40° flaps, figure A6-7, Sheet 1, is used to obtain landing ground roll. Applying 8 knots tailwind, 202 feet pressure altitude, 35°C OAT, and weight 21,823 pounds, the landing ground roll is 825 feet. From figure A6-7, Sheet 2, the total landing distance is 825 + 660 = 1485 feet.

TAKE-OFF AND LANDING DATA CARD
TAKE-OFF CONDITIONS

PRESS ALT ____________ DENSITY ALT ____________ TEMP ________ °C

SPEC HUMID ____________ DEWPOINT ____________ °C WIND ____ / ____ °

RCR ____________ RUNWAY ____________ SLOPE ________ GROSS WT ________

TAKE-OFF DATA

TAKE-OFF FACTOR ____________________

MANIFOLD PRESSURE ____________________

FLAP SETTING ____________________

TAKE-OFF AIRSPEED ____________________

TAKE-OFF GW LIMITATIONS ____________________

CRITICAL FIELD LENGTH ____________________

GROUND ROLL ____________________

REFUSAL SPEED ____________________

LANDING IMMEDIATELY AFTER TAKE-OFF

FLAP SETTING ____________________

THRESHOLD SPEED ____________________

GROUND ROLL ____________________

LANDING AT DESTINATION

GROSS WT/FLAP SETTING ____________________

THRESHOLD SPEED ____________________

GROUND ROLL ____________________

Single Engine Service Ceiling Meto Power ____________________

Single Engine Absolute Ceiling Meto Power ____________________

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