T. O. 1C-130(A)A-1-2

flight manual

APPENDIX 1 PERFORMANCE DATA

USAF SERIES
AC-130A AIRCRAFT

F33657-68-C-0707
F09603-76-D-0419

THIS PUBLICATION IS INCOMPLETE WITHOUT T.O. 1C-130(A)A-1.

THIS PUBLICATION REPLACES T.O. 1C-130(A)A-1-2 DATED 1 NOVEMBER 1972.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS PUBLICATION TO THE ATTENTION OF ALL AFFECTED PERSONNEL.

Refer to Index, T.O. 0-1-1-3, for the current status of Flight Manuals, Safety/Operational Supplements and Flight Crew Checklists.

PUBLISHED UNDER THE AUTHORITY OF THE SECRETARY OF THE AIR FORCE.

1 APRIL 1977

PART 1. INTRODUCTION

TABLE OF CONTENTS

LIST OF CHARTS

PURPOSE OF PERFORMANCE CHARTS.

The purpose of the performance charts is for planning complete missions from take-off to landing for operating conditions normally encountered. The conditions and operating procedures on which the performance is based are shown on the charts, or in the text, and to realize the maximum performance from the airplane, these conditions and procedures must be followed. The operating procedures are consistent with the normal procedures shown in Section II, the emergency procedures in Section III, and all weather procedures in Section IX of T.O. 1C-130(A)A-1.

The data basis for the airplane performance is the C-130A phase IV flight test results with T56-A-9 engines and Aeroproducts propellers. The engine performance is based on the use of JP-4 fuel at 6.5 pounds per gallon with a heating value of 18,650 BTU per pound and 100 percent engine rpm (13,820 rpm). The atmospheric conditions are for an ICAO atmosphere. No factor of conservation is used in establishing the airplane performance. Should unusual conditions exist for which operating procedures are not established, the operating personnel are expected to use their best judgment under the existing circumstances.

AIRPLANE CONFIGURATIONS.

The basic performance data contained in this manual are for USAF series AC-130A airplanes. Changes in this airplane configuration result generally in different performance levels. These performance levels are related to the magnitude of drag added to or subtracted (delta drag) from the basic drag value.

A delta drag index number of 50 or less has a negligible effect on take-off and landing performance, even with zero flaps. The climb and cruise performance is affected by this delta drag.

A drag index of +20 reflects in ferry configuration. The ferry configuration is an AC-130A with closeout panels and wing tanks installed and ECM pods removed. A drag index of +35 reflects an AC-130A in combat configuration with the cargo ramp and aft cargo door closed. A drag index of +85 reflects an AC-130A in combat configuration with cargo ramp closed and aft cargo door open. The combat configuration includes external ECM pods installed with external fuel tanks and closeout panels removed.

AIRPLANE CONFIGURATION	DRAG INDEX
C-130A with external tanks	0
Without external tanks	-18
AC-130A PERMANENTLY INSTALLED EQUIPMENT AN/AAD-7, AN/APQ-150, AN/ASD-5 less external tanks	
Crew door installed	+2
External tanks	+18
All guns installed	+18
Remove crew door	+5
ECM PODS installed	+10
Aft cargo door open, Ramp closed	+50

CHART EXPLANATION.

Descriptive explanations and sample problems are included in the text of each part of the appendix to illustrate the use of the performance charts. Guide lines on the charts for the sample problems show the path to follow when using the charts.

ABBREVIATIONS AND SYMBOLS.

ATO	Assisted take-off
BTU	British Thermal Units
°C	Temperature in degrees Centigrade
CAS or V_c	Calibrated airspeed; indicated airspeed corrected for installation (position error)
EAS or V_e	Equivalent airspeed; calibrated airspeed corrected for compressibility
°F	Temperature in degrees Fahrenheit
FPM	Feet per minute
f_{co}	Climb-out factor
$f_{t.o.}$	Take-off factor
G.I.	Ground idle
GS	Ground speed; true airspeed corrected for wind effect
GW	Gross weight
H_d	Density altitude

H_p	Pressure altitude
IAS	Indicated airspeed; the airspeed indicator reading corrected for instrument error
ICAO	International Civil Aviation Organization
in.-Hg	Inches of mercury
in.-lb.	Inch-pounds, the measure of engine torque
IOAT	Indicated outside air temperature
Nau mi	Nautical miles
NTS	Negative torque system
OAT	Outside air temperature (actual)
psi	Pressure in pounds per square inch
psig	Gage pressure, pounds per square inch
R/C	Rate of climb
R/D	Rate of descent
rpm	Engine speed (revolutions per minute)
SHP	Engine shaft horsepower
TAS or V_t	True airspeed; equivalent airspeed corrected for density
TIT	Turbine inlet temperature
Torque	Inch-pounds torque = SHP x 4.56
V_d	Maximum permissible speed
V_h	Structurally limited maximum level flight speed (recommended speed)
V_{MCA}	Air minimum control speed
V_s	Power-off stall speed
V/W_f	Nautical miles per pound of fuel
$\triangle$	Indicates an increment
$\triangle V_c$	Compressibility correction
$\triangle V_{pc}$	Position correction
ρ	Atmospheric density in slugs per cubic foot
ρ_o	Standard sea level atmospheric density; 0.002378 slugs per cubic foot
σ	Atmospheric density ratio
$\frac{1}{\sqrt{\sigma}}$	Correction for air density applied to EAS (SMOE factor)
μ	Friction coefficient
Headwind	Headwind is that component of the existing wind condition which acts opposite to the direction of travel
Tailwind	Tailwind is that component of the existing wind condition which acts in the direction of travel

AIRSPEED CALIBRATION CORRECTION CHARTS.

The AC-130A Gunship configuration uses static sources located on wing-tip mounted static probes. This change in static source changes the position error corrections between the basic C-130A transport and the AC-130A Gunship. AC-130A position error correction charts are presented in Figures A1-1 thru A1-3.

Example.

Given:

Gross weight: 113,000 pounds
Landing gear: Down

Flaps: 50 percent

Airspeed in KCAS in ground effect

Procedure:

To find KCAS in ground effect, enter Figure A1-2 with 120 KIAS. Move vertically up to the 113,000 pound line and read 119 KCAS.

AIRSPEED COMPRESSIBILITY CORRECTION CHARTS.

The correction to airspeed due to the compressibility of the atmosphere is shown in figure A1-4 This chart provides the speed increments for changing CAS to EAS. The Density Altitude Chart, figure A1-6 or the Density Altitude Table, figure A1-7 supplies the $1/\sqrt{\sigma}$ values required to convert EAS to TAS or vice versa. In addition, the density altitude can be found, although density altitude is normally not required for performance calculations. The relationships of the various speeds are expressed by the following equations:

$$CAS = IAS + \Delta V_{pc}$$

$$EAS = CAS - \Delta V_{c}$$

$$TAS = EAS \times 1/\sqrt{\sigma}$$

Example.

Given:

Pressure altitude: 25,000 feet.

True temperature: Standard -20°C. (When working with Indicated OAT, correct as shown in the Temperature Correction paragraph.)

Gross weight: 95,000 pounds.

Indicated airspeed: 186 knots.

Find:

True airspeed:

Procedure:

At the given altitude, the airplane would be in the clean configuration: therefore, enter figure A1-1 with 186 KIAS, move vertically up to the given weight line and to the left and read 188 KCAS. To convert CAS to EAS, enter the chart for compressibility correction, figure A1-4 with 188 KCAS. Move up to 25,000 feet and read a ΔV_c of 3.0 knots. The equivalent airspeed is then 188 -3.0 = 185 knots. From figure A1-5 determine the standard temperature at 25,000 feet as -34.5°C. Standard temperature minus 20°C is then -54.5°C.

The SMOE ($1/\sqrt{\sigma}$) factor is found from figure A1-6 by entering with the standard temperature minus 20°C and moving vertically to the pressure altitude of 25,000 feet. A factor of 1.43 is read at the SMOE ($1/\sqrt{\sigma}$) - scale. The true airspeed is 185 x 1.43 = 264 knots.

TEMPERATURE CORRECTION.

The temperature read from the indicator during flight will show higher values due to the energy loss in airspeed at the pickup. The correct value for the outside air temperature must be obtained from the Temperature Correction chart, figure A1-5. This chart also has a scale from which the deviation from standard temperature can be read.

Example.

Given:

Indicated airspeed: 200 knots.

Pressure altitude: 20,000 feet.

Indicated outside air temperature: -20°C.

Find:

True outside air temperature.

Procedure:

Enter figure A1-5 with 200 KIAS and move horizontally to the right to the given pressure altitude. From this point, move vertically to -20°C indicated OAT. Move horizontally either to the left and read a true outside air temperature of -28°C, or move to the right, intersecting the given pressure altitude, and find a deviation from standard temperature of -3.5°C.

STANDARD ATMOSPHERE.

The Standard Atmosphere table, figure A1-8, is provided to show standard values of the atmosphere as defined by the International Civil Aviation Organization (ICAO). The ICAO assumes a temperature of +15°C (59°F) and a pressure of 29.92 inches of mercury (in.-Hg) as standard sea level conditions. The temperature variation (lapse rate) with altitude is approximately constant at -2°C per 1,000 feet from sea level to 36,089 feet. At 36,089 feet, the stratosphere is assumed to begin and the temperature remains constant, for all practical purposes, with increases in altitude.

The Standard Atmosphere table shows values for every 1,000-foot increment in altitude and includes temperatures in both degrees Fahrenheit and degrees Centigrade. In addition, a Temperature Conversion chart, figure A1-9 is provided for conversion of temperatures.

AIRSPEED CALIBRATION

IN OR OUT OF GROUND EFFECT

GEAR UP OR DOWN **FLAPS UP**

MODEL: AC-130A
T56-A-9 ENGINES

DATE: JULY 1972
DATA BASIS: PHASE IV FLIGHT TEST

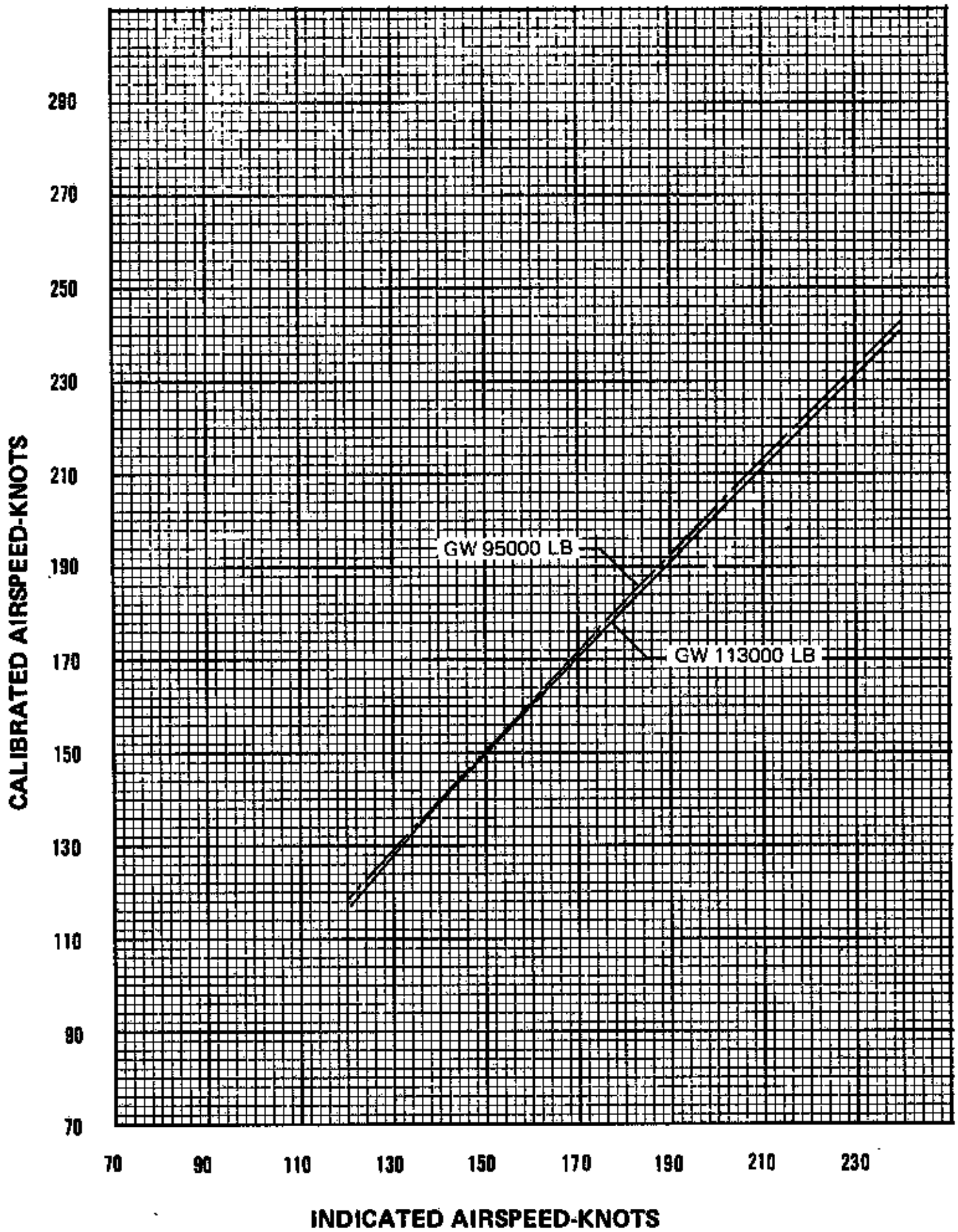

Figure A1-1

AIRSPEED CALIBRATION

IN OR OUT OF GROUND EFFECT

GEAR UP OR DOWN 50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: JULY 1972
DATA BASIS: PHASE IV FLIGHT TEST

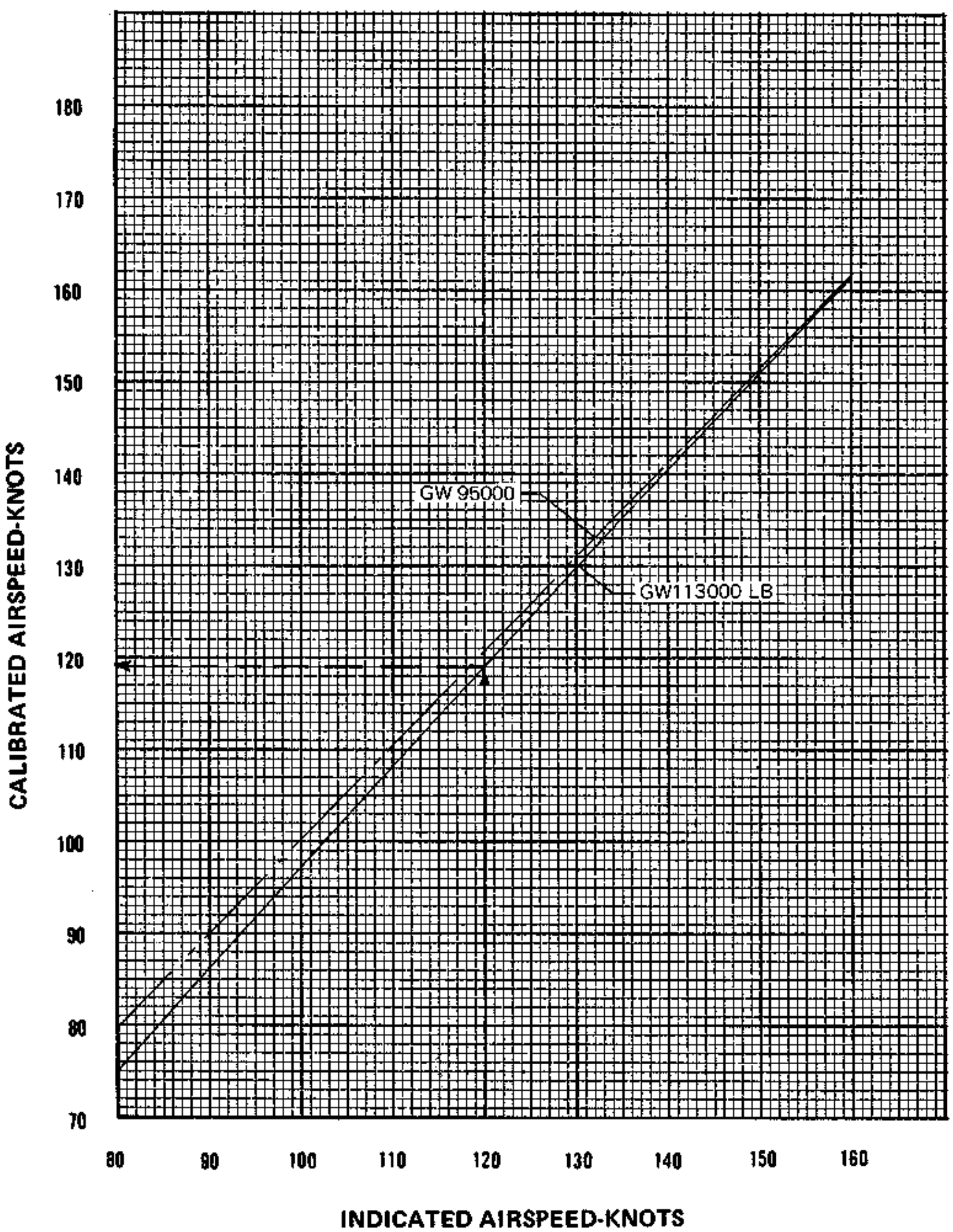

Figure A1-2

AIRSPEED CALIBRATION

IN OR OUT OF GROUND EFFECT

GEAR UP OR DOWN 100 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: JULY 1972
DATA BASIS: PHASE IV FLIGHT TEST

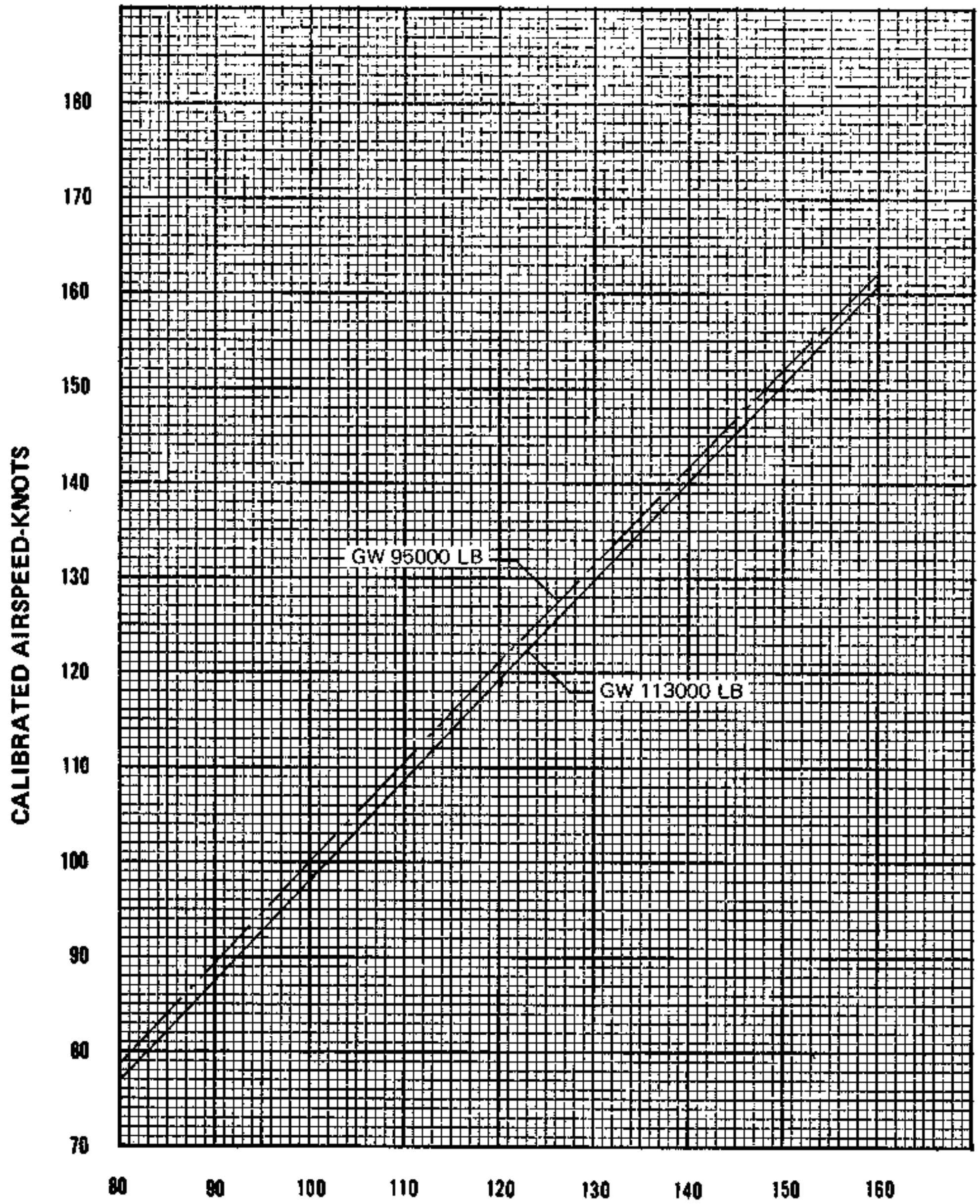

Figure A1-3

COMPRESSIBILITY CORRECTION TO CALIBRATED AIRSPEED

NOTE

Subtract correction from calibrated airspeed to obtain equivalent airspeed. $V_e = V_c - \Delta V_c$

DATE: DECEMBER 1969
DATA BASIS: CALCULATED

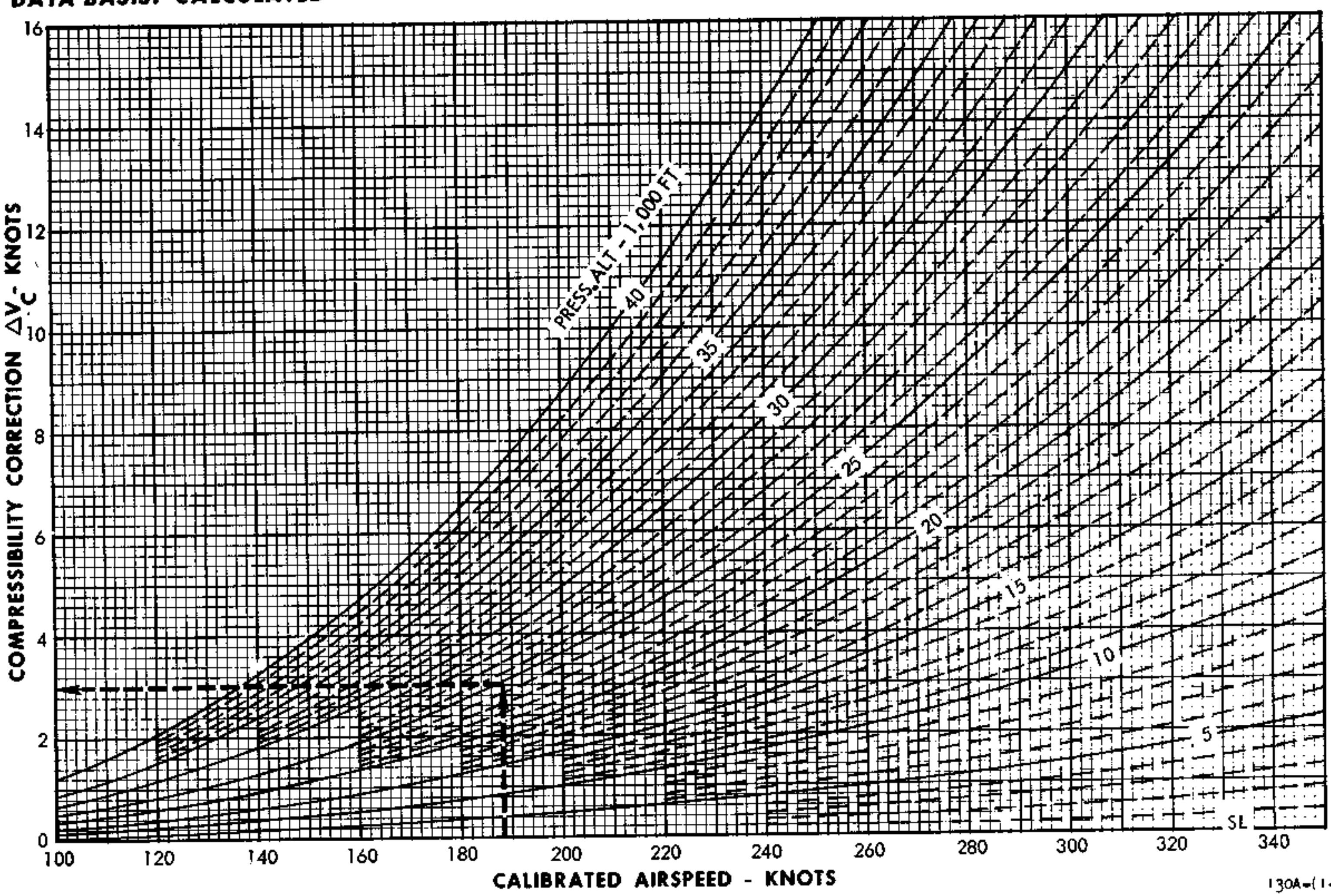

Figure A1-4

TEMPERATURE CORRECTION

CRUISE CONFIGURATION
RECOVERY FACTOR=0.9

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

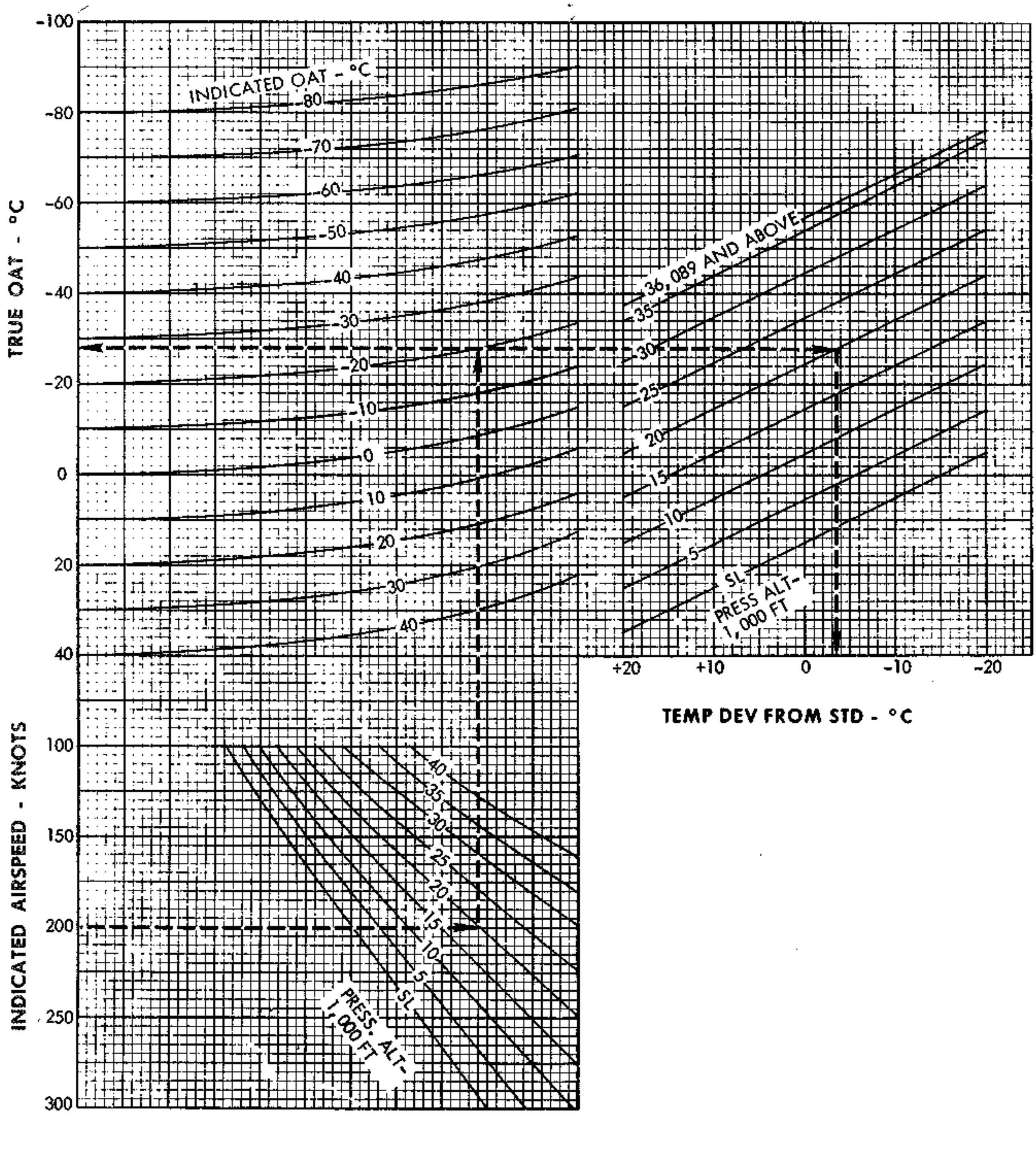

Figure A1-5

DENSITY ALTITUDE CHART

DATE: DECEMBER 1969

DATA BASIS: CALCULATED

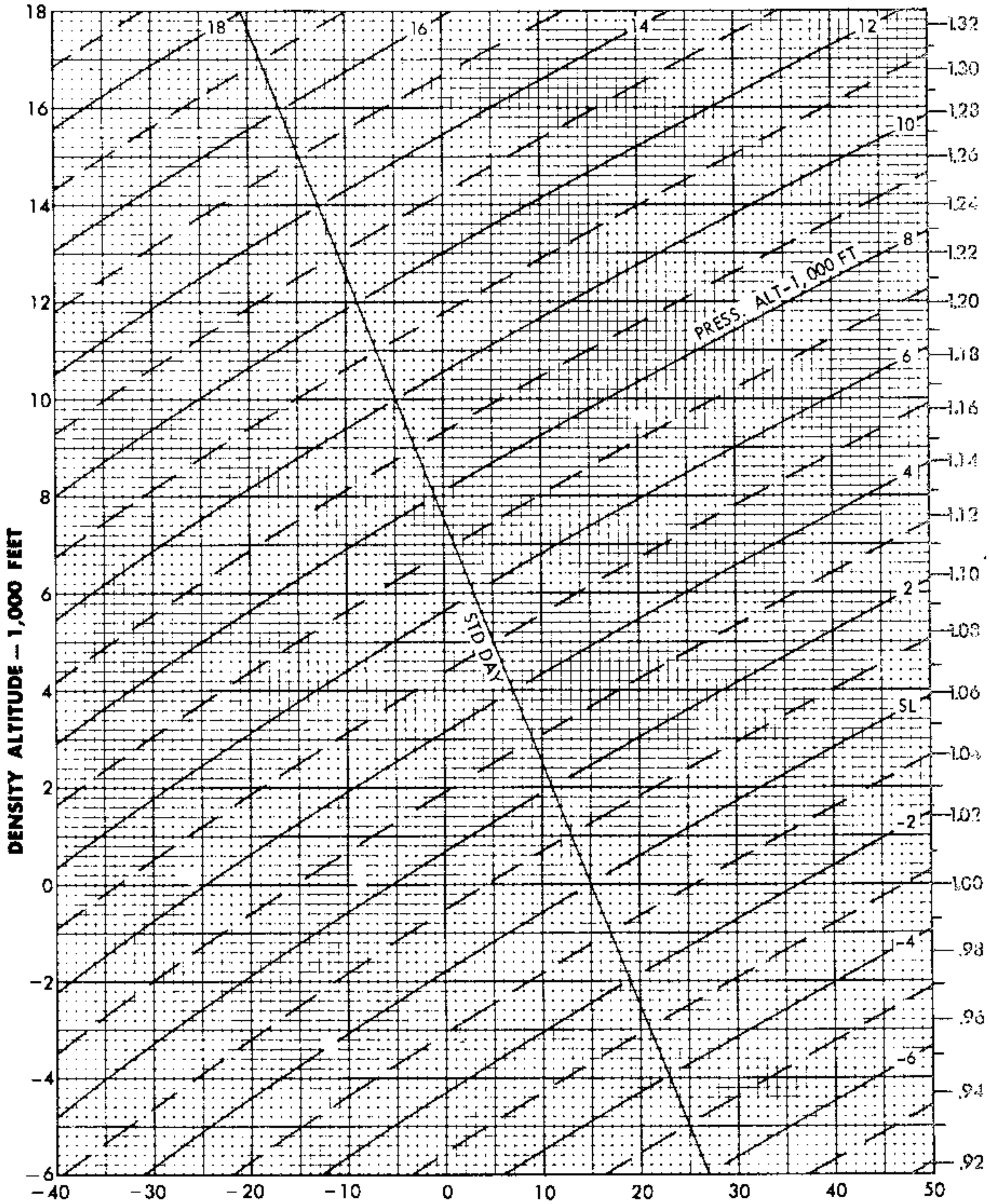

Figure A1-6. (Sheet 1 of 2)

DENSITY ALTITUDE CHART

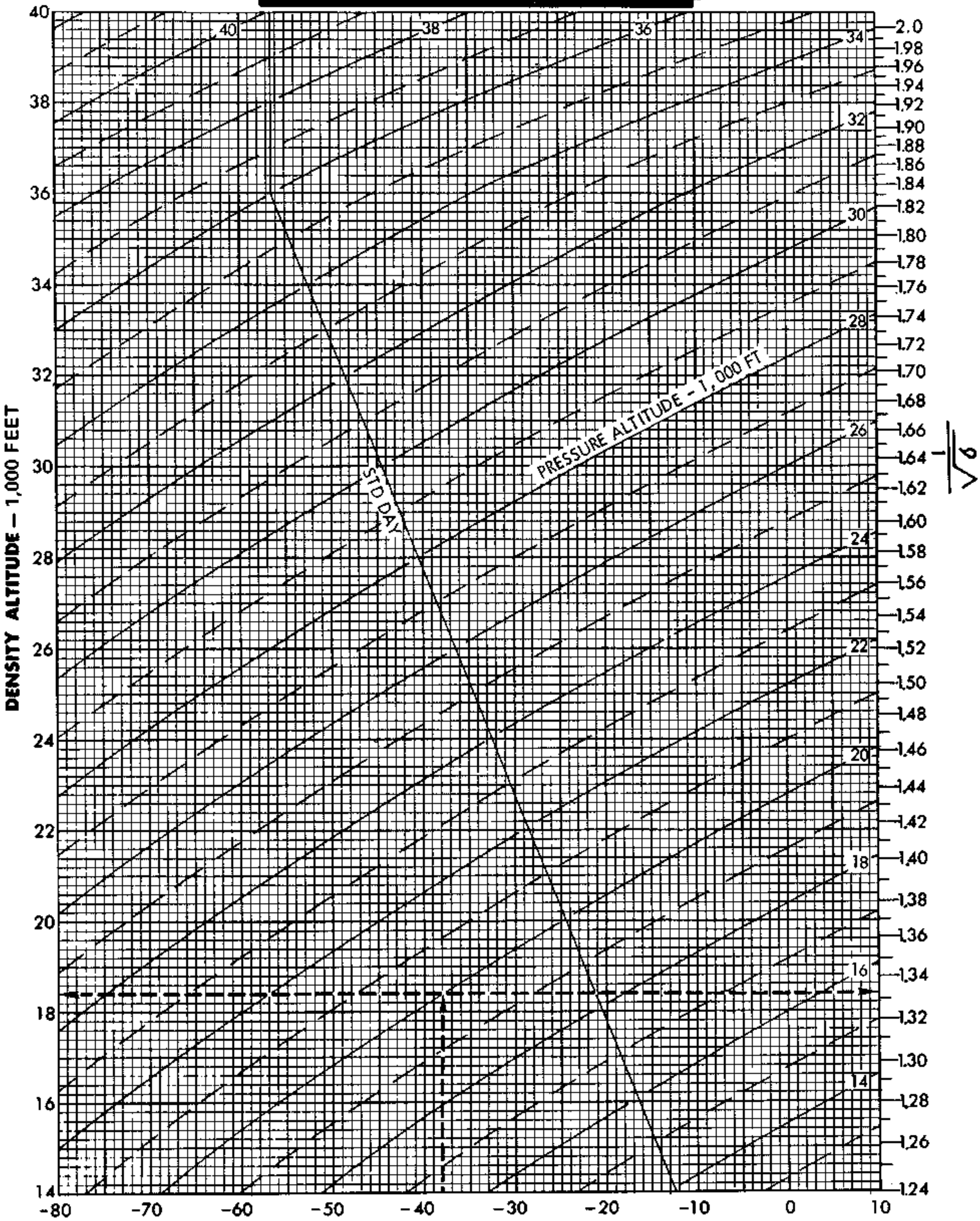

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Figure A1-6. (Sheet 2 of 2)

DENSITY ALTITUDE TABLE

$$\text{TRUE AIRSPEED} = \text{EQUIVALENT AIRSPEED} \times \frac{1}{\sqrt{\sigma}}$$

DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$
100	1.0015	3300	1.0501	6500	1.1022	9700	1.1582	12900	1.2185	16100	1.2835
200	1.0029	3400	1.0516	6600	1.1039	9800	1.1600	13000	1.2204	16200	1.2857
300	1.0044	3500	1.0532	6700	1.1056	9900	1.1618	13100	1.2225	16300	1.2878
400	1.0058	3600	1.0547	6800	1.1073	10000	1.1637	13200	1.2244	16400	1.2900
500	1.0074	3700	1.0564	6900	1.1090	10100	1.1655	13300	1.2264	16500	1.2920
600	1.0089	3800	1.0580	7000	1.1106	10200	1.1674	13400	1.2284	16600	1.2942
700	1.0103	3900	1.0595	7100	1.1123	10300	1.1692	13500	1.2303	16700	1.2963
800	1.0118	4000	1.0611	7200	1.1141	10400	1.1710	13600	1.2323	16800	1.2985
900	1.0138	4100	1.0627	7300	1.1158	10500	1.1729	13700	1.2343	16900	1.3006
1000	1.0148	4200	1.0644	7400	1.1176	10600	1.1747	13800	1.2362	17000	1.3028
1100	1.0163	4300	1.0660	7500	1.1192	10700	1.1766	13900	1.2382	17100	1.3050
1200	1.0178	4400	1.0676	7600	1.1210	10800	1.1784	14000	1.2404	17200	1.3070
1300	1.0193	4500	1.0692	7700	1.1227	10900	1.1804	14100	1.2424	17300	1.3092
1400	1.0208	4600	1.0708	7800	1.1245	11000	1.1822	14200	1.2444	17400	1.3115
1500	1.0223	4700	1.0724	7900	1.1261	11100	1.1840	14300	1.2464	17500	1.3137
1600	1.0239	4800	1.0740	8000	1.1279	11200	1.1860	14400	1.2484	17600	1.3158
1700	1.0253	4900	1.0756	8100	1.1297	11300	1.1878	14500	1.2505	17700	1.3180
1800	1.0268	5000	1.0772	8200	1.1315	11400	1.1896	14600	1.2525	17800	1.3201
1900	1.0284	5100	1.0789	8300	1.1331	11500	1.1916	14700	1.2545	17900	1.3224
2000	1.0299	5200	1.0805	8400	1.1349	11600	1.1935	14800	1.2566	18000	1.3247
2100	1.0315	5300	1.0821	8500	1.1368	11700	1.1953	14900	1.2587	18100	1.3268
2200	1.0330	5400	1.0839	8600	1.1384	11800	1.1973	15000	1.2607	18200	1.3291
2300	1.0346	5500	1.0855	8700	1.1403	11900	1.1992	15100	1.2626	18300	1.3314
2400	1.0361	5600	1.0872	8800	1.1421	12000	1.2011	15200	1.2647	18400	1.3335
2500	1.0376	5700	1.0889	8900	1.1438	12100	1.2031	15300	1.2668	18500	1.3358
2600	1.0392	5800	1.0904	9000	1.1456	12200	1.2050	15400	1.2689	18600	1.3380
2700	1.0407	5900	1.0922	9100	1.1474	12300	1.2069	15500	1.2710	18700	1.3403
2800	1.0422	6000	1.0937	9200	1.1492	12400	1.2088	15600	1.2731	18800	1.3425
2900	1.0437	6100	1.0954	9300	1.1510	12500	1.2108	15700	1.2752	18900	1.3448
3000	1.0454	6200	1.0971	9400	1.1527	12600	1.2127	15800	1.2773	19000	1.3470
3100	1.0469	6300	1.0988	9500	1.1546	12700	1.2146	15900	1.2794	19100	1.3493
3200	1.0484	6400	1.1005	9600	1.1563	12800	1.2165	16000	1.2814	19200	1.3515

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Figure A1-7. ***(Sheet 1 of 2)***

DENSITY ALTITUDE TABLE

TRUE AIRSPEED = EQUIVALENT AIRSPEED X $\dfrac{1}{\sqrt{\sigma}}$

DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$	DENSITY ALTITUDE (FEET)	$\frac{1}{\sqrt{\sigma}}$
19300	1.3539	22300	1.4251	25500	1.5072	28600	1.5934	31700	1.6875	34800	1.7895
19400	1.3661	22500	1.4300	25600	1.5099	28700	1.5964	31800	1.6903	34900	1.7931
19500	1.3585	22600	1.4325	25700	1.5124	28800	1.5992	31900	1.6938	35000	1.7963
19600	1.3607	22700	1.4349	25800	1.5152	28900	1.6023	32000	1.6969	35100	1.7999
19700	1.3630	22800	1.4374	25900	1.5179	29000	1.6051	32100	1.7001	35200	1.8034
19800	1.3654	22900	1.4399	26000	1.5207	29100	1.6080	32200	1.7033	35300	1.8070
19900	1.3676	23000	1.4424	26100	1.5232	29200	1.6111	32300	1.7065	35400	1.8103
20000	1.3701	23100	1.4443	26200	1.5260	29300	1.6139	32400	1.7097	35500	1.8139
20100	1.3723	23200	1.4474	26300	1.5288	29400	1.6171	32500	1.7129	35600	1.8175
20200	1.3746	23300	1.4499	26400	1.5314	29500	1.6200	32600	1.7161	35700	1.8208
20300	1.3770	23400	1.4524	26500	1.5342	29600	1.6228	32700	1.7194	35800	1.8245
20400	1.3793	23500	1.4550	26600	1.5370	29700	1.6260	32800	1.7227	35900	1.8278
20500	1.3816	23600	1.4575	26700	1.5396	29800	1.6289	32900	1.7259	36000	1.8315
20600	1.3841	23700	1.4601	26800	1.5425	29900	1.6319	33000	1.7292	36089	1.8350
20700	1.3864	23800	1.4626	26900	1.5451	30000	1.6348	33100	1.7325	36100	1.8352
20800	1.3887	23900	1.4652	27000	1.5480	30100	1.6380	33200	1.7355	36200	1.8396
20900	1.3912	24000	1.4678	27100	1.5509	30200	1.6410	33300	1.7388	36400	1.8485
21000	1.3935	24100	1.4704	27200	1.5535	30300	1.6439	33400	1.7422	36600	1.8574
21100	1.3959	24200	1.4730	27300	1.5564	30400	1.6469	33500	1.7455	36800	1.8664
21200	1.3982	24300	1.4756	27400	1.5593	30500	1.6502	33600	1.7489	37000	1.8753
21300	1.4008	24400	1.4782	27500	1.5620	30600	1.6532	33700	1.7522	37200	1.8844
21400	1.4031	24500	1.4808	27600	1.5649	30700	1.6562	33800	1.7556	37400	1.8935
21500	1.4055	24600	1.4832	27700	1.5676	30800	1.6592	33900	1.7590	37600	1.9026
21600	1.4079	24700	1.4859	27800	1.5706	30900	1.6622	34000	1.7624	37800	1.9117
21700	1.4104	24800	1.4885	27900	1.5733	31000	1.6656	34100	1.7655	38000	1.9210
21800	1.4128	24900	1.4912	28000	1.5763	31100	1.6686	34200	1.7690	38200	1.9302
21900	1.4152	25000	1.4939	28100	1.5790	31200	1.6717	34300	1.7724	38400	1.9395
22000	1.4176	25100	1.4966	28200	1.5820	31300	1.6748	34400	1.7759	38600	1.9488
22100	1.4201	25200	1.4990	28300	1.5848	31400	1.6779	34500	1.7794	38800	1.9583
22200	1.4225	25300	1.5017	28400	1.5878	31500	1.6810	34600	1.7825	39000	1.9677
22400	1.4276	25400	1.5044	28500	1.5906	31600	1.6841	34700	1.7860	39200	1.9772

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Figure A1-7. ***(Sheet 2 of 2)***

ICAO STANDARD ATMOSPHERE TABLE

PRESSURE ALTITUDE - FEET	DENSITY RATIO - $\rho/\rho_o = \sigma$	$\frac{1}{\sqrt{\sigma}}$	TEMPERATURE		SPEED OF SOUND RATIO - $a/a_o = \sqrt{\theta}$	SPEED OF SOUND - KNOTS	PRESSURE	
			DEG C	DEG F			IN. Hg	RATIO- $P/P_o = \delta$
0	1.000	1.000	15	59.0	1.000	661.7	29.92	1.000
1,000	.9711	1.0148	13.019	55.4	.9966	659.5	28.86	.9644
2,000	.9428	1.0299	11.037	51.9	.9931	657.2	27.82	.9298
3,000	.9151	1.0454	9.056	48.3	.9896	654.9	26.82	.8962
4,000	.8881	1.0611	7.075	44.7	.9862	652.6	25.84	.8637
5,000	.8617	1.0772	5.094	41.2	.9827	650.3	24.90	.8320
6,000	.8359	1.0937	3.113	37.6	.9792	647.9	23.98	.8014
7,000	.8106	1.1107	1.132	34.0	.9756	645.6	23.09	.7716
8,000	.7860	1.1279	-.850	30.5	.9721	643.3	22.22	.7428
9,000	.7620	1.1456	-2.831	26.9	.9686	640.9	21.39	.7148
10,000	.7385	1.1637	-4.812	23.3	.9650	638.6	20.58	.6877
11,000	.7156	1.1822	-6.794	19.8	.9614	636.2	19.79	.6614
12,000	.6932	1.2011	-8.775	16.2	.9579	633.9	19.03	.6360
13,000	.6713	1.2204	-10.756	12.6	.9543	631.5	18.29	.6113
14,000	.6500	1.2404	-12.737	9.1	.9506	629.1	17.58	.5874
15,000	.6292	1.2607	-14.718	5.5	.9470	626.7	16.89	.5643
16,000	.6090	1.2814	-16.700	1.9	.9434	624.3	16.22	.5420
17,000	.5892	1.3028	-18.681	-1.6	.9397	621.9	15.57	.5203
18,000	.5699	1.3247	-20.662	-5.2	.9361	619.4	14.94	.4994
19,000	.5511	1.3470	-22.643	-8.8	.9324	617.0	14.34	.4791
20,000	.5328	1.3701	-24.624	-12.3	.9287	614.6	13.75	.4595
21,000	.5150	1.3935	-26.605	-15.9	.9250	612.1	13.18	.4406
22,000	.4976	1.4176	-28.587	-19.5	.9213	609.6	12.64	.4223
23,000	.4806	1.4424	-30.568	-23.0	.9175	607.2	12.11	.4046
24,000	.4642	1.4678	-32.549	-26.6	.9138	604.7	11.60	.3876
25,000	.4481	1.4939	-34.530	-30.2	.9100	602.2	11.10	.3711
26,000	.4325	1.5207	-36.511	-33.7	.9062	599.7	10.63	.3552
27,000	.4173	1.5480	-38.492	-37.3	.9024	597.2	10.17	.3398
28,000	.4025	1.5763	-40.473	-40.9	.8986	594.7	9.72	.3250
29,000	.3881	1.6051	-42.455	-44.4	.8948	592.1	9.30	.3107
30,000	.3741	1.6348	-44.436	-48.0	.8909	589.5	8.89	.2970
31,000	.3605	1.6656	-46.417	-51.6	.8870	587.0	8.49	.2837
32,000	.3473	1.6969	-48.398	-55.1	.8832	584.4	8.11	.2709
33,000	.3345	1.7292	-50.380	-58.7	.8793	581.8	7.74	.2586
34,000	.3220	1.7624	-52.361	-62.2	.8754	597.2	7.38	.2467
35,000	.3099	1.7963	-54.342	-65.8	.8714	576.7	7.04	.2353
36,000	.2981	1.8315	-56.324	-69.4	.8675	574.0	6.71	.2243
37,000	.2844	1.8753	-56.500	-69.7	.8671	573.8	6.40	.2138
38,000	.2710	1.9210	-56.500	-69.7	.8671	573.8	6.10	.2038
39,000	.2583	1.9677	-56.500	-69.7	.8671	573.8	5.81	.1942
40,000	.2462	2.0155	-56.500	-69.7	.8671	573.8	5.54	.1851
41,000	.2346	2.0646	-56.500	-69.7	.8671	573.8	5.28	.1764
42,000	.2236	2.1148	-56.500	-69.7	.8671	573.8	5.03	.1681
43,000	.2131	2.1662	-56.500	-69.7	.8671	573.8	4.79	.1602
44,000	.2031	2.2189	-56.500	-69.7	.8671	573.8	4.57	.1527
45,000	.1936	2.2729	-56.500	-69.7	.8671	573.8	4.35	.1455
46,000	.1845	2.3282	-56.500	-69.7	.8671	573.8	4.15	.1387
47,000	.1758	2.3848	-56.500	-69.7	.8671	573.8	3.96	.1322
48,000	.1676	2.4428	-56.500	-69.7	.8671	573.8	3.77	.1260
49,000	.1597	2.5022	-56.500	-69.7	.8671	573.8	3.59	.1201
50,000	.1522	2.5631	-56.500	-69.7	.8671	573.8	3.42	.1144

Standard Sea Level Air:
T = 15°C (59°F)
P_o = 14.70 lb/sq in. = 29.921 in. of Hg

w = 0.07651 lb/cu ft
1 in. Hg = 70.727 lb/sq ft = 0.49116 lb/sq in.
a_o = 661.7407 knots = 1116.89 ft/sec

ρ_o = 0.002378 slugs/cu ft

Figure A1-8

130A-(1-1)-0-195

TEMPERATURE CONVERSION CHART

NOTE

°F = (9/5°C) + 32°
°C = 5/9 (°F - 32°)

DATE: DECEMBER 1969
DATA BASIS: CALCULATED

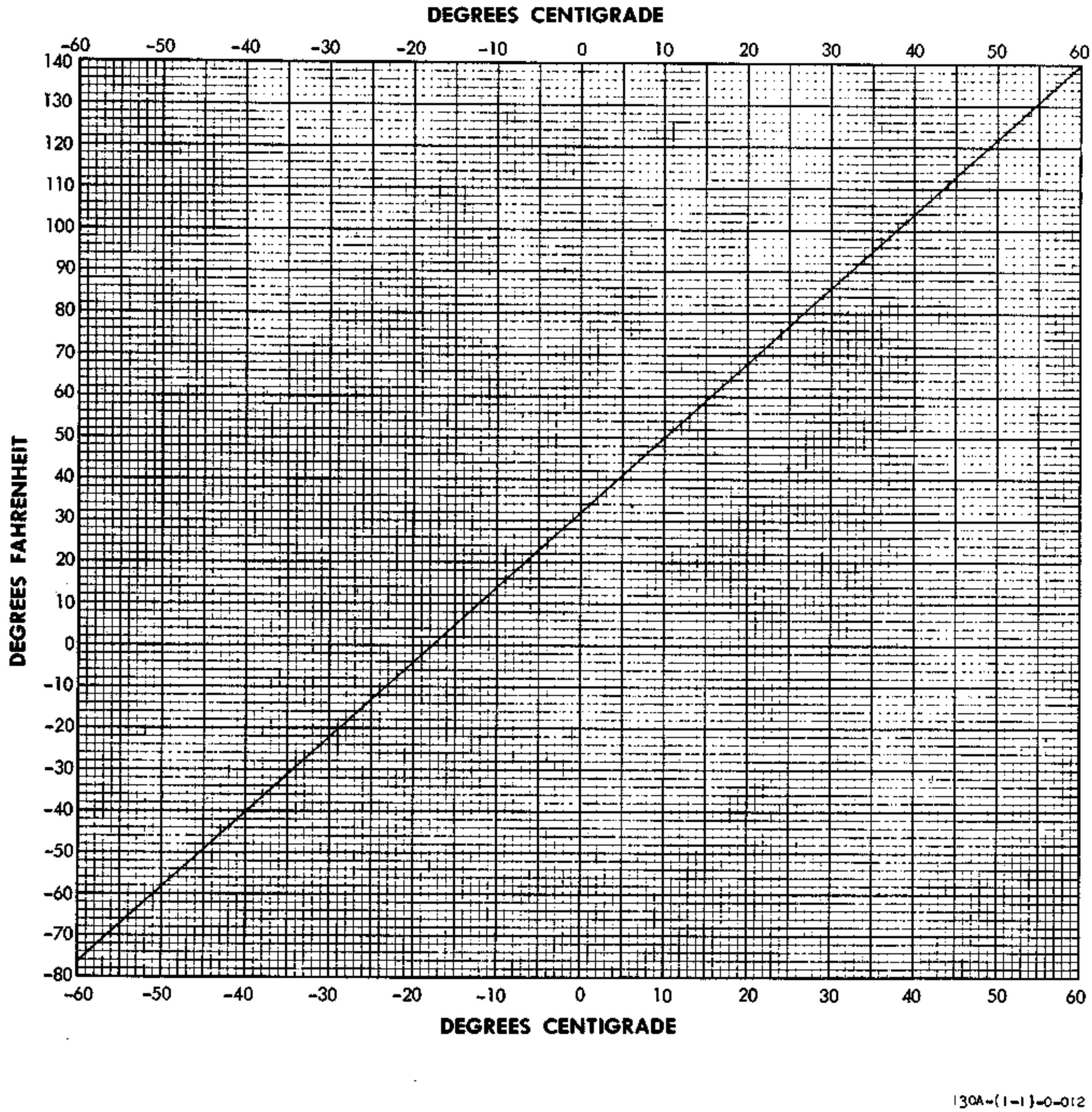

Figure A1-9

PART 2. ENGINE POWER AND FUEL FLOW

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LIST OF CHARTS

INTRODUCTION.

Engine operating data for inflight operations are presented in this part. The basic data are shown on a torque and a fuel flow chart for normal operating conditions. Changes in the data, due to changes in engine bleed flow for other conditions, are shown in additional charts. These data were derived from C-130A Phase IV flight test results and include the effects of ram efficiencies, normal power extraction, and pressurization and air conditioning bleed.

The T56-A-9 turboprop engines operate at a constant 13,820 rpm (100 percent). The shaft horsepower, given by the engine manufacturer's specifications and corrected as noted above, is converted to torque in inch-pounds by the following equation:

$$\text{Torque} = 4.56 \text{ SHP}$$

The reciprocal of this equation, using indicated torque from the charts, gives shaft horsepower:

$$\text{SHP} = \frac{\text{Torque}}{4.56} = 0.2193 \text{ Torque}$$

CHART DESCRIPTION.

Figures A2-1 and A2-2 show engine torque and fuel flow for any combination of altitude, airspeed, temperature, and TIT when engine bleed condition is normal. This condition exists when all engines are operating and when anti-icing bleed is not required. With one or more engines shut down, the air conditioning and pressurization systems require more bleed from the operating engines, so corrections to the basic charts are required. Figures A2-3 and A2-4 show engine torque and fuel flow corrections due to additional bleed requirements for anti-icing. The reference numbers on the Inflight Power Available and Inflight Fuel Flow charts (figures A2-1 and A2-2) are used to facilitate transferring from the first page of the chart to the second. Note that the reference number used to find torque may not be used to find fuel flow at the same condition.

Example.

Given:

Cruise altitude: 25,000 feet.

Cruise speed: 200 knots CAS.

IOAT: 20°C.

TIT: 750°C.

4-engine operation (normal bleed).

Find:

Torque per engine.

Fuel flow per engine.

Procedure:

To find torque per engine, enter sheet 1 of figure A2-1 with a pressure altitude of 25,000 feet, move horizontally to 200 knots CAS, vertically to -20°C IOAT, and horizontally to the TIT base line. From this point, follow the guidlines down to 750°C TIT, move horizontally and read a reference number of 3.37. Enter sheet 2 with this reference number, move horizontally to a pressure altitude of 25,000 feet, and read a torque of 4,900 inch-pounds per engine. Using figure A2-2 in the same manner, fuel flow is found to be 700 pounds per hour per engine.

CORRECTION CHARTS.

A curve correcting inflight torque for losses due to all bleed on, is provided. An inflight fuel flow correction chart due to all bleed on is likewise provided. To use either of these charts a value for normal bleed is necessary to enter the charts. For the case of inflight power available, enter with normal bleed torque and move directly to the altitude line and read all bleed torque on the vertical scale to the left. For fuel flow the procedure is the same except for the altitude factor, the one curve is good for all altitudes.

MODEL: AC-130A
T56-A-9 ENGINES

DATE: SEPTEMBER 1971
DATA BASIS: PHASE IV FLIGHT TEST

INFLIGHT POWER AVAILABLE

4 ENGINES

NORMAL BLEED 100 PERCENT RPM

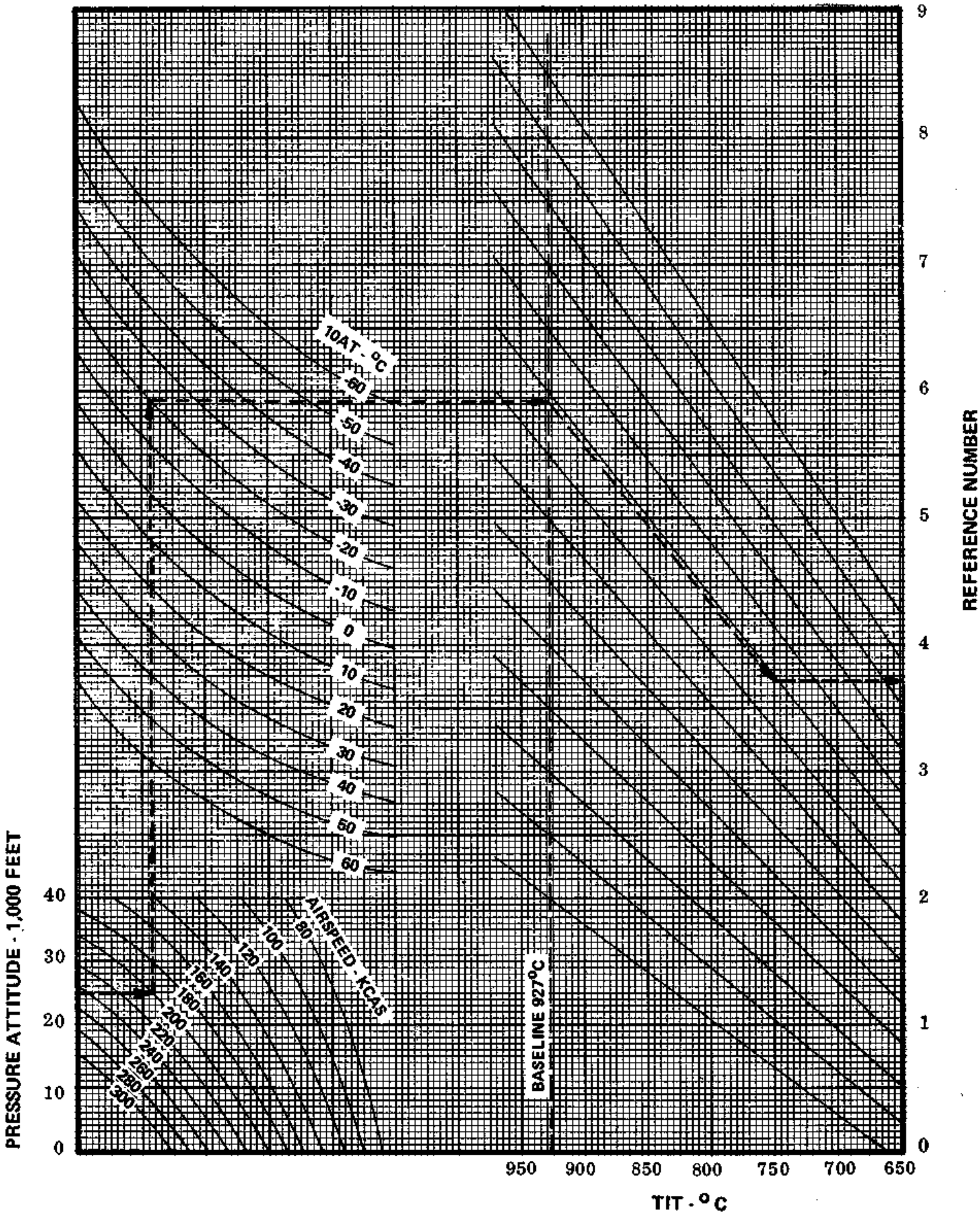

Figure A2-1. (Sheet 1 of 2)

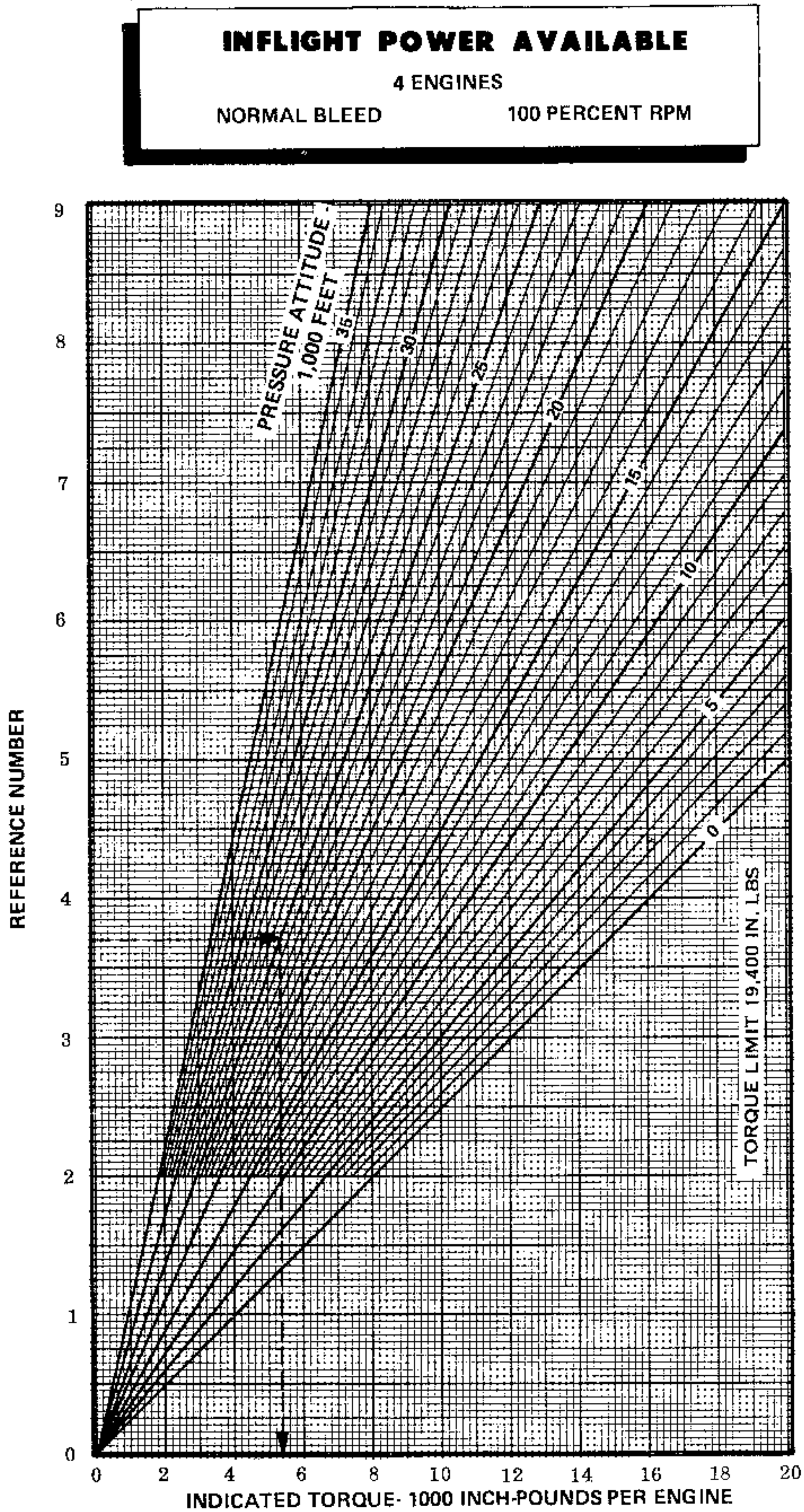

Figure A2-1. (Sheet 2 of 2)

MODEL: AC-130A
T56-A-9 ENGINES

DATE: SEPTEMBER 1971
DATA BASIS: PHASE IV FLIGHT TEST

INFLIGHT FUEL FLOW

4 ENGINES

NORMAL BLEED 100 PERCENT RPM

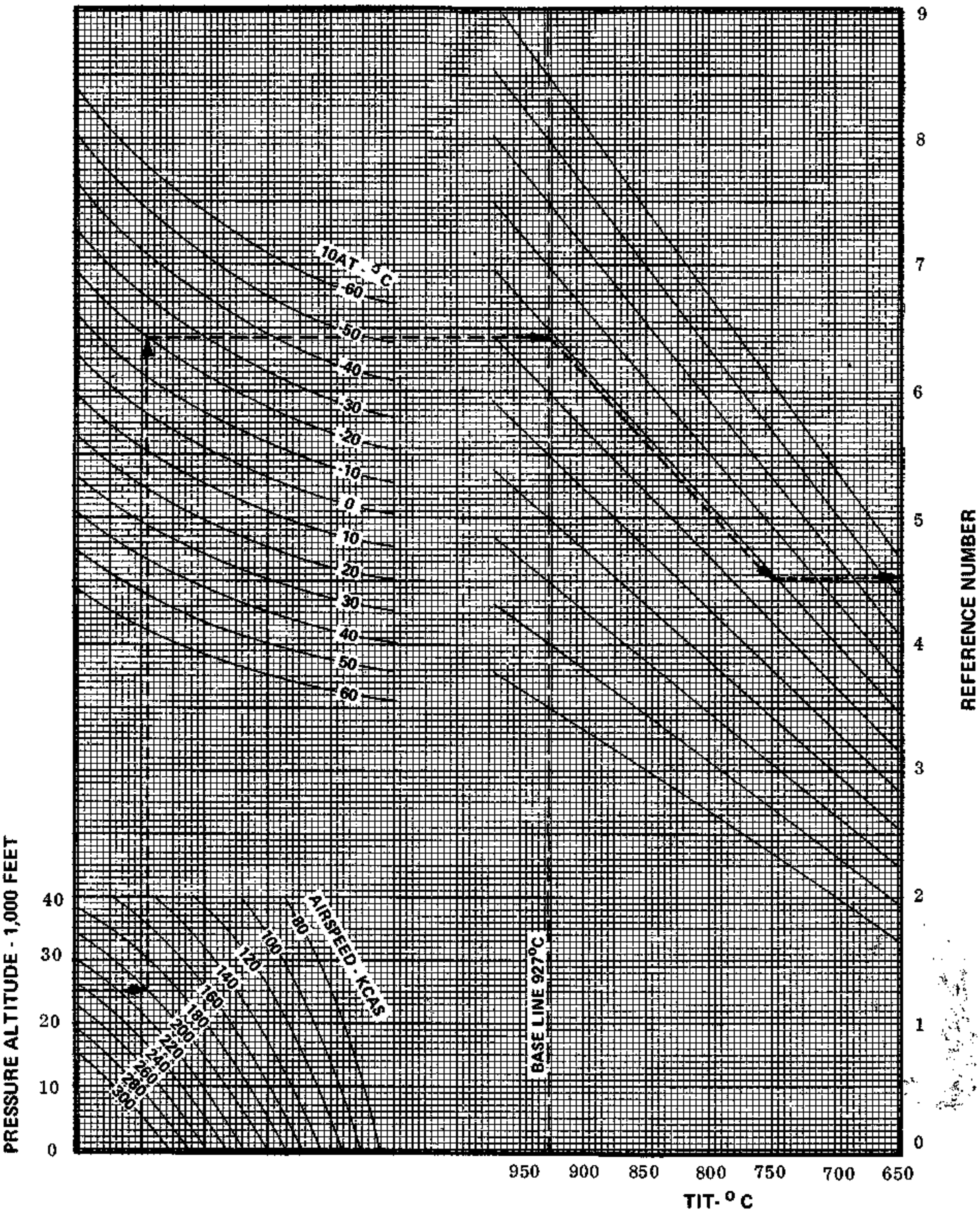

Figure A2-2. (Sheet 1 of 2)

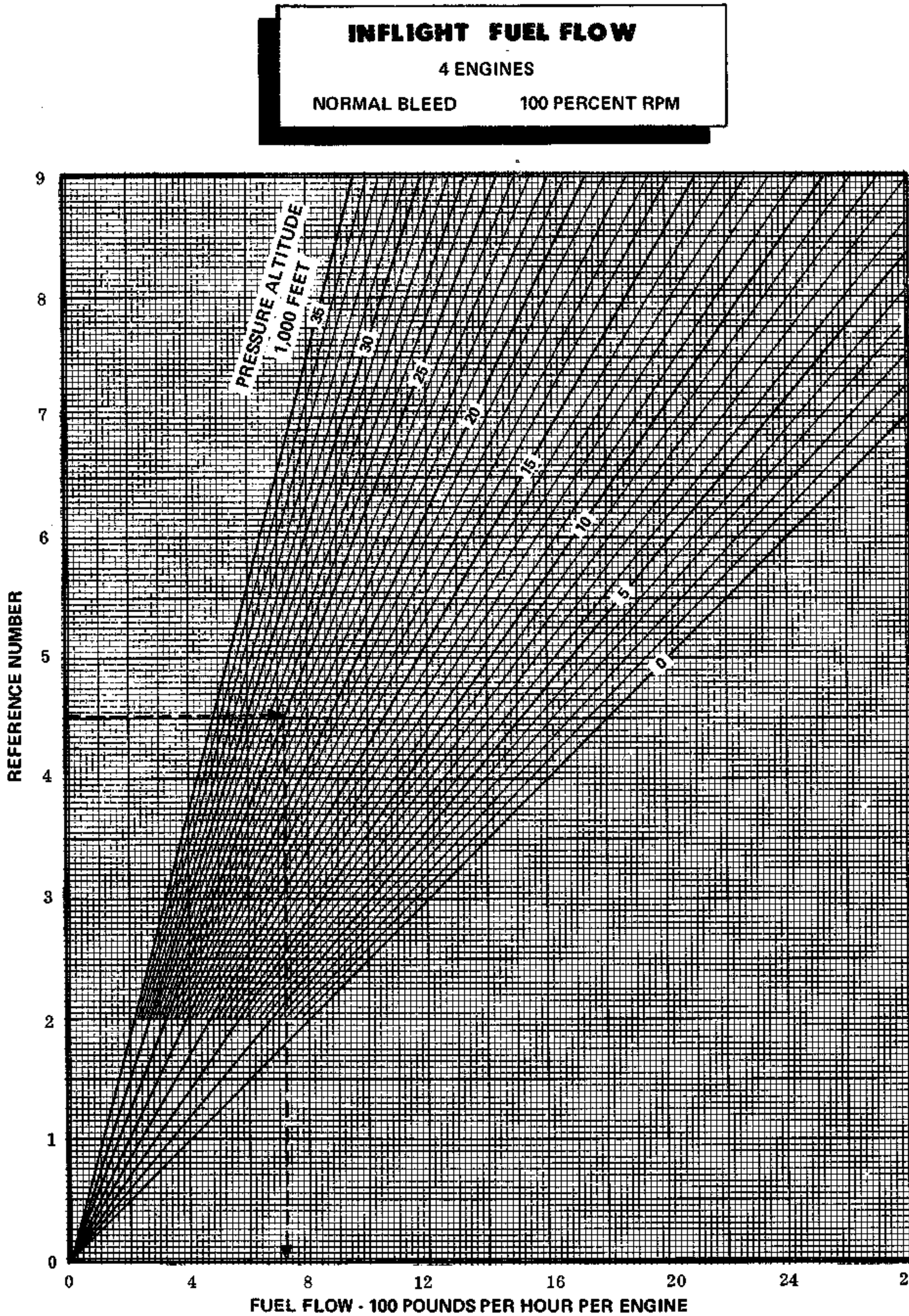

Figure A2-2. (Sheet 2 of 2)

INFLIGHT TORQUE LOSS DUE TO ALL BLEED ON

4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

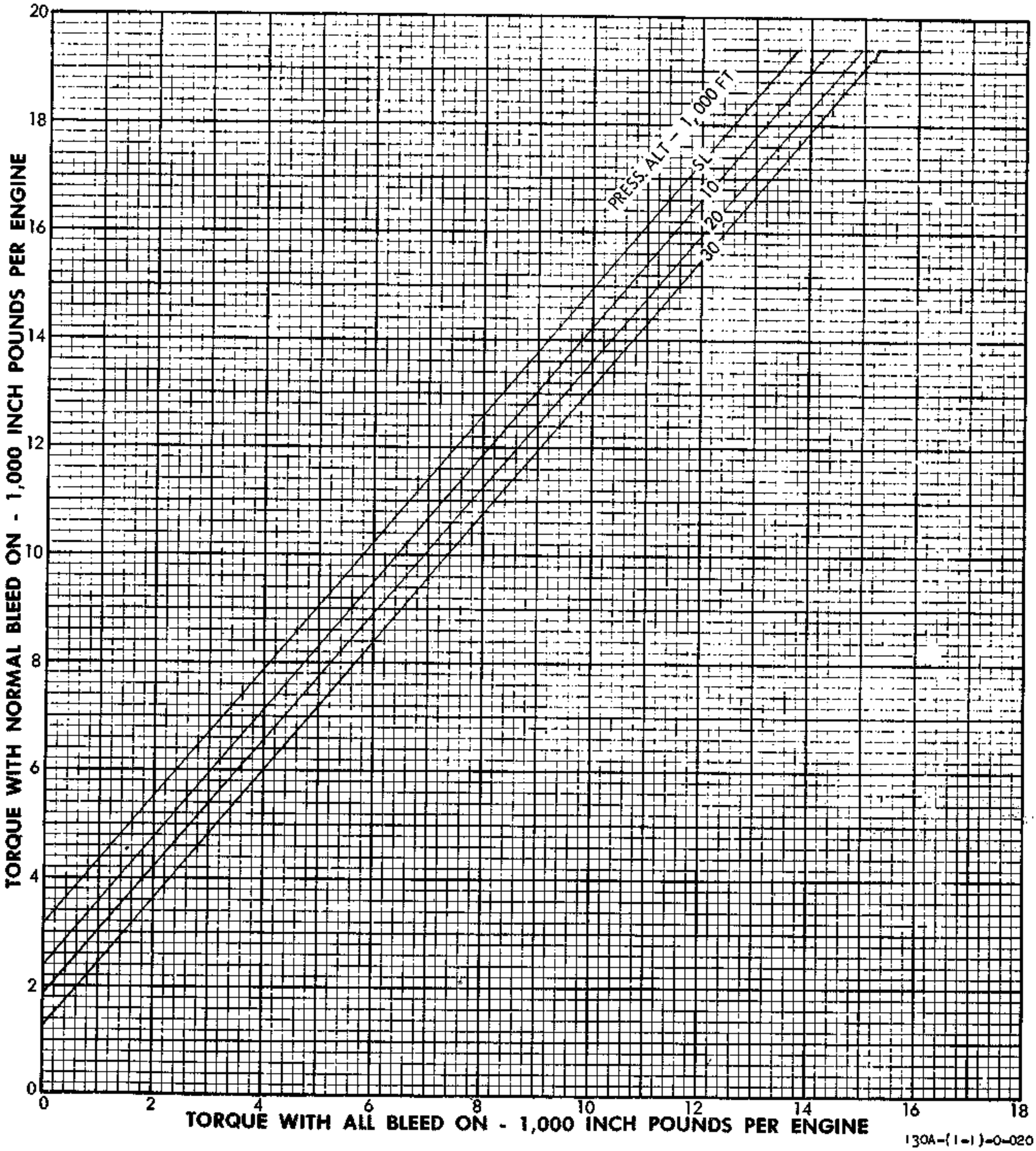

Figure A2-3.

FUEL FLOW CHANGE DUE TO ALL BLEED ON

4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

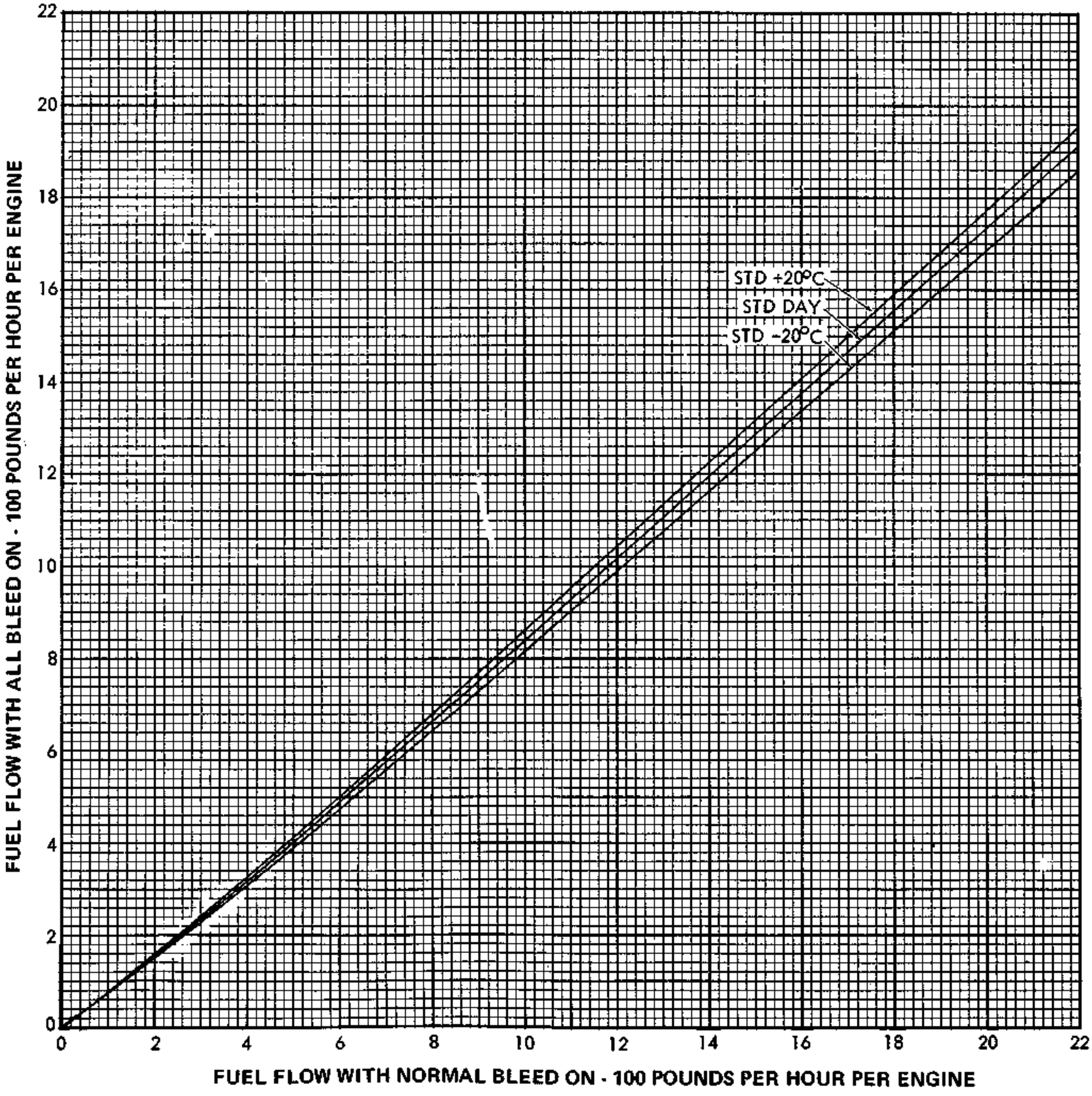

Figure A2-4.

PART 3. TAKE-OFF PERFORMANCE

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LIST OF CHARTS

LIST OF CHARTS (Cont)

INTRODUCTION.

Take-off performance is important in the operation of the airplane, since payload and range may be seriously cut by the maximum weight limitations imposed by take-off conditions. Generally, the runway length available imposes the most stringent limits on take-off weight. However, obstacle clearance and climb performance may also determine the gross weight limit. Factors affecting the take-off and climb-out performance of the airplane include pressure altitude, outside air temperature, wind velocity, runway slope, runway condition, and surface covering. In this part of the Appendix, data are presented for determining the take-off performance and applicable limitations for both four- and three-engine operation. The normal take-off configuration is all engines at maximum power with air conditioning and pressurization bleed on, 50 percent flaps, and gear down. The take-off performance data consider ground effect where it is applicable. Ground effect, in general, refers to a reduction in the drag of an airplane when operated in close proximity to the ground. The degree of drag reduction will vary with distance of the wing from the ground, being greatest when the wing is at ground level, and becomes negligible when the wing is one-half of the wing span above the ground. The reduction in drag is greatest at low velocities.

Take off distances (Critical field lengths and ground runs) are not significantly affected by drag increases of the AC-130A configurations. Take-off and obstacle clearance speeds and air minimum control speeds are given in terms of AC-130A indicated airspeeds. Variant configuration curves are presented for take-off gross weight limited by three-engine climb performance. Climb-out factor adjustments are made by use of auxiliary scales for 4 and 3 engine configurations.

GRAPHIC TAKE-OFF ILLUSTRATION.

The first stopping condition shown on figure A3-1 presents the minimum recommended take-off condition of runway length equal to the critical field length. For this condition, critical engine failure speed is equal to refusal speed, and the distance to continue on three engines is equal to the distance to stop. Figure A3-1 also shows the recommended take-off condition of runway length longer than critical field length. With this condition refusal speed is always higher than critical engine failure speed. This is because V_R is based on runway available, while V_{CEF} is based on the required critical field length. If an engine failure occurs at critical engine failure speed, some runway length is available whether the decision is made to continue or to stop. The decision can be delayed until reaching refusal speed, where the decision to stop would demand the maximum stopping capability of the airplane.

Note

If critical field length is longer than the runway available, for normal operation, the take-off gross weight should be reduced until critical field length is equal to or less than runway available.

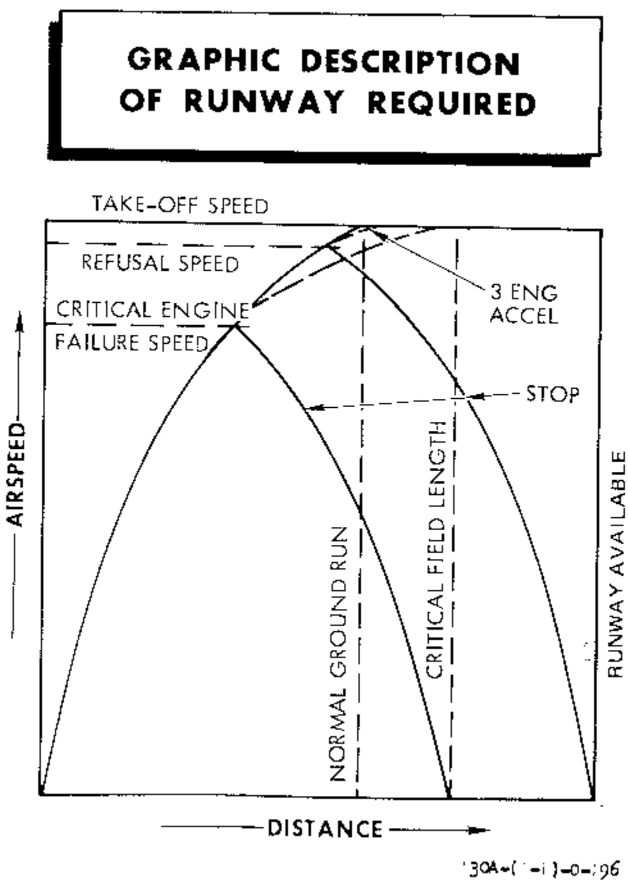

Figure A3-1.

TAKE-OFF TORQUE SETTING.

The take-off torque setting chart (figure A3-3) presents indicated torque for various values of outside air temperature and pressure altitude for maximum power (971° TIT), with the maximum allowable torque limit shown at 19,400 inch-pounds. The torque values presented are for zero airspeed (static conditions) with air conditioning and pressurization bleed on. At airspeeds greater than zero, there is an increase in torque due to inlet ram pressure as shown on the chart. The increased torque values due to ram pressure are included in the take-off calculations and are not to be used when determining take-off factor. Should it be necessary to operate the antiicing system during take-off, the torque correction for all bleed on chart (figure A3-4) should also be used. This chart shows indicated torque with all bleed on as a function of normal torque and altitude. If take-off performance is critical prior to brake release, the actual values of torque should be compared with the chart values. Take-off performance shown in this Appendix can be achieved only if the average static torque produced by the engines matches that shown on the chart. If predicted torque has not been obtained by the time refusal speed is reached, the take-off should be aborted. When the take-off is limited by critical field length, obstacle clearance, or if making a maximum effort take-off, it is recommended that all bleed air systems be turned off to ensure that maximum take-off power is obtained.

Example.

Given:

Pressure altitude: 2,000 feet.

Outside air temperature: +10° C.

Find:

Torque per engine with normal bleed and all bleed on.

Procedure:

Enter the Torque Setting for Maximum Power chart (figure A3-3) with +10° C and move vertically up to the 2,000-foot altitude line. Move horizontally to the left and read 14,850 inch-pounds of torque per engine with normal bleed. To find torque with all bleed on, enter the Bleed Effect On Take-Off Power chart (figure A3-4) with 14,850 inch-pounds torque. Move vertically up to the curve representing all bleed on and read an all bleed on torque of 10,250 inch-pounds per engine.

TAKE-OFF FACTOR.

To simplify the determination of the take-off performance, a take-off factor (figure A3-5) is used. This take-off factor combines the parameters of torque, field pressure altitude, and runway temperature. The take-off factor chart is based on zero airspeed take-off torque setting (figure A3-3). When take-off is performed with other than normal bleed (air conditioning and pressurization on) the take-off factor found from figure A3-5 must be corrected using the Bleed Effect on Take-off Factor chart, figure A3-6. The correction shows a temperature effect due to the difference in the engine characteristics with normal bleed and all bleed on.

Example 1.

Given:

Pressure altitude: 1,000 feet.

Outside air temperature: +30° C.

Find:

Take-off factor for normal bleed and all bleed on.

Procedure:

Enter the Take-off Factor chart (figure A3-5) with +30° C, move vertically up to the 1,000-foot pressure line, and read horizontally to the right a normal bleed on take-off factor of 2.05.

To find the take-off factor for all bleed on, enter the Bleed Effect On Take-off Factor chart (figure A3-6) with 2.05 on the horizontal scale, move vertically to the curve representing all bleed on and read a take-off factor of 2.8 on the left scale for all bleed on.

THREE-ENGINE CLIMB LIMITATION.

Take-off gross weight, limited by three-engine climb performance, is presented in figure A3-7 for various rates of climb in the climb-out configuration as follows:

A weight variant chart to convert AC-130A weight to equivalent basic C-130A weight is given to Figure A3-8. This chart is used in conjunction with Figure A3-7 to determine AC-130A take-off gross weight limited by three engine climb performance.

50 percent flaps

Gear up

Maximum power on all available engines

Inoperative engine with propeller feathered

Normal obstacle clearance speed (figure A3-18)

Out of ground effect

Note

The capability of the airplane to climb prior to reaching obstacle clearance speed is seriously reduced while the gear is retracting (18 seconds) and the propeller is being feathered.

Criteria for minimum rates of climb on take-off are specified by applicable command regulations. When such a criterion has been selected, figure A3-7 can be used to determine the maximum permissible take-off weight.

Example.

Given:

Take-off factor: 3.2

Pressure Altitude: 3,500 feet.

Outside air temperature: +38°C. (standard: +8°C)

Rate of climb: 500 feet per minute

Drag index +80

Find:

Is the three-engine climb capability limiting the take-off gross weight of 120,000 pounds.

Procedure:

To find the take-off gross weight permitted by three-engine climb capability, enter figure A3-7 with the take-off factor of 3.2, move vertically up to the temperature line of standard day 30°C, and then to the right. Interpolate at the intersection of this line with the 500 feet per minute rate of climb line and obtain the maximum permissible take-off gross weight of 120,000 lbs. Enter variant configuration on figure A3-8 with this gross weight, move vertically up to the drag index of 80, and then to the left and obtain a take-off gross weight of 117,500 lbs.

Note

As soon as circumstances permit, the aft cargo door and ramp should be closed to reduce drag. This drag reduction will permit available power remaining to be used for accelerating to climb speed or improved climb performance. If a potential for onboard fire exists the flares should be jettisoned before the aft cargo door is closed.

Do not jettison the flare launcher unless it is essential to aircraft recovery. Refer to the basic flight manual for additional emergency procedures.

RUNWAY CONDITION AND RUNWAY SURFACE COVERING.

Runway condition reading (RCR) is a value which relates the average braking effectiveness of the particular runway surface to the braking capability of the airplane. 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 condition. In order to relate this categorization to an RCR or when RCR values are not available, the following relationship will be used:

RUNWAY CONDITION	ICAO REPORT	RCR
Dry	Good	23
Wet	Medium	12
Icy	Poor	05

Runway surface covering (RSC) is a value which relates to depth and type of runway covering such as water or slush, and is reported in tenths of an inch in depth (one inch is the equivalent of an RSC of 10). The surface covering affects both the acceleration and stopping performance of the airplane and, therefore, is a factor

WIND SUMMARY

TYPE OF WIND	HOW TO OBTAIN COMPONENTS	USE OF WIND COMPONENT
HEADWIND	Runway Component	Always apply 100% of component to any distance or speed when computing acceleration check.
	Enter wind component chart with steady wind value.	When used, apply 50% of component to all distances or speeds except for acceleration check, rotation and minimum control speeds.
		Do not apply headwinds for terrain clearance.
TAILWIND	Runway Component	Always apply 150% of component to any distance or speed when computing acceleration check.
	Enter wind component chart with steady wind value plus the gust increment.	Always apply 150% of component to all distances or speeds except for acceleration check, rotation and minimum control speeds.
		Always apply 150% of component for terrain clearance.
CROSSWIND	Enter wind component chart with steady wind value plus the gust increment.	Check necessity of increased take-off and landing speeds.
GUSTS	Gust Increment	Always increase rotation, take-off, approach, threshold and landing speeds by the full gust increment not to exceed 10 knots.
	Reported wind in excess of steady wind value.	

in determining such performance as take-off ground run, critical field length, and refusal speed. Under average conditions the depth of the surface covering would vary widely in different locations on the runway, and it is preferable to plan the take-off such that the lift-off point should have the least depth reported. The retarding force is a function of many variables such as tire pressure, density of covering, ground speed, weight, and tread and spray pattern of the tire. Extreme care should be exercised in any slush take-off.

WIND DEFINITIONS.

The following definitions apply to the discussions of winds:

Steady Wind Value	- Reported steady wind.
Gust Increment	- Reported wind in excess of steady wind value.
Component	- Effective wind parallel or across the runway.
Headwind	- Effective wind parallel to the runway, determined from the steady wind value.
Tailwind	- Effective wind parallel to the runway, determined from the steady wind value plus the gust increment.
Crosswind	- Effective wind across the runway, determined from the steady wind value plus the gust increment.

APPLICATION OF WINDS TO TAKE-OFF AND LANDING.

WIND DIRECTION AND VELOCITY.

Winds are usually measured at some fixed point on the airfield and, within instrument limitations, are valid for the point where measured. However, if the airfield is located in an area of variable terrain, the possibility exists that over various portions of the airfield, wind velocity and direction will vary. Likewise, wind shear can result in varying winds during climb-out and landings.

Because of these variables, it is recommended that 50 percent of the headwind component and 150 percent of the tailwind component be applied when using the chart.

Gusts may cause a temporary increase in airspeed; therefore, rotation speed, takeoff, approach speed, threshold speed and touchdown speed should be increased by the full gust increment, but not to exceed 10 knots. Distances should only be adjusted for gusts when they accompany a tailwind.

ACCOUNTING FOR WIND.

Benefits derived from headwinds should be accepted as an increased margin of safety. Headwind should only be considered when necessary for mission accomplishment. Always apply headwinds when computing the acceleration check. Always apply tailwinds. When headwinds or tailwinds are applied, all distances and speeds except rotation speed and minimum control speeds must be corrected during take-off planning.

TAKE-OFF CROSSWIND CHART.

Figure A3-9 presents the maximum recommended crosswind to which the C-130 airplane can be subjected on the ground and still remain under directional control. The figure presents maximum crosswind as a function of gross weight, RCR, and headwind. Maximum rudder deflection may be used, but neither brakes nor asymmetric power are applied. The smaller values of crosswind from either figure A3-9 or A3-10 should be used for takeoff.

Example.

Given:

Gross Weight: 100, 000 pounds

RCR: 12

Wind: 10-knot headwind

Find:

Maximum recommended crosswind for take-off.

Procedure:

Enter figure A3-9 at 100,000 pound weight line, move horizontally to the RCR line of 12, move vertically to the 10-knot headwind line, then move horizontally to the right to the maximum crosswind line of 21 knots. A check of figure A3-10 shows the wind vector in the recommended area of the chart. The airplane may takeoff if the crosswind is not greater than 21 knots.

The Take-off Crosswind chart (figure A3-10) presents headwind and crosswind components in knots for wind directions of zero to 90 degrees from the runway heading and wind speeds up to 60 knots. For crosswind components in excess of 35 knots, a high degree of pilot skill is necessary for crosswind correction. Variations in asymmetrical power and use of less flaps than normally recommended will result in improved crosswind capability. When the crosswind component and normal take-off speed fall within the caution area, the take-off speed should be increased until the recommended area is reached, or the airspeed has been increased 10 knots. If the recommended area still has not been reached after increasing airspeed 10 knots, then caution should be exercised during take-off. Refer to paragraphs entitled Wind Definitions and Application of Winds To Take-off and Landing in this Part for a discussion of winds.

Example.

Given:

Take-off runway: 12.

Wind: From 180 degrees at 20 knots gusting to 32 knots.

Gross weight: 120,000 pounds.

Find:

Whether take-off is in normal zone at predicted take-off speed.

Procedure:

From Take-off and Obstacle Clearance Speed chart (figure A3-18 determine predicted take-off speed of 109.5. The runway wind angle is (180° -120) 60 degrees. Enter the Take-off Crosswind chart (figure A3-10 with the wind angle of 60 degrees and a speed of 32 knots and find the crosswind component of 27 knots. Move vertically to the predicted take-off speed of 109.5 knots and determine that the take-off will be in the CAUTION zone. Increase the take-off speed by moving vertically up again to the RECOMMENDED zone or until the airspeed has been increased 10 knots. The new take-off speed is 119.5 knots. To find the increased refusal distance due to increased take-off speed, see paragraph entitled Acceleration Check Time.

CRITICAL FIELD LENGTH.

The critical field length is the total runway distance required to accelerate on all engines to critical engine failure speed, experience an engine failure, then continue the take-off or stop. It is used during take-off planning together with the climb-out data to determine the maximum gross weight for a safe take-off and climb-out. For a safe take-off, the critical field length must be no greater than the length of runway available. Critical field length is determined from figure A3-11 by using take-off factor, take-off weight, and applying the corrections for flap setting, runway slope, wind, RCR, and RSC as required.

WARNING

When computing critical field length with anti-skid inoperative, increase critical field length by 1400 feet. This correction factor is not valid if wheels lock or tires skid.

Example.

Given:

Gross weight: 120,000 pounds.

Take-off factor: 2.05.

Runway length: 7,000 feet.

Runway slope: 2 percent uphill.

Tower reported wind: 10-knot headwind.

RCR: 12.

RSC: 2.5.

Find:

Critical field length.

Maximum take-off weight as limited by critical field length.

Procedure:

Enter the Critical Field Length chart (figure A3-11) with the take-off factor of 2.05, move vertically up to the 120,000-pound line, and horizontally, obtaining an uncorrected critical field length of 4,300 feet. Continuing horizontally through a slope of two percent, wind of five knots (50 percent of reported wind), RCR of 12, and RSC of 2.5, the corrected critical field length is 5,350 feet.

To find the maximum take-off weight limited by the critical field length, enter the Critical Field Length chart (figure A3-11) with a corrected critical field length equal to the runway length of 7,000 feet. Read to the left through the RSC, RCR, wind and slope correction curves to an uncorrected distance of 5,250 feet. Continue reading across to a point that intersects

with a take-off factor of 2.05 and read a take-off gross weight of 130,000 pounds plus.

REFUSAL SPEED.

Refusal speed is based on the runway available and is defined as the maximum speed to which the airplane can accelerate with engines at maximum power and then stop within the remainder of the runway available, with two engines in reverse thrust and maximum anti-skid braking.

Refusal speeds are presented in figure A3-12 as a function of take-off factor, available runway length, gross weight, runway surface condition and covering, and wind. The effect of runway slope on speed is negligible. When corrected refusal speed exceeds take-off speed, use take-off speed as refusal speed. Refer to Section III of T.O. 1C-130(A)A-1 for emergency operating procedures. The distance required to accelerate to refusal speed from brake release is defined as refusal distance. Refusal distance can be calculated using the Acceleration Time Check chart, figure A3-23. See example following the Acceleration Time Check paragraph.

WARNING

When computing refusal speed with anti-skid inoperative, decrease runway available by 1400 feet. This correction factor is not valid if wheels lock or tires skid.

Example.

Given:

Gross weight: 120,000 pounds.

Take-off factor: 2.05.

Runway available: 7,000 feet.

Zero wind.

RCR: 12.

RSC: 2.5.

Find:

Refusal speed.

Procedure:

Enter the Refusal Speed and Critical Engine Failure Speed chart (figure A3-12) with the take-off factor of 2.05, move horizontally to the 7,000-foot available runway length line and vertically down to the 120,000-pound weight line. Move horizontally and read an uncorrected refusal speed of 125 KIAS. Enter the wind correction scale with 125 knots, move horizontally to the RCR base (reference) line, and follow the guideline to an RCR of 12. Move horizontally to the RSC zero line, follow the guideline to an RSC of 2.5, and read a corrected refusal speed of 93 KIAS. As shown by this example, the various corrections can reduce the refusal speed by significant amounts. It is possible, therefore, that an uncorrected refusal speed might be greater than take-off speed (which would not be usable) but that the corrections could reduce the refusal speed to a value less than take-off speed. It is important to note that the corrections on the refusal speed chart are never applied to the take-off speed.

CRITICAL ENGINE FAILURE SPEED.

Critical engine failure speed (V_{CEF}) is based on critical field length and is that speed to which the airplane can accelerate, lose an engine, and then either continue to take-off with the remaining engines, or stop in the same total runway distance. Critical engine failure speed may be found from the refusal speed chart by substituting critical field length for available runway length. Acceleration distances are based on all engines set at maximum power, not exceeding 19,400 inch-pounds of torque. Stopping distances are based on two engines in reverse thrust, one engine in ground idle, one propeller windmilling, and maximum braking.

Note

There is no correction factor for computing critical engine failure speed with anti-skid inoperative; however, if corrected anti-skid inoperative critical field length is less than actual field length, corrected anti-skid-inoperative refusal speed can be used as critical engine-failure speed.

Example.

Given:

Critical field length: 5,000 feet.

Gross weight: 120,000 pounds.

Take-Off factor: 2.05.

RCR: 12.

Find:

Critical engine failure speed.

Procedure:

Enter the Refusal Speed and Critical Engine Failure Speed chart (figure A3-12) with the take-off factor of 2.05, move horizontally to the 5,000-foot available runway length line and vertically down to the 120,000-pound weight line. Correct for RCR and read a critical engine failure speed of 92 KIAS.

MINIMUM FIELD LENGTH FOR MAXIMUM EFFORT TAKE-OFF.

WARNING

Maximum effort operation results in take-off speeds which will probably be less than air minimum control speed depending on gross weight, pressure altitude, and outside air temperature.

Note

Maximum effort operation should be utilized only when authorized by the Major Command concerned.

The minimum field length for maximum effort take-off is defined as a minimum field length on which a maximum effort take-off should be attempted. When the runway available equals the minimum field length for maximum effort take-off and an engine failure occurs at or below refusal speed, a stop will be executed. When engine failure occurs above refusal speed, it is questionable if a successful take-off can be accomplished on the remaining runway. The probability of a successful take-off in this instance depends on where in the take-off run engine failure occurs. If engine failure occurs immediately after passing refusal speed, it is probable that a successful take-off cannot be made. The nearer to computed maximum effort take-off speed that engine failure occurs, the greater the probability of a successful three-engine take-off.

WARNING

Do not attempt a three-engine liftoff at the computed maximum effort take-off speed. Increase airspeed as much as possible above maximum effort take-off speed, up to air minimum control speed, before a liftoff is attempted.

Note

Because of the many variables encountered, the final decision to abort or attempt to take-off must remain with the pilot.

Example.

Given:

Take-off factor: 1.15.

Gross weight: 120,000 pounds.

Slope: 2 percent uphill.

Wind: 10-knot tailwind.

RCR: 12.

RSC: 2.5.

Find:

Minimum field length for maximum effort take-off.

Maximum effort decision speed.

Refusal speed.

Procedure:

Enter figure A3-13 with the take-off factor of 1.15, move vertically to the 120,000-pound line and read at the right an uncorrected minimum field length of 2,175 feet. Continue on sheet 2 of figure A3-13 correcting for slope, wind, RCR, and RSC and obtain a minimum field length of 3,900 feet.

CLIMB-OUT FLIGHT PATH.

The climb-out factor (figures A3-14 and A3-16) depends on gross weight, take-off factor and drag index. The climb-out flight path charts show the climb-out flight paths for various values of climb-out factor. Figure A3-2 shows a typical climbout flight path profile. Figures A3-14 and A3-16 show the 4-engine and 3-engine 50 percent flaps climbout. The 4-engine climb-out flight path is based on 4-engine acceleration to lift-off and gear retraction initiated 3 seconds after lift-off while the airplane climbs at obstacle clearance speed. After gear retraction, the airplane accelerates to flap retraction speed, at which time flap retraction is initiated. After the flaps are up, the airplane is accelerated to the best climb speed and continues climbing at that speed. The 3-engine climb-out flight path charts are based on 4-engine acceleration from brake release to critical engine failure speed, and 3-engine acceleration from critical engine failure speed throughout the climb-out. The charts also assume gear retraction initiation 3 seconds after take-off and propeller feathering initiation 6 seconds after take-off.

CLIMB OUT FLIGHT PATH PROFILE

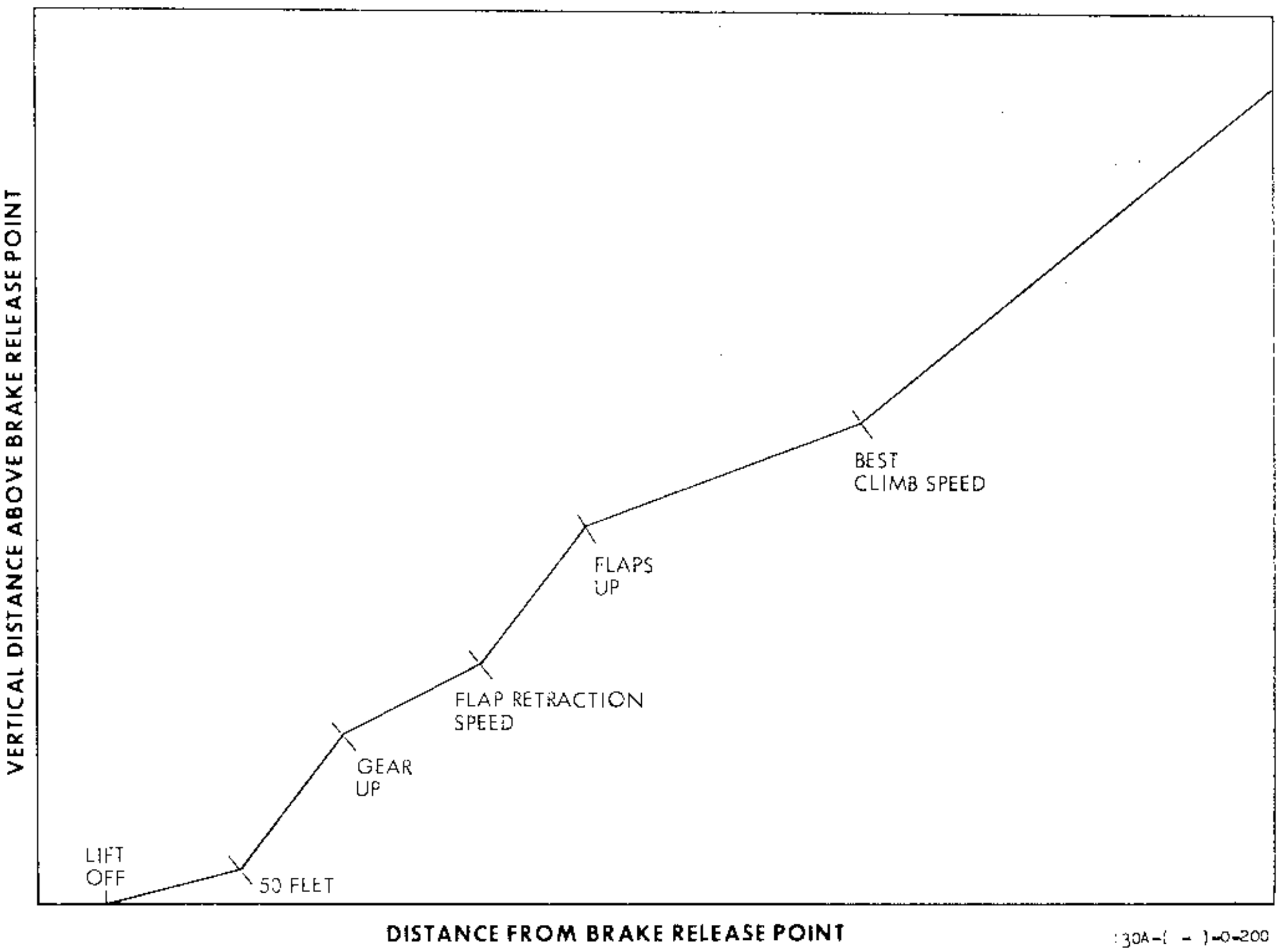

Figure A3-2.

These charts permit the determination of obstacle distance from brake release required to clear a given obstacle height as a function of climb-out factor. The critical field length portion of the total distance shown is for a dry level runway.

Note

For other than dry runway conditions or with an uphill slope, critical field length is extended, resulting in a reduced inflight distance to the obstacle. For this case, it is necessary, before entering the chart, to decrease the known distance from brake release by the difference between actual critical field length (corrected for existing RCR, RSC, and slope) and the critical field length for dry level runway. In determining the corrected critical field length do not apply a correction for headwind but always apply tailwind. Refer to paragraph entitled Application of Winds to Take-off and Landing in this Part.

FOUR-ENGINE CLIMB-OUT.

Example.

Given:

Take-off factor: 2.05.

Gross weight: 120,000 pounds.

Obstacle: 1,500 feet high, four miles from brake release.

Flaps: 50 percent.

Drag index +80

Find:

Climb-out factor.

Height of airplane four miles from brake release.

Procedure:

To find the climb-out factor, enter the Climb-out Factor for Climb-out Flight Path chart (figure A3-14) with the take-off factor of 2.05, move horizontally to the 120,000-pound weight line, and read a climb-out factor of 138 for a drag index of zero. Follow parallel to the guidelines to a drag index of +80 move vertically downward from +80 to read a climb-out Factor of 152.

To find the height of the airplane four miles from brake release, enter the 4-Engine Climb-out Flight Path chart (figure A3-15) with four miles, move vertically up to the 152 climb-out factor line, and read a vertical distance of 1100 feet. Therefore, the airplane will not clear the obstacle.

To find the weight at which the airplane will clear the obstacle enter the Climb-out Flight Path chart (figure A3-15) with four miles from brake release on the horizontal scale and with 1,500 feet on the vertical scale. The intersection of these two lines determines the climb-out factor of 137. Enter the Climb-out Factor chart (figure A3-14) with this factor (137) and at the intersection for the given take-off factor read a gross weight of 111,000 pounds.

THREE-ENGINE CLIMB-OUT.

The three-engine climb-out factor (figure A3-16) and the three-engine flight path (figure A3-17) charts are used in the same manner as the four-engine data. If an uncorrected critical field length is a known factor and corrections for slope, RCR, and RSC are applied, the obstacle distance must be decreased by the difference between actual and uncorrected critical field length.

Example.

Given:

Climb-out factor: 120.

Uncorrected critical field length: 4,500 feet.

Runway slope: 2 percent uphill.

Flaps: 50 percent.

RCR: 12.

RSC: 2.5.

Find:

Height at 15,000 feet from brake release.

Procedure:

Enter the Critical Field Length Correction chart (figure A3-11) with the given uncorrected critical field length of 4,500 feet. Continue through the slope, RCR, RSC correction guide (do not correct for wind), obtaining a corrected critical field length of 6,250 feet. The increase in critical field length is 6,250 minus 4,500, or 1,750 feet. In using the Climb-out Flight Path chart, the obstacle distance must be decreased by the difference between actual and uncorrected critical field length. Now enter the 3-Engine 50 Percent Flap, Climb-out Flight Path chart (figure A3-17) with the adjusted obstacle distance of 15,000 feet minus 1,750 = 13,250. Move vertically to the climb-out factor line of 120 and read an airplane height of 690 feet.

TAKE-OFF SPEEDS.

All operational speeds for use during take-off and climb-out have been established to provide adequate margins above stall speed, to guarantee comfortable flight characteristics, and to provide tolerance for gusts and for the maneuvering which may be required in following a proper flight path. Due to the position errors inherent in airspeed measuring system, the indicated stall speeds (Section VI of T.O. 1C-130(A)A-1 must be corrected prior to the increase by specific percentage margins. The position error is then applied to the increased speed to obtain the indicated take-off or obstacle clearance speed. The appropriate margins are used to define the take-off and obstacle clearance speeds which are shown in the speed charts and all the performance has been computed using those speeds.

TAKE-OFF AND OBSTACLE CLEARANCE SPEEDS.

The normal and maximum effort take-off and obstacle clearance speeds are obtained from figure A3-18. These speeds are the same for a four- or three-engine take-off. The flap setting for take-off is 50 percent. When air minimum control speed (one-engine-inoperative, in ground effect) is greater than the chart take-off speed, use this air minimum control speed for take-off speed. The obstacle clearance speed for this condition is the chart obstacle clearance speed or air minimum control speed (one-engine-inoperative, in ground effect), whichever is greater. For a normal take-off, the minimum flap retraction speed is obstacle clearance speed; however, normal flap retraction speed is take-off speed plus 20 KIAS. The minimum flap retraction speed for a maximum effort take-off is obstacle clearance speed plus 10 KIAS. The normal take-off speeds are equal to 1.1 times the power-off stall speed and the normal obstacle clearance speeds are equal to 1.2 times the power-off stall speed. The maximum effort take-off and obstacle clearance speeds are 1.2 and 1.3 times the power-on stall speed, respectively.

AIR MINIMUM CONTROL SPEEDS.

Minimum control speed is defined as the minimum speed at which directional control of the airplane can be maintained for a set of specified conditions. With one engine inoperative, the air minimum control speed is the minimum speed for directional control with maximum power on all operative engines, the inoperative engine propeller windmilling on NTS, full rudder deflection, or 180 pounds of pedal force and five degrees of bank away from the failed engine. The two-engine inoperative air minimum control speed is the minimum speed for directional control with the two engines inoperative on the same side, with the propeller feathered on the inboard inoperative engine and the propeller windmilling on NTS on the outboard, the operative engines at maximum power, full rudder deflection, or 180 pounds of pedal force and with five degrees of bank away from the failed engines. Increasing the bank away from the failed engine reduces air minimum control speed because of the favorable effect of the sideslip angle which must accompany the increased bank angle. The yawing tendency caused by both asymmetric thrust and windmilling drag of the failed engine is increased with decreasing speed. This yawing tendency must be balanced by the aerodynamic controls, which become less effective with decreasing speed. The air minimum control speed is then the minimum speed at which the yawing tendency caused by the asymmetric thrust and windmilling propeller can be balanced with maximum rudder at the specified bank angle.

Air minimum control speed is presented for in and out of ground effect figures A3-19 and A3-20. The airplane is in ground effect for approximately one-half the wing span.

Example.

Given:

Gross weight: 120,000 pounds.

Pressure altitude: 2,000 feet.

Outside air temperature +10° C.

Find:

Normal take-off and obstacle clearance speed.

Air minimum control speed, one engine inoperative, in ground effect.

Procedure:

Enter the Take-off and Obstacle Clearance Speed chart (figure A3-18) with the gross weight of 120,000 pounds, move vertically up, read at the take-off speed line 109.5 KIAS, and at the obstacle clearance speed 121.5 KIAS. Now enter the Air Minimum Control Speed chart (figure A3-19), one engine inoperative with the outside air temperature of +10°C, move up to the pressure altitude of 2,000 feet, and read an air minimum control speed of 101 KIAS. This speed is less than the take-off speed and the air minimum control speed is not limiting.

TAKE-OFF GROUND RUN CHARTS.

The take-off ground run is defined as the distance required to accelerate to take-off speed and leave the runway. These distances are presented as a function of gross weight, take-off factor, runway slope, wind, and RSC, and are based on all engines set at maximum power during the take-off run.

NORMAL TAKE-OFF.

Figure A3-21 is for a normal take-off using the normal take-off and obstacle clearance speeds from figure A3-18 and normal take-off procedures.

THREE-ENGINE TAKE-OFF AND CLIMB-OUT.

The three-engine take-off performance from brake release is based on the take-off speed or one-engine inoperative air minimum control speed in ground effect, whichever is greater, and on the propeller being feathered on the inoperative engine or altogether removed. The procedure to use for a three-engine take-off is described in T.O. 1C-130(A)A-1 Section III. Figure A3-30 represent three-engine take-off performance based on take-off and obstacle clearance speeds shown in figure A3-18.

The three-engine obstacle clearance distance from brake release can be determined using the Three-Engine Climb-out Flight Path chart (figure A3-17). The horizontal distance in figure A3-17 includes the critical field length, which is different from the three-engine take-off distance (figure A3-30). In order to use the Climb-out Flight Path chart, 3 engines, figure A3-17 sheet 2, determine for the given conditions the critical field length and subtract it from the three-engine take-off distance. The obstacle distance has to be reduced by this positive difference prior to establishing the climb-out capability.

Example.

Given:

Take-off factor: 2.23.

Gross weight: 120,000 pounds.

Runway slope: 2 percent uphill.

Wind: 10-knot headwind tower reported.

Obstacle height: 200 feet.

Obstacle distance from brake release: 10,000 feet.

Find:

Take-off ground run on three engines from brake release, climb-out capability.

Procedure:

Enter the Take-off Ground Run (figure A3-30), 3 Engines chart with the take-off factor of 2.23, read up to the weight line of 120,000 pounds and, applying the slope and wind correction as shown before, find the ground run to be 7,150 feet. Now enter, with the same take-off factor, the Critical Field Length chart (figure A3-11) and subtract this uncorrected field length from the ground run (7,150 - 4,500 = 2,650). Enter figure A3-17 sheet 2 with the obstacle distance of 7,350 feet reduced by the difference above (10,000 - 2,650 = 7,350 feet). Move up to the climb-out factor of 145 from figure A3-11 and find a vertical height above brake release of 43 feet.

ACCELERATION CHECK TIME DURING TAKE-OFF GROUND RUN.

The take-off performance, as shown on the charts, can be realized only if normal acceleration is attained. Dragging brakes, excess flap deflection, low power output, and similar factors will reduce the rate of acceleration. The Acceleration Check Time chart (figure A3-23) provides the time normally required to accelerate to a given speed. The acceleration check should be made at speeds approximately 10 knots below the refusal speed. The chart also shows the effects of runway slope and wind on acceleration time. To obtain the true time, a correction grid for altitude (SMOE) is provided.

This chart can also be used to determine the refusal distance by multiplying the refusal speed by the true time and a constant of .845.

Example.

Given:

Altitude: 1,000 feet.

Outside air temperature: +30° C.

Take-off factor: 2.05.

Gross weight: 120,000 pounds.

Runway available: 4,500 feet.

Refusal speed: 95 knots.

Check speed: 85 knots.

Runway slope: 2 percent uphill.

Wind: 10-knot headwind.

RCR: 12.

RSC: 2.5.

Find:

True time to accelerate to given check speed.

Procedure:

Enter figure A3-23 with the take-off factor of 2.05. Move to the 120,000-pound weight line, and then vertically down to the check speed line of 85 KIAS. This check speed is derived from refusal speed (95 KIAS) minus 10 KIAS. Find an uncorrected time of 22 seconds. Correct this in the normal manner for runway slope and wind. (Note that 100 percent of the wind is to be used.) From figure A1-6 find the SMOE factor of 1.046 for an altitude of 1,000 feet and outside air temperature of +30° C. This results in the corrected true time of 24 seconds.

Example.

Given:

Same as example above.

Find:

Refusal distance.

Procedure:

Proceed as in the example above, but use the refusal speed as check speed. Find a true time of 29 seconds. The refusal distance is then the true time multiplied by .845 V_R, where .845 V_R is the average speed in knots coverted to feet/second. Refusal distance = .845 x 29 x 95 = 2328 feet.

RUNWAY SLOPE CORRECTION GRID.

The critical field length chart and the normal take-off ground run charts contain a correction grid for runway slopes up to 5 percent. To correct ground run for slopes greater than 5 percent, the Effect of Runway Slopes on Normal Take-off Distance and Critical Field Length chart (figure A3-24) must be used. The chart is entered with a ground distance (critical field length or take-off ground run) only. After determination of the ground distance with slope, return to the respective chart and continue to apply the other corrections. The limit shown on the uphill slopes is where the airplane climb capability is equal to the runway slope with one-engine inoperative, and should be respected as a limit on take-off unless the mission requires the risk involved. The limit shown on downhill slopes represents the slope below which the critical engine failure speed is less than 60 knots. Critical engine failure speeds below 60 are not shown on the critical engine failure speed chart because of inaccuracies inherent in airspeed systems at these lower speeds.

Example.

Given:

Altitude of 1000 feet.

Uncorrected critical field length: 5,480 feet.

Tower reported wind: 10-knot headwind.

Flap setting: 50 percent.

Runway slope: 5 percent uphill.

RCR: 12.

RSC: 2.5.

Find:

Corrected critical field length.

Procedure:

Enter the Effect of Runway Slope on Normal Take-off Distance and Critical Field Length chart (figure A3-24) with the uncorrected critical field length of 5,480 feet and move vertically. The critical field length limit due to zero rate of climb capability line is intersected after the +5 percent slope line is reached. This shows that one-engine-out climb capability to 50 feet is greater than the slope. Therefore, the take-off may be attempted.

TORQUE SETTING FOR MAXIMUM POWER

AIR CONDITIONING AND PRESSURIZATION
BLEED ON

STATIC MAXIMUM POWER 971 °C TIT
100 PERCENT RPM

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. The torque increase due to ram rise will be as follows:

Temp °C	Torque In. Lb.
-50	+1000
-25	+900
0	+760
+25	+600
+50	+450

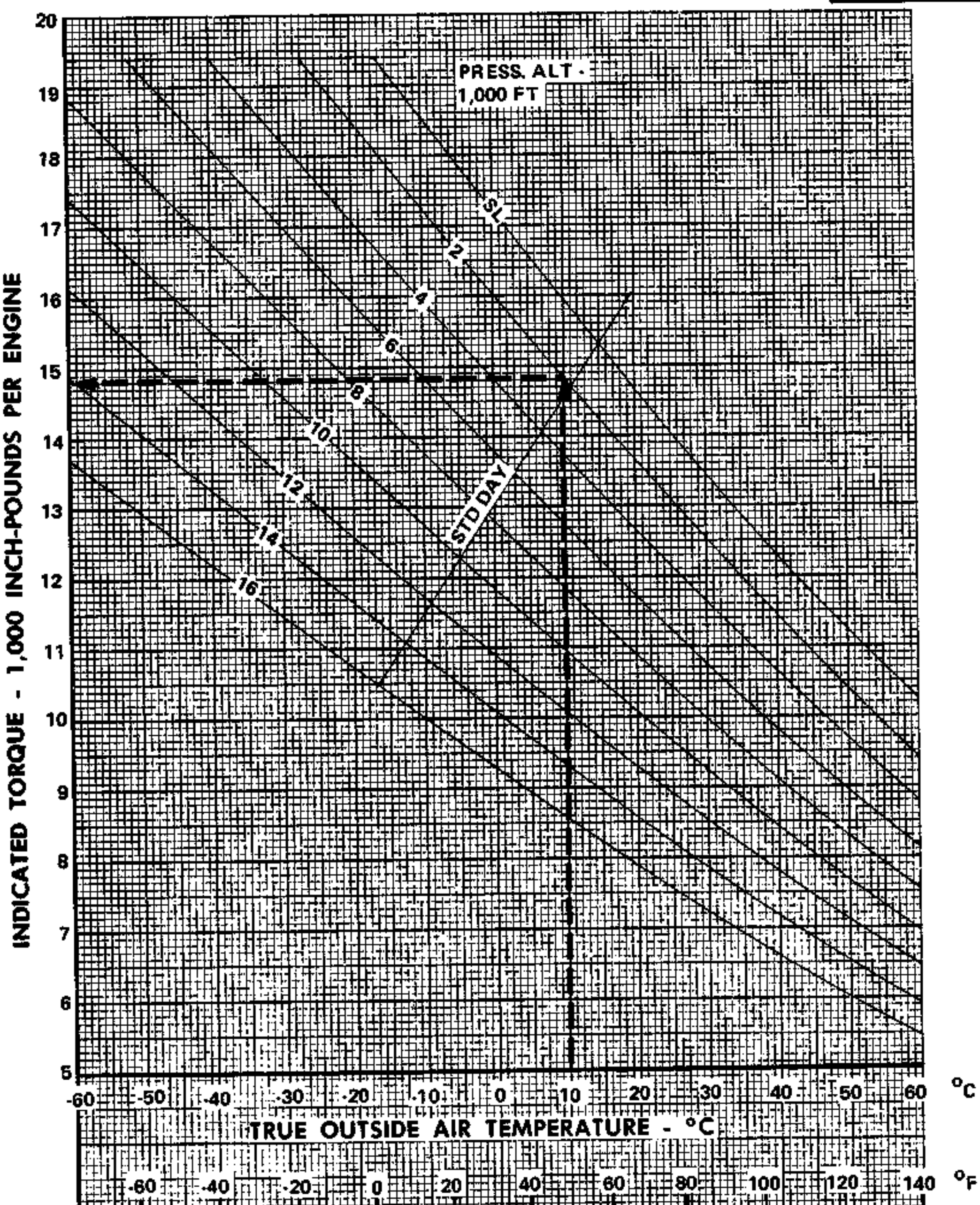

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Figure A3-3.

BLEED EFFECT ON TAKE-OFF POWER

4 ENGINES STATIC

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

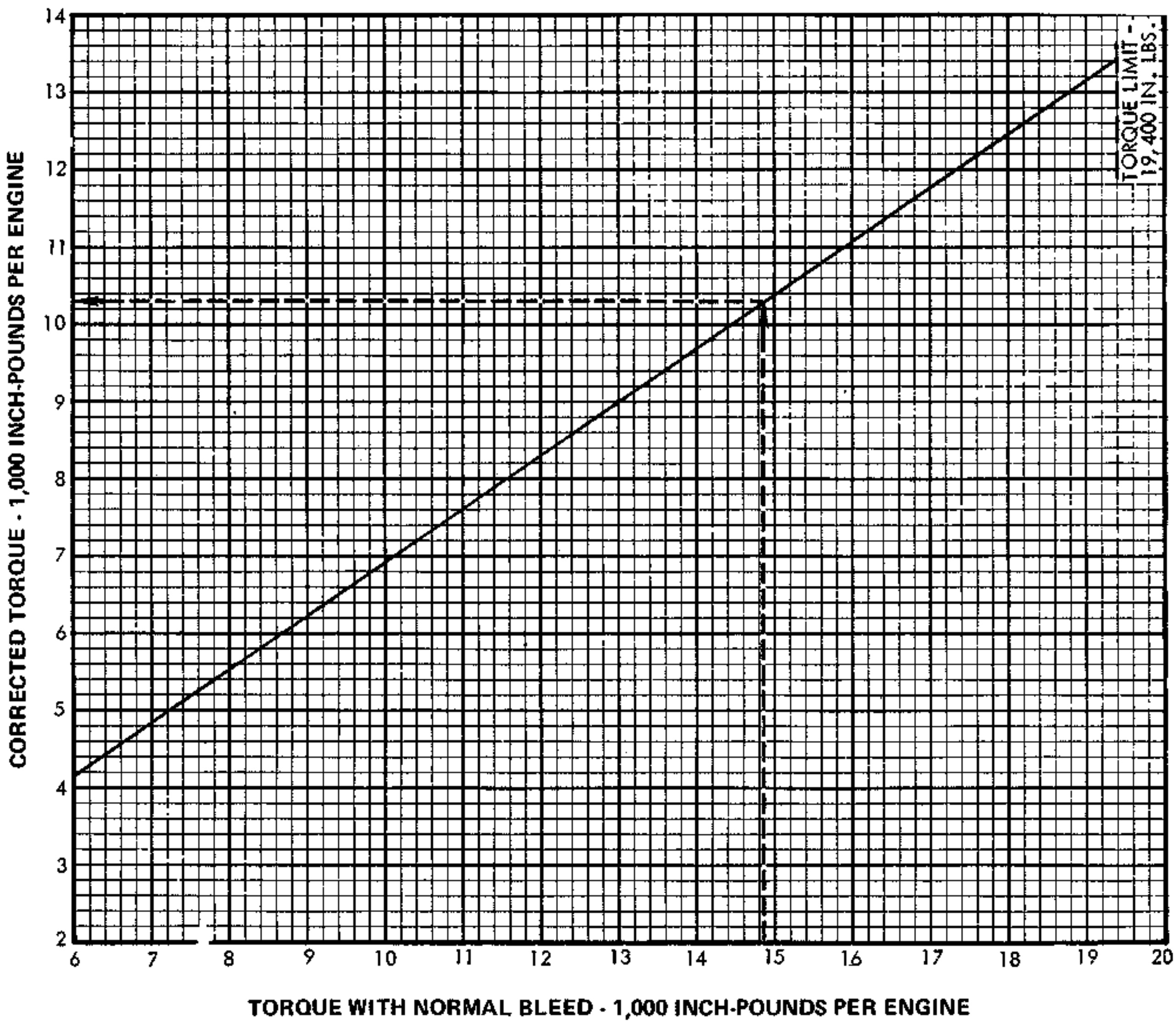

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Figure A3-4.

TAKE-OFF FACTOR

NORMAL BLEED

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

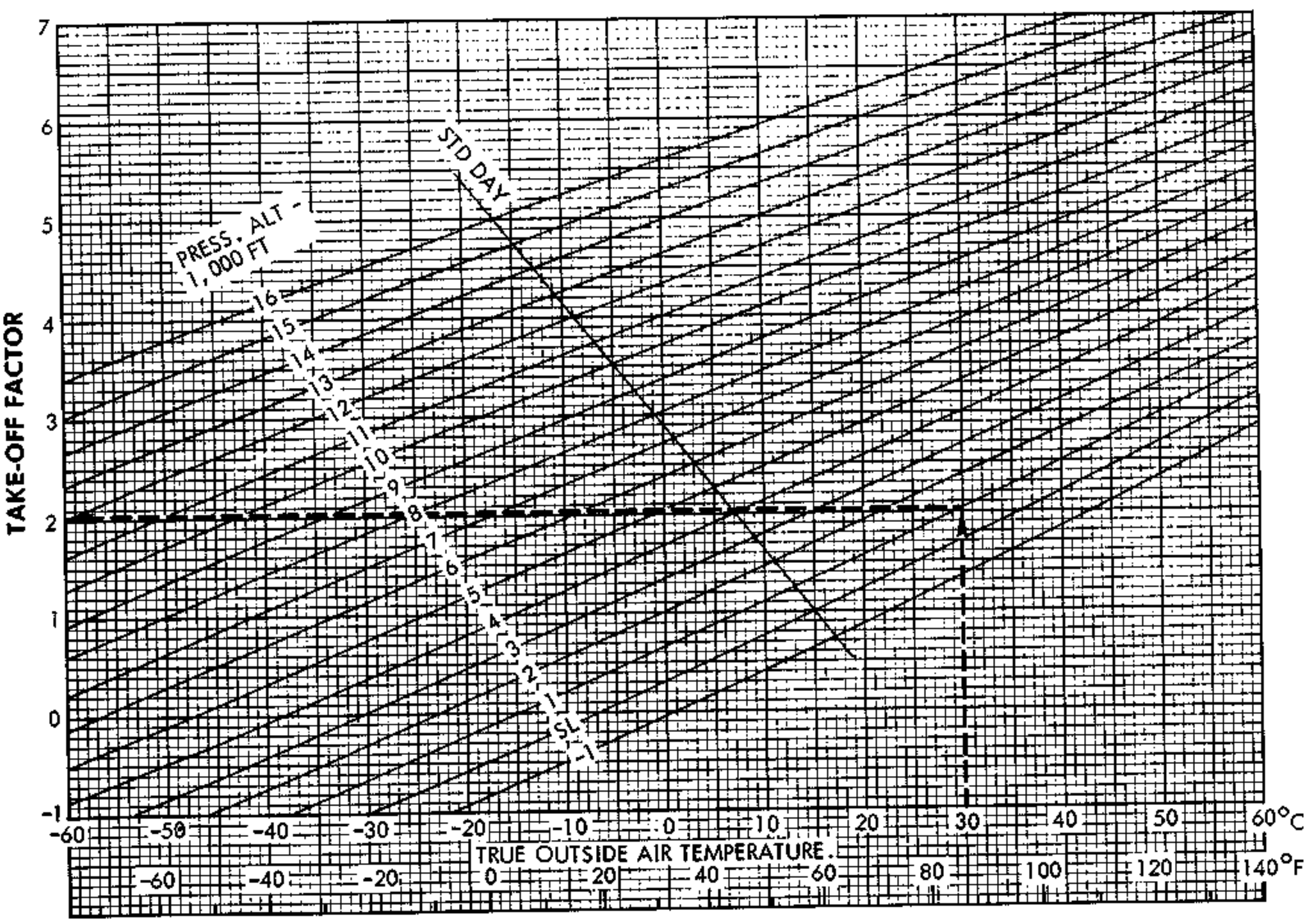

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Figure A3-5

BLEED EFFECT ON TAKE-OFF FACTOR

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

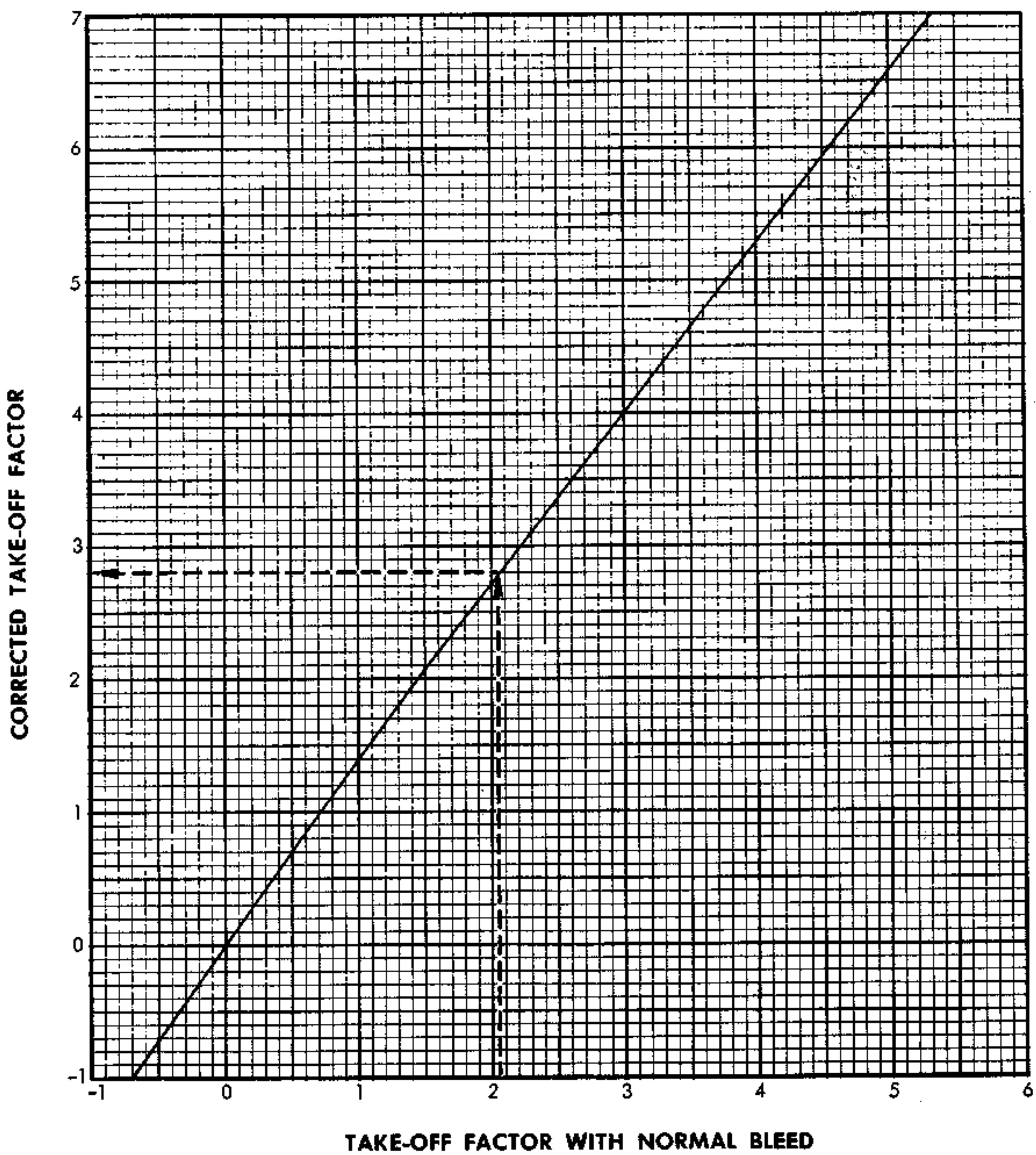

Figure A3-6.

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: *PHASE IV FLIGHT TEST*

TAKE-OFF GROSS WEIGHT LIMITED BY THREE ENGINE CLIMB PERFORMANCE

50 PERCENT FLAPS
OUT OF GROUND EFFECT
GEAR UP
MAXIMUM POWER

NOTE

1. Rate of climb for $1.2V_S$ (Power-Off) or V_{MCA} (one-engine-inoperative in Ground Effect).
2. Propeller feathered on inoperative engine.
3. Observe engine power limitations in Section V of T.O. 1C-130A-1.

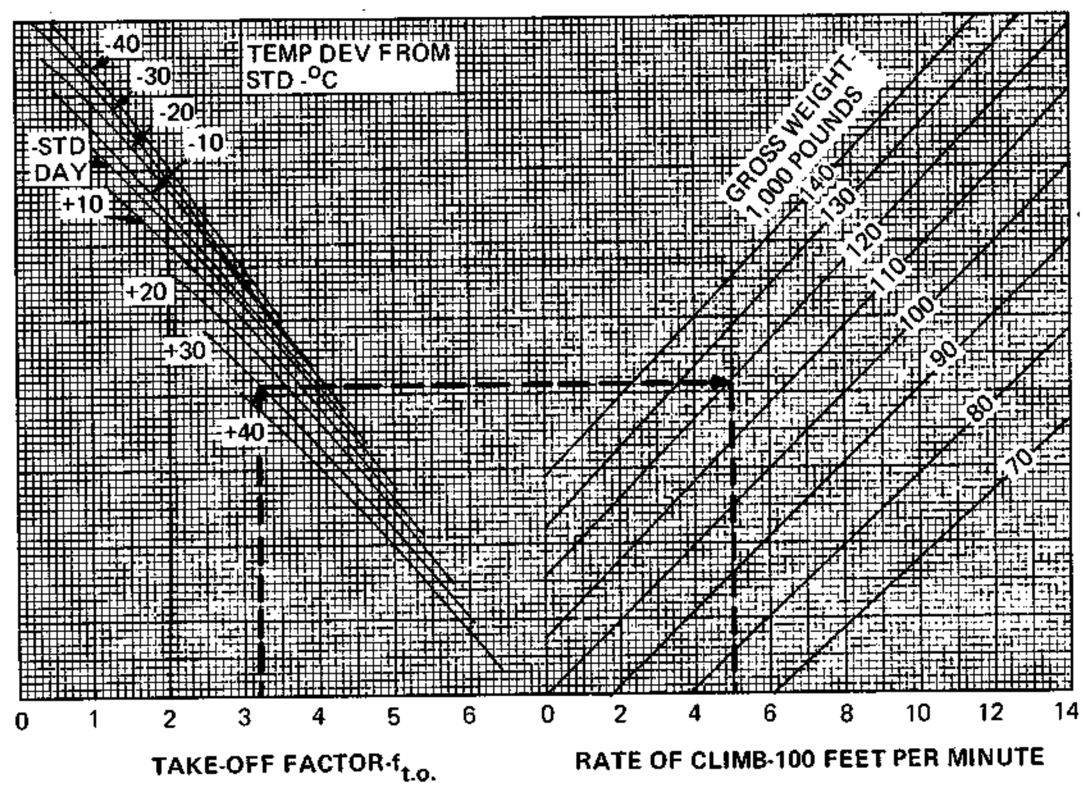

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Figure A3-7.

TAKE-OFF GROSS WEIGHT LIMITED BY THREE ENGINE CLIMB PERFORMANCE FOR VARIANT CONFIGURATION

GEAR UP
MAXIMUM POWER

50 PERCENT FLAPS
OUT OF GROUND EFFECT

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

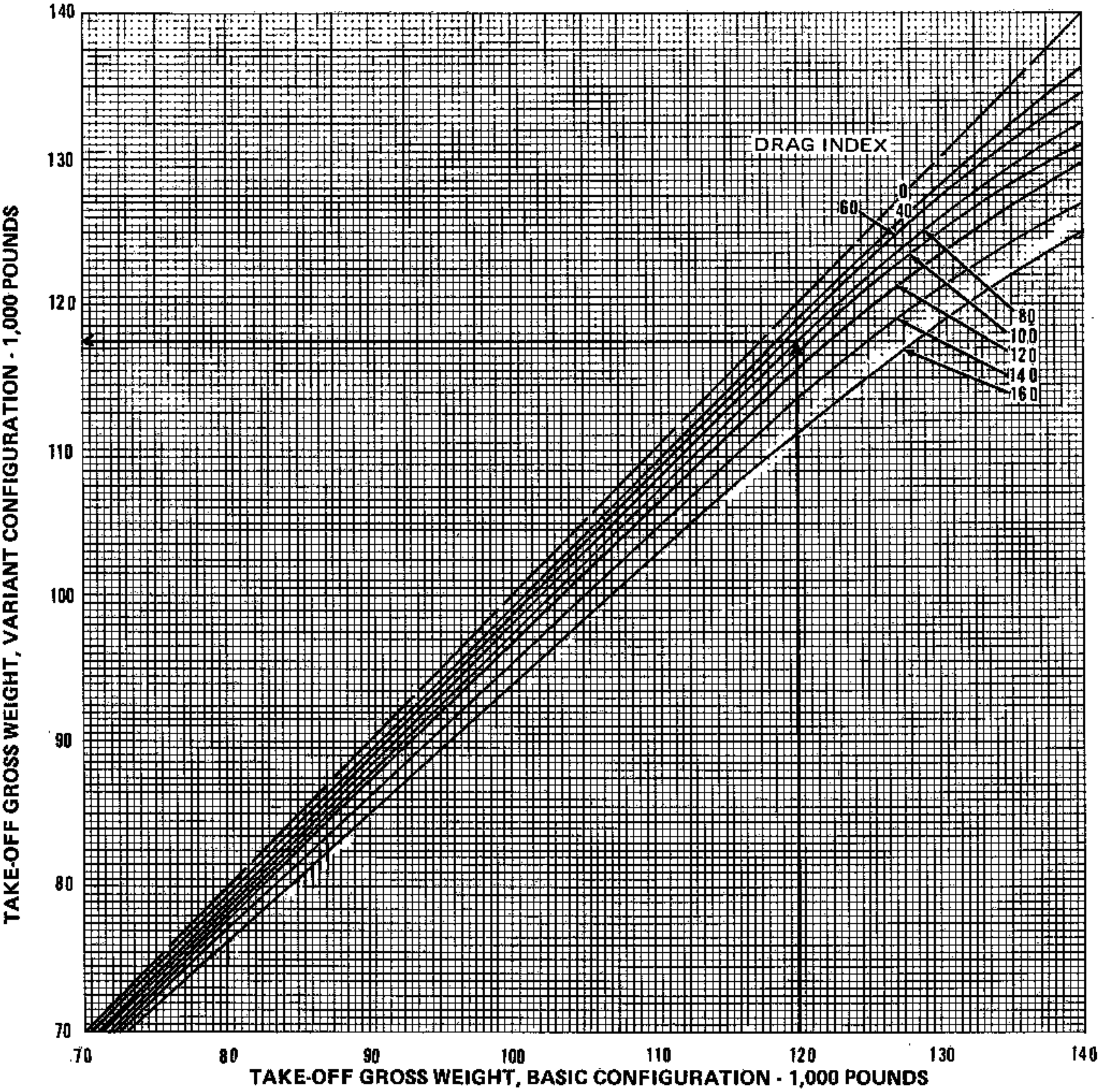

Figure A3-8.

MAXIMUM RECOMMENDED CROSSWIND FOR TAKEOFF

MODEL: AC-130A
T56-A-9 ENGINES

DATE: MAY 1974
DATA BASIS: ESTIMATED

NOTE

1. Elevators and ailerons in neutral position.
2. Symmetrical power from engines.
3. Brakes not applied.
4. Do not exceed recommendations of figure A3-10

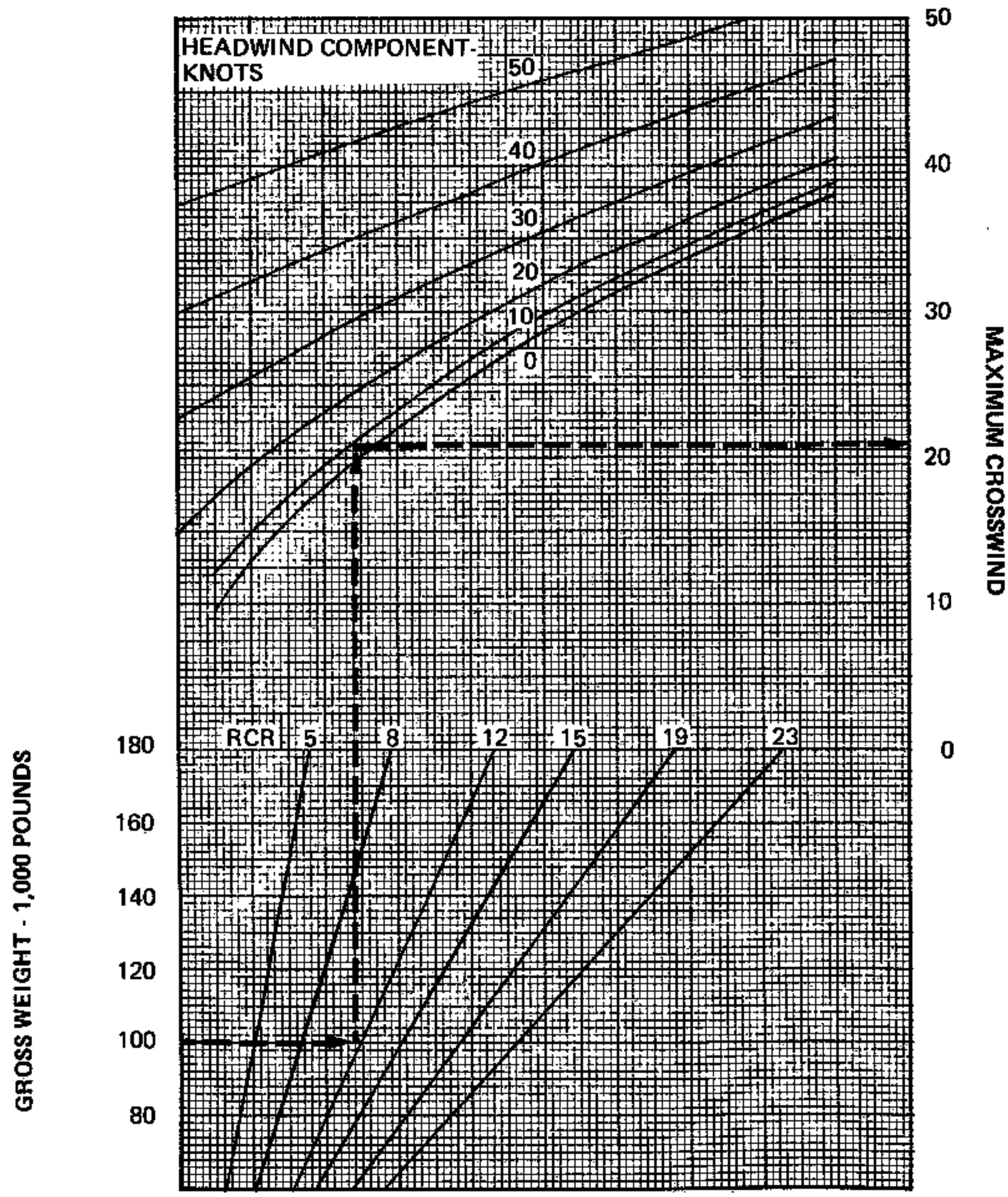

Figure A3-9.

MODEL: AC-130A
T56-A-9 ENGINES

TAKE-OFF CROSSWIND CHART

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

EXAMPLE:

GIVEN: Take-Off Runway 12. Wind 180° at 20 knots gusting at 32 knots. Gross weight 120,000 pounds.

FIND: Is take-off in normal zone at predicted take-off speed.

SOLUTION:

1. From take-off speed chart determine predicted take-off speed of 104.5 knots.
2. Runway wind angle is (180° - 120°)60°.
3. At wind velocity (with gusts) of 32 knots and 60° runway wind angle, find crosswind component of 27 knots.
4. Proceed to predicted take-off speed of 104.5 knots and determine take-off is in the CAUTION zone.
5. Increase the take-off speed until the RECOMMENDED zone is reached or until the airspeed has been increased 10 knots. The new take-off speed is 114.5 knots and is in the CAUTION zone.

REMARKS

See text for explanation of crosswind take-offs. If take-off is made in the CAUTION zone, a slight yaw may be expected between rotation and lift-off.

See Section II for crosswind taxiing capabilities.

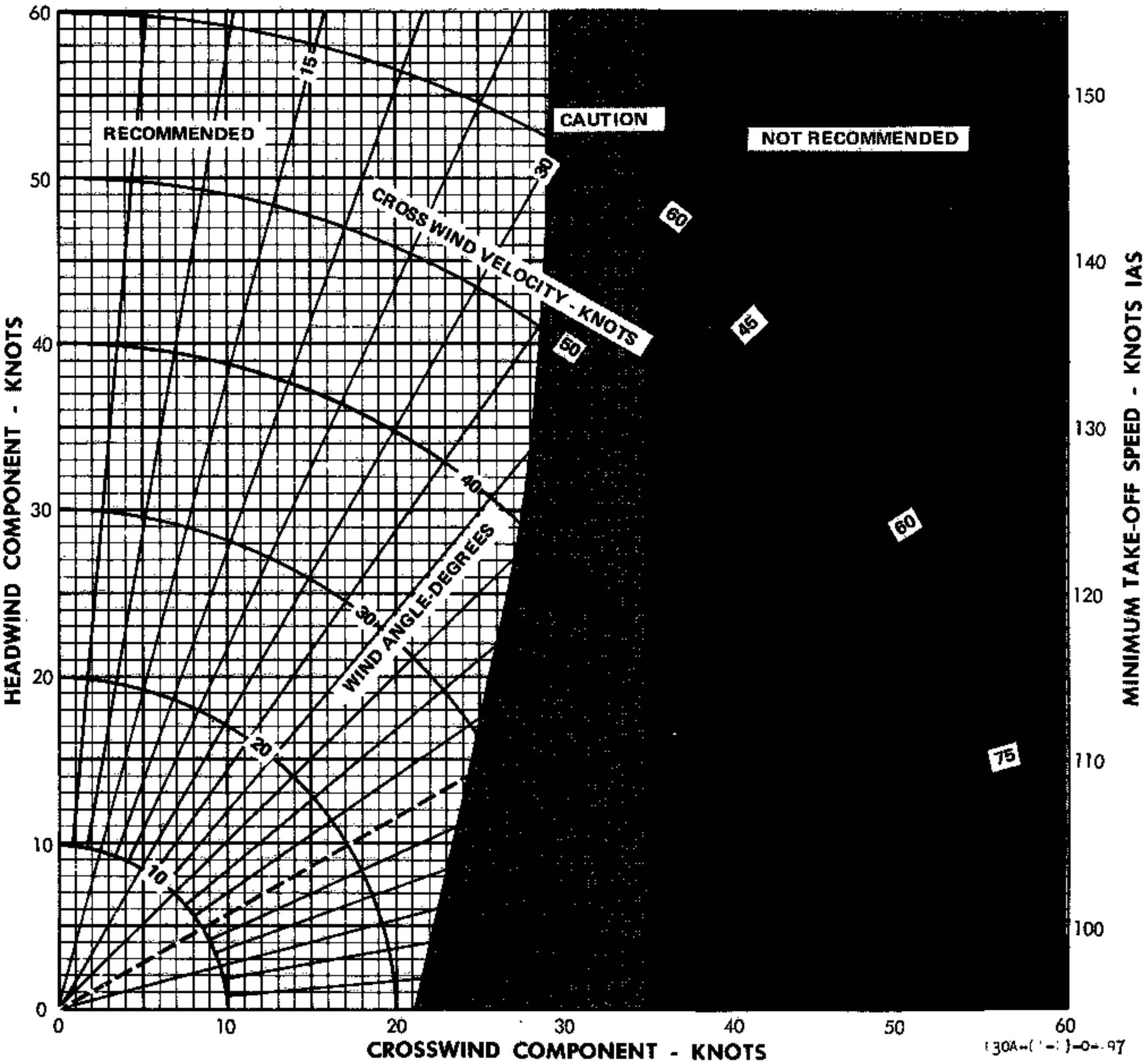

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Figure A3-10.

CRITICAL FIELD LENGTH

4 ENGINES MAXIMUM POWER
50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Stop based on two engines reverse. One engine in ground idle. One propeller windmilling and with maximum anti-skid braking.
2. An RSC value of 10 is equivalent to one inch of slush or water.

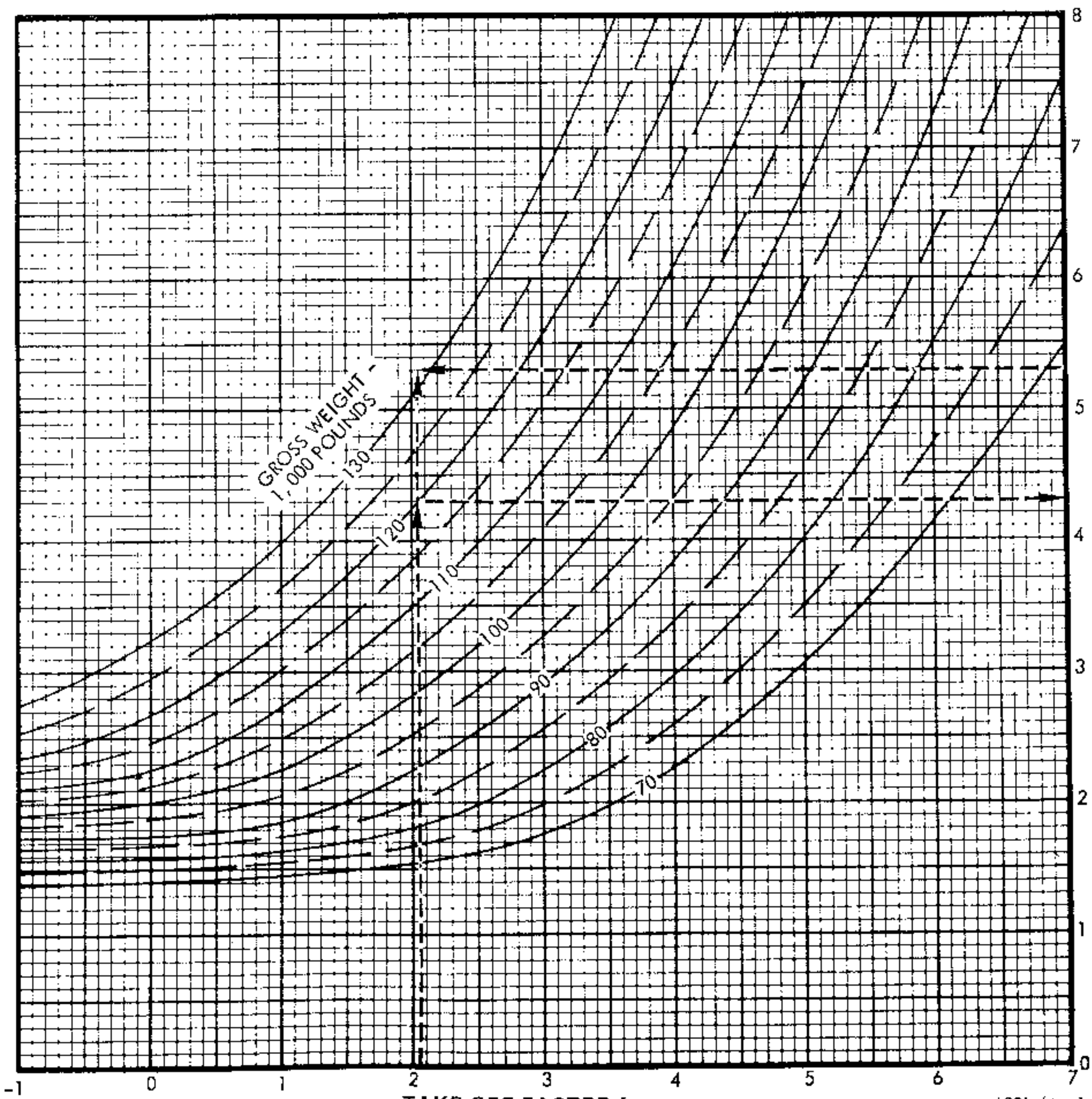

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Figure A3-11. (Sheet 1 of 2)

CRITICAL FIELD LENGTH

4 ENGINES MAXIMUM POWER

50 PERCENT FLAPS

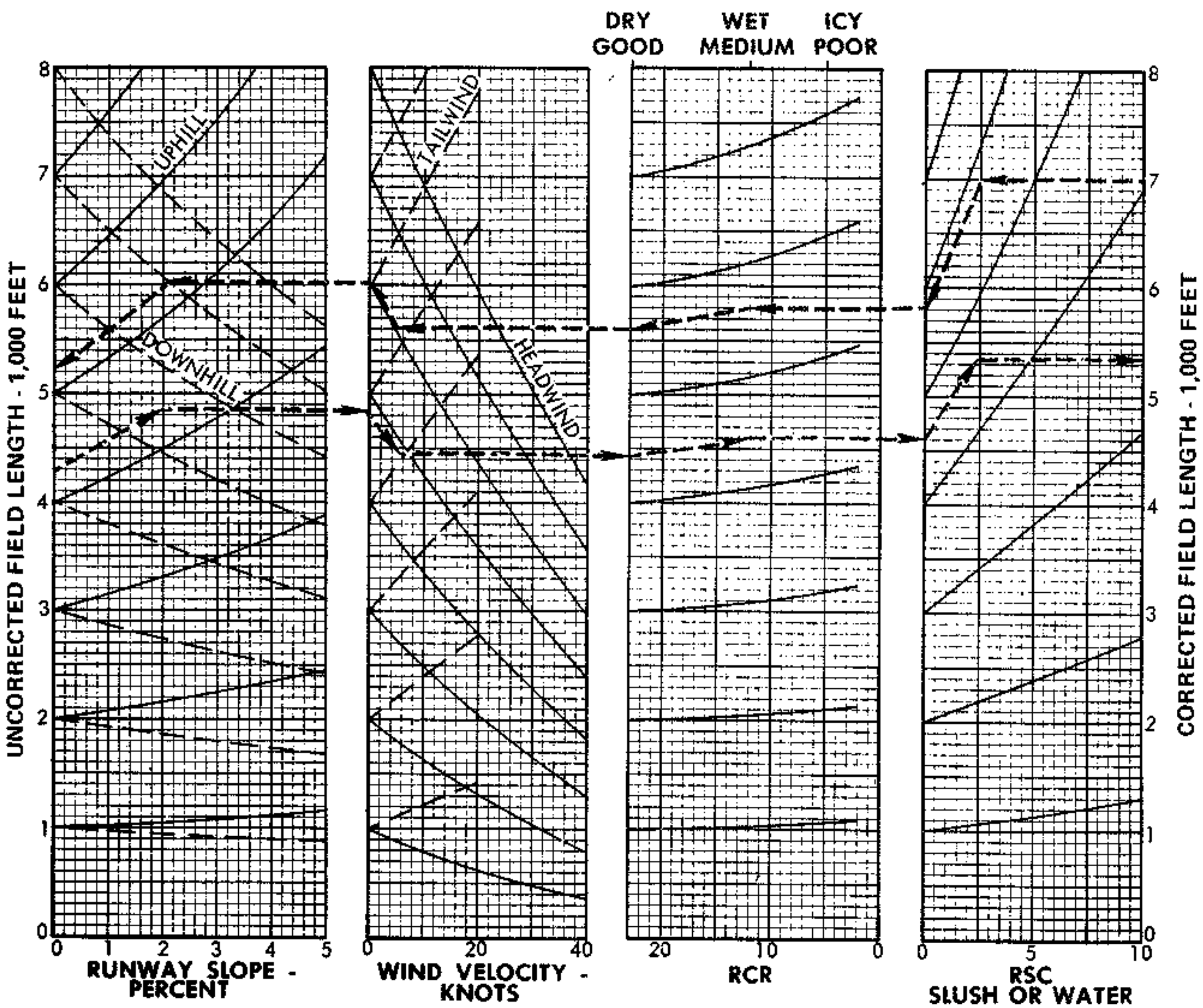

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Figure A3-11. (Sheet 2 of 2)

REFUSAL SPEED AND CRITICAL ENGINE FAILURE SPEED

50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

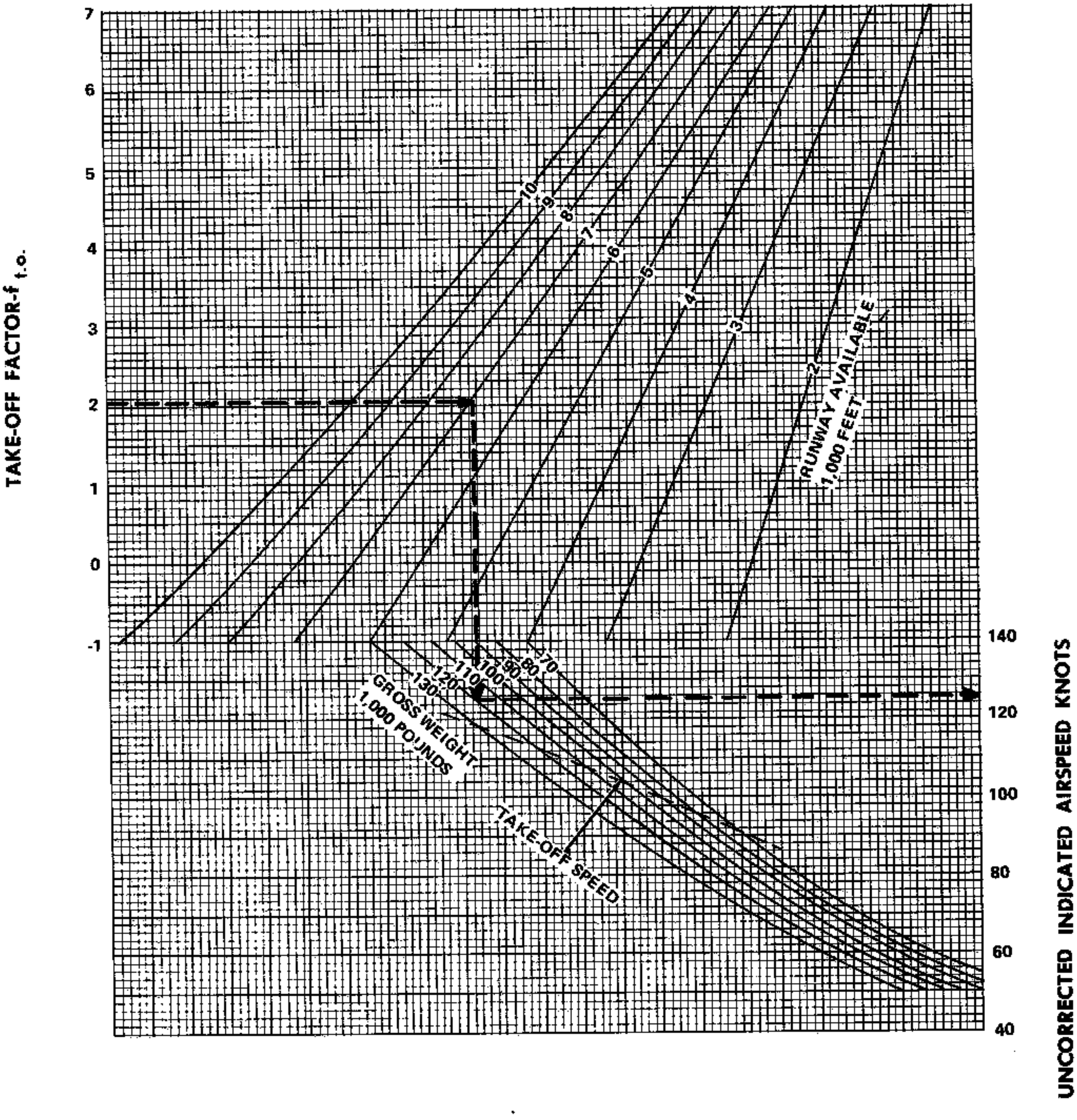


Figure A3-12. (Sheet 1 of 2)

REFUSAL SPEED AND CRITICAL ENGINE FAILURE SPEED

50 PERCENT FLAPS

NOTE

1. Based on engines set at maximum power.
2. Stop based on two engines in reverse, one engine in ground idle, one propeller windmilling, and with maximum anti-skid braking.
3. When refusal speed exceeds take-off speed, use take-off speed as refusal speed.
4. For determination of critical engine failure speed, use corrected critical field length as runway length.
5. When an RCR value is not available, the following representative values are recommended as typical of the conditions noted:

Condition	RCR
Dry Runway	23
Wet Runway	12
Icy Runway	5

6. An RSC value of 10 is equivalent to one inch of slush or water.
7. Runway slope effect on speed is negligible.

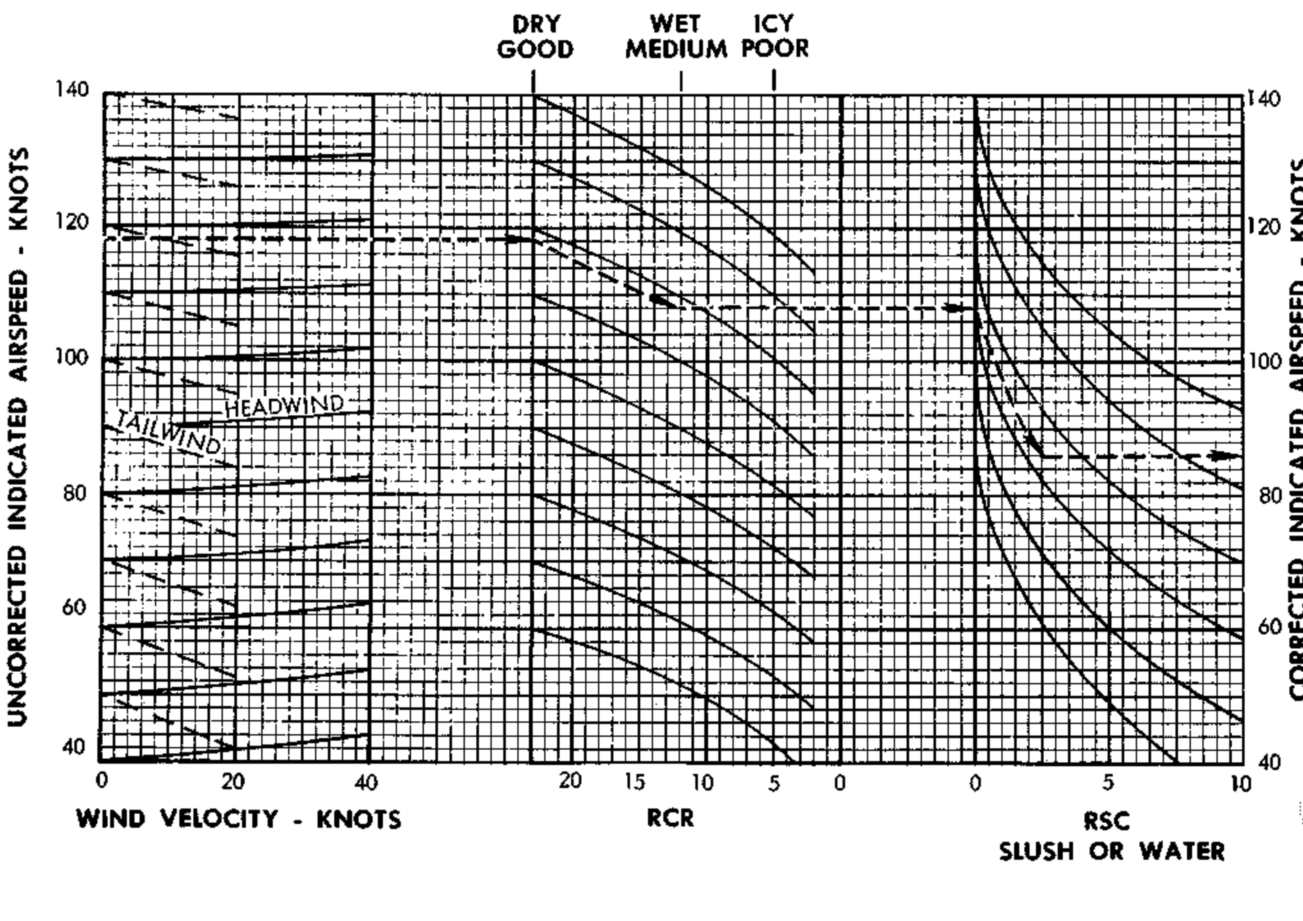


Figure A3-12. (Sheet 2 of 2)

MINIMUM FIELD LENGTH FOR MAXIMUM EFFORT TAKE-OFF

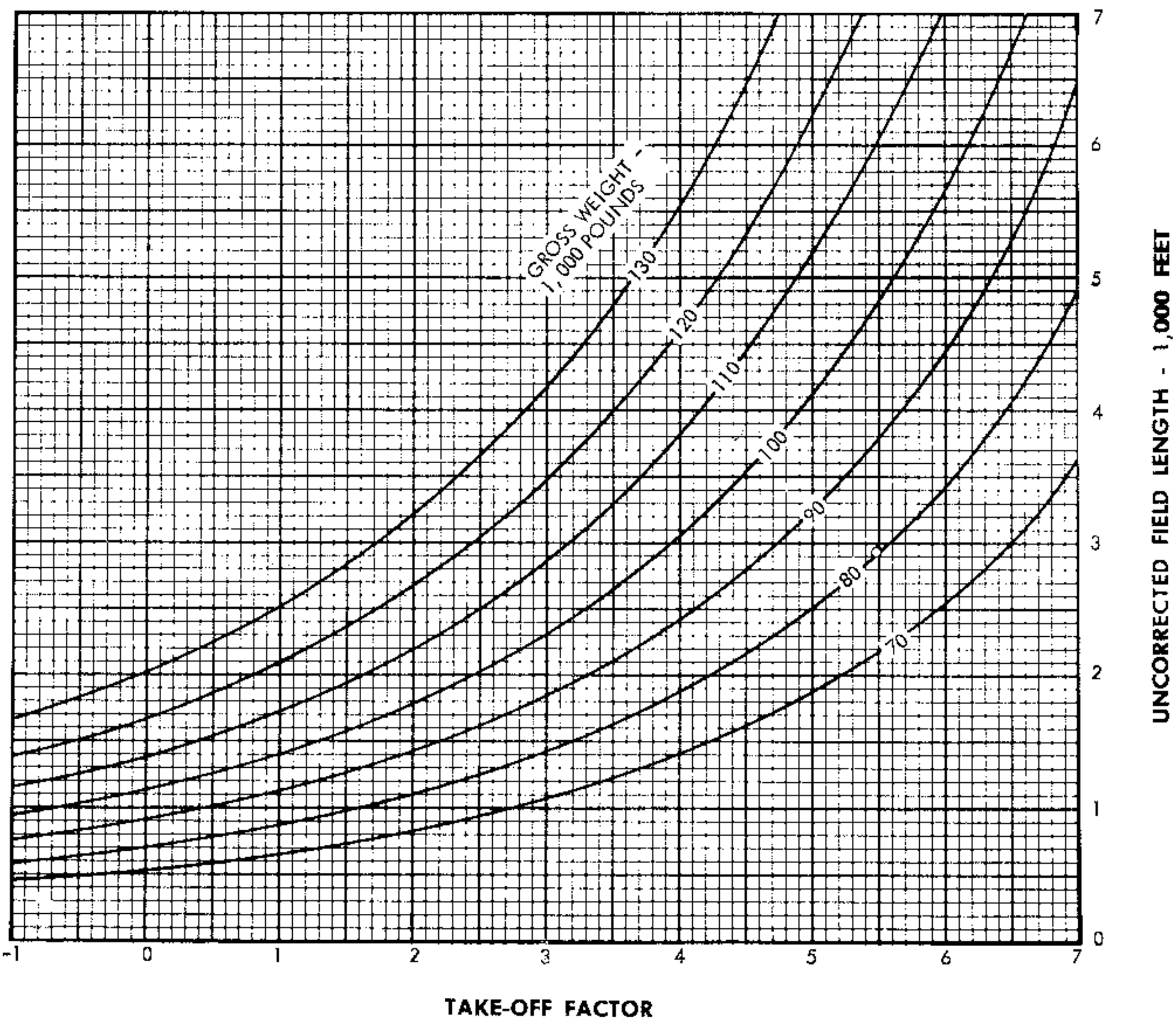
50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Based on 4 engines maximum effort take-off.
2. No considerations have been allowed for the restriction of V_{MCG} and V_{MCA}, in this chart.



130A-(1-)-0-158-1

Figure A3-13. (Sheet 1 of 2)

MINIMUM FIELD LENGTH FOR MAXIMUM EFFORT TAKE-OFF

50 PERCENT FLAPS

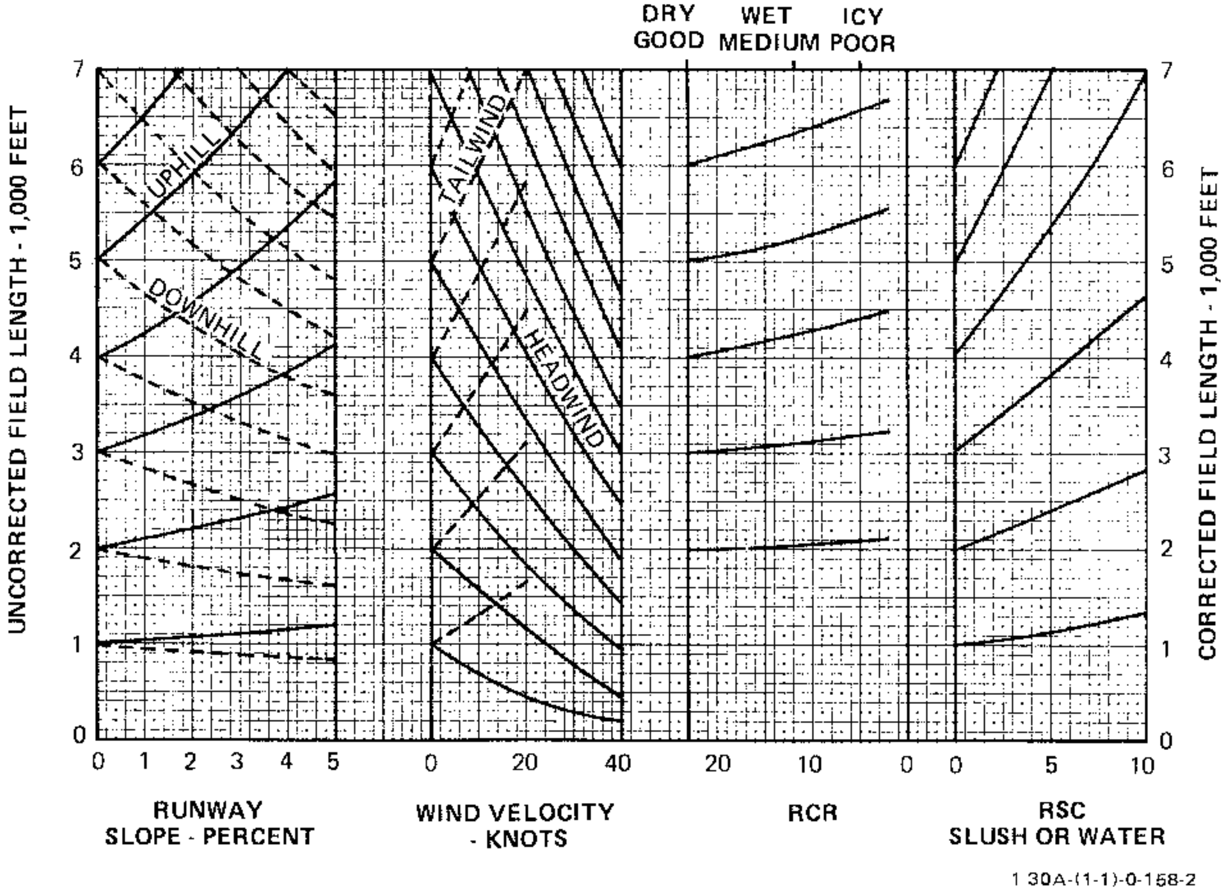


Figure A3-13. (Sheet 2 of 2)

CLIMB-OUT FACTOR FOR CLIMB-OUT FLIGHT PATH

4 ENGINES

MAXIMUM POWER 50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

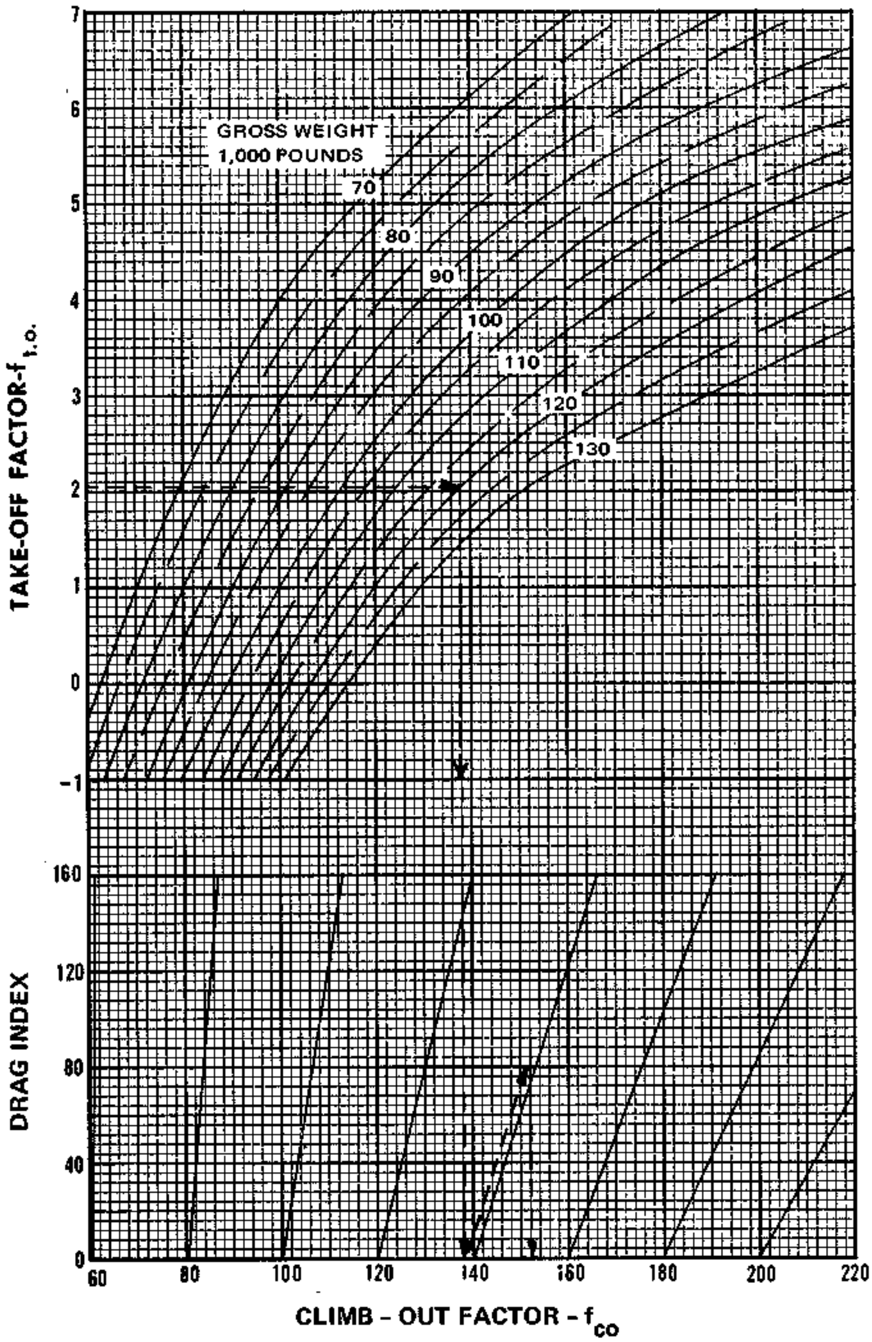


Figure A3-14.

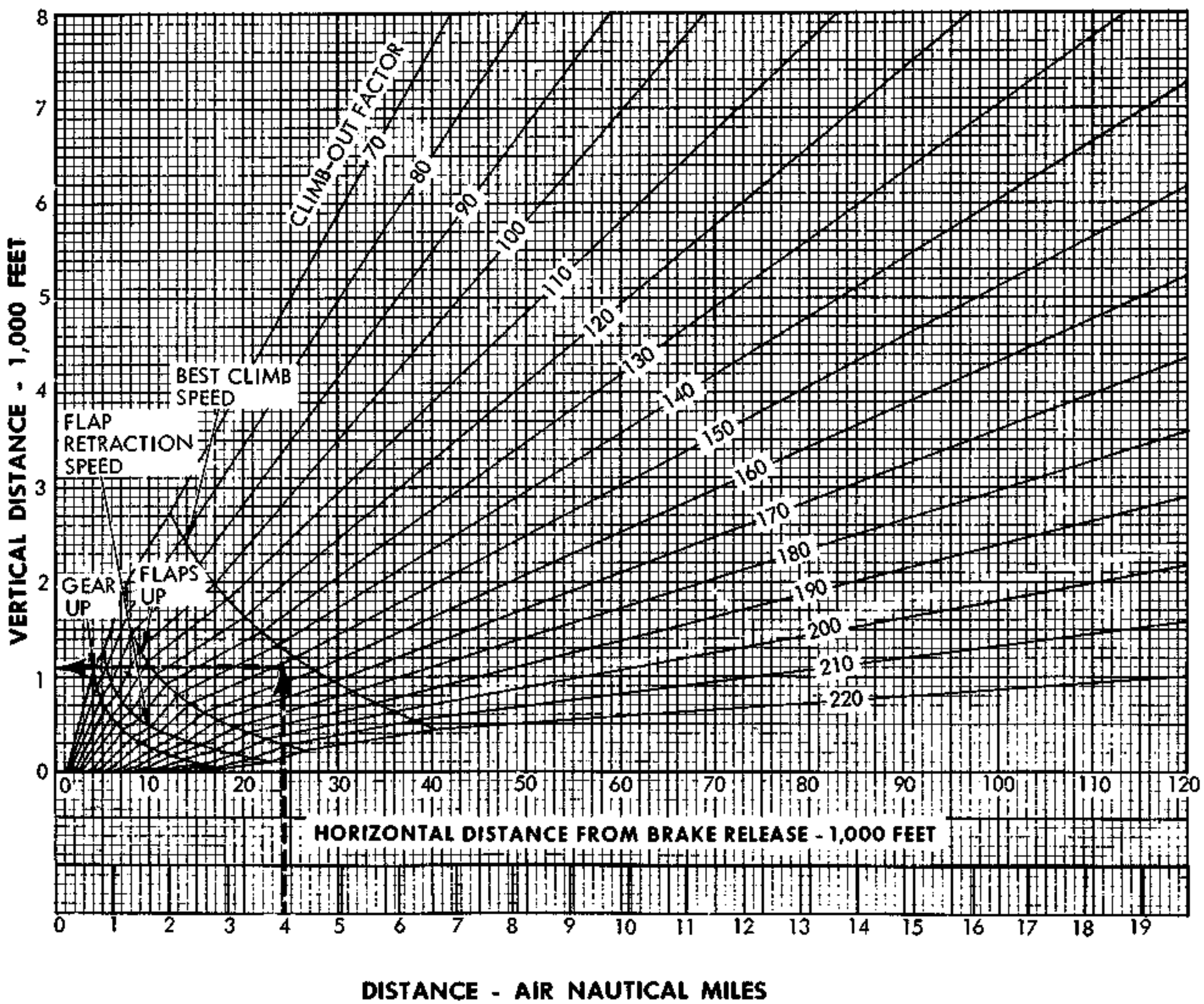
CLIMB-OUT FLIGHT PATH

4 ENGINES MAXIMUM POWER

50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST



NOTE

1. Maintain maximum power until best climb speed or 5 minutes operation is reached, whichever occurs first.
2. Gear retraction initiated 3 seconds after liftoff.
3. Climb at obstacle clearance speed.
4. Includes ground effect where applicable.
5. Initiation of flap retraction after reaching flap retraction speed.
6. After flaps are up, accelerate to best climb speed.
7. Climb at maximum continuous power at best climb speed.
8. Sheet 2 of this chart is an enlargement of the initial phase of Sheet 1.

130A-(1-1)-0-189-1

Figure A3-15. (Sheet 1 of 2)

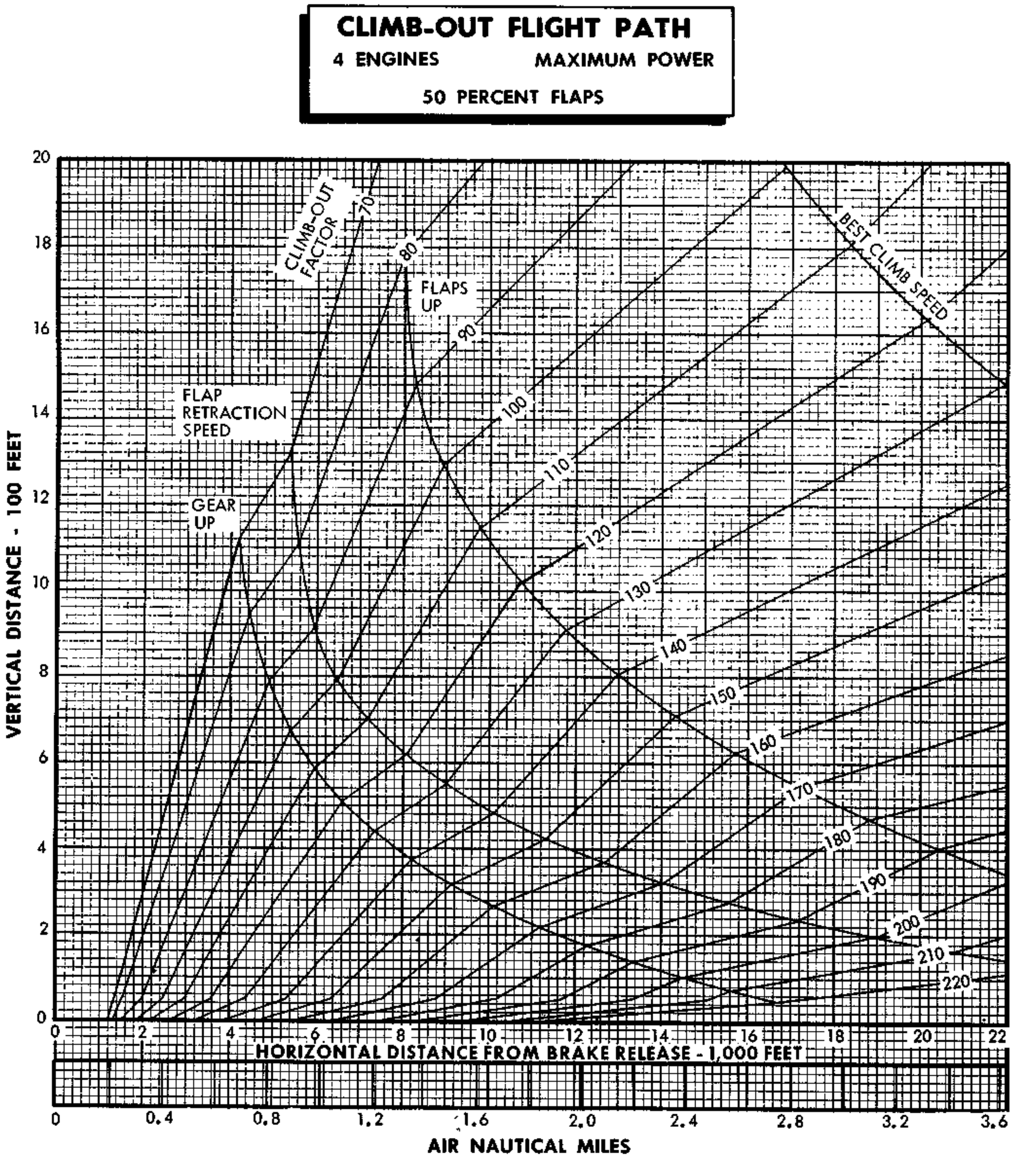


Figure A3-15. (Sheet 2 of 2)

CLIMB-OUT FACTOR FOR CLIMB-OUT FLIGHT PATH

3 ENGINES

MAXIMUM POWER 50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

NOTE
Propeller feathered on inoperative engine.

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

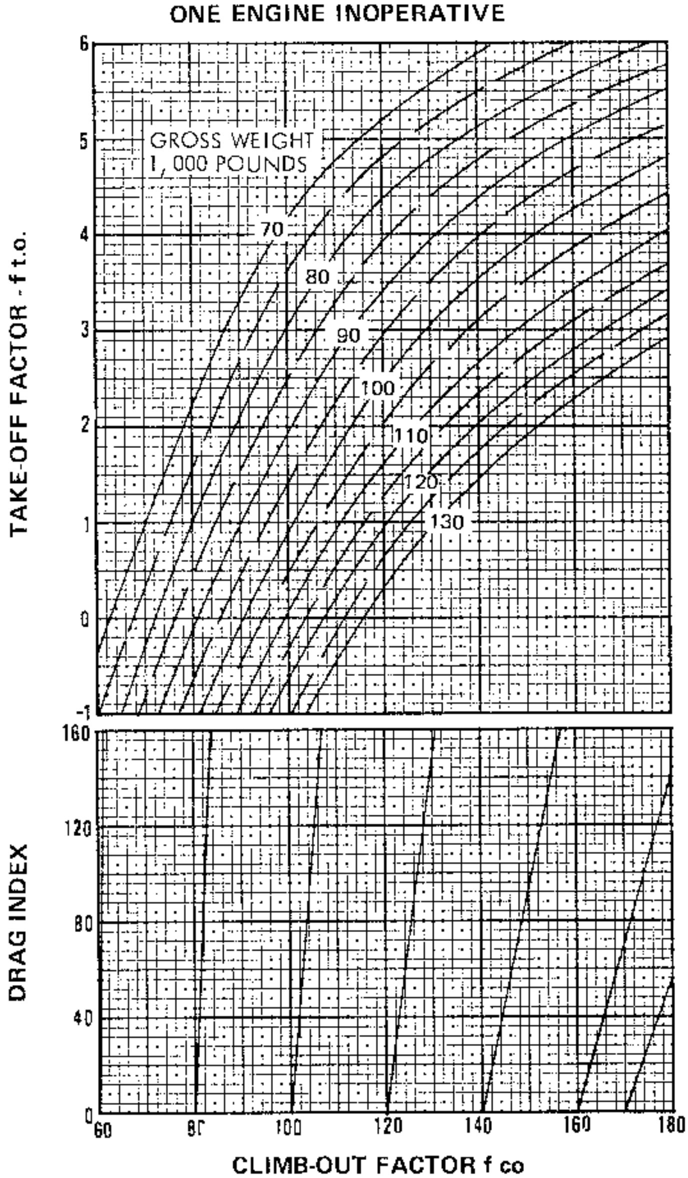


Figure A3-16.

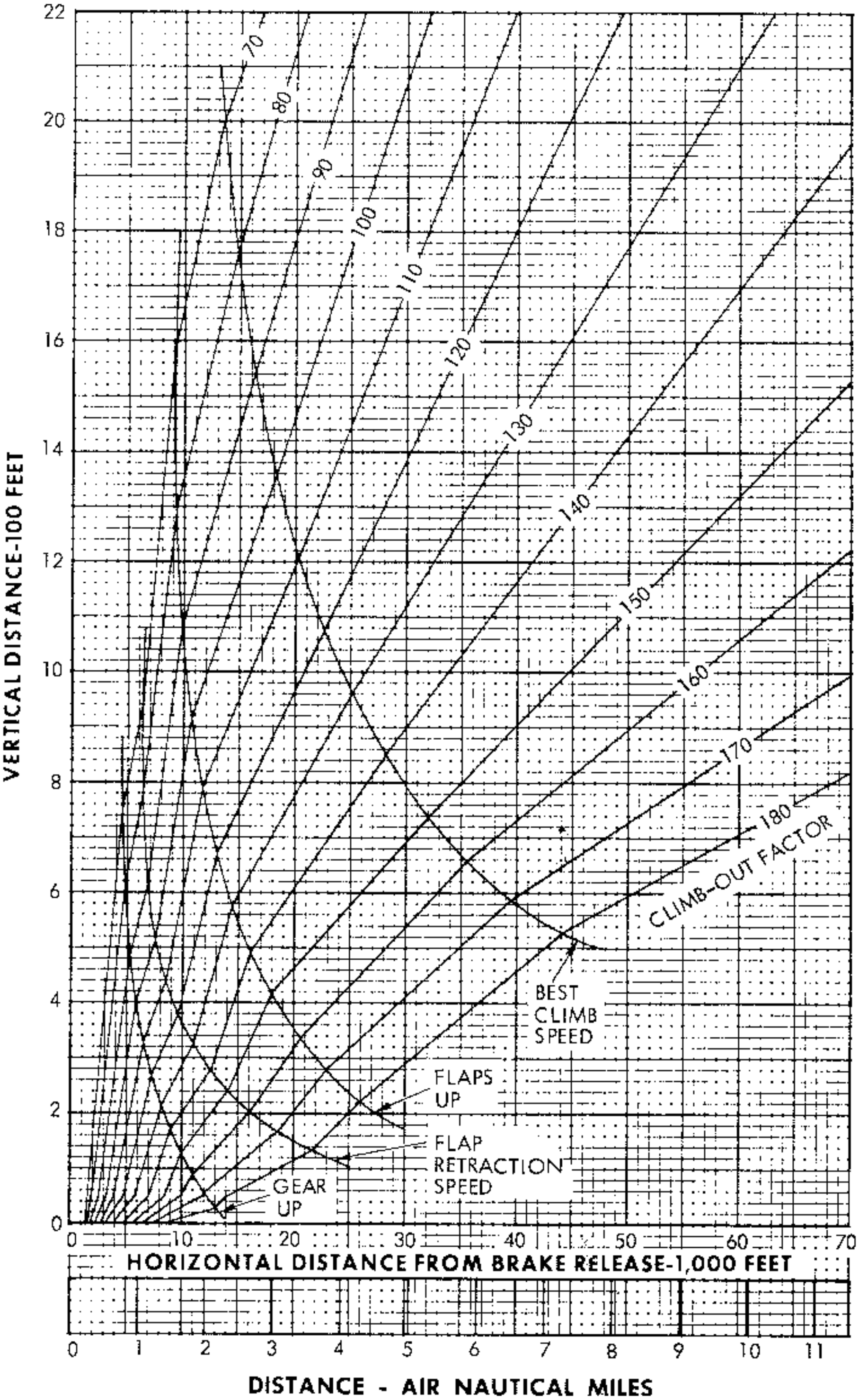
CLIMB-OUT FLIGHT PATH

3 ENGINES MAXIMUM POWER

50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST



NOTE

1. Maintain maximum power until best climb speed or 5 minutes operation is reached, whichever occurs first.
2. Gear retraction initiated 3 seconds after liftoff.
3. Climb at obstacle clearance speed.
4. Includes ground effect where applicable.
5. Initiation of flap retraction after reaching flap retraction speed.
6. After flaps are up, accelerate to best climb speed.
7. Climb at maximum continuous power at best climb speed.
8. Based on four engine acceleration to critical engine failure speed and three engine acceleration thereafter.
9. Sheet 2 of this chart is an enlargement of the initial phase of Sheet 1.

30A-(-)-0-190-

Figure A3-17. (Sheet 1 of 2)

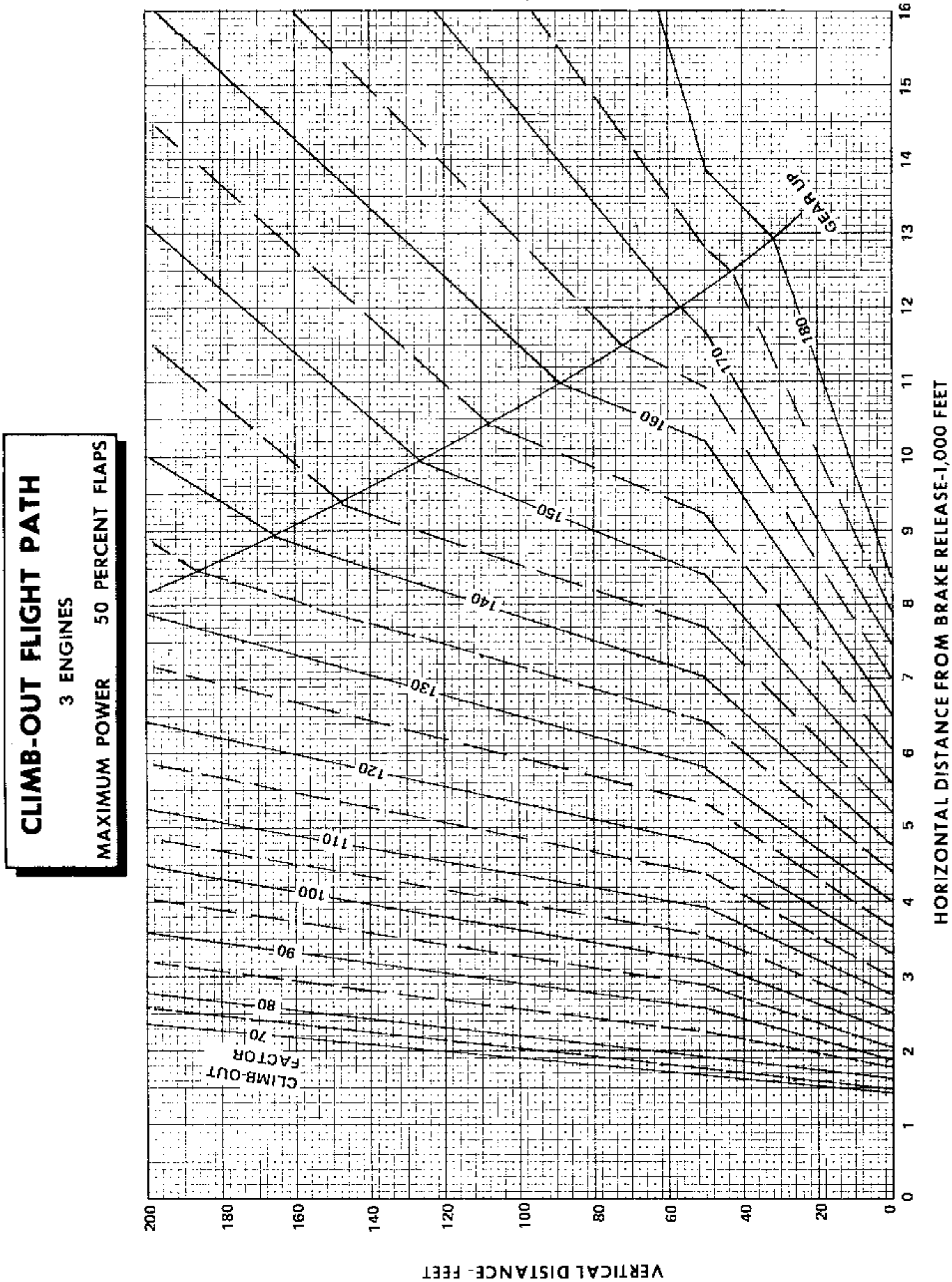


Figure A3-17. (Sh[illegible] of 2)

TAKE-OFF AND OBSTACLE CLEARANCE SPEEDS

4 AND 3 ENGINES   50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Normal Take-Off

1. Take-Off speed is 1.1 V_S.
2. Obstacle clearance speed is 1.2 V_S.
   V_S= Stall speed - Power off,
   50° Percent flaps, landing gear extended.
3. When V_{MCA} (in ground effect) is greater than the chart take-off speed, use this air minimum control speed. The obstacle clearance speed is the chart speed or air minimum control speed whichever is higher.
4. Rotation speed is 5 KIAS less than plotted take-off speed but not less than V_{MCA} (in ground effect, one engine inoperative).
5. Minimum flap retraction speed for normal take-off is obstacle clearance speed.

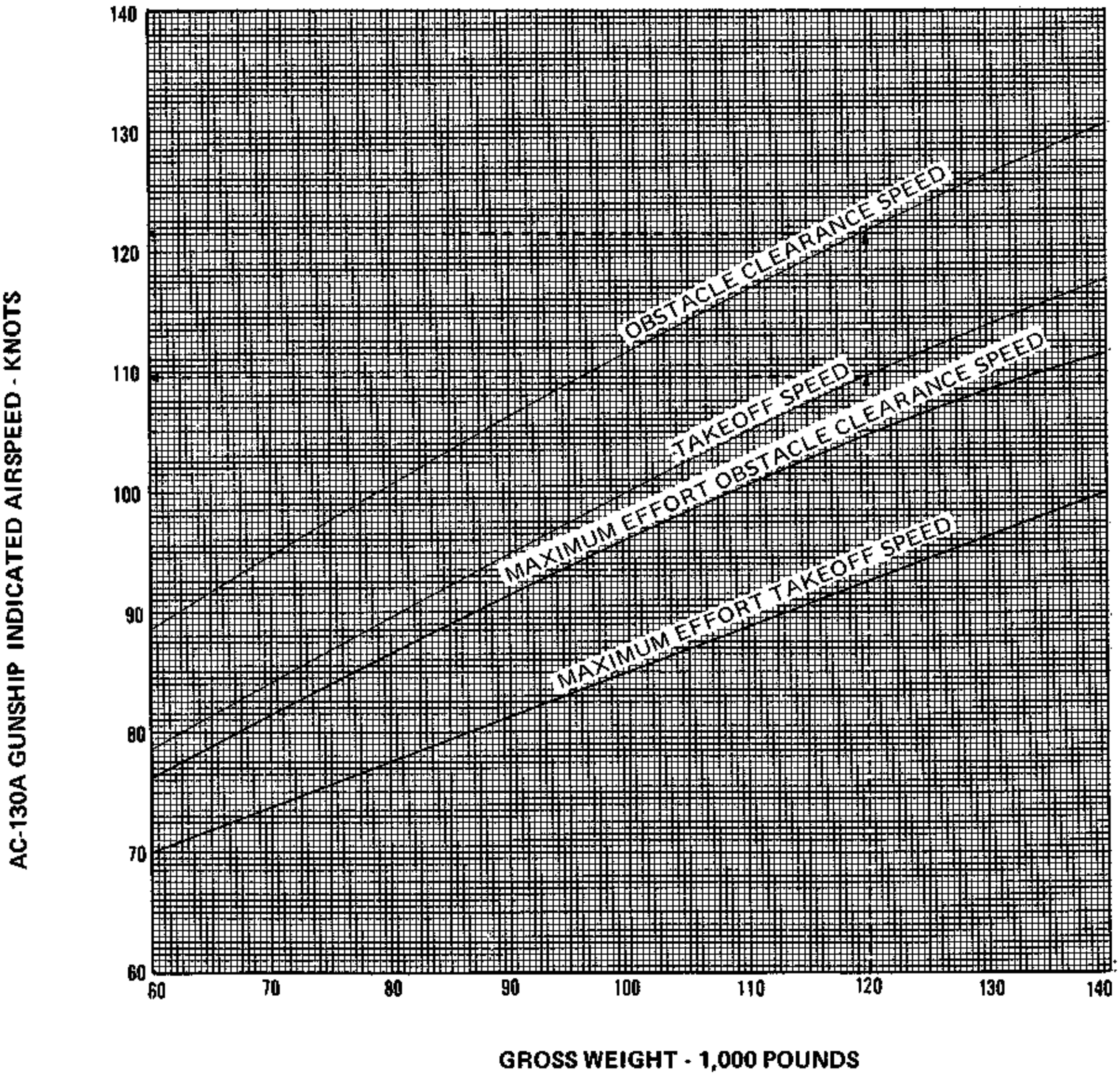


Figure A3-18.

AIR MINIMUM CONTROL SPEED

IN GROUND EFFECT

GEAR DOWN 3 ENGINES 50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Propeller feathered on inoperative engine.

ONE ENGINE INOPERATIVE

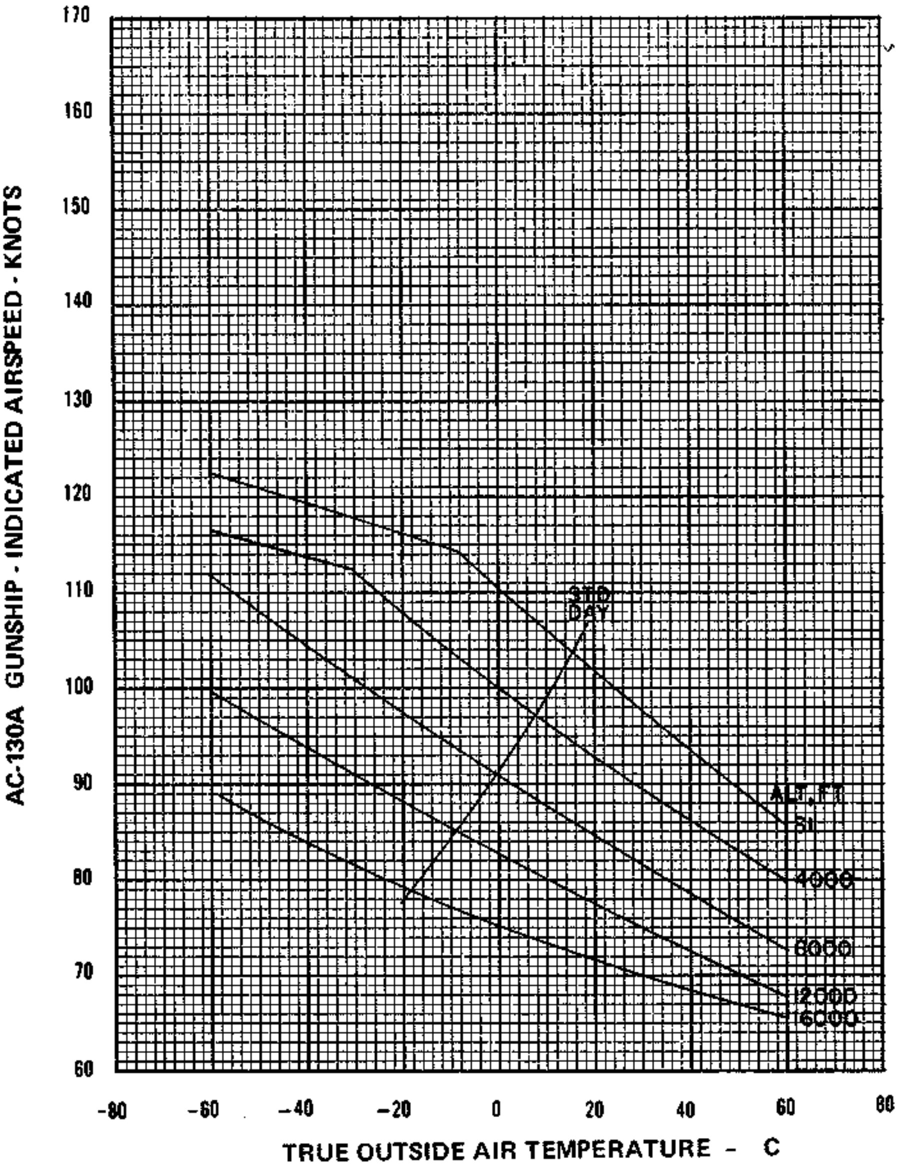


Figure A3-19.

AIR MINIMUM CONTROL SPEED

IN OR OUT OF GROUND EFFECT

GEAR DOWN 2 ENGINES 50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Propeller feathered on inoperative engine.

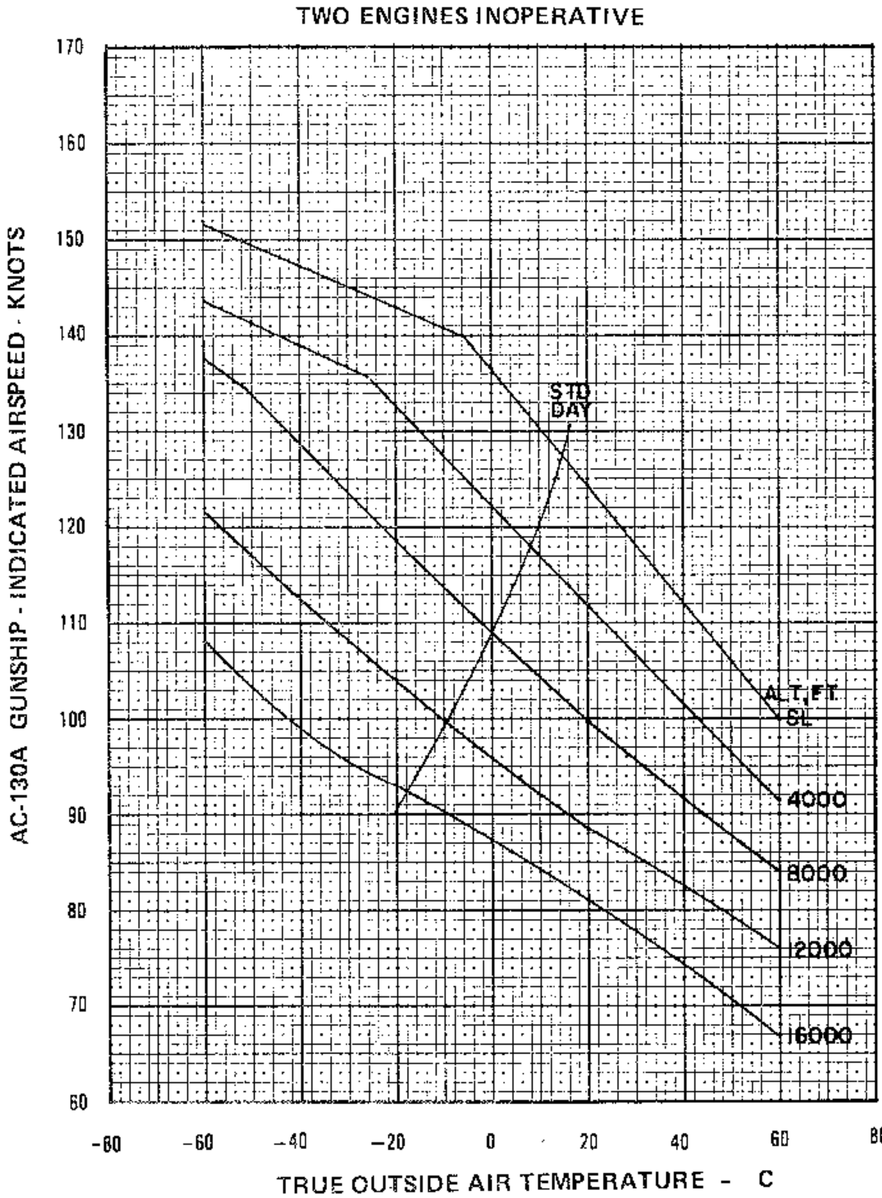


Figure A3-20.

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

TAKE-OFF GROUND RUN

4 ENGINES MAXIMUM POWER
50 PERCENT FLAPS

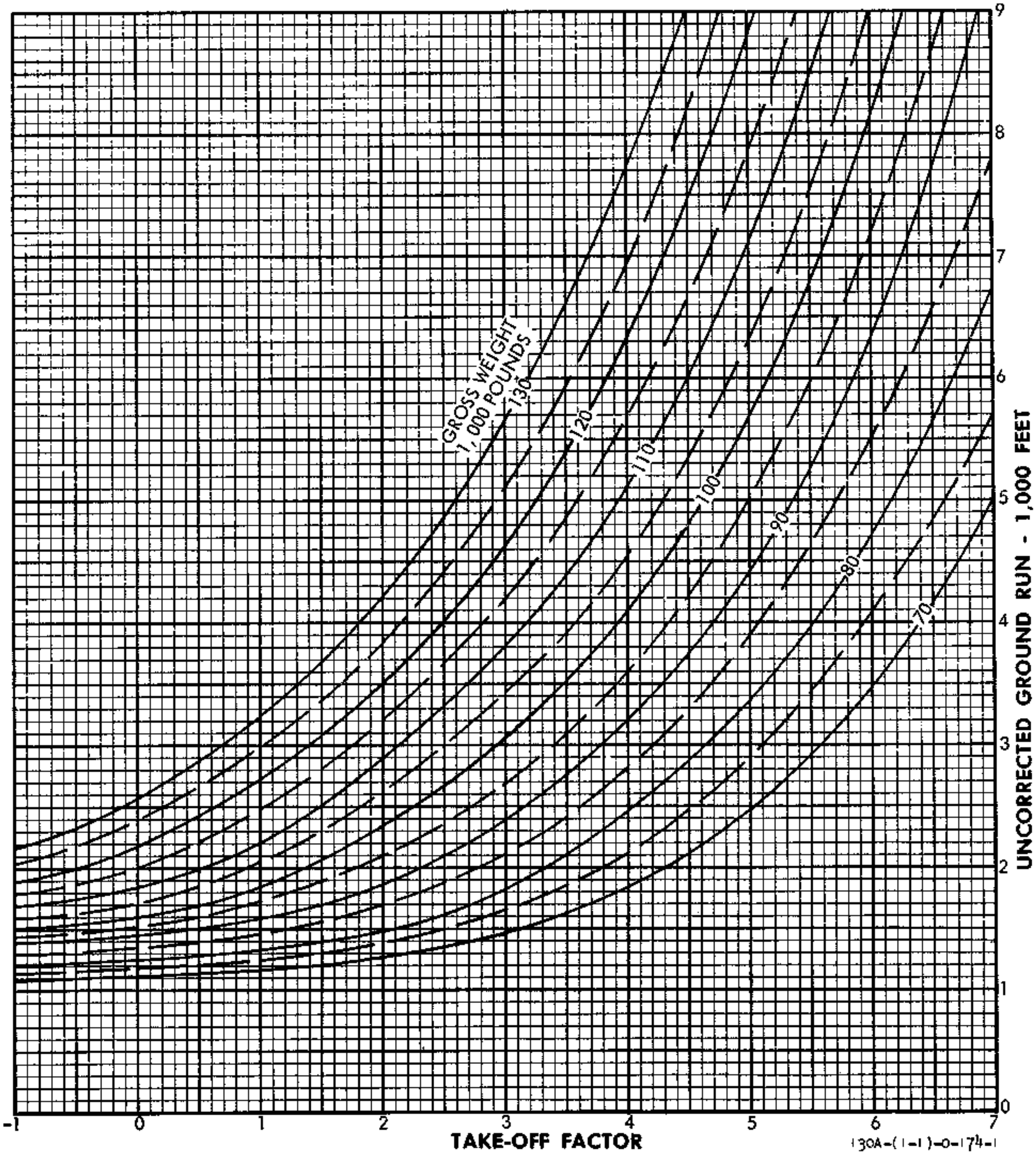


Figure A3-21. (Sheet 1 of 2)

TAKE-OFF GROUND RUN

4 ENGINES — MAXIMUM POWER
50 PERCENT FLAPS — NO ATO

NOTE

1. Use take-off speeds shown on the take-off and obstacle clearance speed chart.
2. Observe engine power limitations in Section V of T.O. 1C-130A-1
3. An RSC value of 10 is equivalent to one inch of slush or water

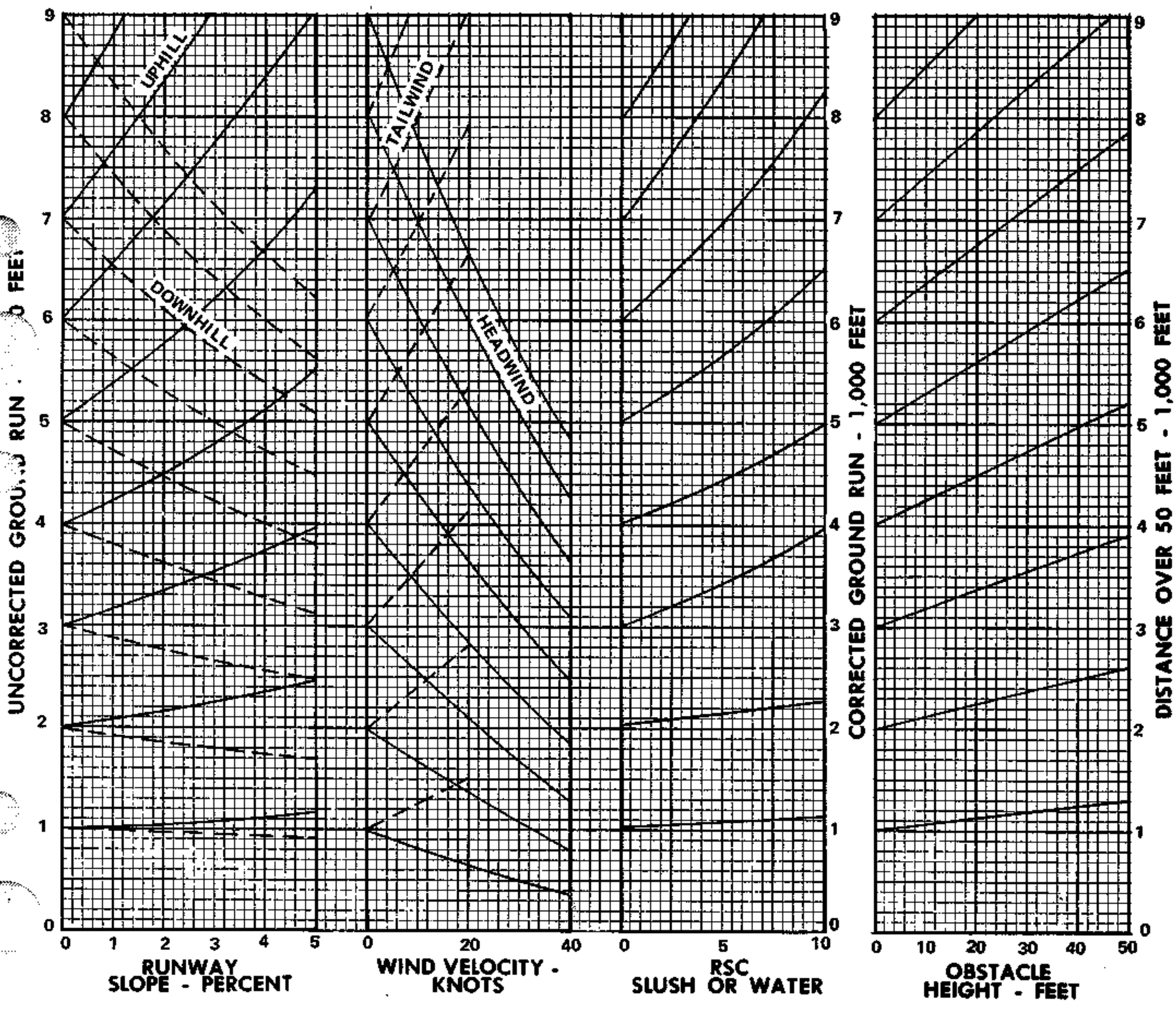


Figure A3-21. (Sheet 2 of 2)

TAKE-OFF GROUND RUN

MAXIMUM EFFORT

4 ENGINES MAXIMUM POWER

50 PERCENT FLAPS NO ATO

MODEL: AC-130A
T56-A-9 ENGINES

DATE: NOVEMBER 1971

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Use take-off speeds shown on the take-off and obstacle clearance speeds chart.
2. Observe engine power limitations in Section V of T.O. 1C-130A-1.

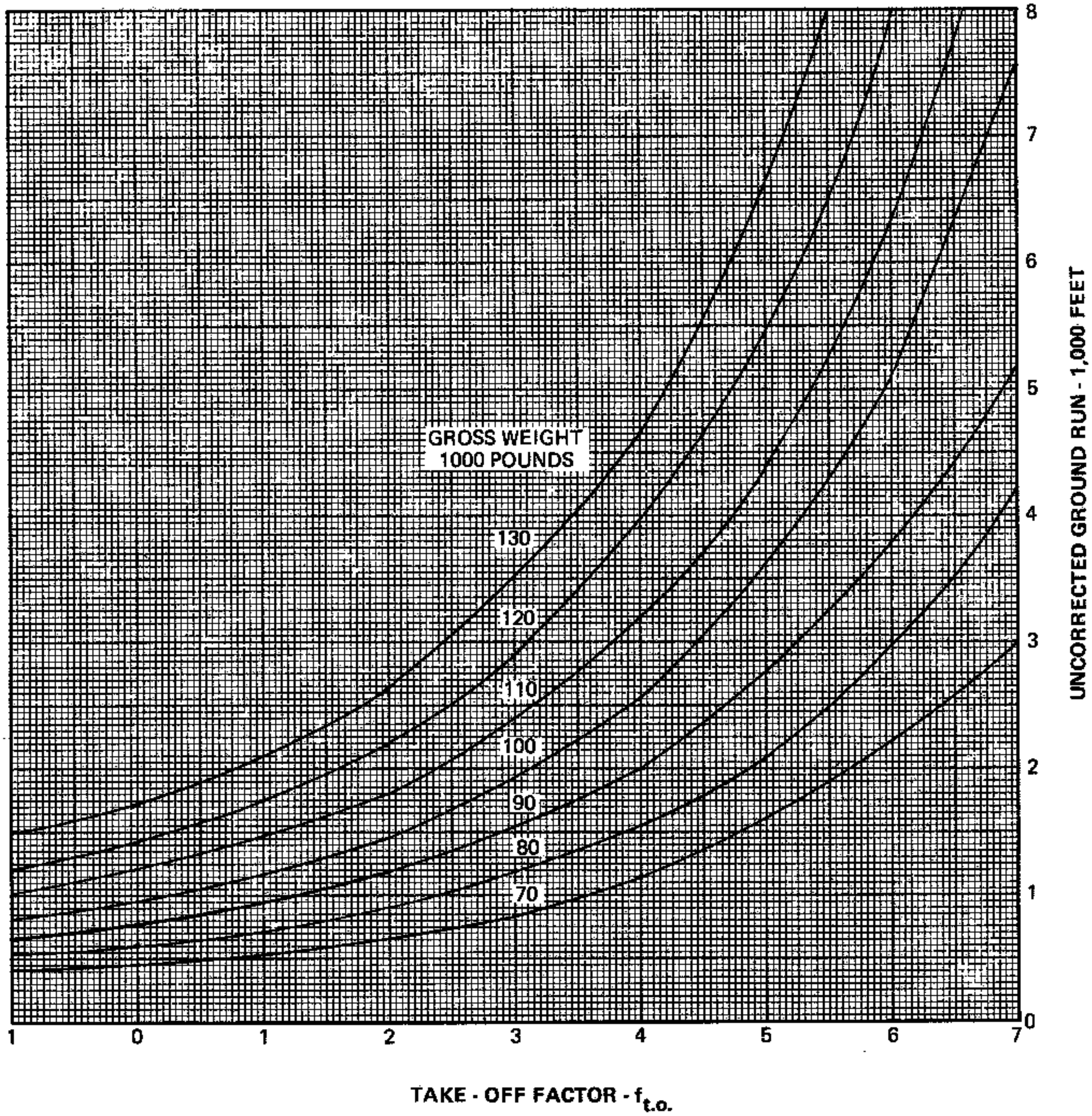


Figure A3-22. (Sheet 1 of 2)

TAKE-OFF GROUND RUN

MAXIMUM EFFORT

4 ENGINES MAXIMUM POWER

50 PERCENT FLAPS NO ATO

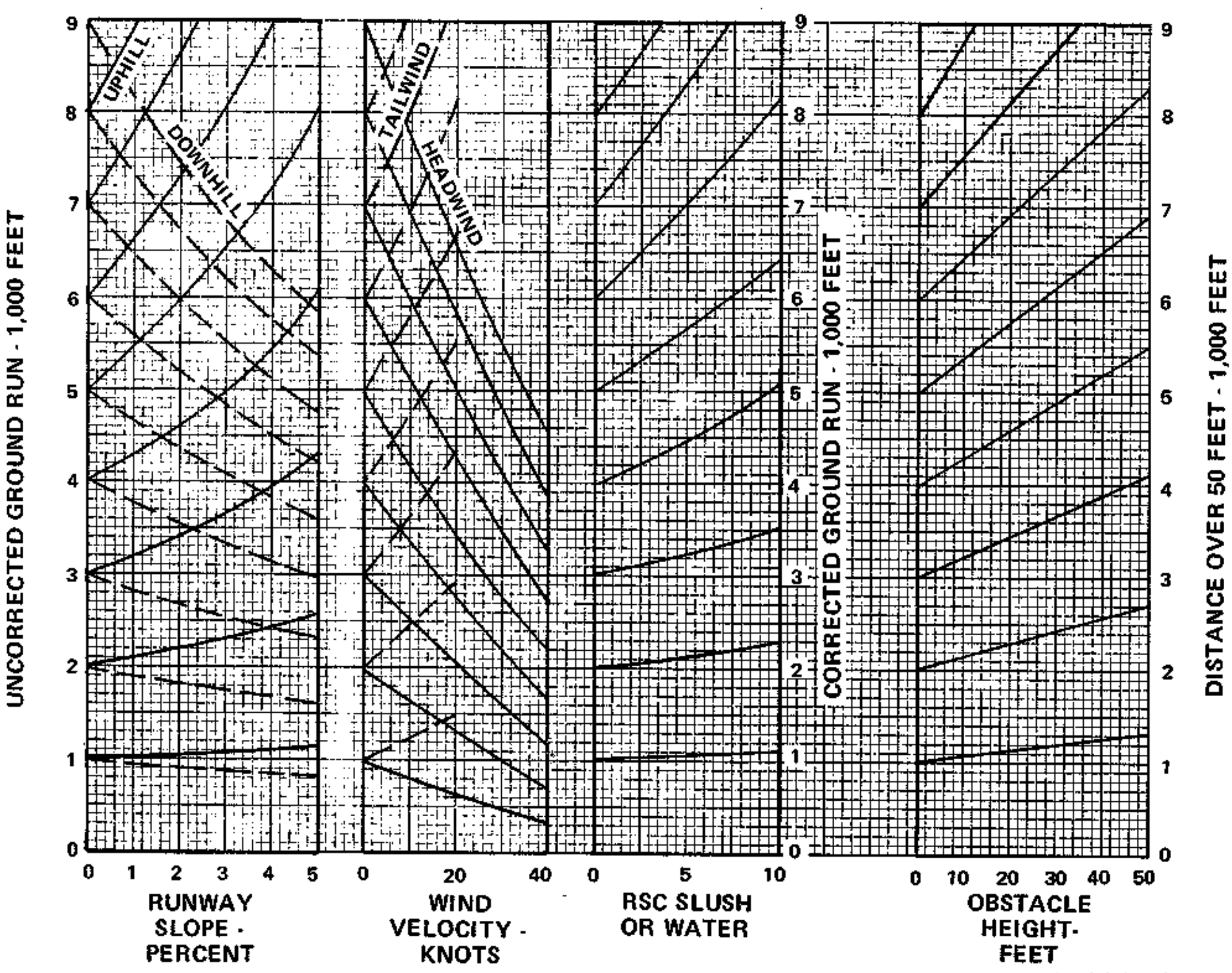


Figure A3-22. (Sheet 2 of 2)

ACCELERATION CHECK TIME

4 ENGINES MAXIMUM POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

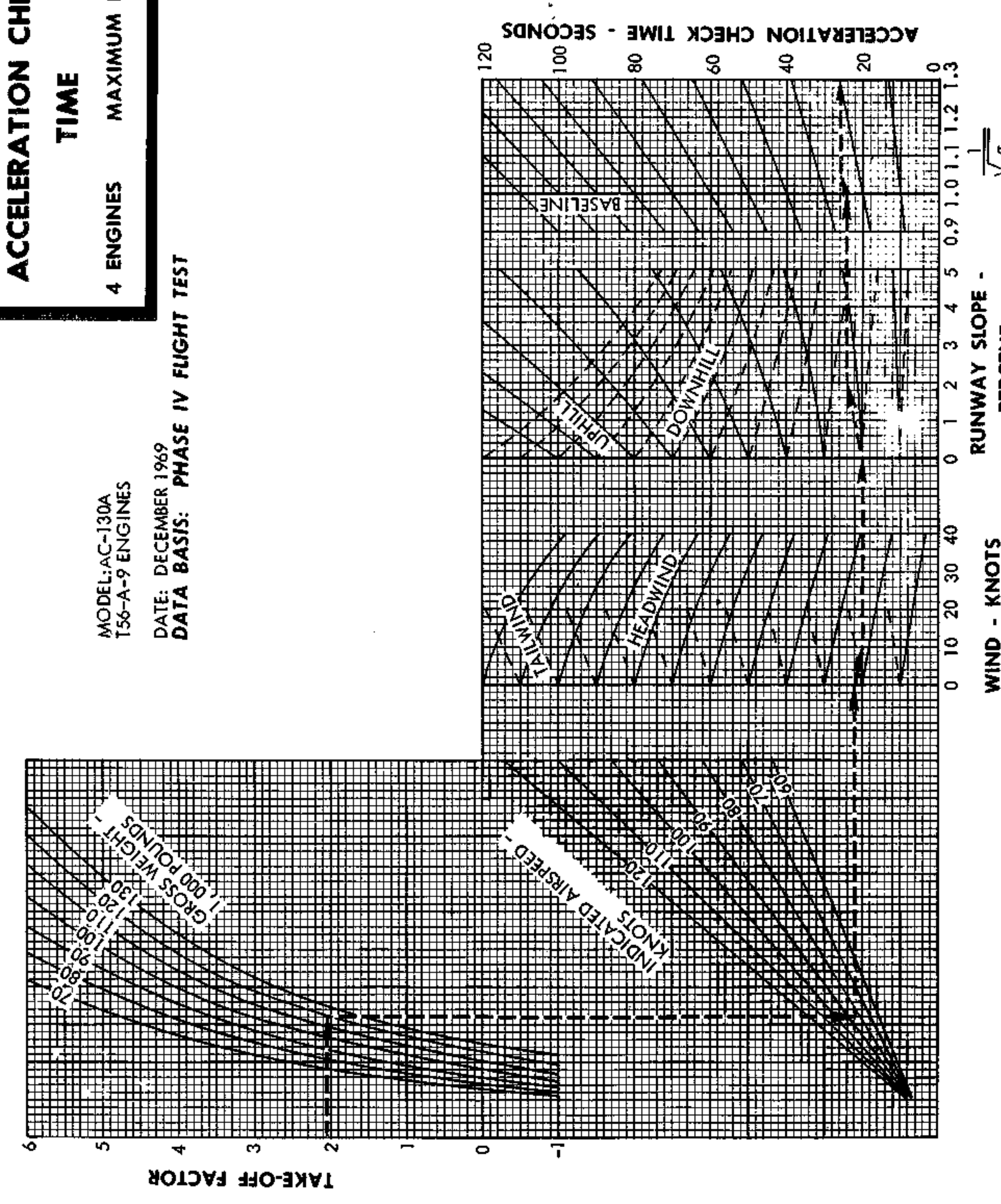


Figure A3-23.

EFFECT OF RUNWAY SLOPE ON NORMAL TAKE-OFF DISTANCE AND CRITICAL FIELD LENGTH

MAXIMUM POWER NO WIND NO RSC

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Critical field length limit due to zero rate of climb capability.
2. Critical field length limit due to inaccuracy of air speed indicator below 60 knots.

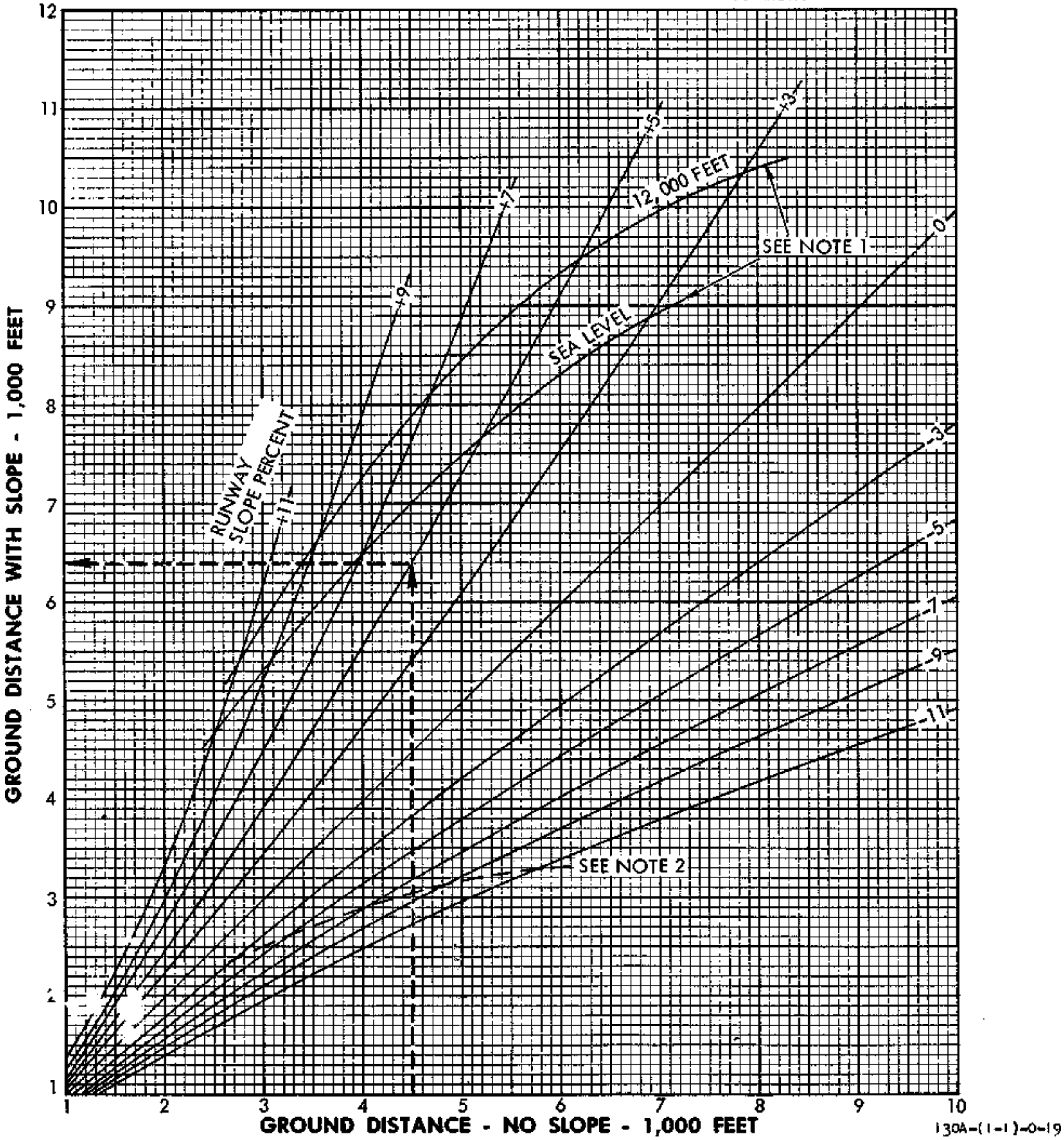


Figure A3-24.

TAKE-OFF AND OBSTACLE CLEARANCE SPEEDS

FLAPS UP

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Take-off speed is 1.15 V_S power off stall speed.
2. Obstacle clearance speed is 1.20 V_S power off stall speed.
3. When V_{MCA} (in ground effect) is greater than plotted take-off speed, use V_{MCA} (in ground effect) for take-off speed and V_{MCA} (in ground effect) plus the difference between chart take-off speed and obstacle clearance speed for obstacle clearance speed.
4. Rotation speed is 5 KIAS less than plotted take-off speed but not less than V_{MCA} (in ground effect, one engine inoperative).

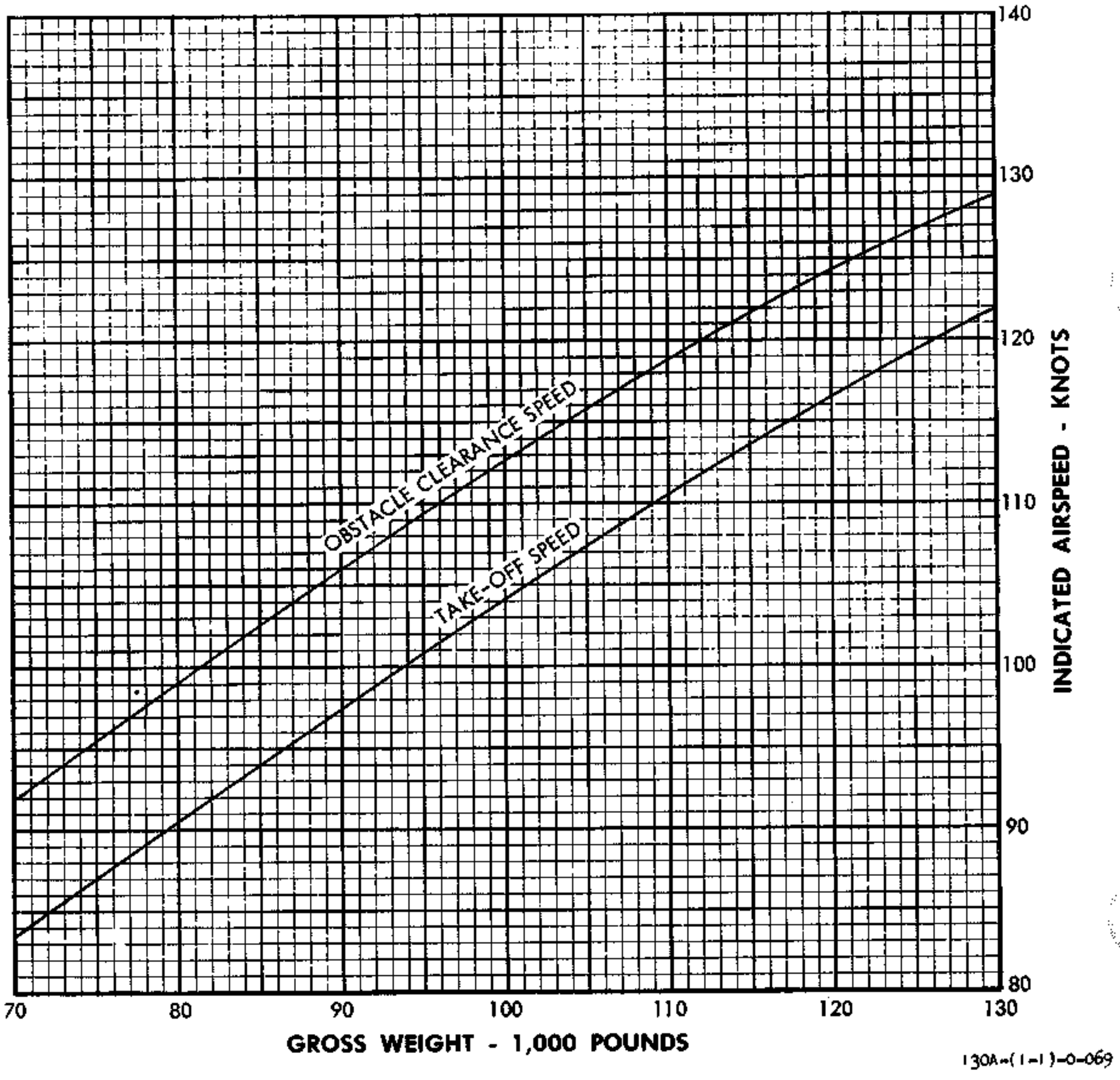


Figure A3-25.

AIR MINIMUM CONTROL SPEED

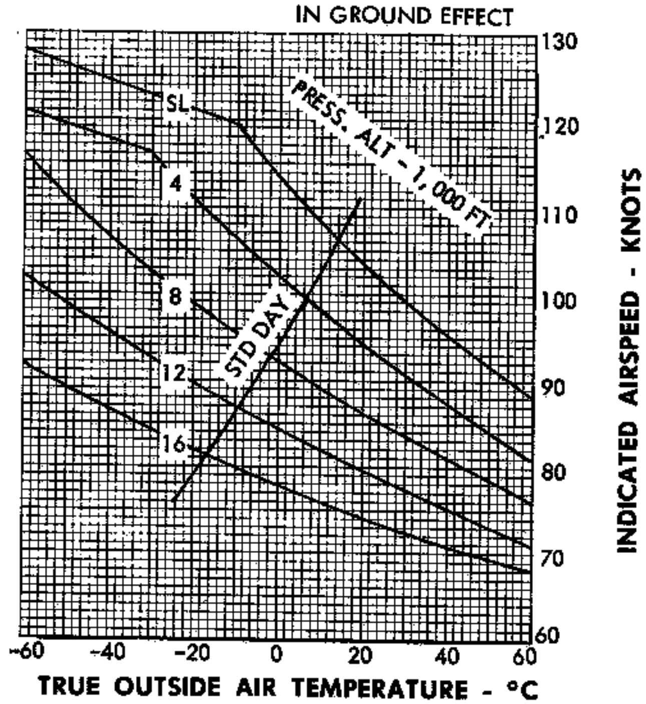
GEAR DOWN ZERO FLAPS

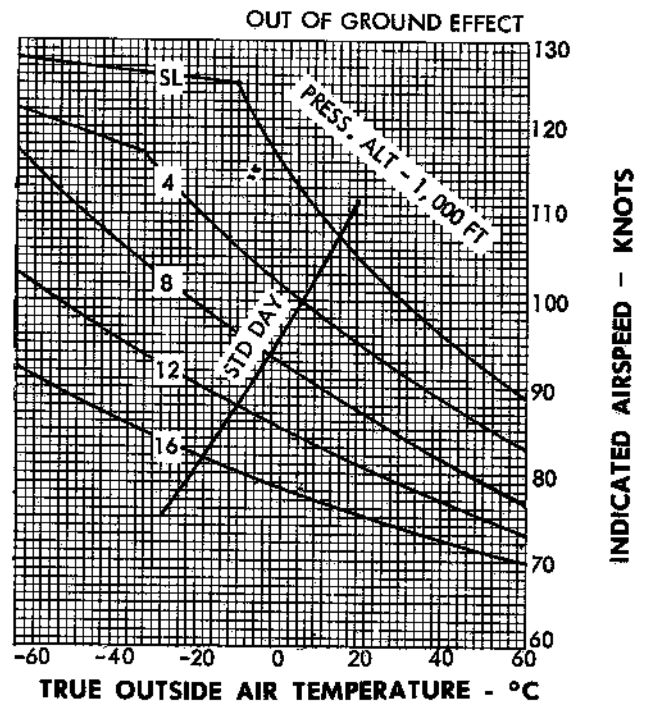
IN AND OUT OF GROUND EFFECT

ONE ENGINE INOPERATIVE

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: *ESTIMATED*





130A-(1-1)-0-(4)

Figure A3-26.

CRITICAL FIELD LENGTH

4 ENGINES MAXIMUM POWER

FLAPS UP

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Stop based on two engines reverse, one engine in ground idle, one propeller windmilling and with maximum anti-skid braking.
2. An RSC value of 10 is equivalent to one inch of slush or water.

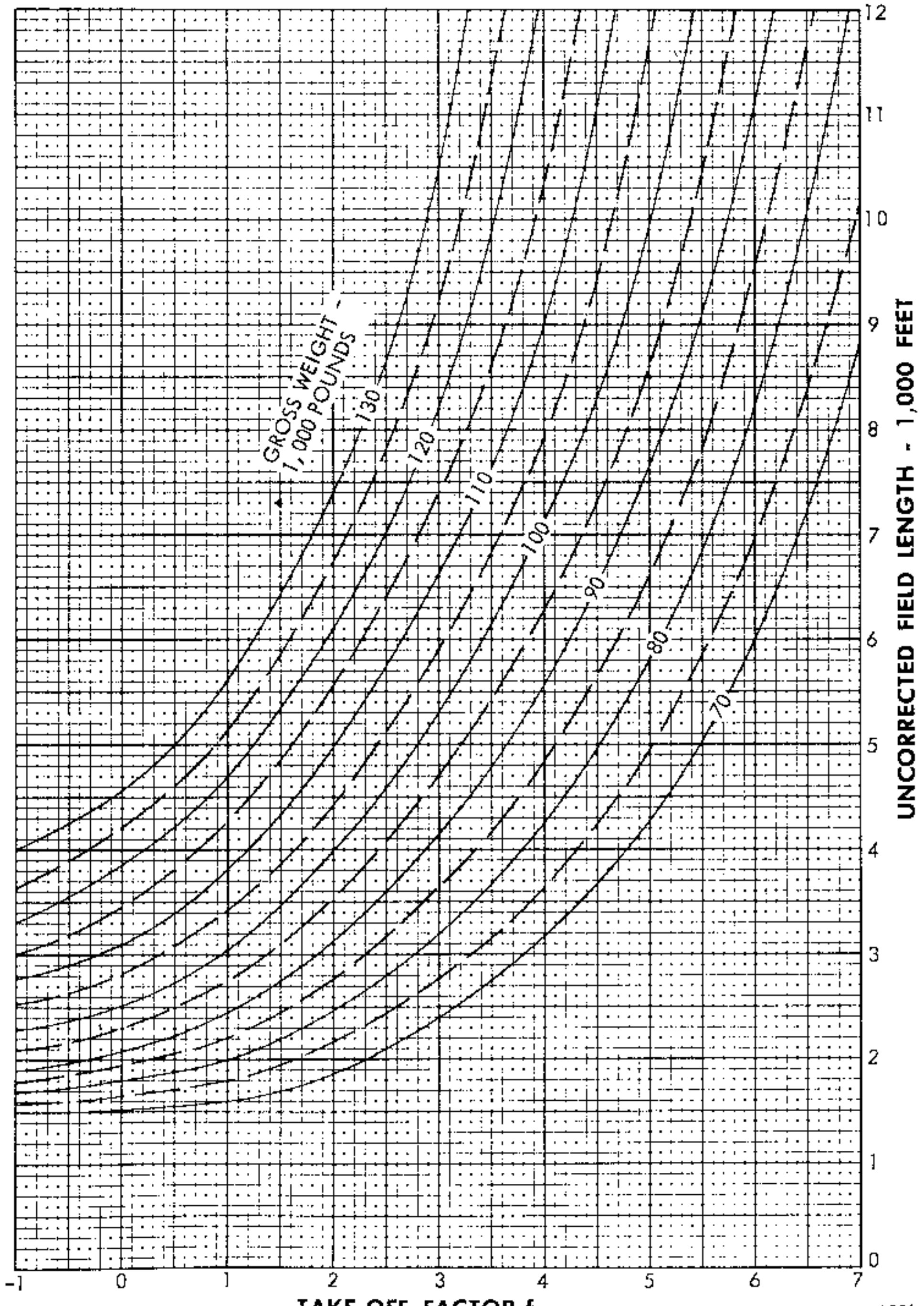
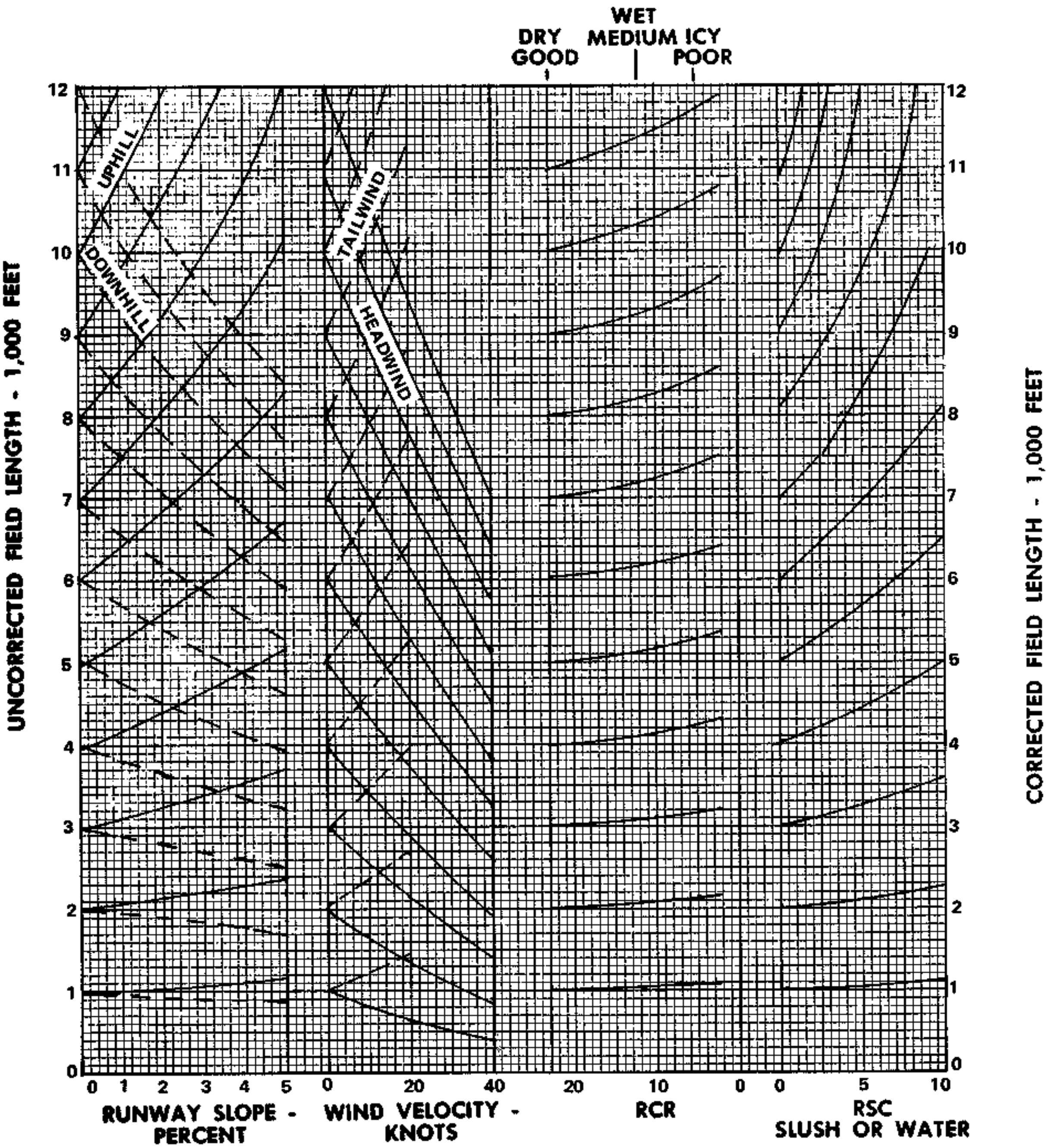


Figure A3-27. (Sheet 1 of 2)

CRITICAL FIELD LENGTH

4 ENGINES MAXIMUM POWER

FLAPS UP



130A-(1-1)-0-183-2

Figure A3-27. (Sheet 2 of 2)

REFUSAL SPEED AND CRITICAL ENGINE FAILURE SPEED

FLAPS UP

MODEL: AC-130A
T56-A-9 ENGINES

DATE: 1 OCTOBER 1974
DATA BASIS: PHASE IV FLIGHT TEST

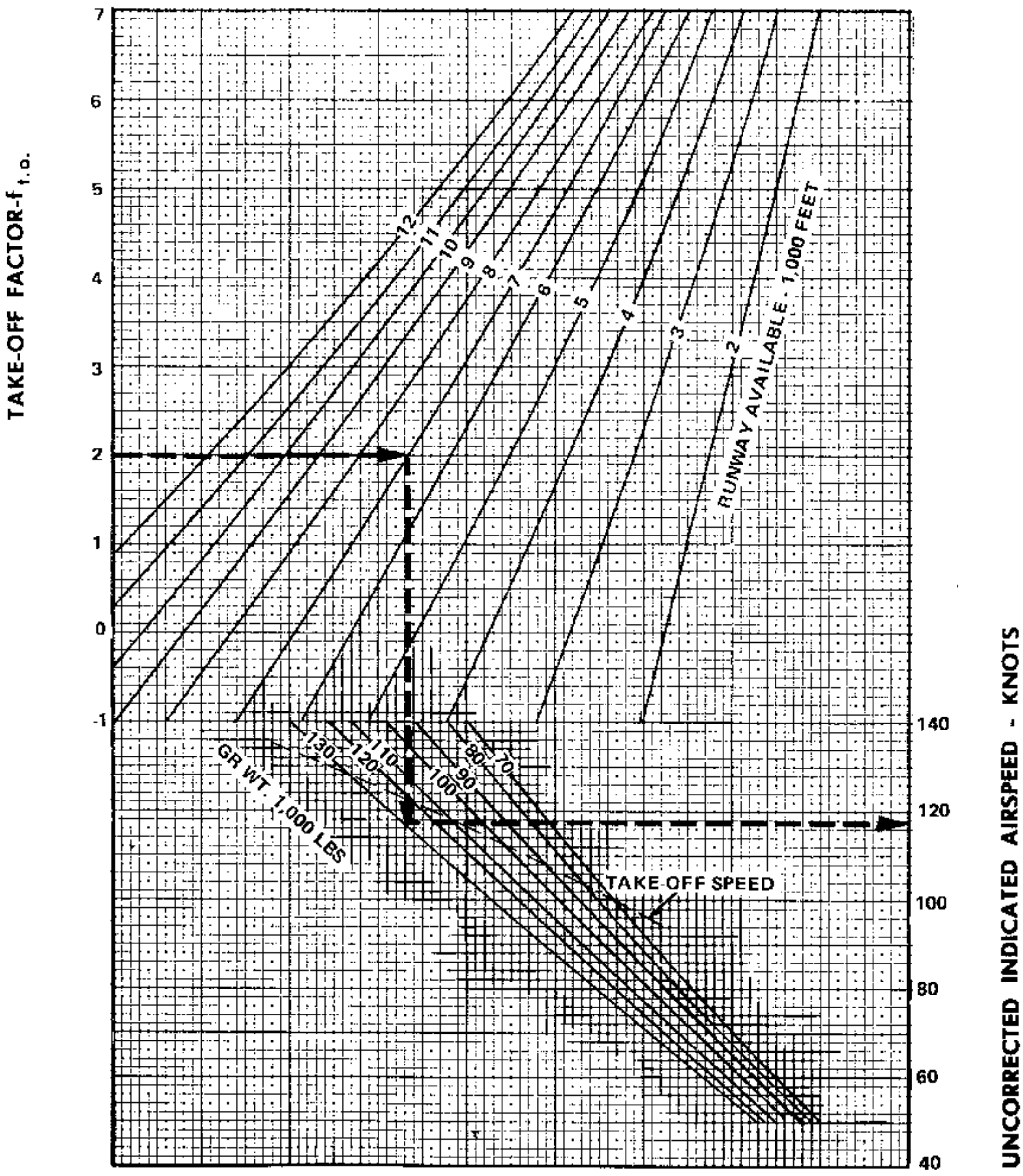


Figure A3-28.

TAKE-OFF GROUND RUN

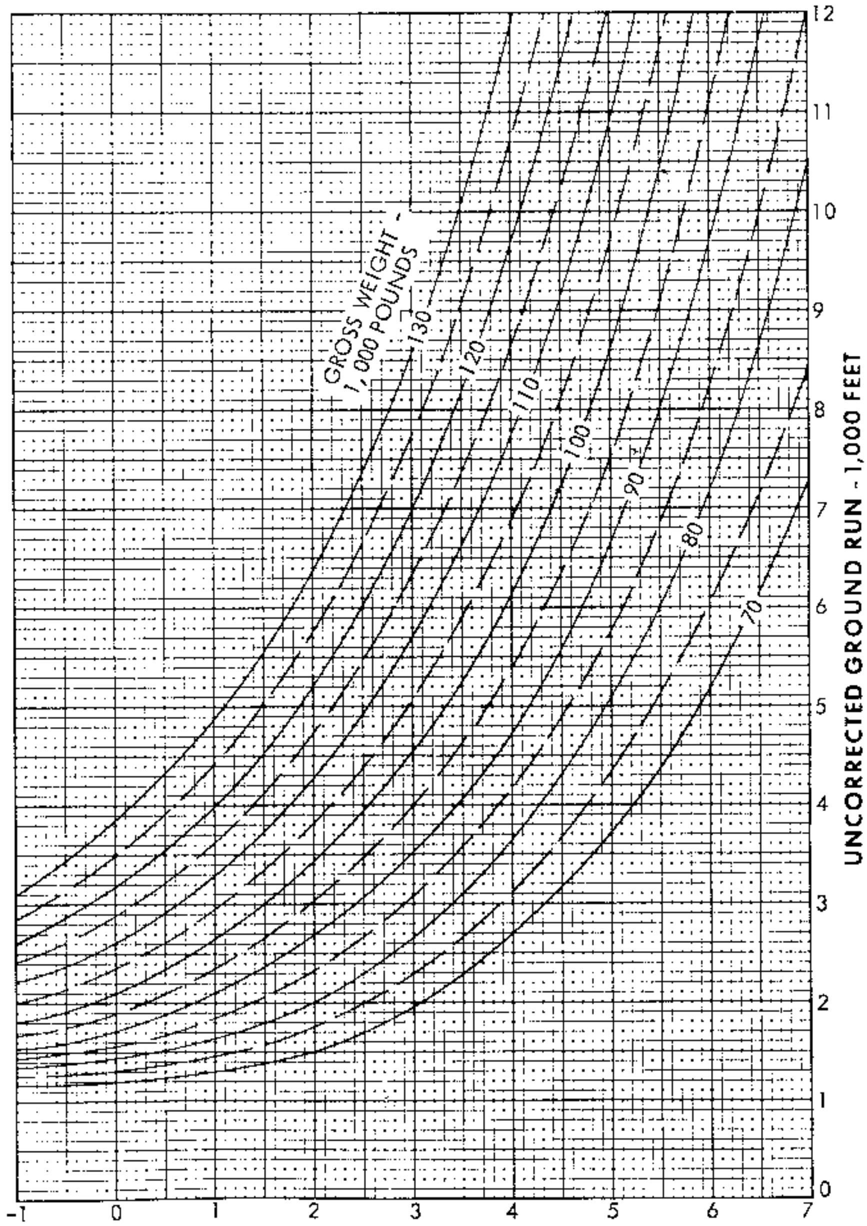
4 ENGINES **FLAPS UP**

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Use take-off speed shown on the flaps up, take-off and obstacle clearance speed chart.
2. Observe engine power limits in Section V of T.O. 1C-130A-1.



130A-(-1)-0-85-1

Figure A3-29 (Sheet 1 of 2).

TAKE-OFF GROUND RUN

4 ENGINES MAXIMUM POWER

FLAPS UP

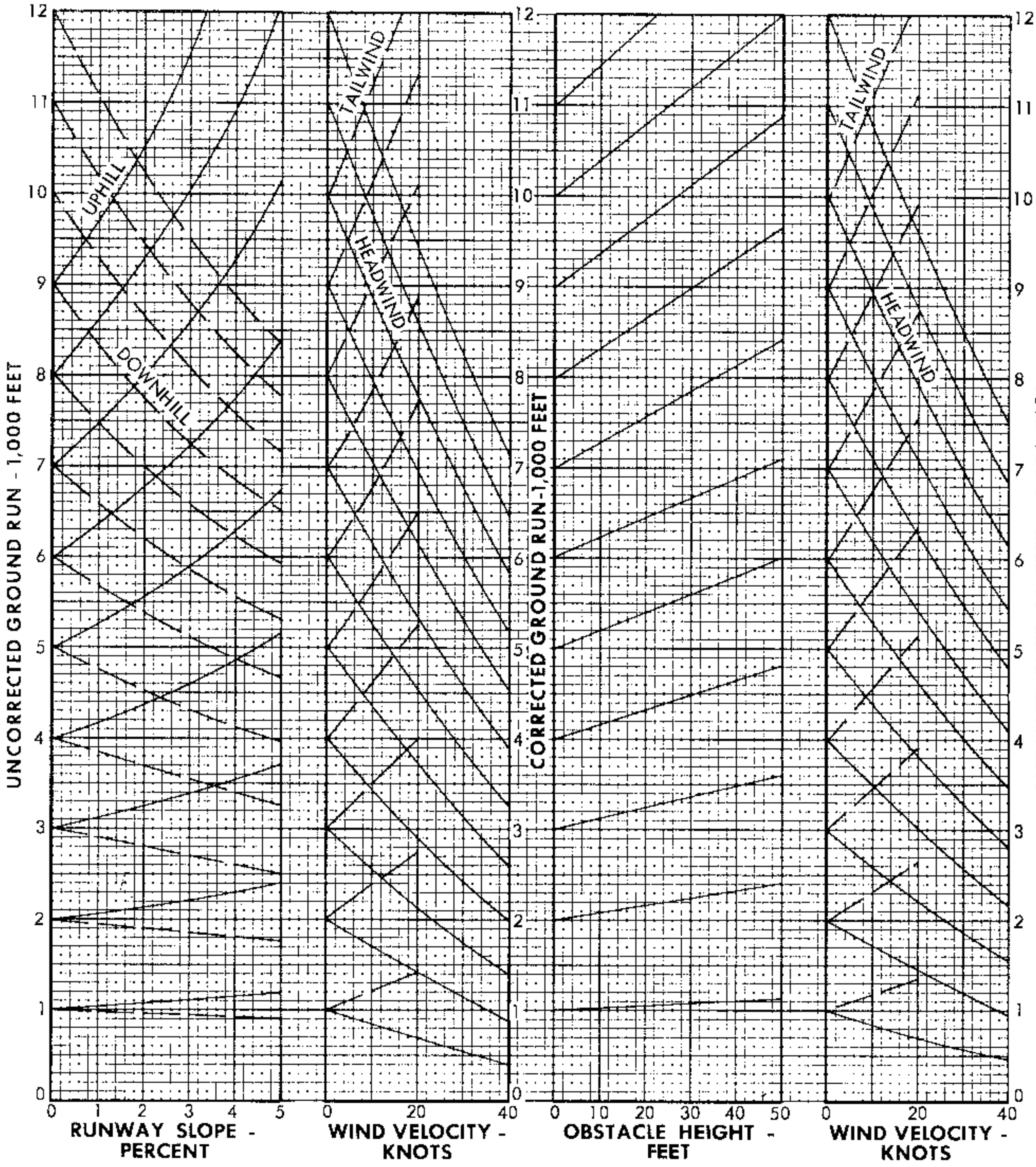


Figure A3-29 (Sheet 2 of 2).

TAKE-OFF GROUND RUN

3 ENGINES **MAXIMUM POWER**
50 PERCENT FLAPS **NO ATO**

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Use take-off speeds shown on the take-off and obstacle clearance speeds chart.
2. Observe the engine power limitations of Section V of T.O. 1C-130A-1.
3. Propeller feathered on inoperative engine.

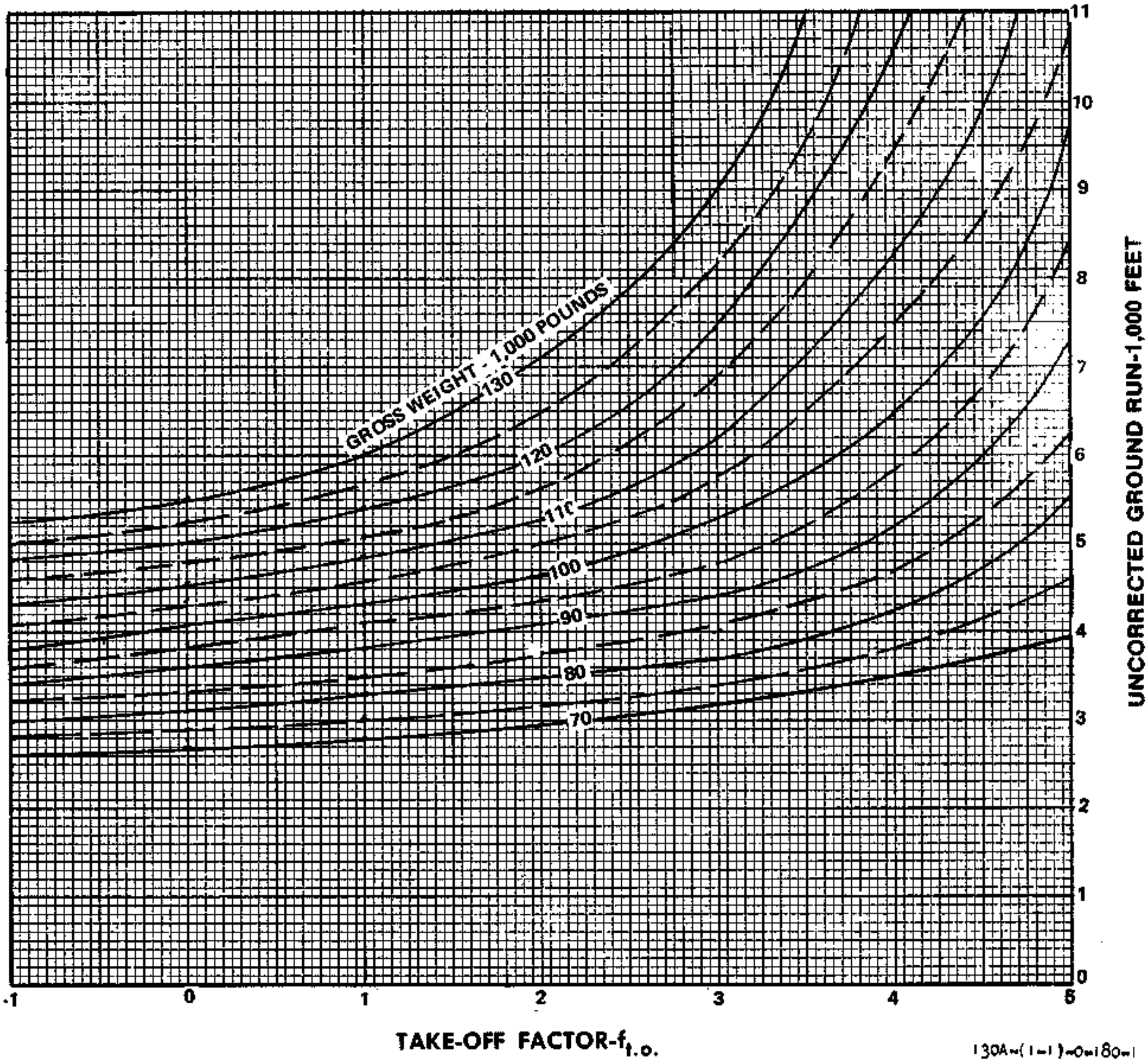
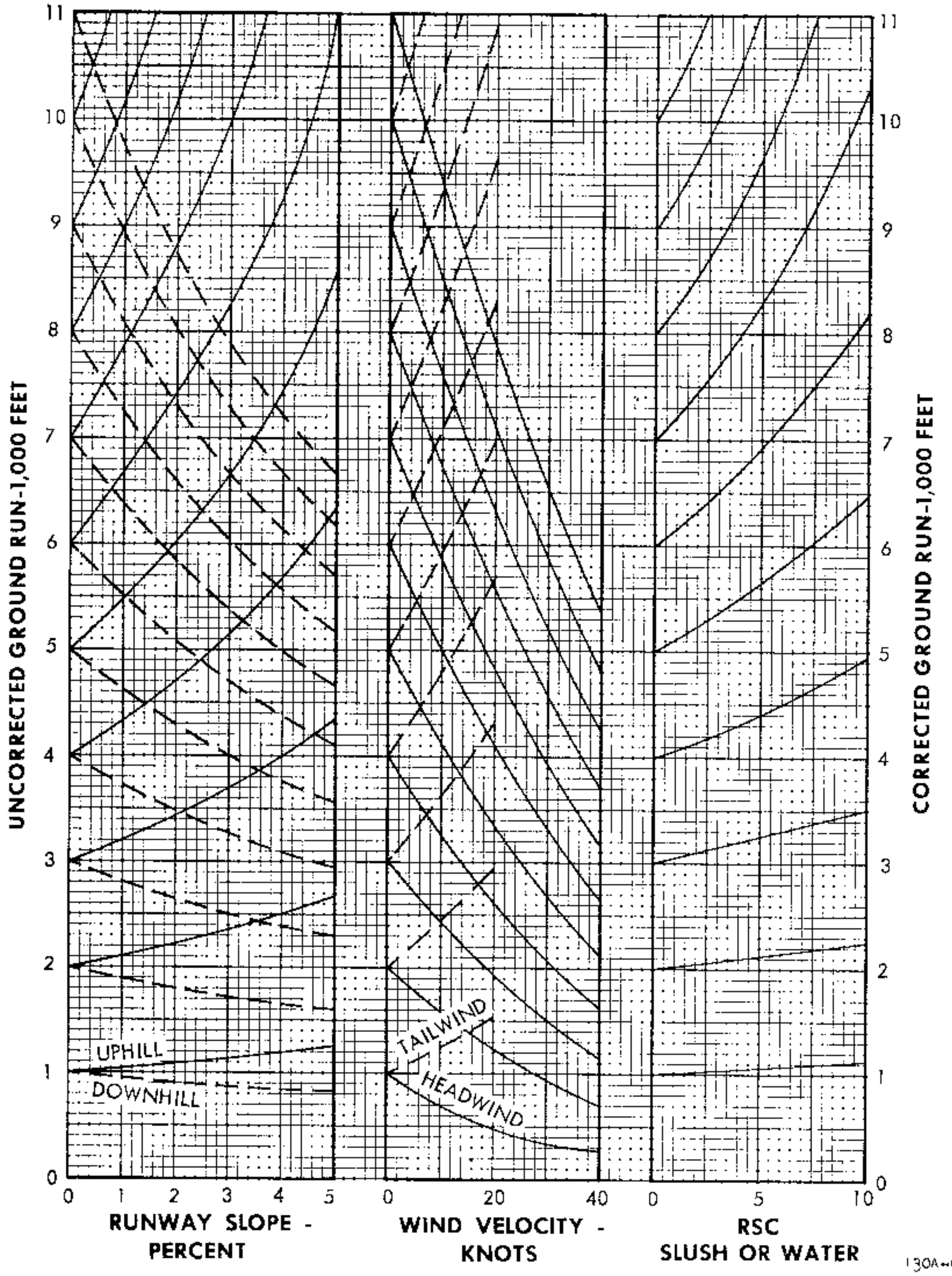


Figure A3-30. (Sheet 1 of 2)

TAKE-OFF GROUND RUN

3 ENGINES MAXIMUM POWER
50 PERCENT FLAPS NO ATO



130A-(1-)-0-180-2

Figure A3-30. (Sheet 2 of 2)

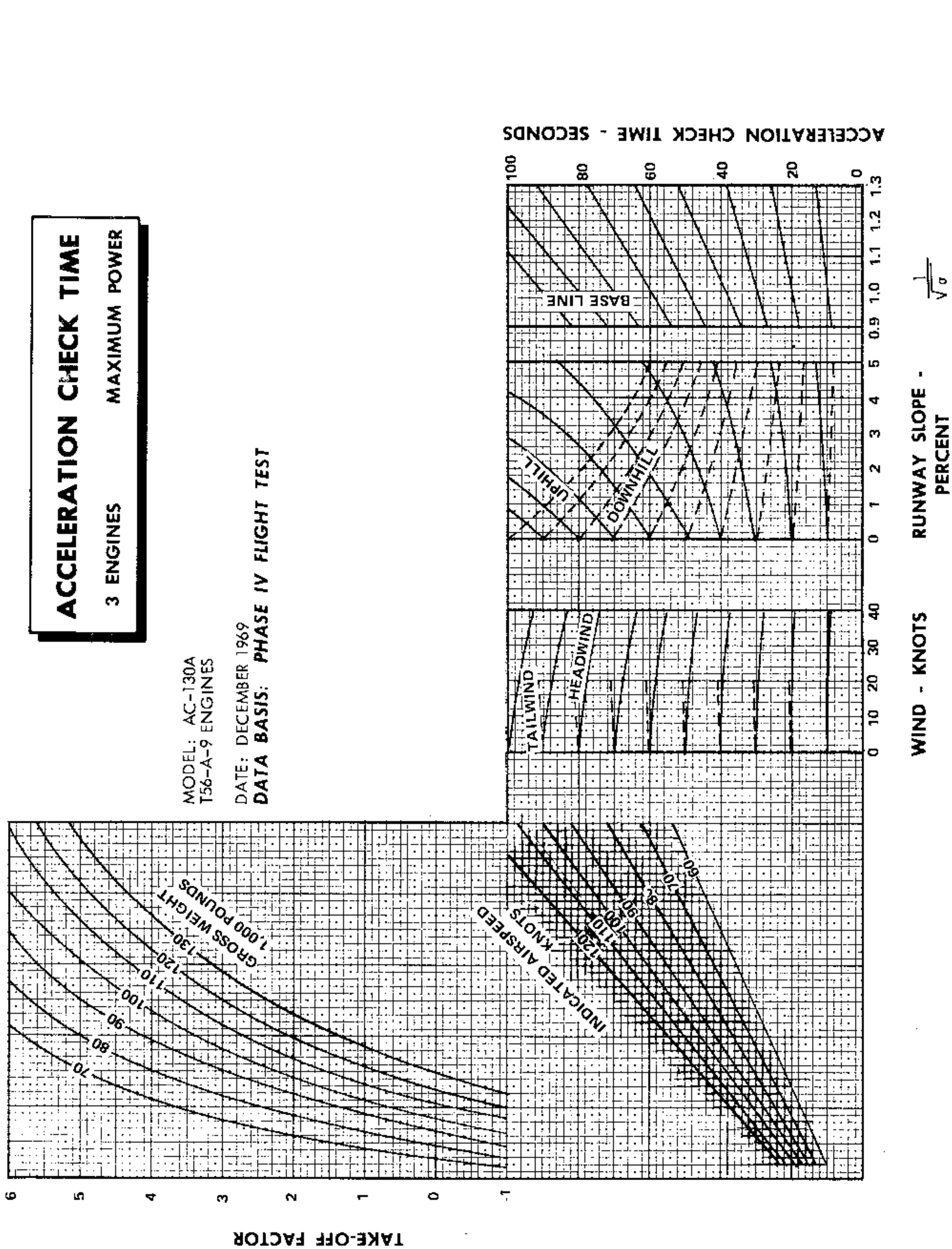

ACCELERATION CHECK TIME
3 ENGINES
MAXIMUM POWER
MODEL: AC-130A
T56-A-9 ENGINES
DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ACCELERATION CHECK TIME - SECONDS
100
80
60
40
20
0
BASE LINE
UPHILL
DOWNHILL
TAILWIND
HEADWIND
GROSS WEIGHT
1,000 POUNDS
130
120
110
100
90
80
70
INDICATED AIRSPEED
KNOTS
120
110
100
90
80
70
60
TAKE-OFF FACTOR
6
5
4
3
2
1
0
-1
WIND - KNOTS
0
10
20
30
40
RUNWAY SLOPE - PERCENT
0
1
2
3
4
5
$\frac{1}{\sqrt{\sigma}}$
0.9
1.0
1.1
1.2
1.3

Figure A3-31.

PART 4. CLIMB PERFORMANCE

TABLE OF CONTENTS

LIST OF CHARTS

CLIMB.

Charts are presented to find the time, distance, and fuel required to climb from any altitude to any other altitude up to the service ceiling. Service ceiling is the altitude where the airplane rate of climb capability is 100 feet per minute. Charts of recommended climb speeds are shown also. It is recommended that the maximum continuous power cruise ceiling not be exceeded for cruise operation, as the range capability is decreased above this altitude. Cruise ceiling is the altitude where the airplane rate of climb capability is 300 feet per minute. The standard-day cruise and service ceilings are shown on the climb charts. To find the temperature effect on ceilings, refer to Part 5.

Climb is usually performed at maximum continuous power, 927° C TIT. TIT gages occasionally give erroneous readings indicating lower than actual TIT's. Prolonged operation at TIT settings greater than recommended results in abnormally fast engine deterioration.

FOUR-ENGINE CLIMB.

The four-engine climb charts for time, distance, fuel, and speeds are presented in figures A4-1 through A4-4 for climb at maximum continuous power (927°C TIT). The data are presented as a function of gross weight. The guidelines extending upward from the weight scale represent the effect of fuel burnoff during the climb. Since fuel burnoff has a negligible effect on the climb speeds, the guidelines are not shown on the climb speed chart. Temperature affects the climb time, distance, and fuel as shown in terms of deviation from the standard temperature for a range of ±20°C from standard. Climb performance deteriorates with anti-icing bleed on. Use the All Bleed On Correction chart (figure A4-8) for the effect on four-engine climb performance. Climb charts for Variant Configurations are presented in figures A4-5 through A4-7.

Example 1.

Given:

Basic configuration: External tanks on (C-130A).

Four-engine operation.

Field elevation: Sea level.

Begin climb weight - 120,000 pounds.

OAT: 25°C (Standard +10°C).

Begin cruise at 20,000 feet pressure altitude.

Climb power: Maximum continuous.

Find:

Time, distance, and fuel to climb.

Climb speed at 12,000 feet.

Distance and fuel if anti-icing system is used.

Procedure:

Enter the Time To Climb chart (figure A4-1) with 120,000 pounds at zero variation from standard day. Follow the guidelines to standard +10°C, move vertically to the sea level line on the time to climb scale, follow parallel to the guidelines, and interpolate for a pressure altitude of 20,000 feet. Next move horizontally and read a time to climb of 21.5 minutes. In a similar manner, read a distance to climb (figure A4-2) of 67 nautical miles, and fuel to climb (figure A4-3) of 1,950 pounds. To determine the best indicated climb speed at 12,000 feet, enter the Four-Engine Maximum Continuous Power Climb Speed chart (figure A4-4) at a pressure altitude of 12,000 feet, move horizontally to 120,000 pounds, and move down vertically to the zero baseline on the temperature variation scale. Next, move upward parallel to the guidelines to standard +10°C, then down vertically to the scale and read an indicated airspeed of 160 knots. To determine the effect of all bleed on climb, enter figure A4-8 at 120,000 pounds and, for a standard day +10°C, read a bleed correction factor of 2.2. Accordingly, the new distance, fuel, and time to climb are:

2.2 x 67	=	147 nautical miles
2.2 x 1,950	=	4,290 pounds
2.2 x 21.5	=	47 minutes

Example 2.

Given:

No external fuel tanks.

Performance from example 1:

Time to climb: 21.5 minutes

Distance to climb: 67 nautical miles

Fuel to climb: 1,950 pounds

Find:

Time, distance, and fuel to climb.

Procedure:

The drag index for No External Fuel Tanks is minus 18 as determined from Part 1. Enter the Time to Climb for Variant Configuration chart (figure A4-5) with 21.5 minutes on the basic configuration scale, move vertically up to drag index of minus 18, and move to the left and read a time of 20.5 minutes on the variant configuration scale. In a similar manner, read a distance to climb (figure A4-6) of 65 nautical miles, fuel to climb (figure A4-7) of 1,860 pounds.

THREE-ENGINE CLIMB.

The data presented for three-engine climb (figures A4-9 through A4-15 are shown for maximum continuous power, 927°C TIT. These charts are used in the same manner as the four-engine climb charts.

TIME TO CLIMB
4 ENGINES
MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

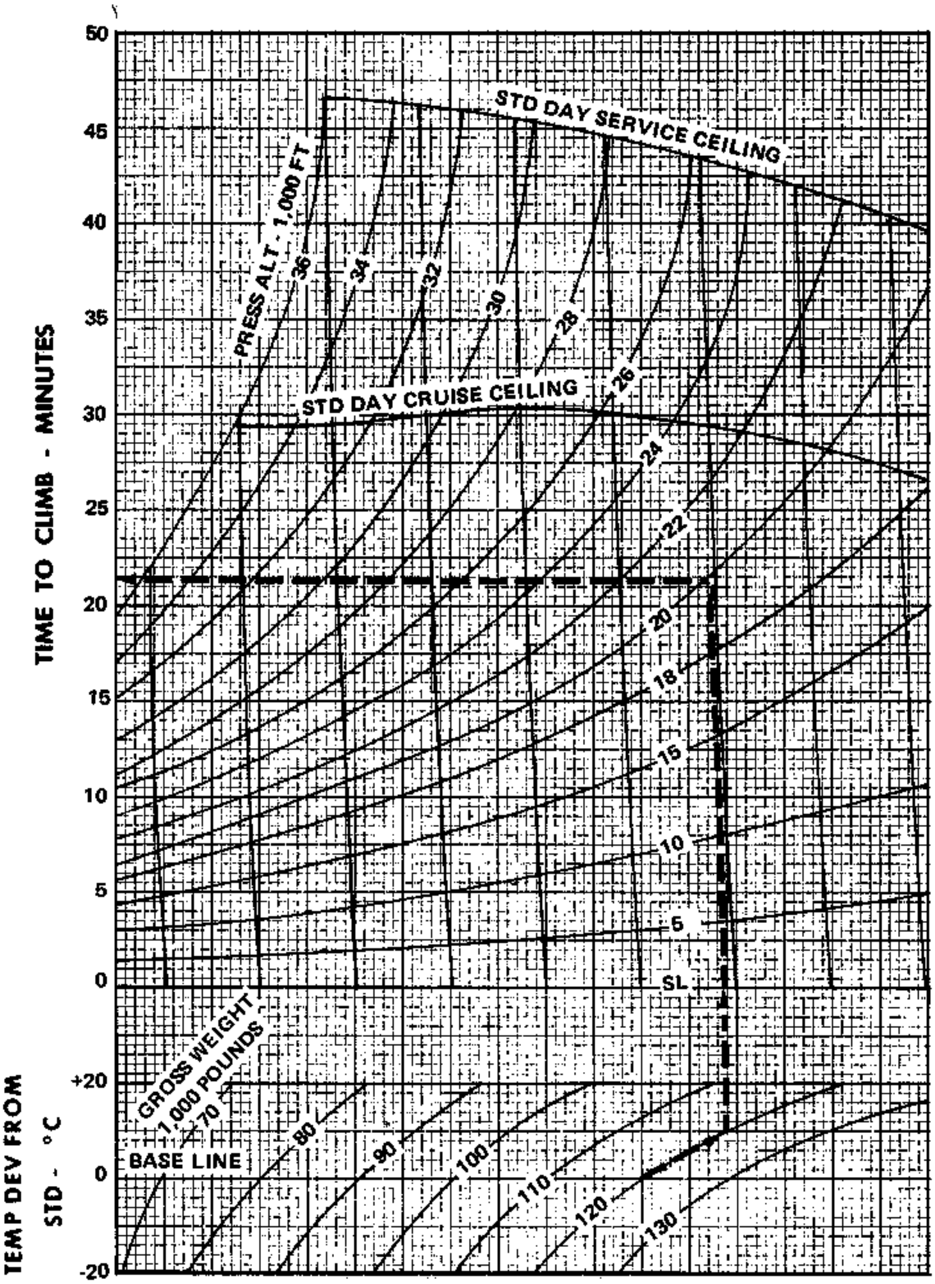


Figure A4-1.

DISTANCE TO CLIMB

4 ENGINES
MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

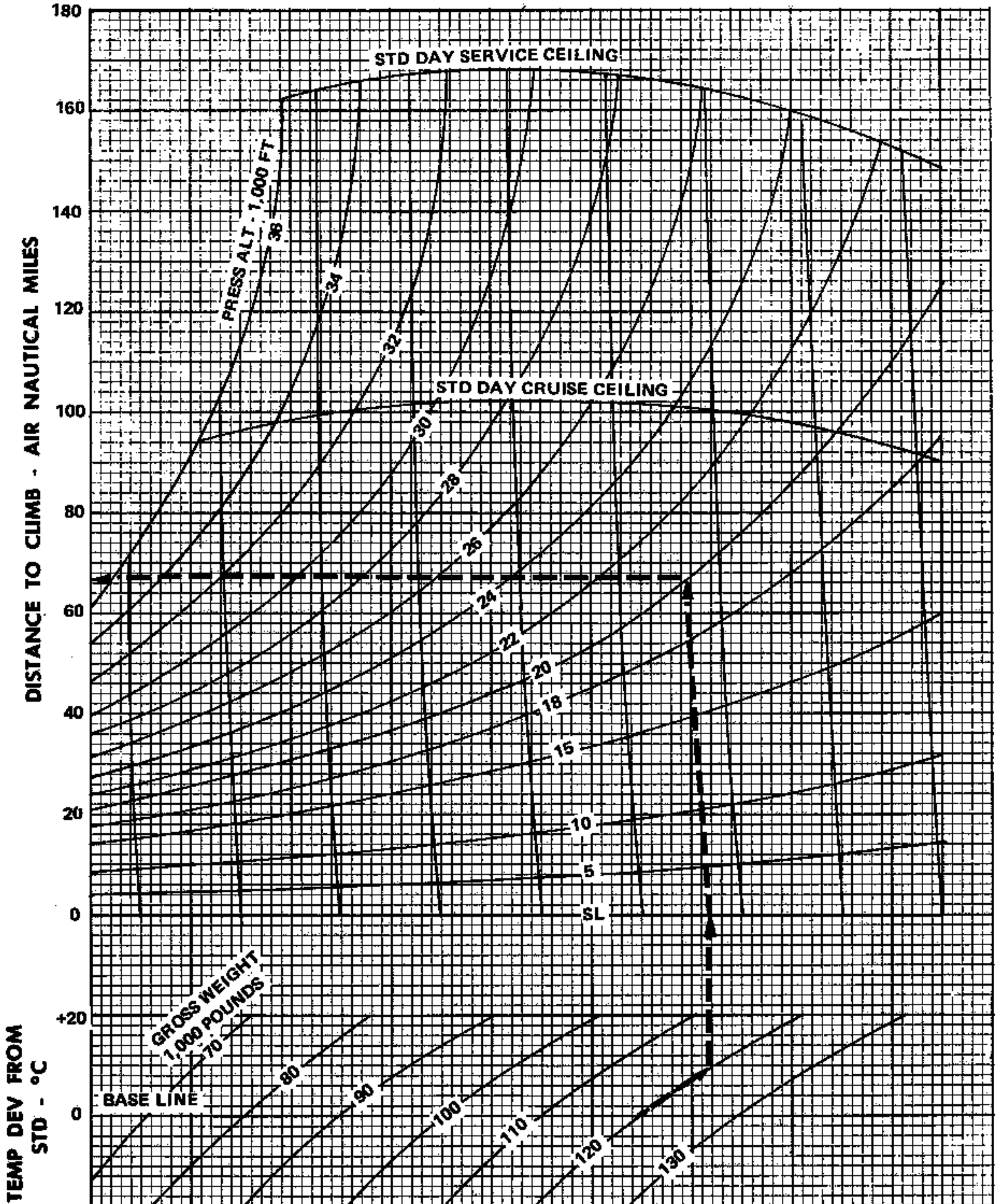


Figure A4-2.

FUEL TO CLIMB

4 ENGINES
MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

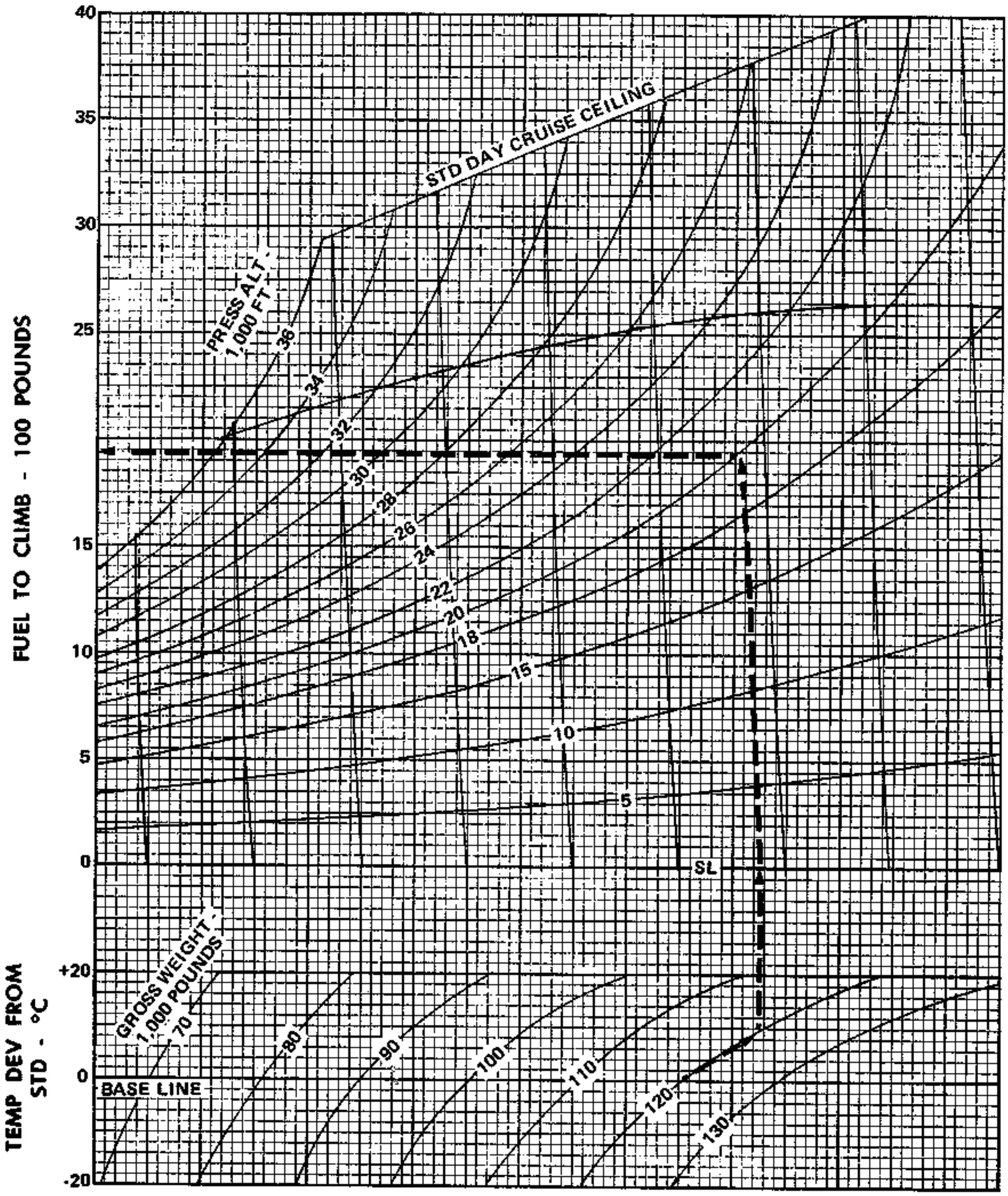


Figure A4-3.

CLIMB SPEEDS

4 ENGINES
MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

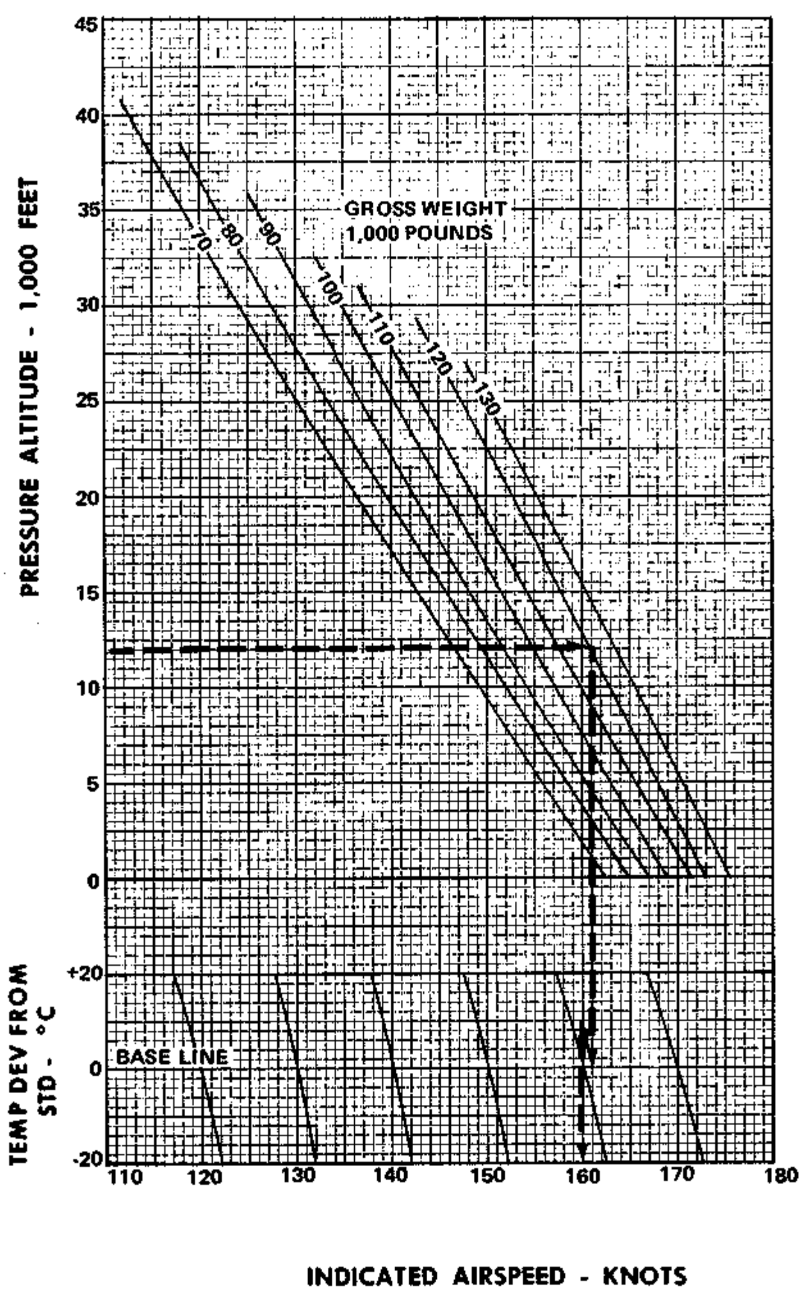


Figure A4-4.

TIME TO CLIMB FOR VARIANT CONFIGURATION

4 ENGINES MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE
Temperature effect is negligible.

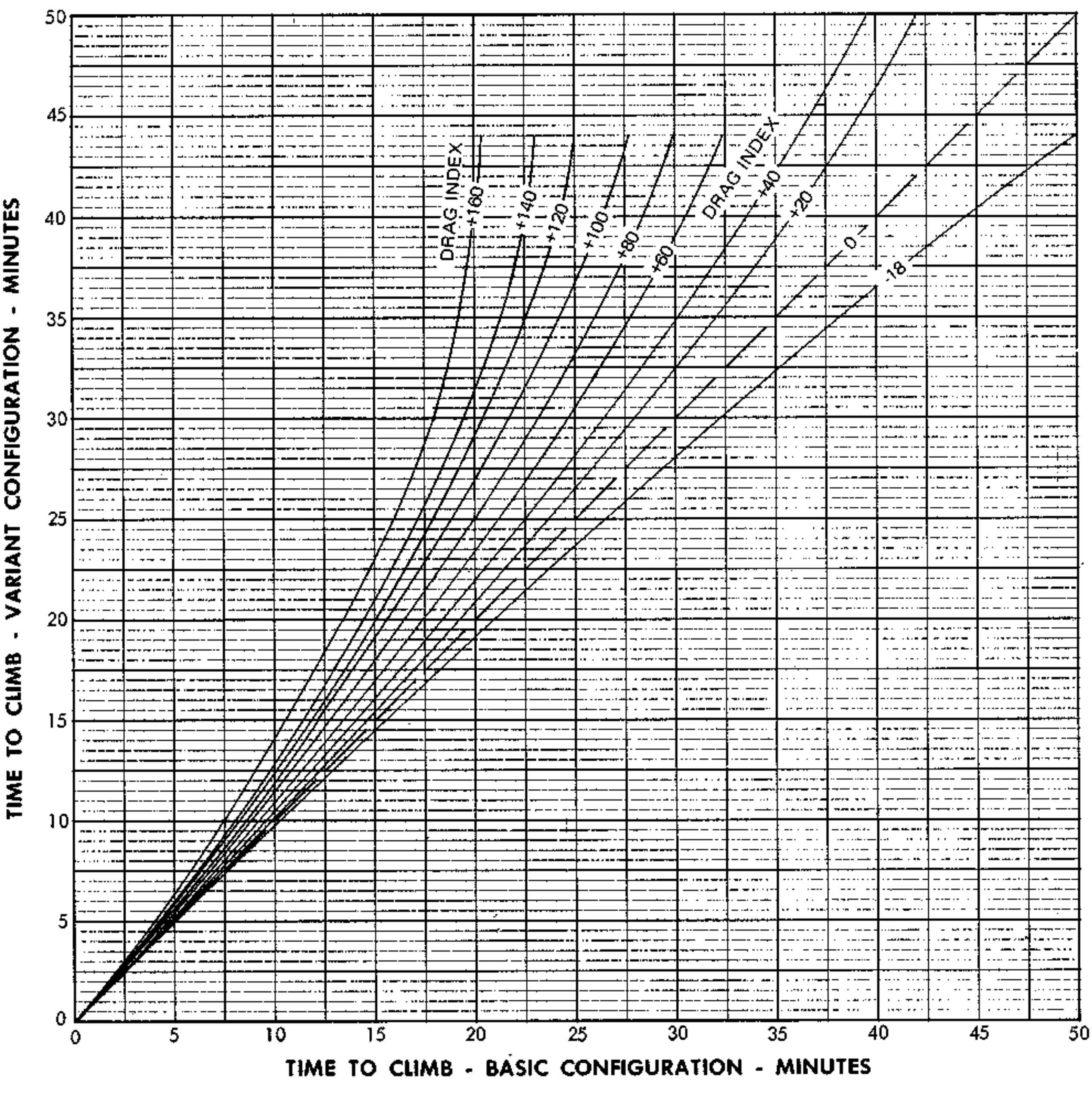


Figure A4-5.

DISTANCE TO CLIMB FOR VARIANT CONFIGURATION

4 ENGINES

MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE
Temperature effect is negligible.

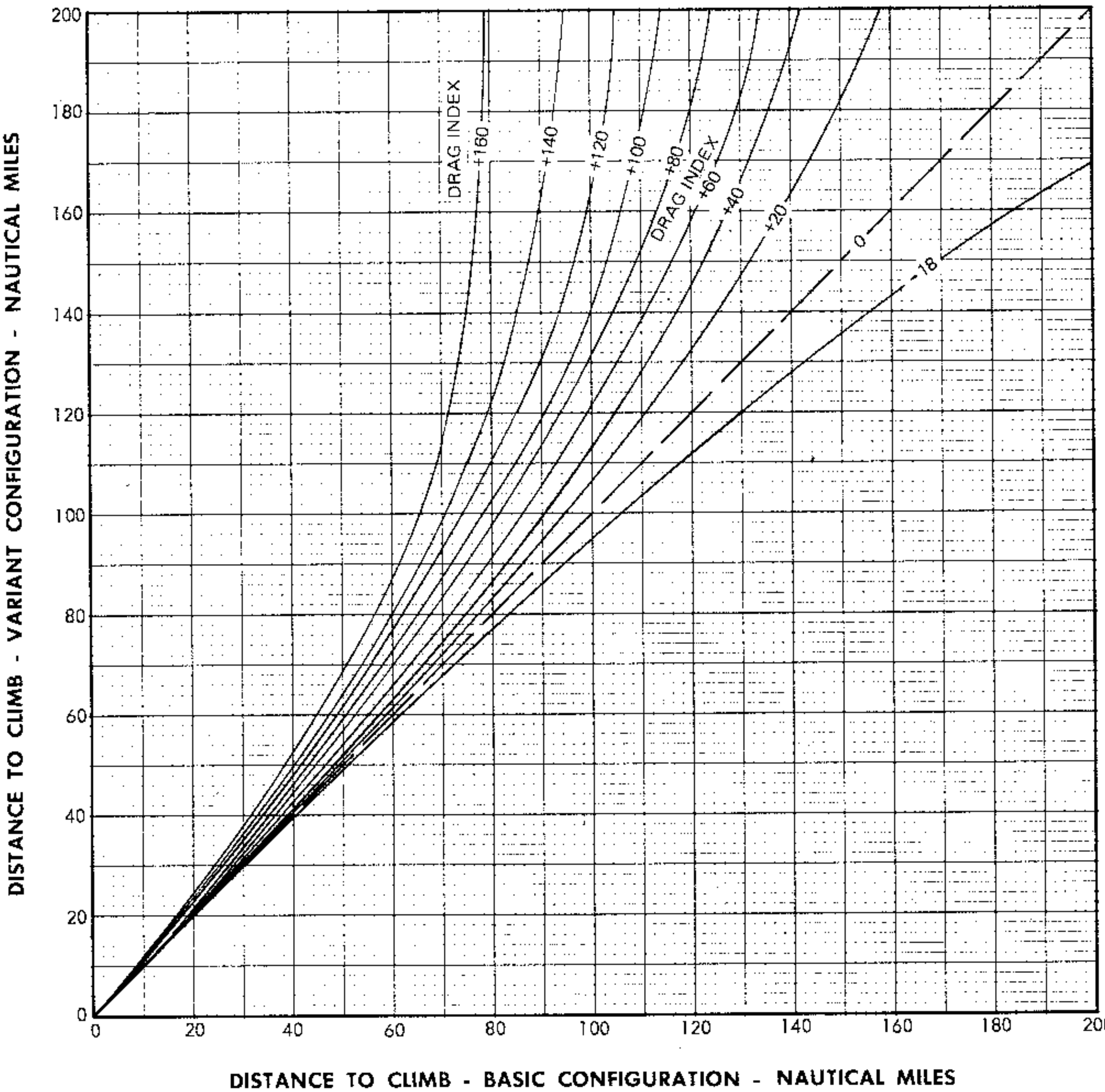


Figure A4-6.

FUEL TO CLIMB FOR VARIANT CONFIGURATION

4 ENGINES MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE
Temperature effect is negligible.

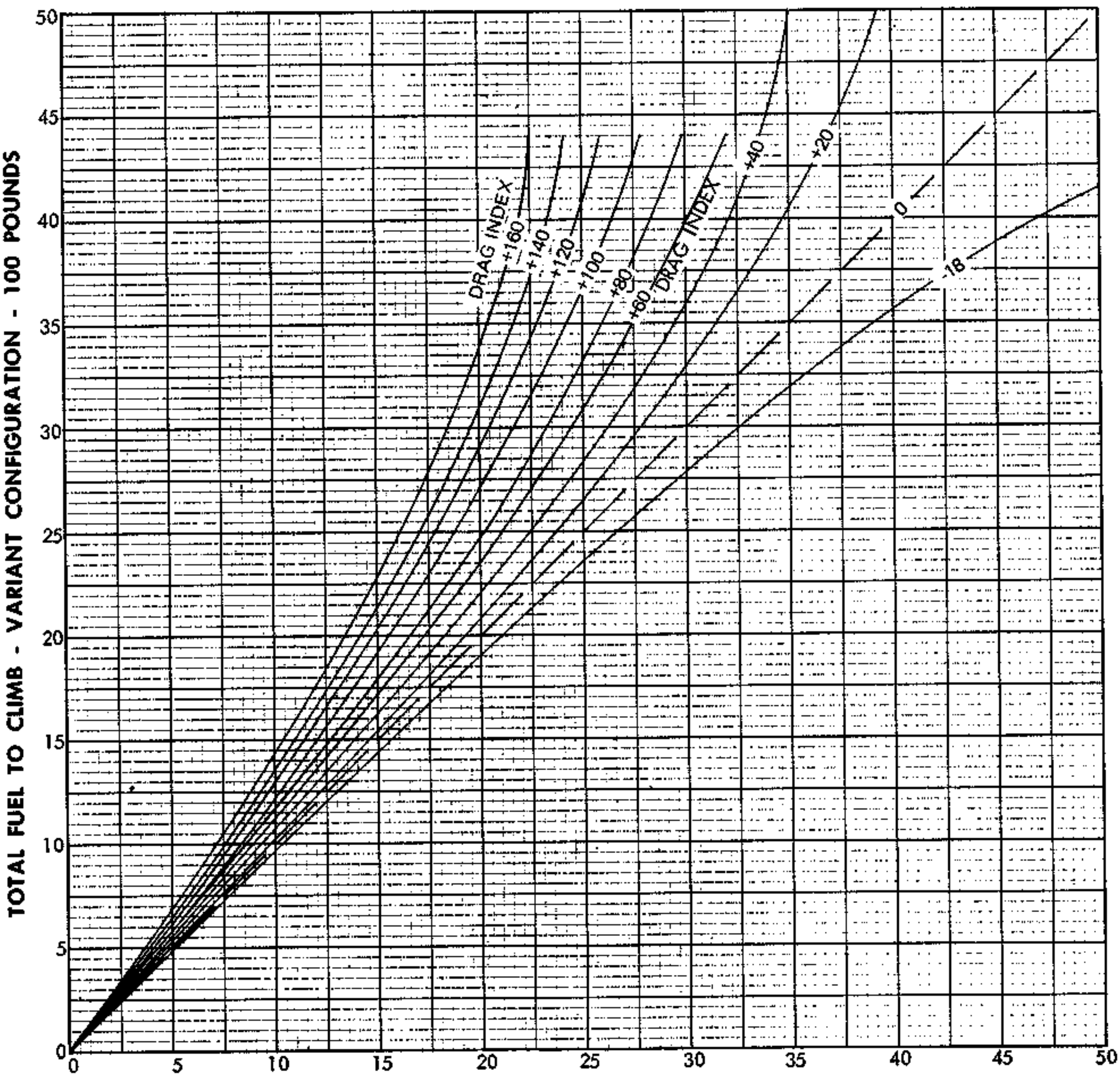


Figure A4-7.

TIME, DISTANCE AND FUEL TO CLIMB CORRECTIONS DUE TO ALL BLEED ON

4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

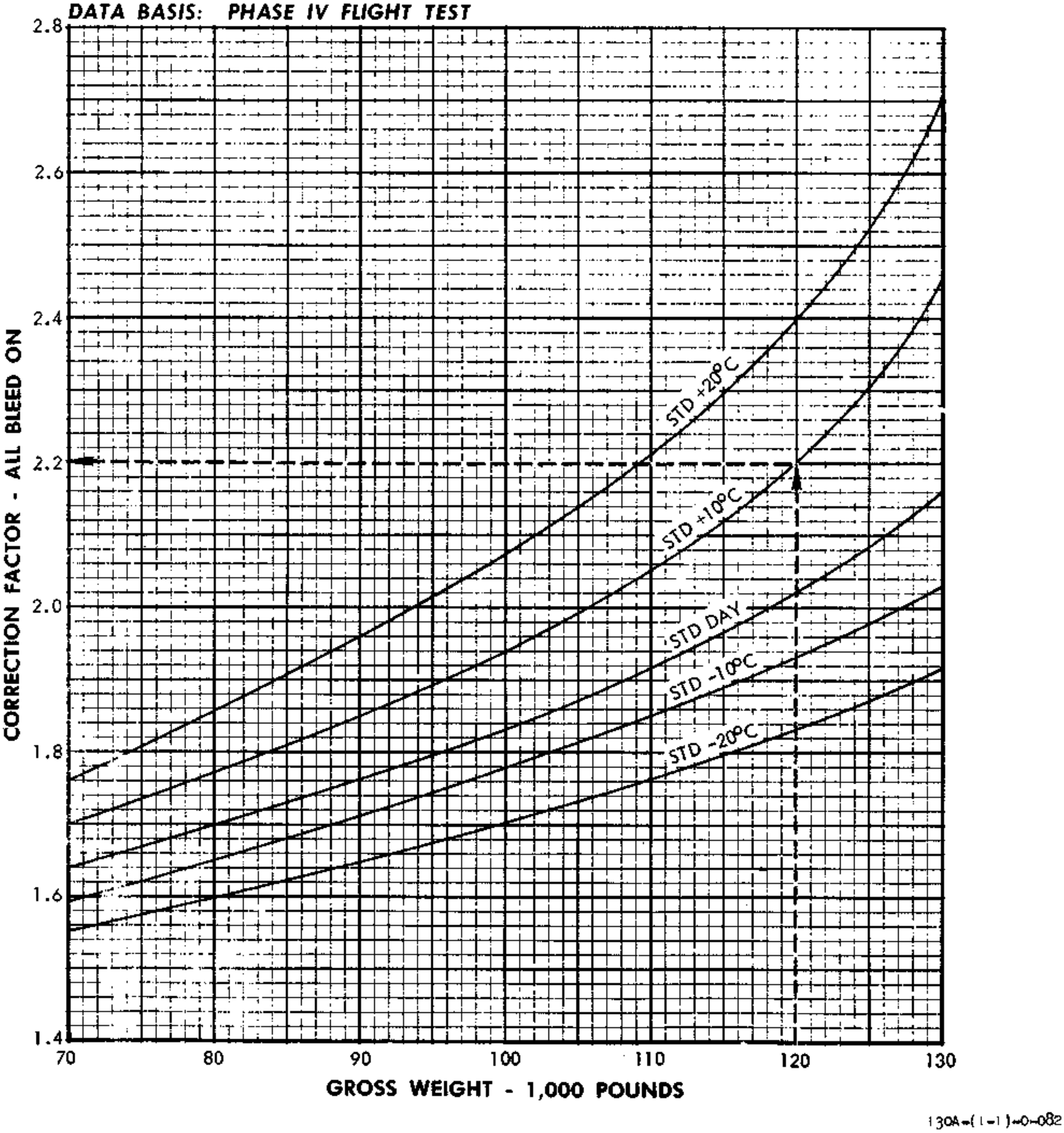


Figure A4-8.

TIME TO CLIMB

3 ENGINES
MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Propeller feathered on inoperative engine.

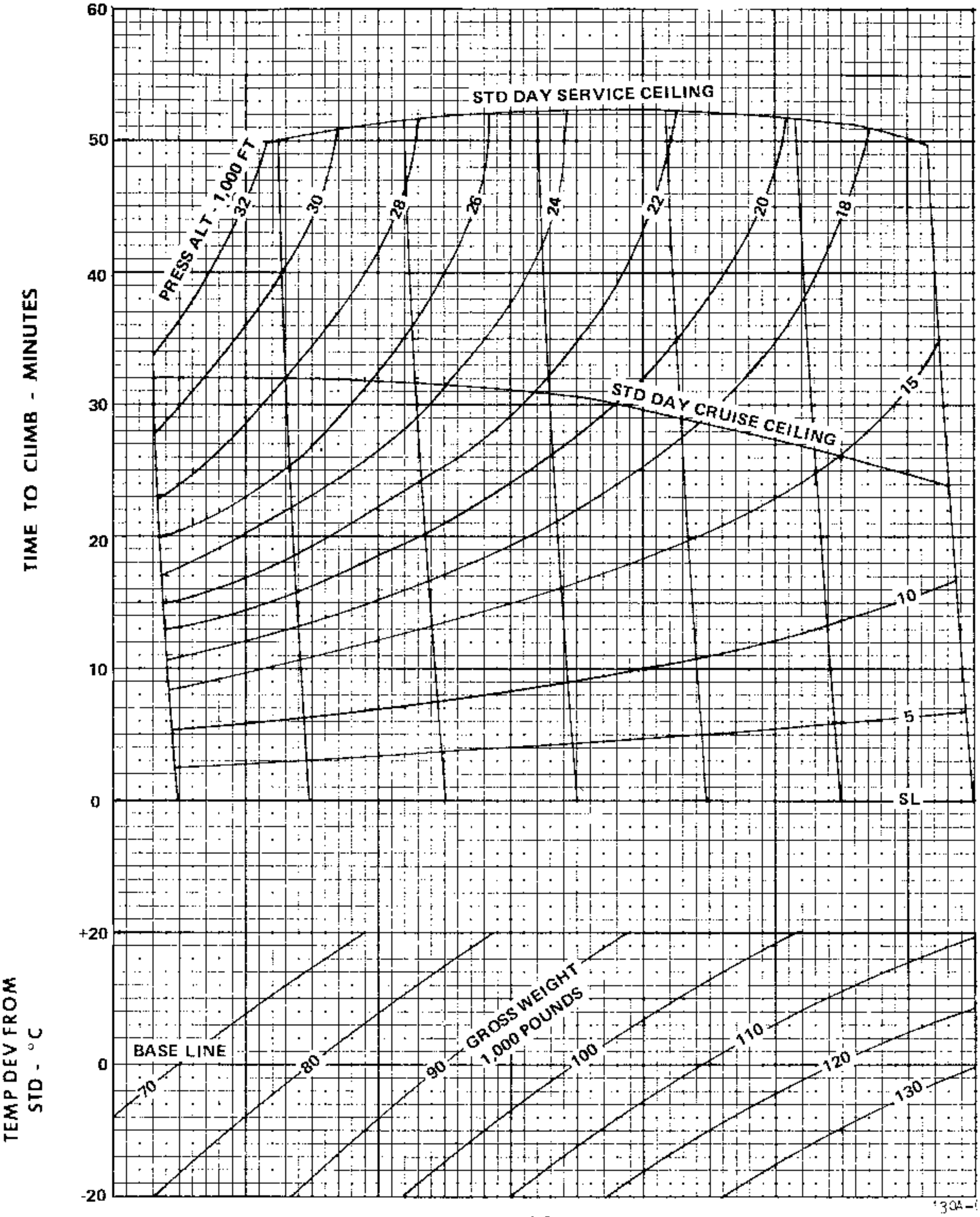


Figure A4-9.

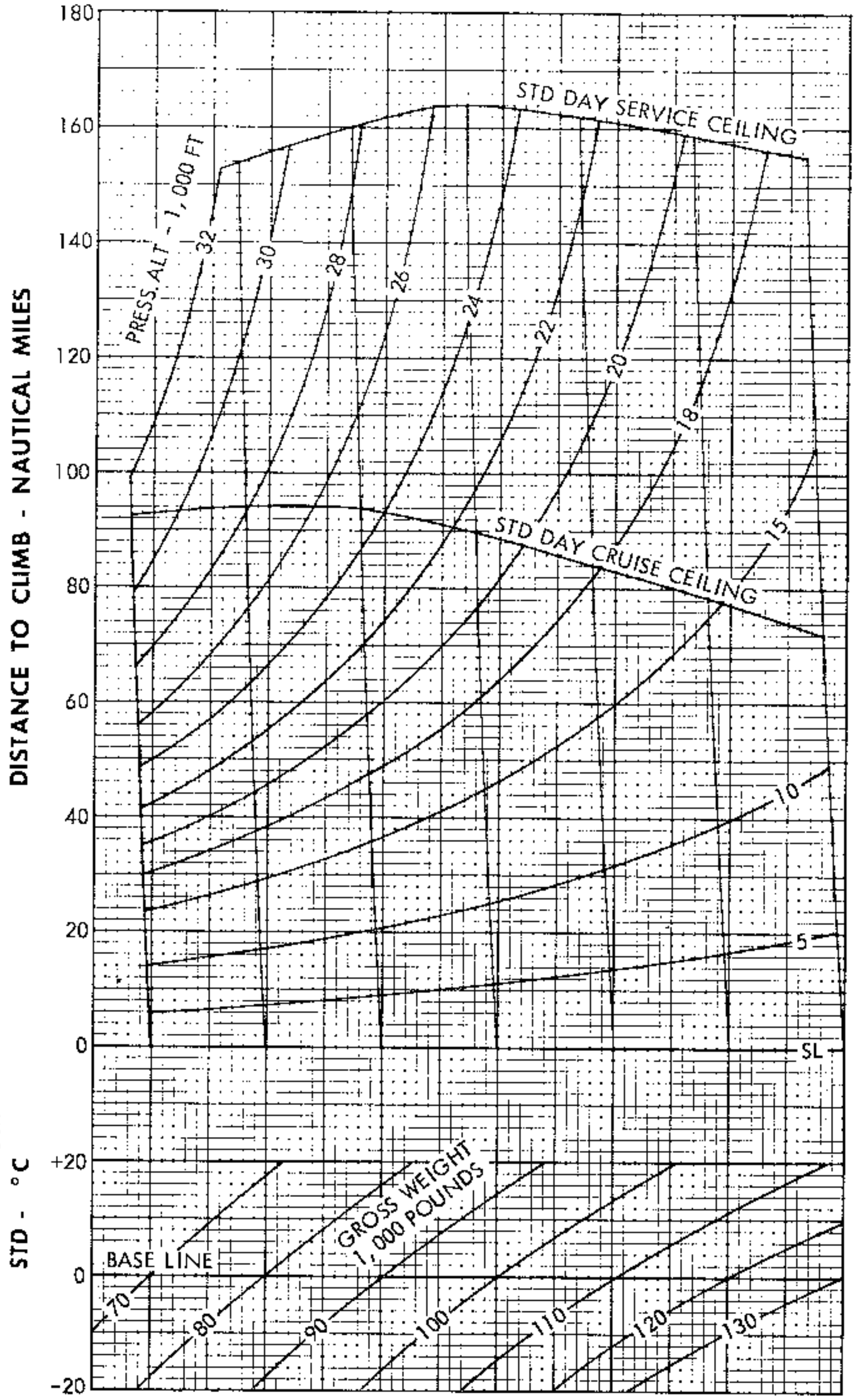
DISTANCE TO CLIMB
3 ENGINES
MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Propeller feathered on Inoperative engine.



130A-(1-1)-0-051

Figure A4-10.

FUEL TO CLIMB
3 ENGINES
MAXIMUM CONTINUOUS POWER

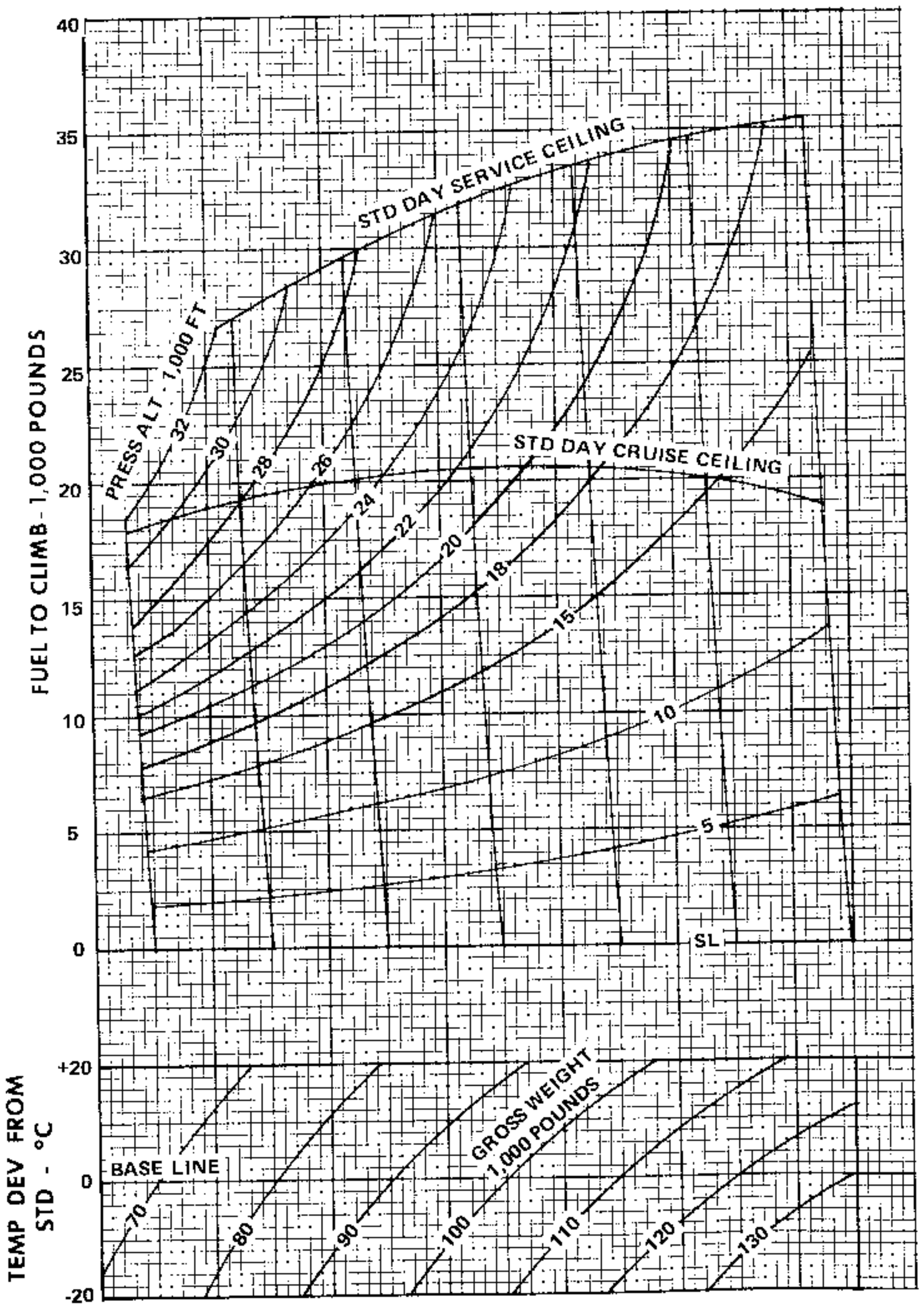
MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Propeller Feathered on Inoperative Engine.



130A-(1-1)-0-022

Figure A4-11.

CLIMB SPEEDS

3 ENGINES

MAXIMUM CONTINUOUS POWER

MODEL: C-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Propeller feathered on inoperative engine.

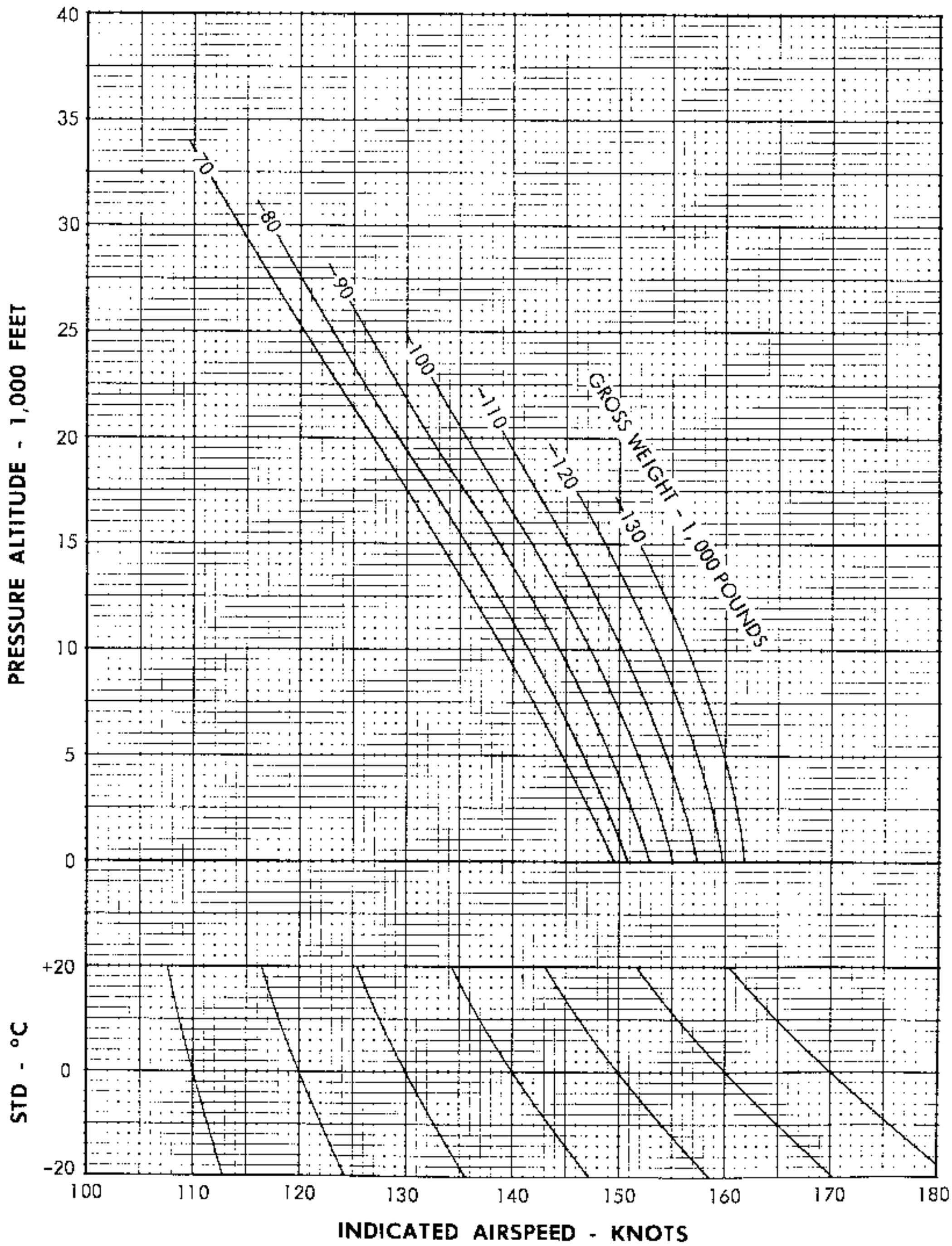


Figure A4-12.

TIME TO CLIMB FOR VARIANT CONFIGURATION

3 ENGINES MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Temperature effect is negligible
2. Propeller feathered on inoperative engine.

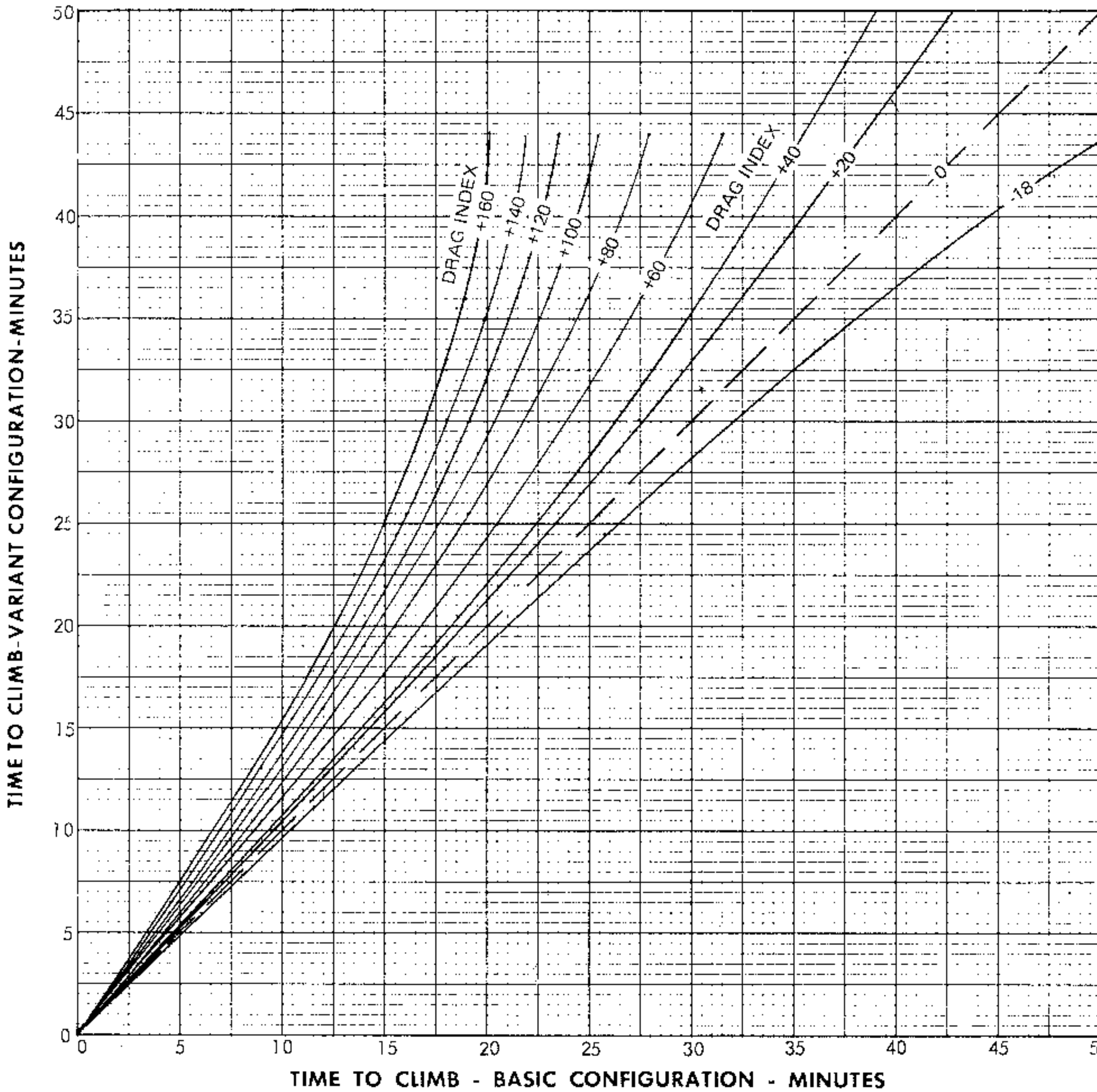


Figure A4-13.

DISTANCE TO CLIMB FOR VARIANT CONFIGURATION

3 ENGINES

MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. Temperature effect is negligible.

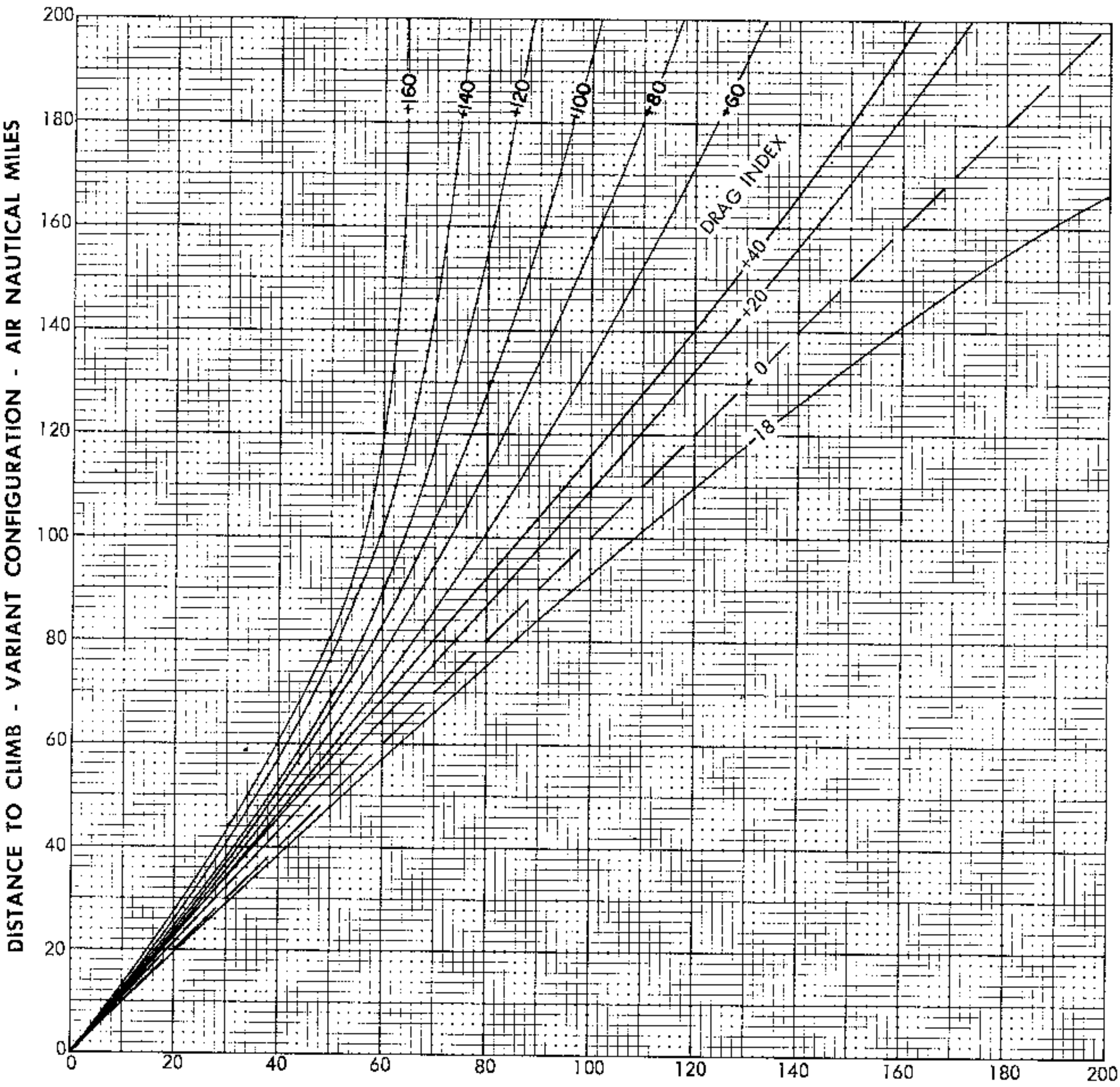


Figure A4-14.

FUEL TO CLIMB FOR VARIANT CONFIGURATION

3 ENGINES
MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. Temperature effect is negligible.

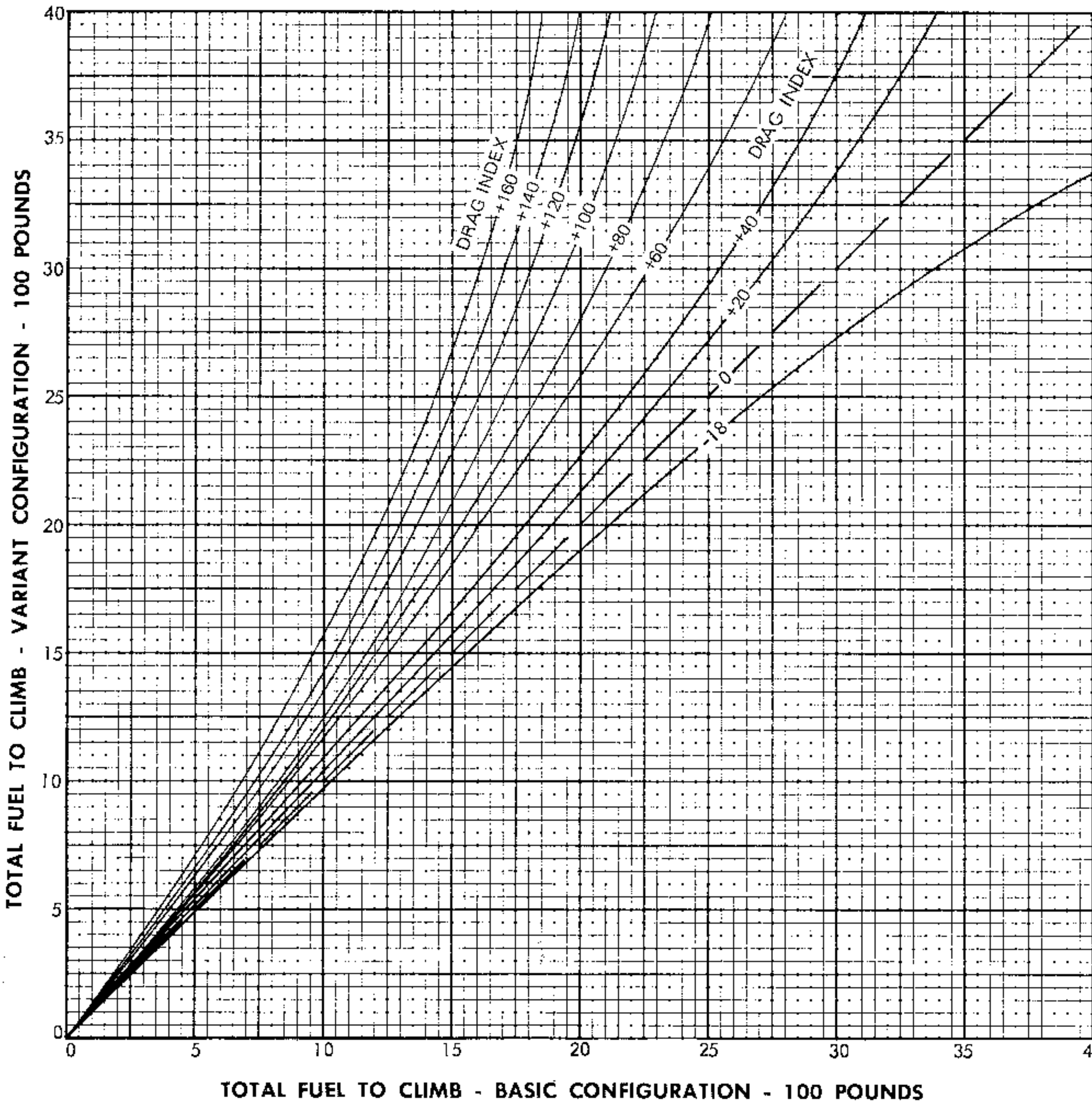


Figure A4-15.

PART 5. RANGE

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Figure Number	Title	Page

LIST OF CHARTS (Cont)

LIST OF CHARTS (Cont)

LIST OF CHARTS (Cont)

LIST OF CHARTS (Cont)

INTRODUCTION

Range capability is a function of fuel consumed and ground speed. Since fuel consumption increases with an increase in power (at a given airplane gross weight and cruise altitude), maximum range capability does not normally occur at maximum speed. For a given mission where fuel economy is more important than speed, the best results will be obtained by flying at reduced power settings. The information contained in this part of the Appendix enables a pilot to choose a cruise option which best suits his particular mission. Charts are included for the basic airplane configuration and for variant airplane configurations.

CAUTION

Observe airplane structural limit speeds shown in this part of the Appendix and in Section V of T.O. 1C-130(A)A-1.

Note

The charts contained herein are corrected for bleed losses required for cabin pressurization and air conditioning. When conditions are encountered which require the operation of anti-icing equipment, the procedures outlined in the paragraph entitled Range and Speed Corrections Due to All Bleed should be consulted.

DEFINITIONS.

The following is a list of expressions and terms used in describing cruise procedures. Some of the terms are essentially synonymous and may be used interchangeably.

Cruise Ceiling - The altitude at which the maximum rate of climb capability at maximum continuous power and best climb speed is 300 feet per minute.

V_t/W_f - Specific range. True airspeed divided by total fuel flow; or nautical miles per pound of fuel.

(V_t/W_f) MAX - The maximum value of specific range for a given weight and altitude.

99% (V_t/W_f) MAX - The value of specific range resulting from increasing true airspeed from the speed at (V_t/W_f) MAX to give a value of specific range which is one percent less than (V_t/W_f) MAX.

Long Range Cruise - Used to described conditions when the airplane is flying at the speed for 99% (V_t/W_f) MAX.

V_h - Structurally limited maximum level flight speed (recommended limit speed). See Section V of T.O. 1C-130(A)A-1 for a complete definition.

Normal Bleed - The engine bleed condition when compressor bleed air is used to operate the air conditioning and pressurization system.

All Bleed - The engine bleed conditions when compressor bleed air is used to operate the engine anti-icing system and the wing and tail surface anti-icing system in addition to the normal bleed.

RANGE PERFORMANCE.

Range performance is determined by the cruise schedule flown in the cruise portion of a mission. The type of mission determines the type of cruise schedule. Therefore, to accomplish a desired mission, the particular cruise schedule must be selected to maximize or minimize the parameter that will assure the most efficient accomplishment of the mission. Data are presented in charts for the following cruise schedules:

a. 2,000-foot step-climb cruise at the nearest odd or even altitude under cruise ceiling at both maximum continuous power and long-range cruise speeds, and at 270 and 290 knots true airspeeds.

b. Cruise at constant altitude at long-range cruise, maximum continuous power speeds, and at 260, 270 and 290 knots true airspeed.

Outside air temperature has a significant effect on airplane performance. Data in this part of the Appendix are presented for an ICAO standard atmosphere, with non-standard temperature correction lines shown where feasible. The temperature corrections are shown as a function of the variation from standard temperature in degrees Centigrade. Figure A1-5 in Part I of the Appendix may be used to determine the variation from standard-day temperature for given conditions of pressure altitude, calibrated airspeed, and indicated outside air temperature.

Maximum range during the cruise portion of the mission is obtained by flying at long-range cruise speed at the cruise ceiling. Cruise ceiling is determined from figures A5-1 through A5-8 which show ceiling as a function of gross weight with lines of constant temperature deviation. These data are presented for four engines at maximum continuous power with both normal bleed and all bleed on for three engines at maximum continuous power with normal bleed and for two engines at maximum continuous power with normal bleed. The cruise ceiling profile for maximum range is one where the altitude increases gradually as the fuel is burned off, maintaining the potential 300 feet per minute rate of climb capability at a constant power setting. This power setting coincides with maximum continuous power (927°C TIT).

The recommended step for a step-climb cruise profile is 2,000 feet. Range prediction charts are included for this type of cruise schedule. To obtain maximum cruise performance for this condition, the following procedure is recommended.

a. Determine the initial airplane gross weight.

b. Determine the cruise ceiling.

c. Select the desired altitude below cruise ceiling.

d. Enter the Range Summary charts to determine cruise speed, fuel flow, and torque setting.

e. Set the recommended power and adjust periodically as necessary as weight decreases due to fuel burnoff. Maintain the constant altitude until the gross weight has been reduced to a value which gives a cruise ceiling 2,000 feet above the altitude being maintained.

f. At this point, advance power to maximum continuous and climb 2,000 feet, and repeat the procedure in d and e above.

Cruise at constant altitude and speeds for 99 percent maximum range for long-range missions may give as much as 10 percent less range for the same mission flown at the step-climb cruise schedule. However, this is the most efficient constant altitude cruise schedule.

Cruise at a constant airspeed approximating long-range cruise speed and at constant altitude provides an operationally convenient schedule at fast speeds, but it results in average powers less than maximum continuous power for most missions, thus improving engine reliability. To facilitate planning for this type of cruise control, data are presented for cruise at a constant true airspeed 260, 270, and 290. The maximum altitudes recommended for cruise at these constant airspeeds at reduced power are either the cruise ceilings (at which 300 feet per minute rate of climb can be attained at the best climb speed) or the maximum altitude at which the appropriate true airspeed can be attained at a turbine inlet temperature of 910°C not to exceed maximum continuous power cruise ceiling. This turbine inlet temperature cannot be used as a precise value because of the variability of engine condition.

EFFECT OF WIND ON RANGE.

The direct effect of winds on airplane range is to increase or decrease the distance flown in proportion to the tailwind or headwind component. For large headwinds the airspeed for best miles per pound of fuel increases. The magnitude of this increase is such that, for winds less than 70 knots, the miles per pound at the no wind long-range cruise increases from the normal 99 percent value to a value closer to 100 percent. Therefore, no correction to air miles per pound of fuel is required for headwinds less than 70 knots. If headwinds of more than 70 knots are encountered, increasing the cruise TAS by 5 knots for every 10 knots above 70 knots headwind, will result in operating the airplane near the maximum nautical miles per pound of fuel. However, the speed may be increased only up to the point of which maximum continuous power is required. When tailwind components exist, the benefits can be maximized by flying at somewhat lower airspeeds, however, conservative flight planning would dictate that no advantage be taken of the increase in ground nautical miles per pound for cruise speeds less than no wind, long-range speeds.

The discussion above is applicable for any known wind condition. If winds are significantly different at different altitudes, another consideration becomes important. For example, if severe headwinds are encountered when flying at high altitudes but lesser headwinds are known to exist at lower altitudes, the trade-off between wind effects and the effect of altitude on range must be considered. A careful analysis should be made of the existing conditions in any specific instance before electing to change altitude on this account.

SPECIFIC RANGE CHARTS.

Specific range data for the basic airplane configuration are shown in figures A5-9 through A5-16 for 4-engine operation from sea level to 35,000 feet, figures A5-19 through A5-24 for 3-engine operation from sea level to 25,000 feet, and figures A5-27 through A5-30 for 2-engine (asymmetrical power) operation from sea level to 15,000 feet. For 2-engine operation under symmetrical power conditions, the specific range should be increased by 2.0 percent. The charts show specific range at constant weights as a function of airspeed. In addition, lines are included for constant fuel flow, recommended long range cruise speeds, military power, maximum continuous power, and structurally limited maximum level flight speeds (V_h), when applicable. Specific range and true airspeeds for variant airplane configurations for long range cruise are shown in figures A5-17 through A5-18 for 4-engine operation, figures A5-25 through A5-26 for 3-engine operation, and figures A5-31 through A5-32 for 2-engine operation.

Example.

Given:

Cruise altitude: 25,000 feet.

Cruise weight: 110,000 pounds.

Cruise speed: Speed for 99% (V_t / W_f) maximum.

Four-engine long range cruise.

Standard day, no wind.

Find:

For the basic airplane configuration and for the variant airplane configuration drag index of -18:

Nautical miles per pound of fuel.

Fuel flow per engine.

TAS.

Procedure:

The basic airplane configuration data are obtained from the 4-engine Specific Range chart for a pressure altitude of 25,000 feet (figure A5-14). Determine the intersection of the long range cruise line with the 110,000-pound line. Read to the left 72.8 nautical miles per 1,000 pounds of fuel and read vertically down 268 KTAS and 182 KCAS. The fuel flow in pounds per hour per engine is found to be 920 at the intersection of the long range cruise line and the 110,000 pound line.

To find the respective values for the variant airplane configuration (drag index of -18), enter figure A5-17 with 268 KTAS, read up to the interpolated drag index of -18, then read at the left 273 KTAS. Enter figure A5-18 with 72.8 nautical miles per 1,000 pounds and read a new nautical mile per 1,000 pounds of 75.2 for the variant configuration. Total fuel flow per hour is obtained by dividing the speed of 273 KTAS by .0752 (75.2 ÷ 1,000) nautical miles per pound of fuel to give 3630 pounds. Fuel flow per engine is 908 (3630 ÷ 4) pounds per hour.

RANGE SUMMARY.

FOUR ENGINES OPERATING.

A summary of range data at long-range cruise speeds is presented in figures A5-33 through A5-35 for altitudes from sea level to cruise ceiling. These data are presented in terms of calibrated airspeed versus gross weight, fuel flow versus gross weight, and torque versus altitude. True airspeeds and fuel flow at long-range cruise speeds for variant airplane configurations are obtained from figures A5-17 and A5-18 Range summary long-range cruise torque for variant airplane configurations is shown in Figure A5-36.

Constant 290-knot true airspeed cruise data are presented in figures A5-37 through A5-40 for the basic airplane configuration. Fuel flow, torque, and TIT for 290-knot true airspeed cruise for variant airplane configuration are shown in figures A5-41 through A5-43. Fuel flow, torque and TIT for 270-knot true airspeed cruise figuration are shown in figures A5-44 through A5-48. (Refer to Section V of T.O. 1C-130(A)A-1 for complete information on structural limit speeds.)

Conditions at which structural limit speeds apply are indicated on the range summary charts by broken lines. For a given gross weight and altitude, if the uncorrected airspeed for the given temperature falls above the broken line, the structural limit speed is applicable.

Note

Observe the structural speed limitations shown on these charts and in Section V of T.O. 1C-130(A)A-1

Example.

Given:

Gross weight: 118,000 pounds.

Pressure altitude: 20,000 feet.

Temperature: Standard day +10° C.

Speed: 4 Engine Long Range Cruise

Find:

For the basic airplane configuration and for a variant airplane configuration drag index of -18:

True airspeed.

Fuel flow.

Torque.

Air nautical miles per 1,000 pounds of fuel.

Procedure:

To find calibrated airspeed for the basic airplane configuration, enter figure A5-33 at 118,000 pounds, proceed vertically to 20,000 feet pressure altitude, correct for temperature deviation, and read 193 KCAS. Convert 193 KCAS to TAS as follows:

$$EAS = CAS - \Delta V_c$$

$$EAS = 193 - 2.3 \text{ (from figure A1-4)}$$

$$EAS = 190.7$$

$$TAS = EAS \times \frac{1}{\sqrt{\sigma}}$$

$$TAS = 190.7 \times 1.397 \text{ (from figure A1-6)}$$

$$TAS = 262 \text{ knots}$$

To find fuel flow for the basic airplane configuration, enter figure A5-34 at 118,000 pounds, proceed vertically to 20,000 feet, move to the standard day temperature line, follow the guidelines to +10° C, and read 1010 pounds per hour per engine. Total fuel flow is 1010 x 4 or 4040 pounds per hour. Torque is found in the same manner from figure A5-35 to be 8,000 inch-pounds per engine. Air nautical miles per 1,000 pounds of fuel is 262 KTAS divided by 4,040 pounds fuel flow per hour times 1,000 or 64.8.

Performance for the variant airplane configuration is obtained from figures A5-17 and A5-18. To find true airspeed enter figure A5-17 with the basic airplane configuration KTAS of 262, move vertically to a drag index of -18, and read 267 KTAS. Air nautical miles per 1,000 pounds of fuel is found in the same manner from figure A5-18 to be 67. Total fuel flow per hour is obtained by dividing 267 KTAS by .067 (67.1÷1,000) nautical miles per pound to give 4,000 pounds. Fuel flow per engine is 1000 pounds per hour. Torque for the variant configuration is obtained from figure A5-36 and is 7,700 inch pounds per engine.

Constant 260-knot true airspeed cruise data is presented in figures A5-49 through A5-53. The 260 KTAS Range Summary, when flying at maximum continuous power cruise ceiling, represents the most economical constant true airspeed fuel consumption for the basic airplane configuration. Use figures A5-41, A5-42, A5-43 and A5-36 for variant airplane configuration for fuel flow, torque, and TIT.

ONE OR TWO ENGINES INOPERATIVE.

Range summary data for 3-engine and 2-engine operating conditions are shown in figures A5-54 through A5-59. Cruise conditions for 3-engine and 2-engine long-range cruise at constant altitude, 2,000 -foot step-climb cruise profile are determined from the respective 3-engine and 2-engine range summary charts in the same manner as the 4-engine cruise conditions were determined in the example. The 2-engine range summary charts are for asymmetrical power. For symmetrical 2-engine operation, cruise performance would show a 2.0 percent improvement. For two-engine cruise at the hotter temperatures, cruise at long range cruise near the cruise ceiling may require maximum continuous power (927°C TIT power setting).

RANGE AND TIME PREDICTION.

FOUR-ENGINE RANGE AND TIME PREDICTION.

The 4-engine range and time prediction charts are presented in figures A5-62 through A5-73 and A5-79 through A5-83. These charts are used to predict distance traveled and time required for cruise at long range cruise speeds, and 270- and 290-knot constant true airspeed. Both constant altitude cruise and 2,000-foot step-climb cruise data are shown. Time prediction charts are not included for the 270 and 290 KTAS cruise since the time is easily calculated for this condition. These data are presented in charts of distance and time versus gross weight for a standard day and ±20°C variation from standard day temperatures. The step-climb curves are a summation of the constant altitude segments for both odd and even altitude steps. Distance, time, and fuel to climb from one altitude to another have been accounted for in the step-climb profile. The 290 KTAS cruise at less than maximum continuous power can not be flown at a standard day +20°C except at weights slightly above the zero fuel weight. For this reason the chart for standard day +20°C is omitted.

Range Prediction Distance and Time chart are provided for variant airplane configurations. There are separate charts for variable cruise altitude (step-climb along cruise ceiling or cruise altitude) and constant altitude cruise, for each of the conditions above.

THREE-ENGINE RANGE AND TIME PREDICTION.

The 3-engine range and time prediction charts presented in figures A5-74 through A5-78 and A5-84 through A5-88 are used to predict distance traveled and time required for cruise at long-range cruise speeds at constant altitudes, and the 2,000-foot step-climb cruise profile. These data are presented in the same format as the four-engine charts.

Example 1.

Given:

Initial cruise weight: 120,000

No wind.

Four-engine, 2,000-foot, step-climb cruise.

Temperature: Standard day.

Long range cruise.

Cruise distance: 2,000 nautical miles.

Find:

For the basic airplane configuration and for a variant airplane configuration drag index of -18:

End cruise weight.

Fuel used during cruise.

Cruise time.

Procedure:

Enter the 4-engine Range Prediction-Distance chart, figure A5-63, with the initial cruise weight of 120,000 pounds. Read up to the variable cruise altitude line and across to a distance of 8,330 miles. Enter the distance scale at a value of 10,330 miles (8,330 + 2,000) read across to the variable cruise altitude line, and down to the end cruise weight of 94,400 pounds. The fuel burned during cruise is the initial cruise weight of 120,000 pounds less the end cruise weight of 94,400 pounds, or 25,600 pounds. The cruise time is determined from figure A5-80 to be 7.1 hours by subtracting the time of 22.4 hours at 120,000 pounds from the time of 29.5 hours at 94,400 pounds.

For a variant airplane configuration drag index of -18 enter figure A5-65 with the range for the basic configuration and for a -18 drag index read 2090 nautical miles.

Example 2.

Given:

Four-engine constant altitude cruise at 12,000 feet at long-range cruise.

Begin cruise weight: 120,000 pounds.

End cruise weight: 90,000 pounds.

Temperature deviation from standard day: +20°C.

Wind: 20-knot tailwind.

Find:

For the basic airplane configuration and for a variant airplane configuration drag index of -18:

Cruise distance.

Cruise time.

Procedure:

Enter the 4-engine Range Prediction-Distance chart, figure A5-62 with the initial cruise weight of 120,000 pounds. Read up to the 12,000-foot altitude line and across to a distance of 2,060 miles. Repeat this procedure with the end cruise weight of 90,000 pounds, and read a distance of 3,870 nautical miles. The cruise distance is 3,870 less 2,060 or 1,810 nautical miles. The ground distance covered is obtained by multiplying this air distance by the ratio of ground speed to true airspeed. From figure A5-33, the cruise calibrated airspeed at the average gross weight of 105,000 pounds is 200 knots. Applying the appropriate corrections, the true airspeed is found to be 247 knots.

$$\text{Ground distance} = \frac{247 + 20}{247} \times 1{,}810$$

$$= 1{,}957 \text{ nautical miles}$$

The average cruise true ground speed at the average cruise weight with a 20-knot tailwind is 247 + 20 = 267 knots. Therefore, the cruise time is:

$$\text{Cruise time} = \frac{1{,}957}{267} = 7.33 \text{ hours}$$

For a variant airplane configuration drag index of -18 enter figure A5-65 with the range for the basic configuration and for a -18 drag index read 2005 nautical miles.

RANGE CORRECTION DUE TO ALL BLEED ON.

The compressor bleed air used to operate the air conditioning and pressurization system, the engine anti-icing system, and the wing and tail surface anti-icing system subtract from the engine power delivered to the propeller. The charts in this Part of the Appendix have been corrected to take into account the losses due to normal pressurization and air conditioning. However, when anti-icing equipment is in operation, airplane performance will be further reduced. Range corrections due to anti-icing bleed are presented in figure A5-89 in terms of an all-bleed-on correction factor versus altitude for lines of constant weight. These correction factors are based on the assumption that the power setting is increased to maintain a given flight condition (airspeed and altitude) after the anti-icing system is turned on. This will require a torque equal to that required for normal bleed at the same flight condition. The correction factors are valid for a temperature range of +20°C from standard day. For a particular weight and altitude, multiply the normal bleed range or nautical miles per pound by the correction factor to obtain the all-bleed-on range or nautical miles per pound. The all-bleed-on fuel flow is obtained by dividing the normal bleed fuel flow by the correction factor. The change in torque due to change in bleed is obtained from figure A2-3. However, to maintain the same altitude and speed, the torque will have to be increased back to the initial value which existed for the normal bleed condition, provided maximum continuous power is not exceeded.

Example.

Given:

Altitude: 20,000 feet.

Weight: 120,000 pounds.

Four-engine operation.

Long range cruise.

Standard conditions.

Nautical miles per pound of fuel: 0.0654 (figure A5-13)

Fuel Flow: 1,010 pounds per hour per engine.

Torque: 8,180 inch-pounds per engine.

Find:

Torque loss per engine due to engine air bleed for the above conditions with the anti-icing equipment in operation.

Corrected nautical miles per pound of fuel.

Corrected fuel flow per engine.

Procedure:

Enter the In Flight Torque Loss Due to All Bleed On chart, figure A2-3, with the normal bleed torque of 8,180 inch-pounds. Read across to the 20,000-foot altitude line and down to the all-bleed-on torque of 5,370 inch-pounds. The torque loss is 8,180 less 6,537, or 2,810 inch-pounds. In order to maintain the same altitude and speed, the all-bleed-on torque must be increased back to the initial value which existed for the normal bleed condition (8,180 inch-pounds per engine).

Enter the Range Corrections Due to All Bleed On chart, figure A5-89 with the altitude of 20,000 feet. Read across to the standard day line and down to the all-bleed-on correction factor of 0.83. The corrected nautical miles per pound is found by multiplying the normal bleed value of 0.0654 by the correction factor of 0.83 which gives a corrected value of 0.0543. The corrected fuel flow is found by dividing the normal bleed value of 1,010 pounds by the correction factor of 0.83, which gives a corrected value of 1,220 pounds.

For variant airplane configuration, a chart of basic configuration correction factor versus variant configuration correction factor is provided.

OPTIMUM ENGINE CONFIGURATION.

The optimum engine configuration chart, figure A5-90, provides a summary of cruise performance for 4-, 3-, and 2-engine operation. This figure can be used to obtain a quick estimate of cruise altitude, range, fuel, and engine configuration for a given mission. Use of this chart will show that, if cruise must be continued at a lower altitude, better economy may be obtained by feathering one or two engines.

Example.

Given:

Initial cruise weight: 90,000 pounds
Distance to be flown: 1,500 nautical miles
Cruise altitude: 15,000 feet
One engine inoperative, propeller feathered

Find:

Cruise fuel.

Procedure:

Enter optimum engine configuration chart, figure A5-90, with 90,000 pounds gross weight. Move vertically to the 1,500 nautical mile line, horizontally to the three-engine line, down to the 15,000 foot cruise altitude line, and read 23,000 pounds of cruise fuel. Similarly, for a given cruise fuel quantity, cruise altitude, engine configuration, and initial cruise weight, cruising range can be determined. Also, for a given initial cruise weight, cruise fuel, cruise altitude, and distance, the optimum engine configuration can be determined. Do not exceed cruise ceiling for any given engine configuration.

DRIFTDOWN.

If failure of one or two engines should occur during four-engine cruise operation, it may be necessary, due to loss of power, for the airplane to descend to a lower altitude. This forced descent is called driftdown. It is important for the pilot to know the driftdown procedure and to be able to predict the loss in altitude as well as the distance traveled and the time required during driftdown. Use of the proper procedure will produce the optimum utilization of fuel during this phase of flight, which will be followed by cruise at a lower altitude where fuel consumption will be greater. This information can be obtained from figures A5-95 and A5-93. These charts present driftdown data for maximum range descent and are based on speeds for maximum lift-to-drag ratio. The procedure for driftdown is to maintain the recommended speed until the rate of descent decreases to 100 feet per minute. From this point a procedure may be selected by the pilot, depending upon range and/or terrain clearance requirements, and the airplane is pulled up to attain level flight at either the service ceiling point or cruise ceiling point. The data presented in these charts are based on a descent to service ceiling or cruise ceiling for one-engine and two-engine out conditions and account for the fuel used during descent. The data are based on the assumption that the propellers are feathered on the inoperative engines and that the operating engines are set at maximum continuous power. For nonstandard conditions, use the standard day increments for altitude lost from Driftdown charts (figures A5-95 and A5-96) and subtract from the nonstandard day four-engine cruise ceiling.

Example 1.

Given:

Gross Weight: 90,000 pounds

Drag Index: +140

Find:

Altitude lost in driftdown and calibrated airspeed.

Procedure:

Enter the Driftdown Maximum Continuous Power Chart, figure A5-22 with 90,000 pounds at zero drag index. Follow the guidelines to drag index of +140 move vertically upward and read 5,050 Ft. Altitude lost and 155 calibrated airspeed.

SERVICE CEILINGS

Service ceilings for 4, 3, and 2-engine operations are presented in Figure A5-91. Charts for service ceilings of variant configuration (AC-130A) are given in figures A5-92 through A5-93 for 4-, 3-, and 2-engine operation.

MODEL: AC-130A
T56-A-9 ENGINES

CRUISE CEILING-MAXIMUM CONTINUOUS POWER

4 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

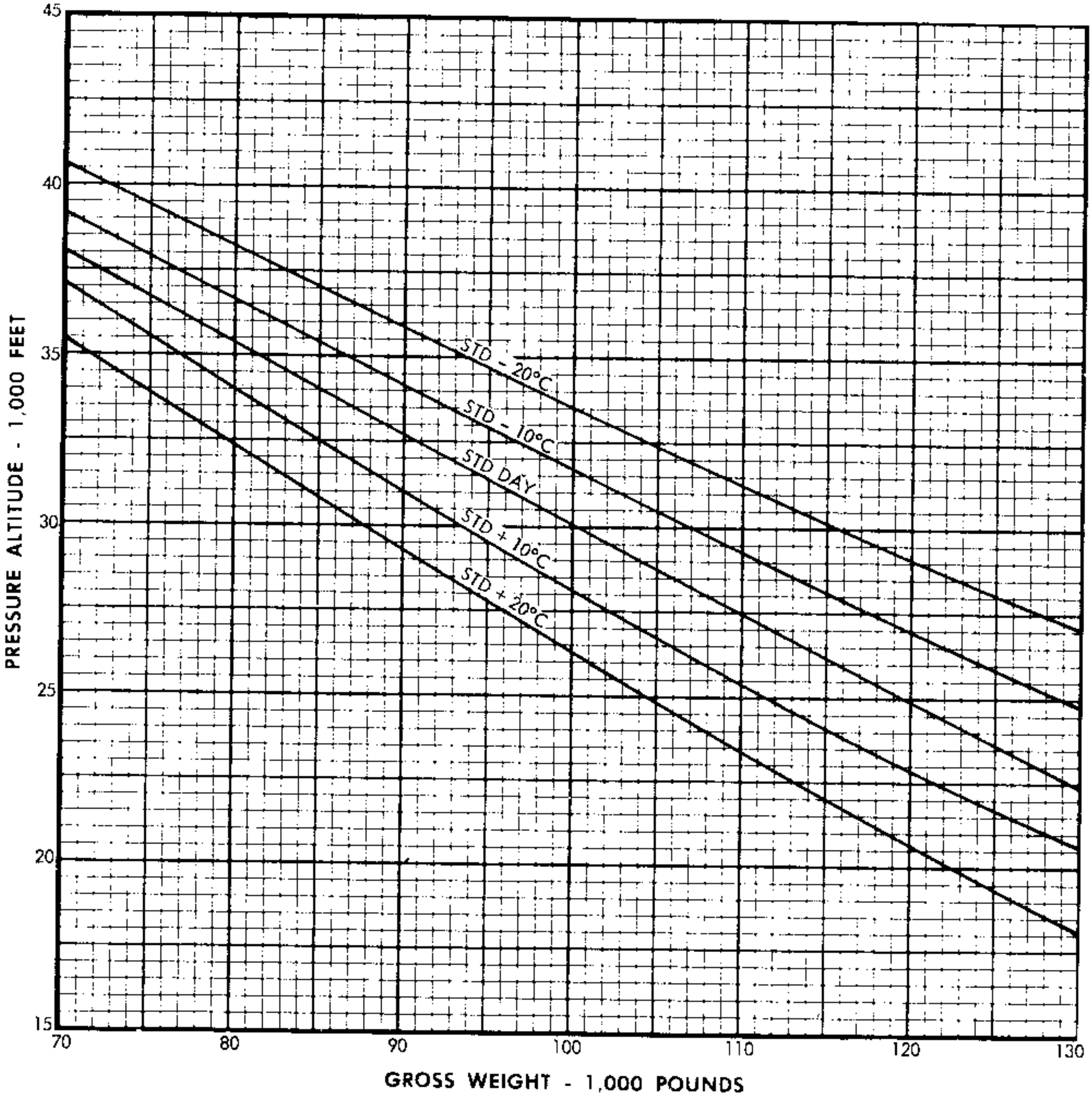


Figure A5-1.

CRUISE CEILING FOR VARIANT CONFIGURATION

4 ENGINES

MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

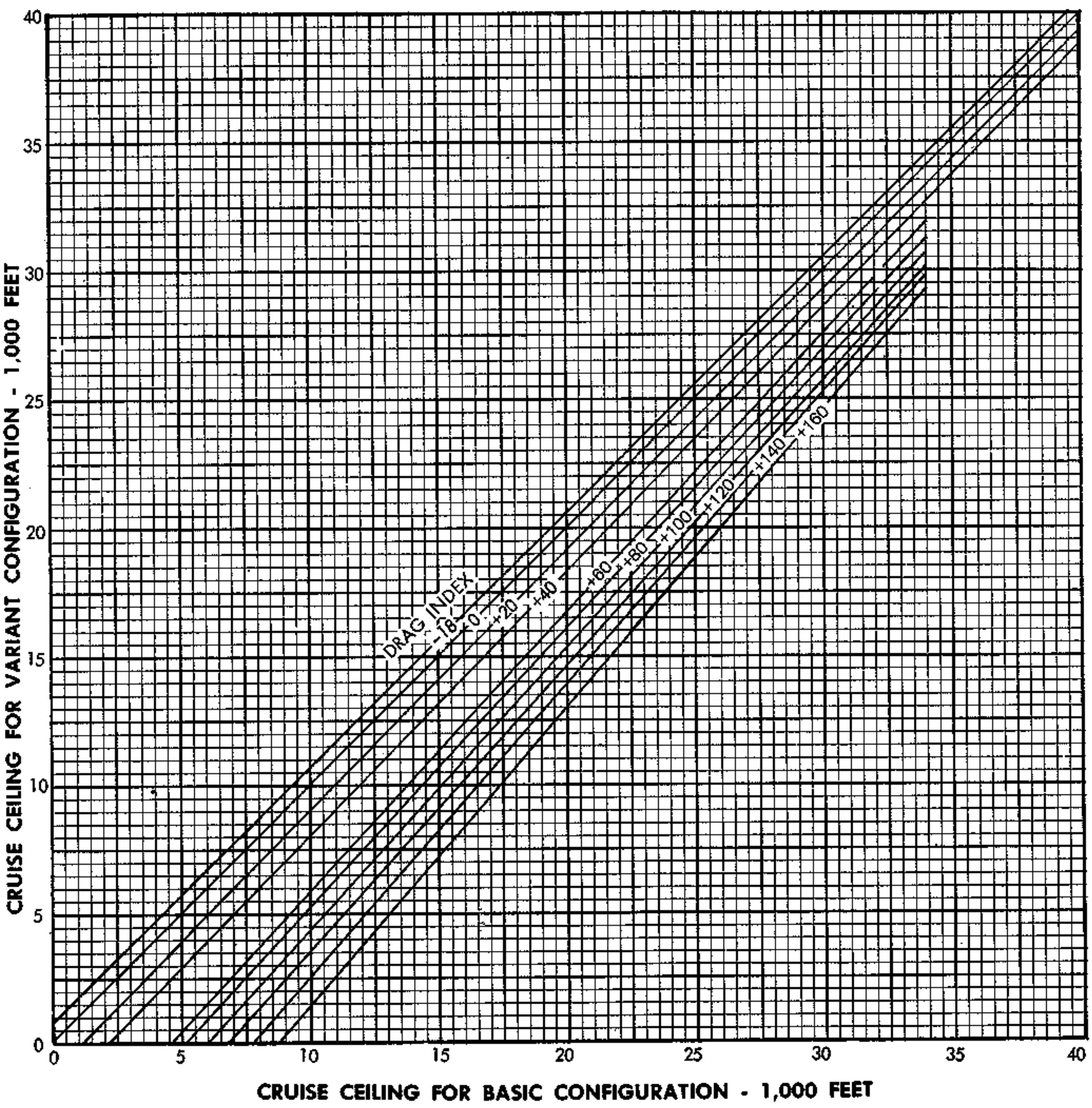


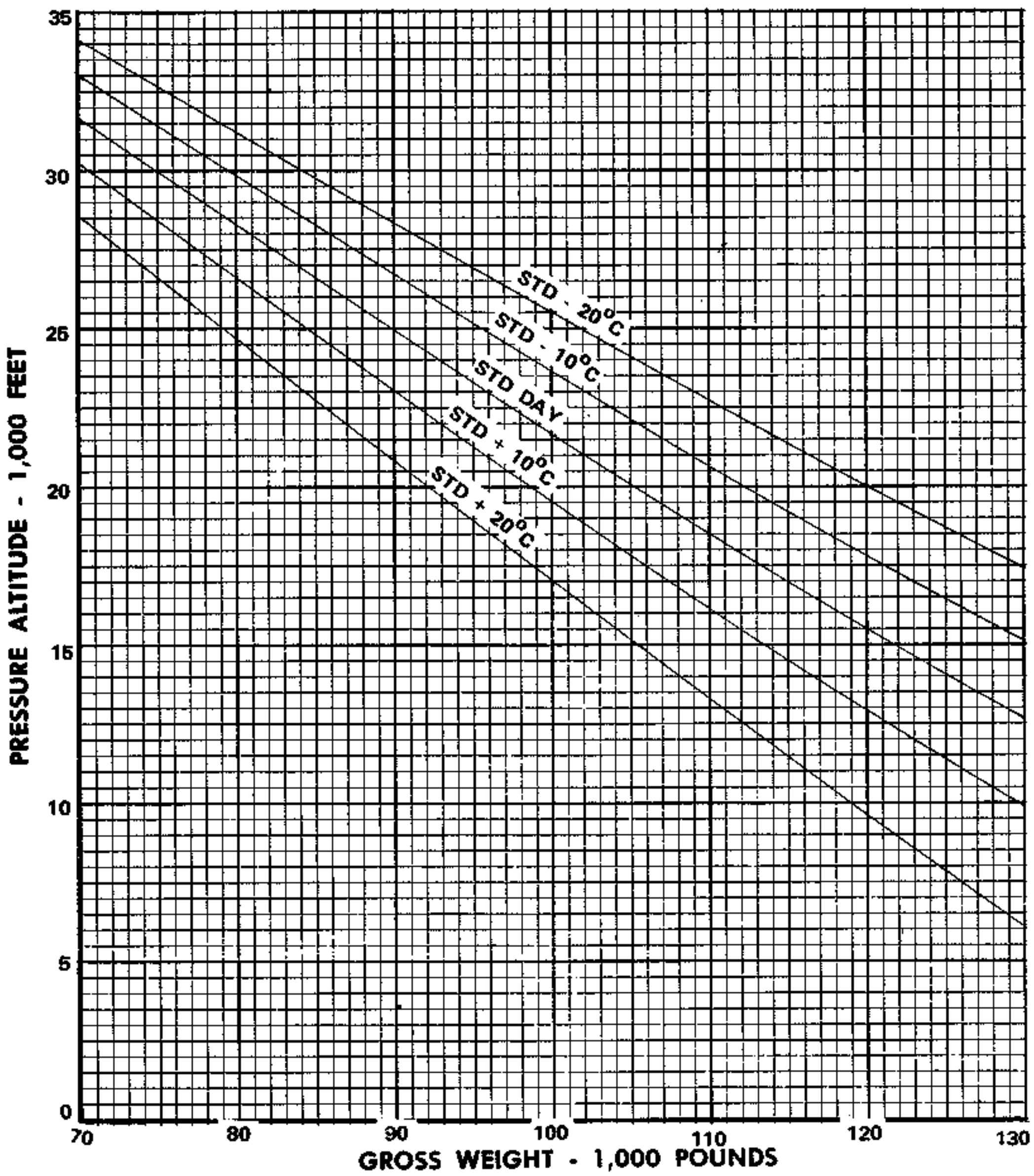
Figure A5-2.

CRUISE CEILING
MAXIMUM CONTINUOUS POWER

4 ENGINES — ALL BLEED ON

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST



130A-(I-I)-0-016

Figure A5-3.

CRUISE CEILING FOR VARIANT CONFIGURATION

4 ENGINES ALL BLEED ON

MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

ESTIMATED ABOVE DRAG INDEX 40

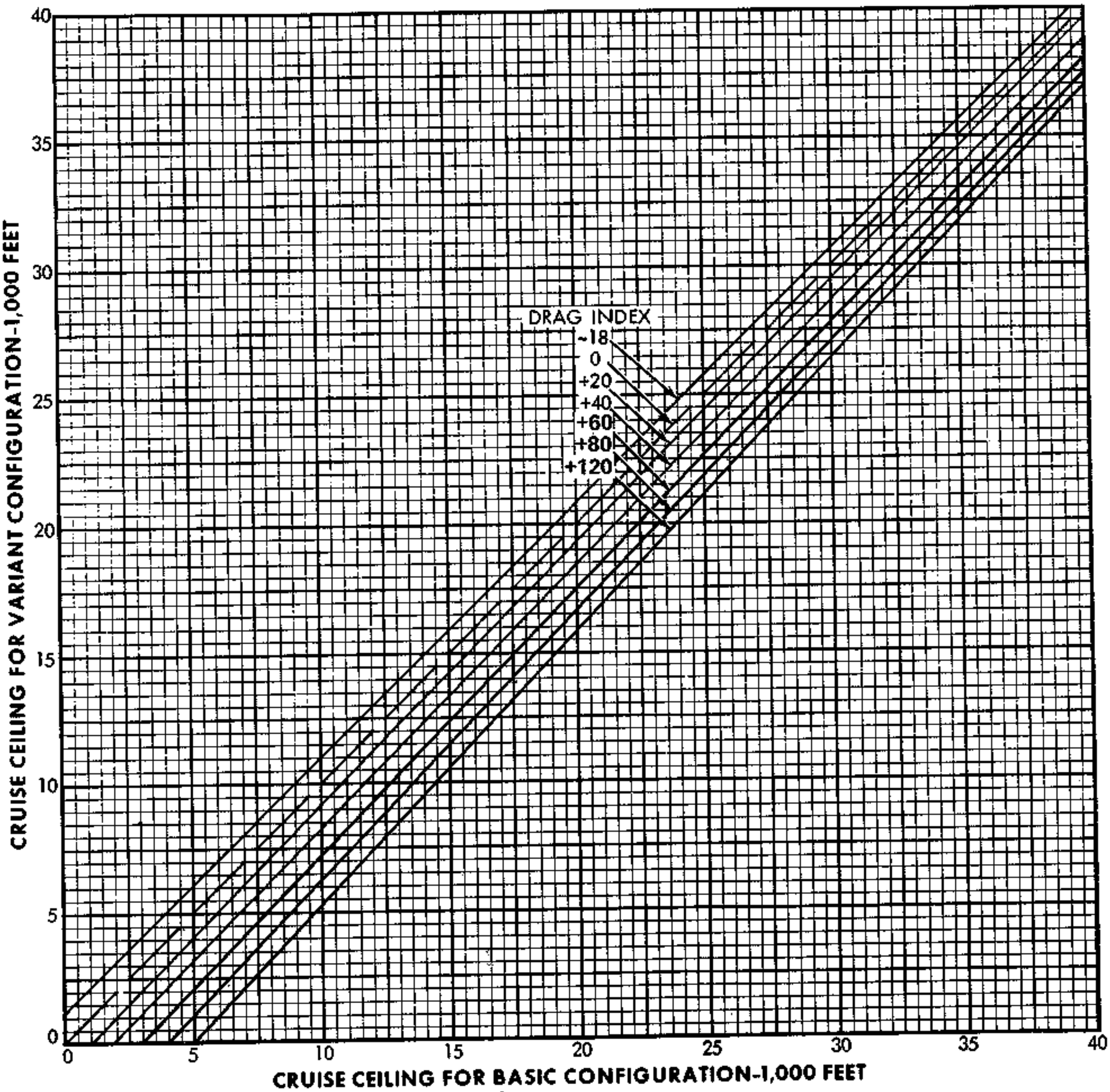


Figure A5-4

CRUISE CEILING-MAXIMUM CONTINUOUS POWER
3 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Propeller feathered on inoperative engine.

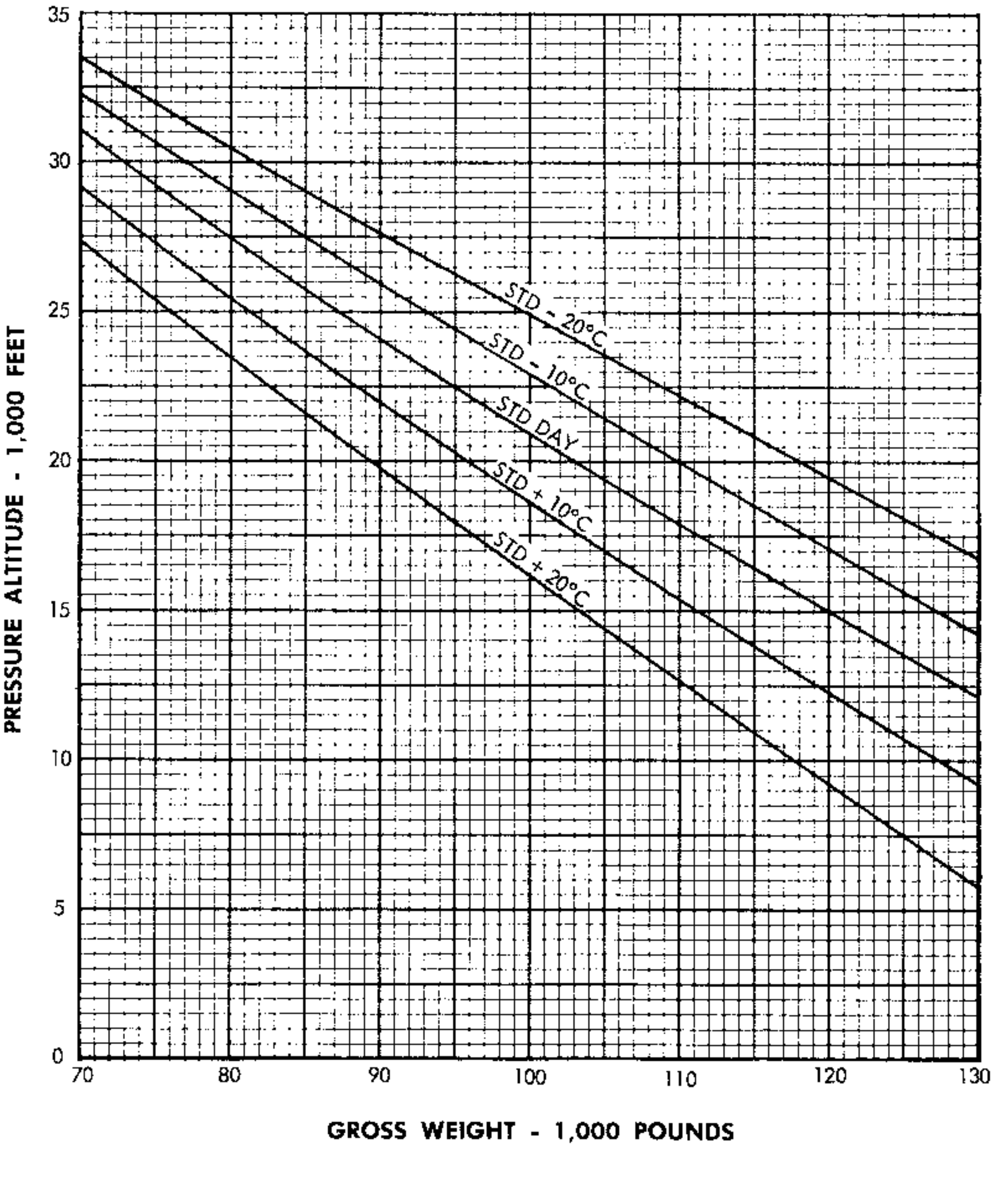


Figure A5-5.

CRUISE CEILING
FOR VARIANT CONFIGURATION

3 ENGINES MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. Temperature effect is negligible.

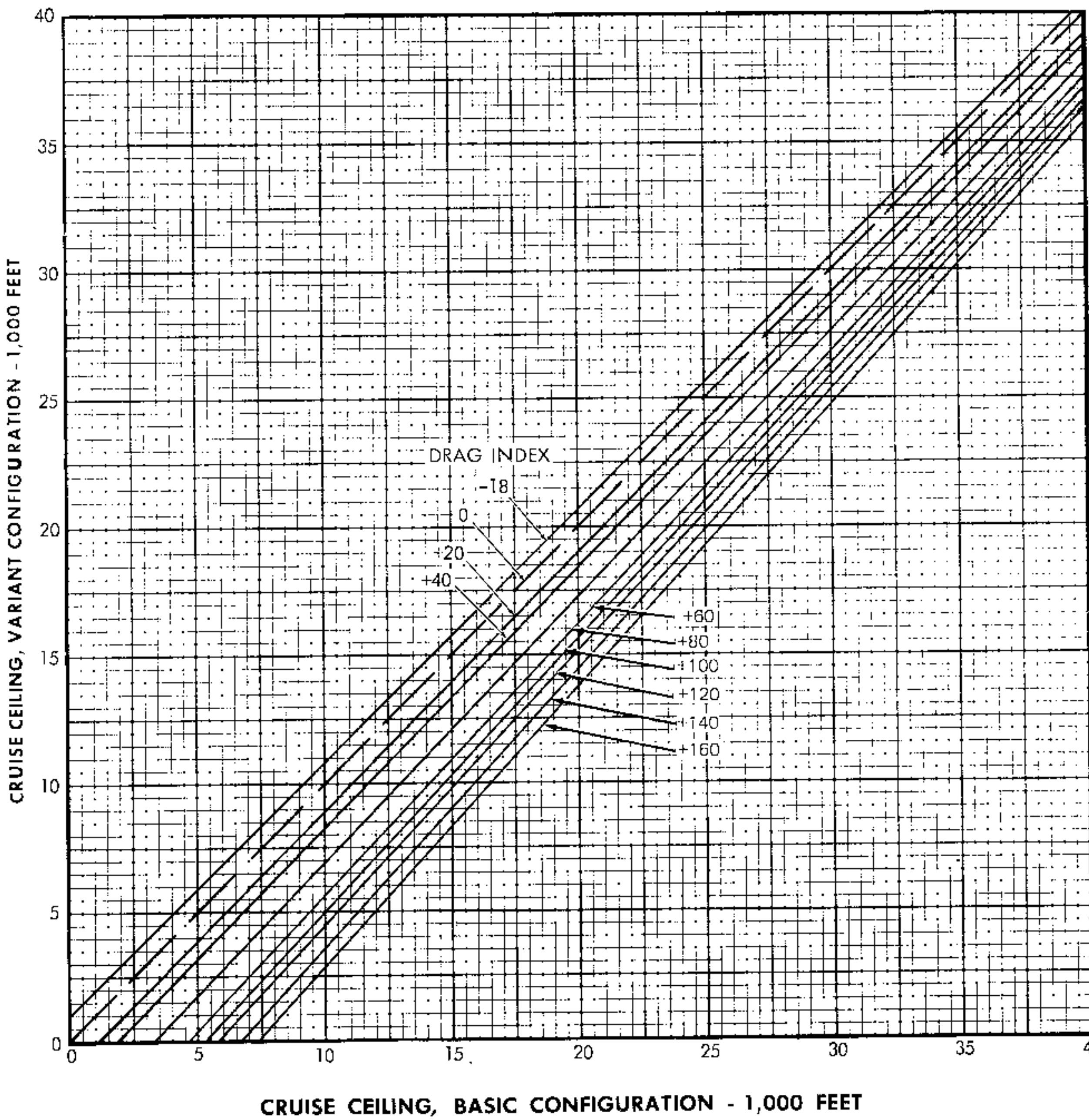


Figure A5-6.

130A-(1-1)-0-019

CRUISE CEILING - MAXIMUM CONTINUOUS POWER

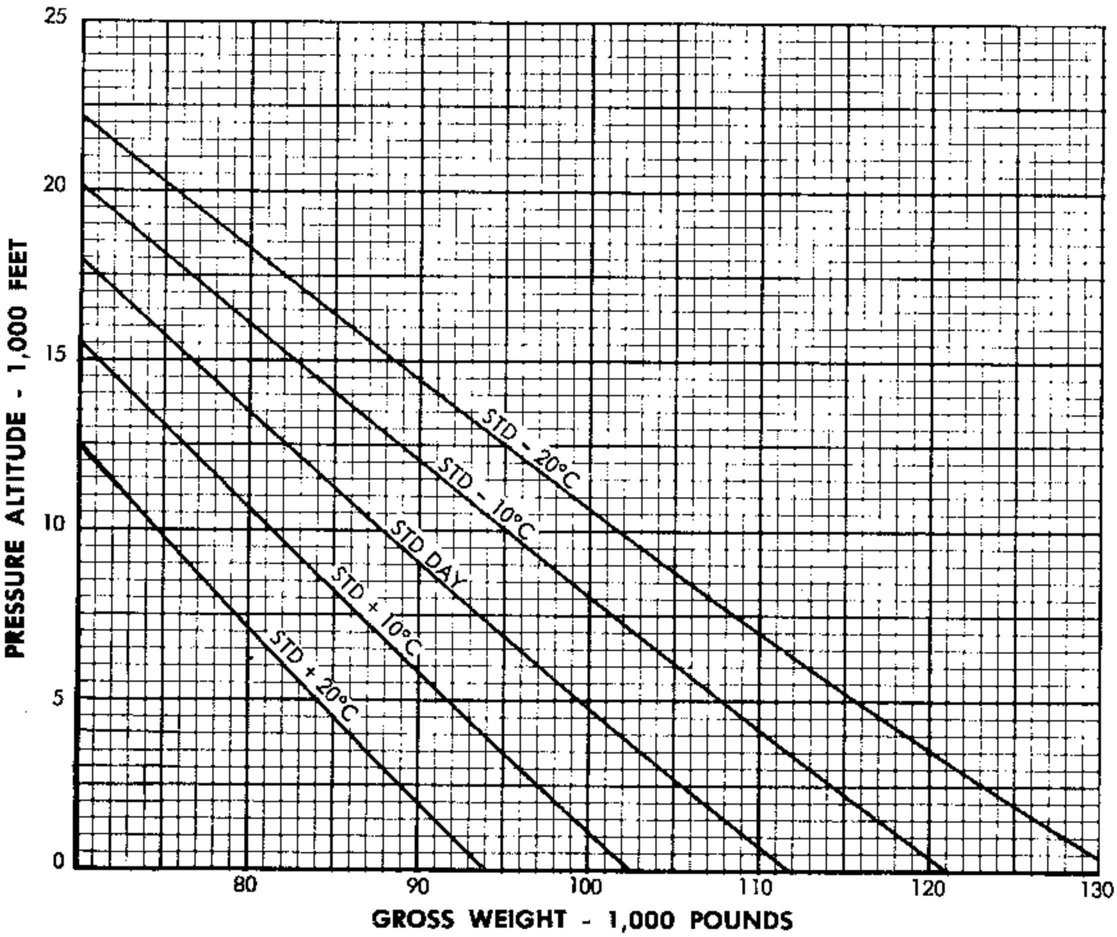
2 ENGINES
ASYMMETRICAL POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propellers feathered on inoperative engines.



130A-(1-1)-0-025

Figure A5-7.

CRUISE CEILING FOR VARIANT CONFIGURATION

2 ENGINES **ASYMMETRICAL POWER**

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. Temperature effect is negligible.

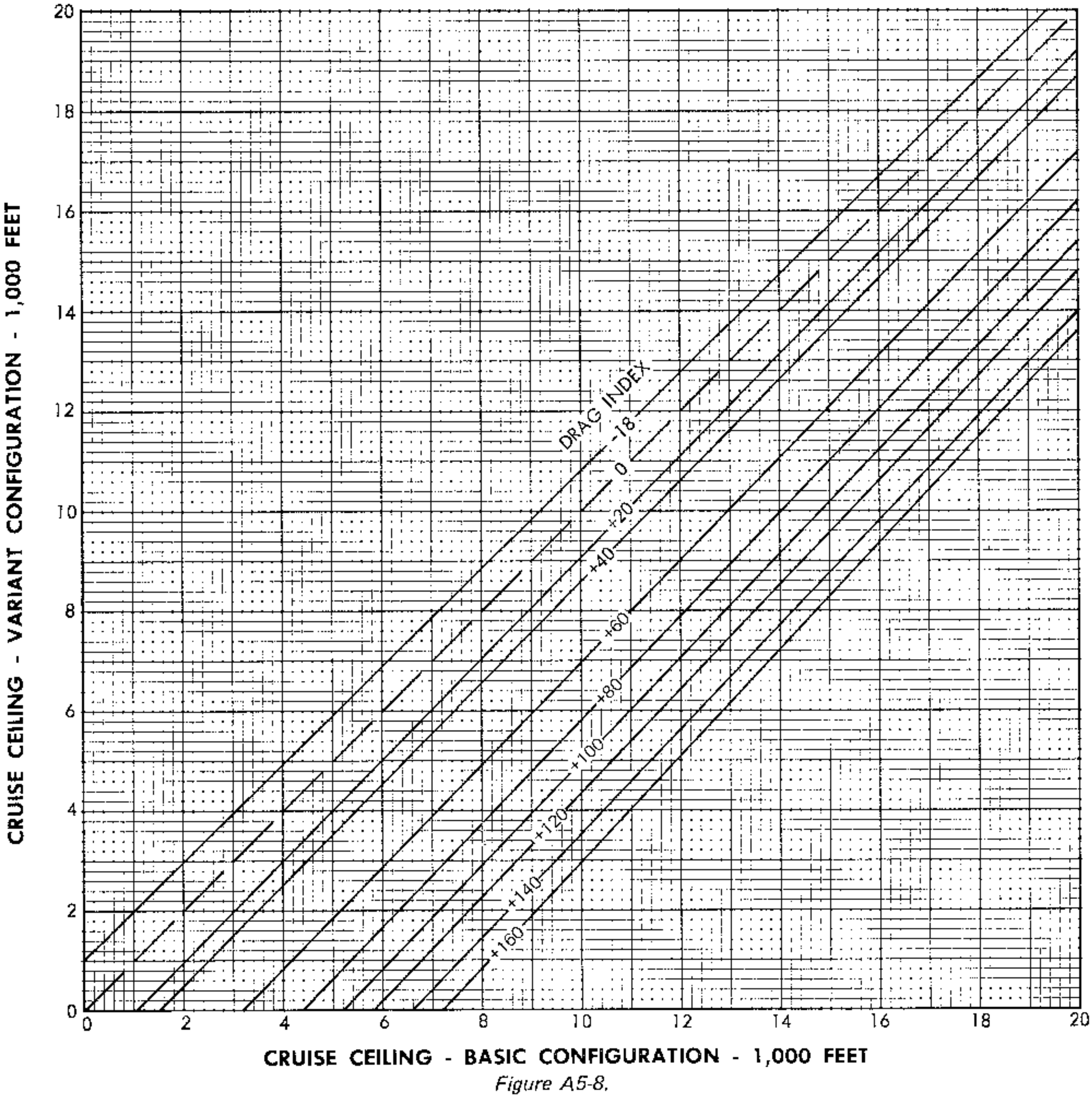


Figure A5-8.

SPECIFIC RANGE

4 ENGINES SEA LEVEL
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$
2. ICAO Standard Atmosphere.
3. $\frac{1}{\sqrt{\sigma}} = 1.000.$
4. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

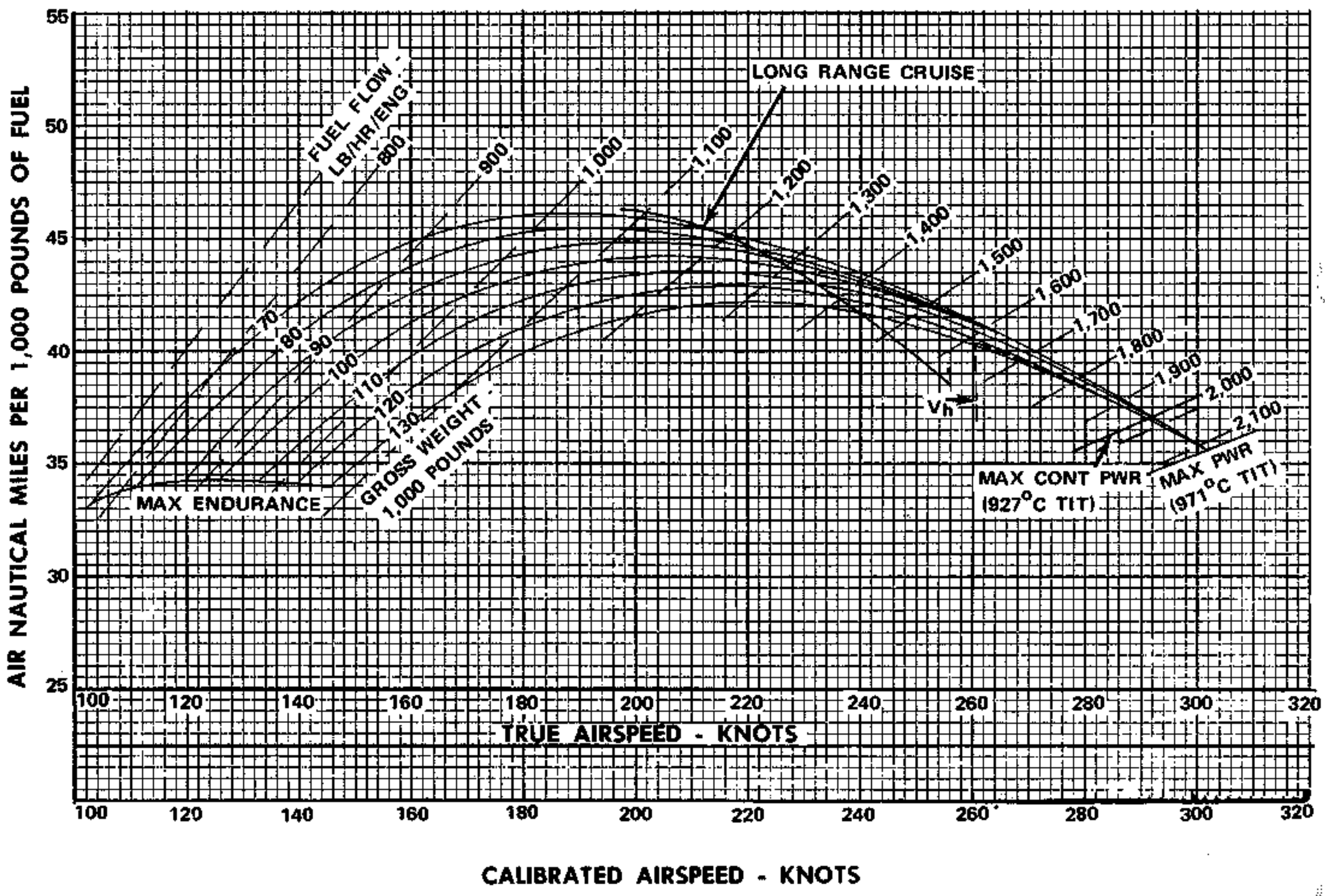


Figure A5-9.

SPECIFIC RANGE

4 ENGINES 5,000 FEET
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$.
2. ICAO Standard Atmosphere.
3. $\frac{1}{\sqrt{\sigma}} = 1.0772$.
4. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

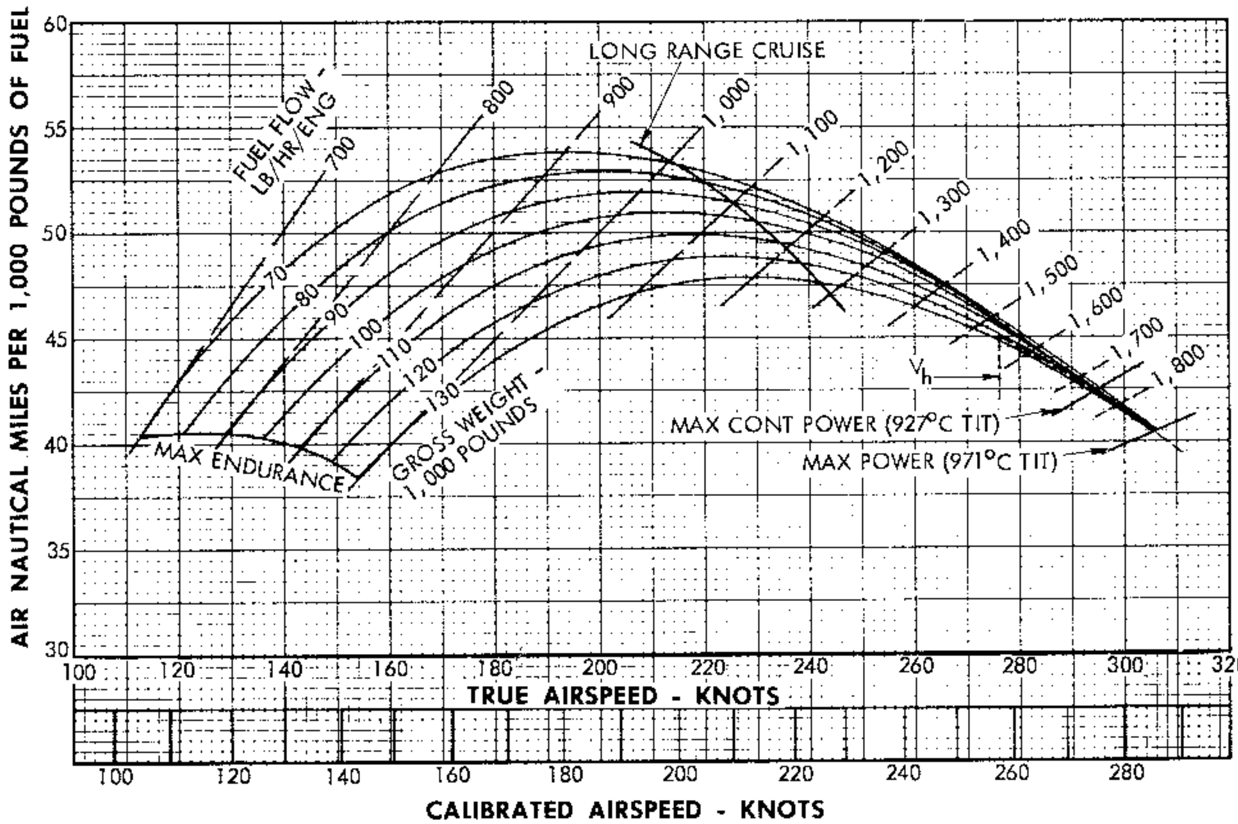


Figure A5-10.

SPECIFIC RANGE

4 ENGINES 10,000 FEET
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Corrections: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$.
2. ICAO Standard Atmosphere.
3. $\frac{1}{\sqrt{\sigma}} = 1.1637$.
4. See Section V of T.O. 1C-130A-1 for additional limitations.

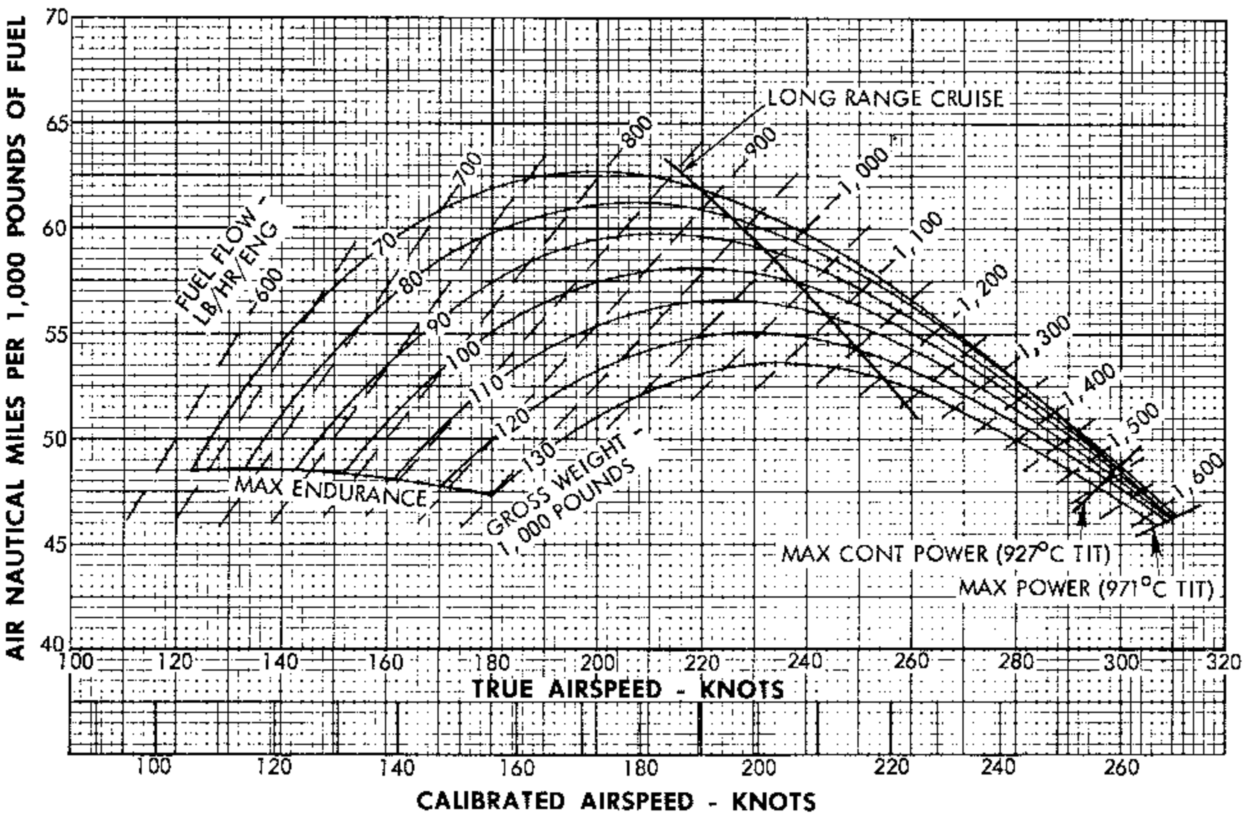


Figure A5-11.

SPECIFIC RANGE

4 ENGINES 15,000 FEET

ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound= Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$.
2. ICAO Standard Atmosphere.
3. $\frac{1}{\sqrt{\sigma}} = 1.2607$.
4. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

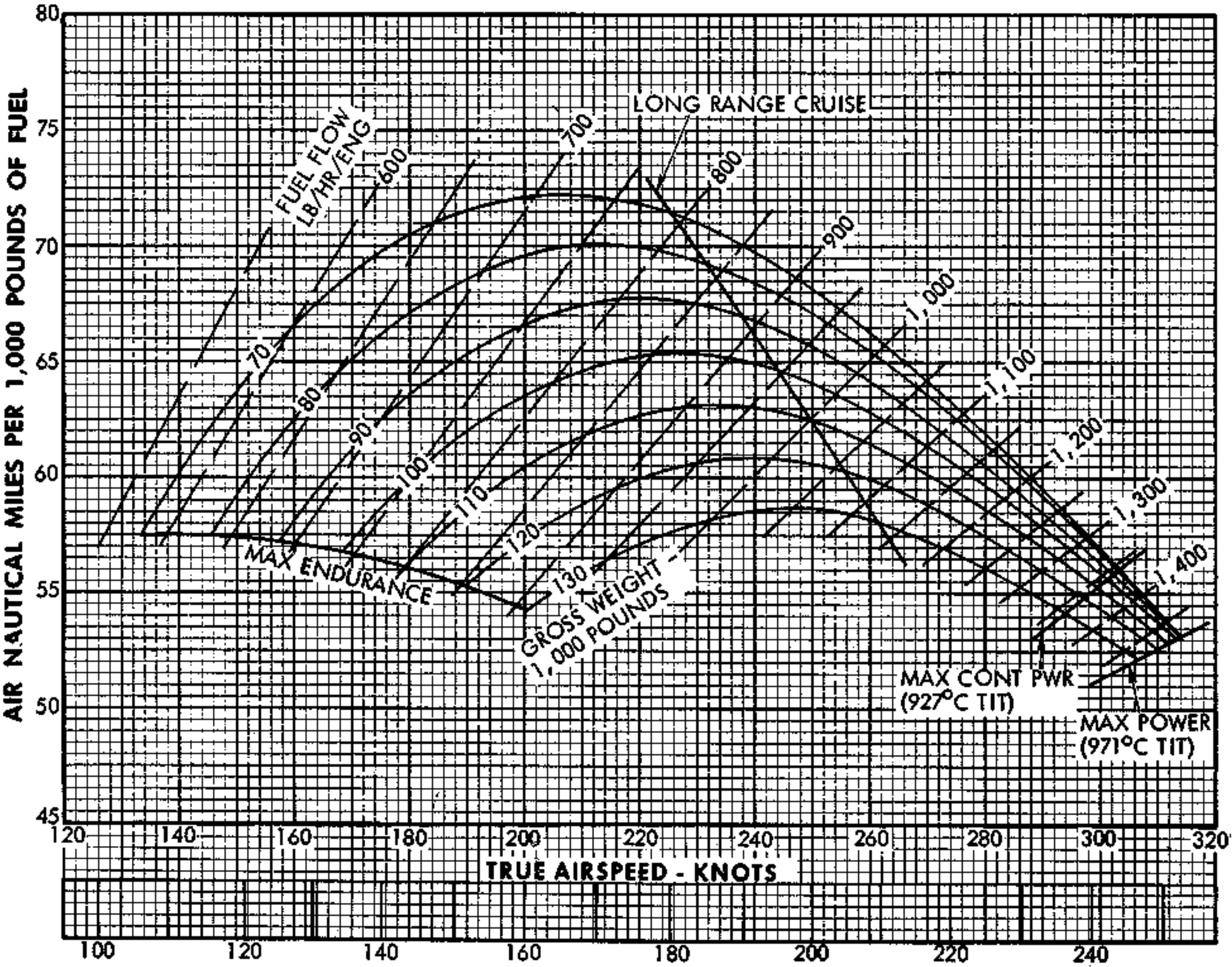


Figure A5-12.

SPECIFIC RANGE

4 ENGINES 20,000 FEET
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$.
2. ICAO Standard Atmosphere.
3. $\frac{1}{\sqrt{\sigma}} = 1.3701$.
4. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

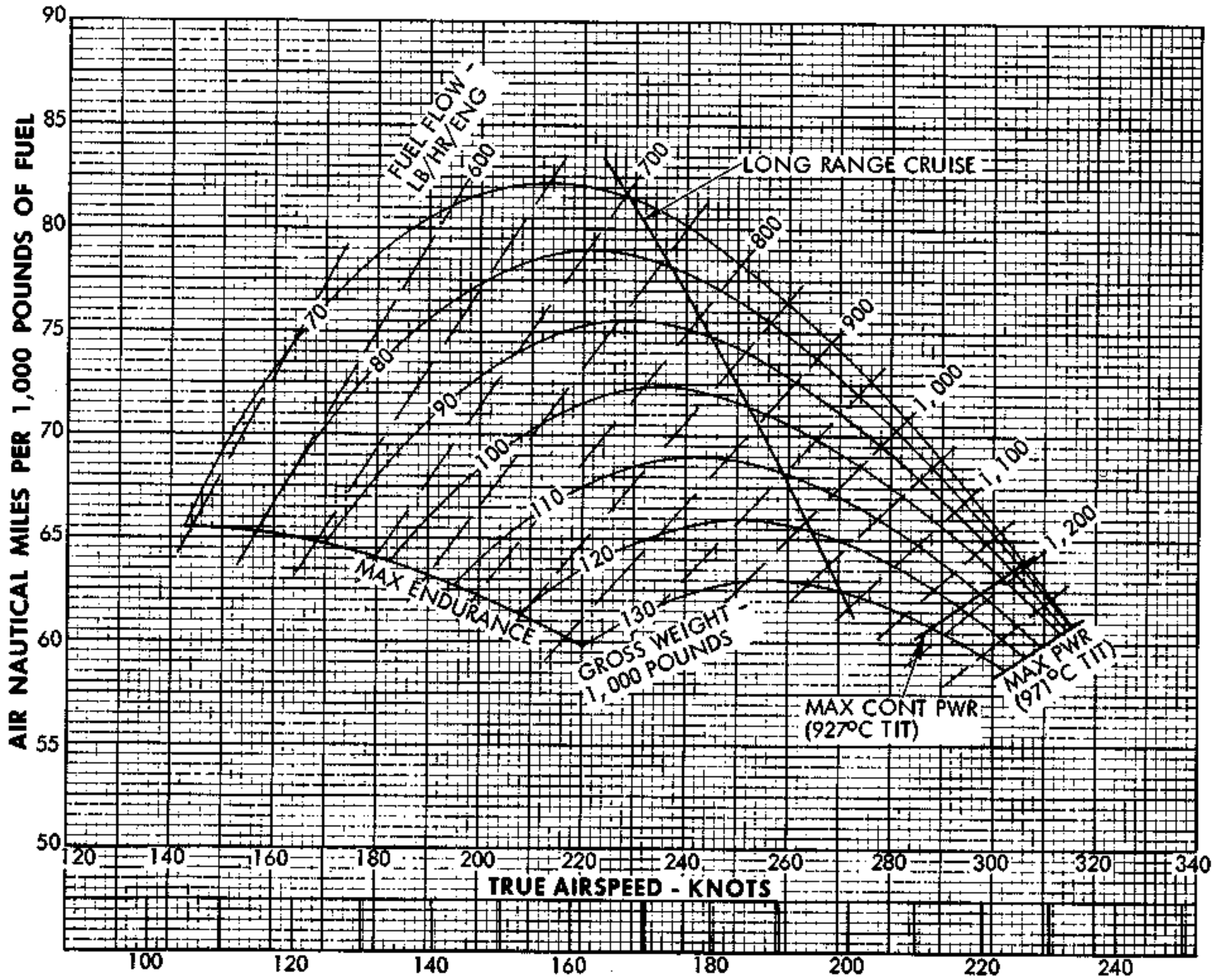


Figure A5-13.

SPECIFIC RANGE

4 ENGINES 25,000 FEET
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind correction: Ground Miles Per Pound = Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$.
2. ICAO standard atmosphere.
3. $\frac{1}{\sqrt{\sigma}} = 1.4939$.
4. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

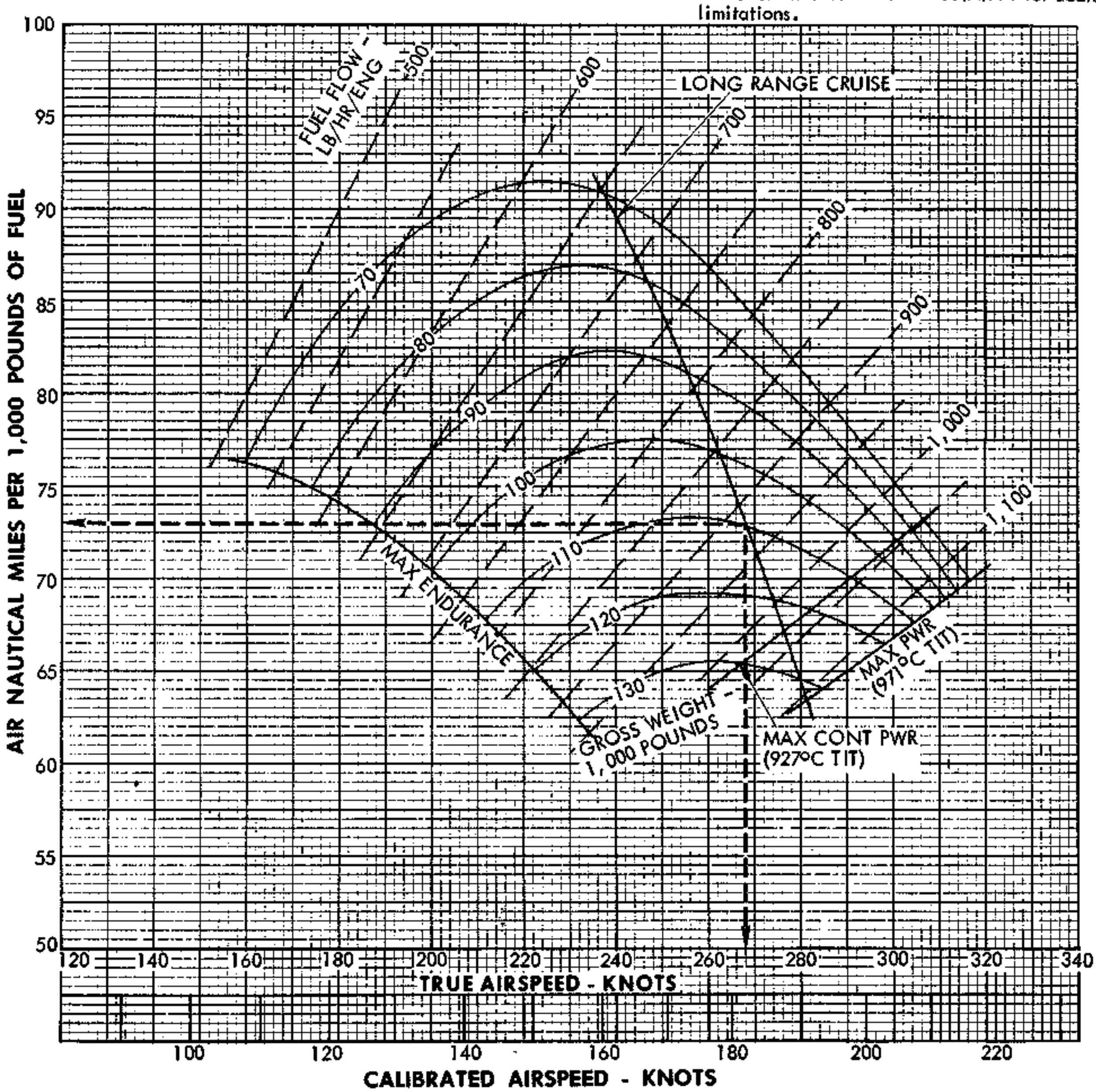


Figure A5-14.

SPECIFIC RANGE

4 ENGINES 30,000 FEET
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Air Speed}}$.
2. ICAO standard atmosphere.
3. $\frac{1}{\sqrt{\sigma}} = 1.6348.$
4. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

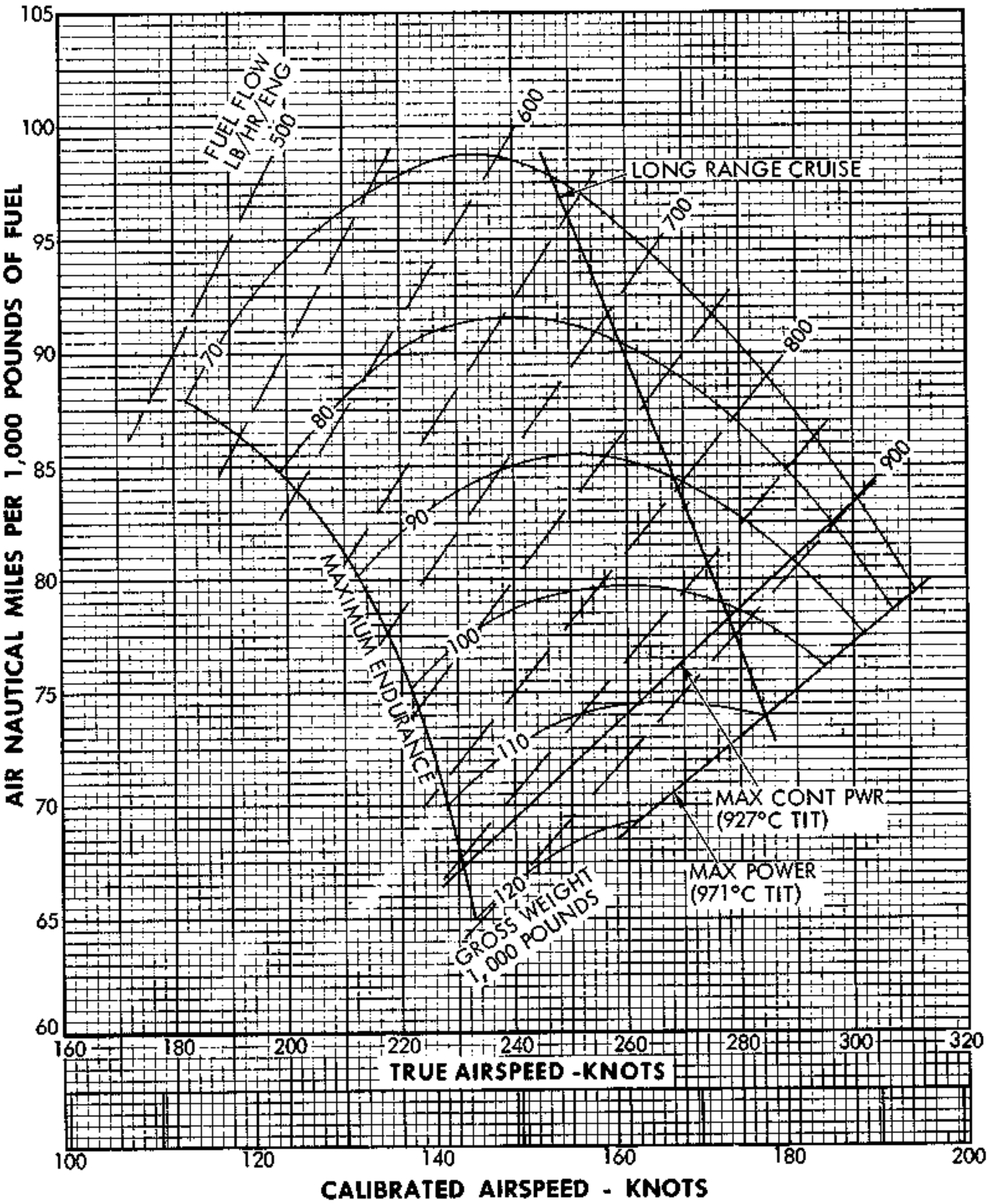


Figure A5-15.

SPECIFIC RANGE

4 ENGINES 35,000 FEET

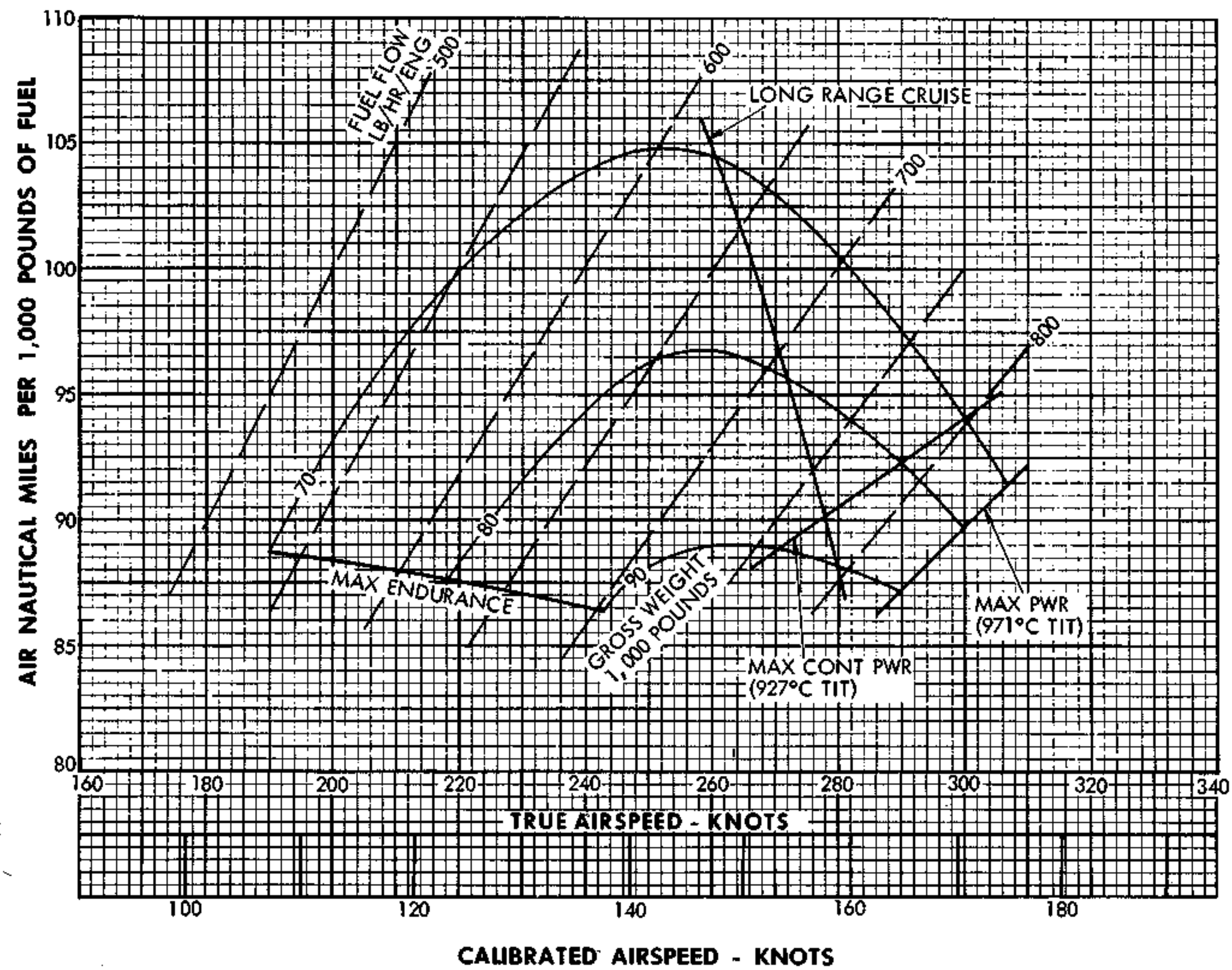
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$.
2. ICAO Standard Atmosphere.
3. $\frac{1}{\sqrt{\sigma}} = 1.7963$.
4. See Section V of T.O. 1C-130(A)A-1 for Additional Limitations.



130A-(1-1)-0-035

Figure A5-16.

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

TRUE AIRSPEED AT LONG RANGE CRUISE FOR VARIANT CONFIGURATION

4 ENGINES

NOTE

Temperature effect is negligible

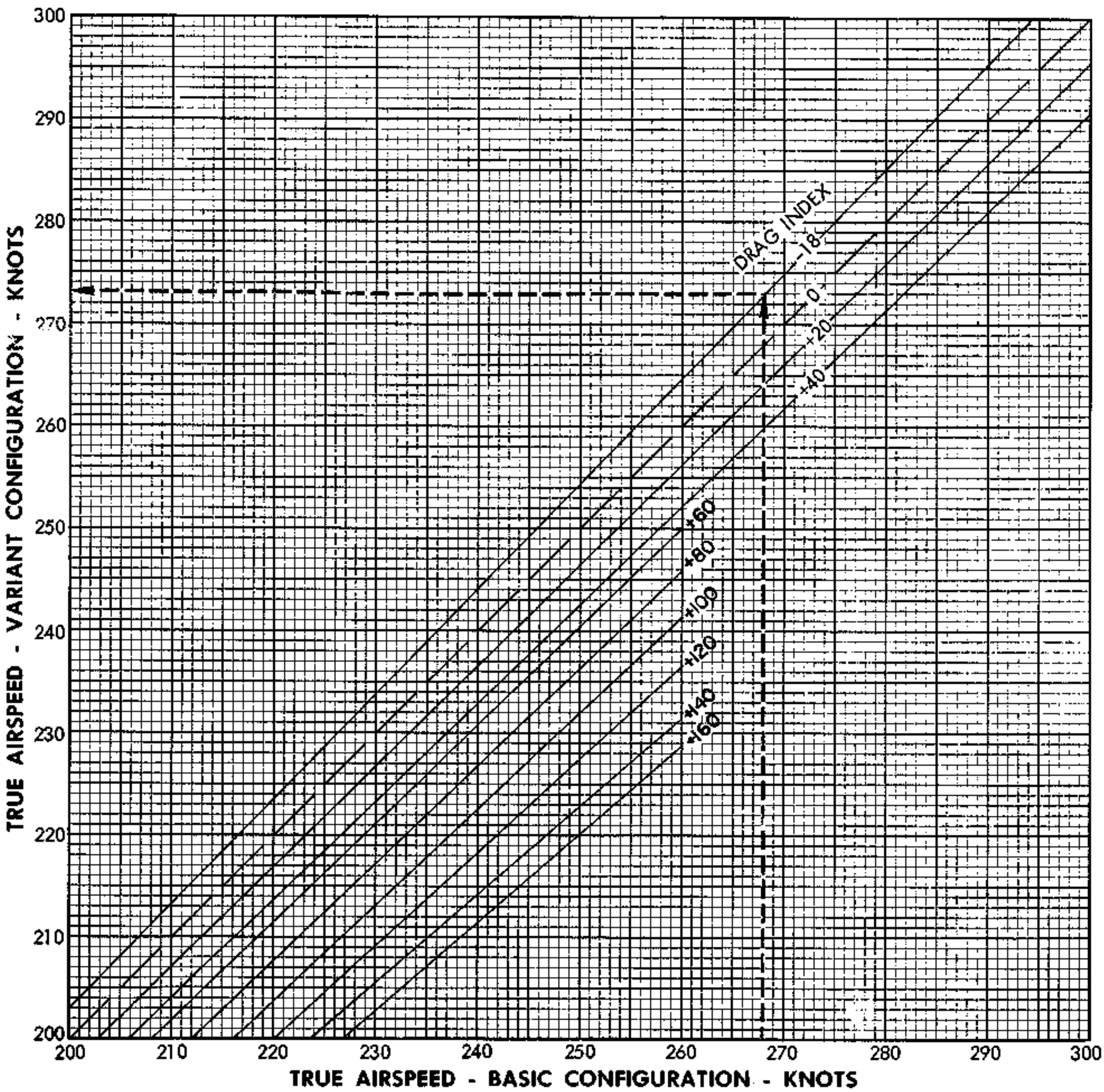


Figure A5-17.

SPECIFIC RANGE FOR VARIANT CONFIGURATION

4 ENGINES LONG RANGE CRUISE

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Temperature effect is negligible.

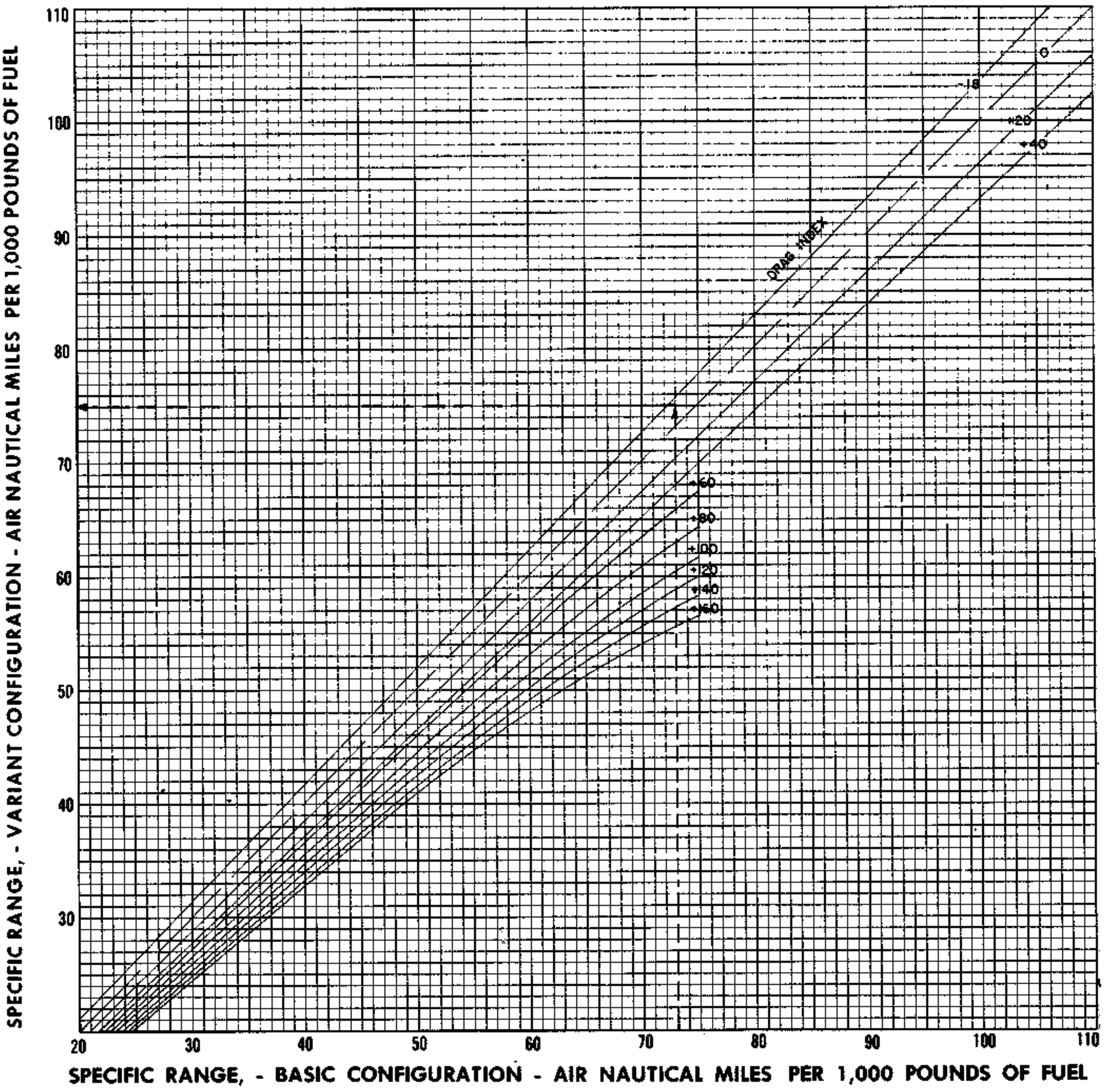


Figure A5-18.

SPECIFIC RANGE
3 ENGINES SEA LEVEL
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X Ground Speed / True Airspeed
2. Propeller feathered on inoperative engine.
3. ICAO Standard Atmosphere.
4. $\sqrt{\sigma}$ = 1.000.
5. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

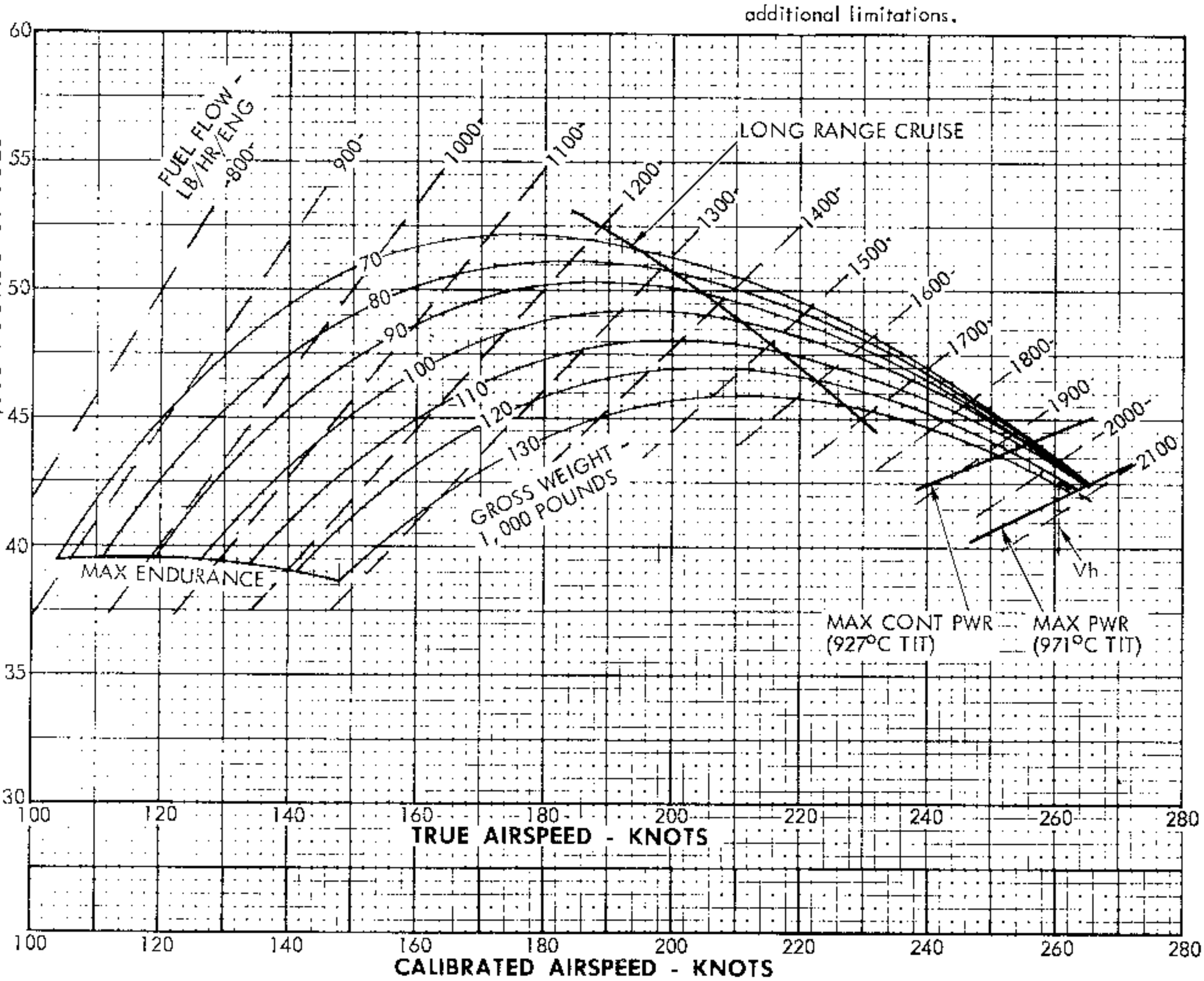


Figure A5-19.

SPECIFIC RANGE

3 ENGINES 5,000 FEET
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X $\frac{\text{Ground Speed.}}{\text{True Airspeed}}$
2. Propeller feathered on inoperative engine.
3. ICAO Standard Atmosphere.
4. $\frac{1}{\sqrt{\sigma}}$ 1.0772.
5. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

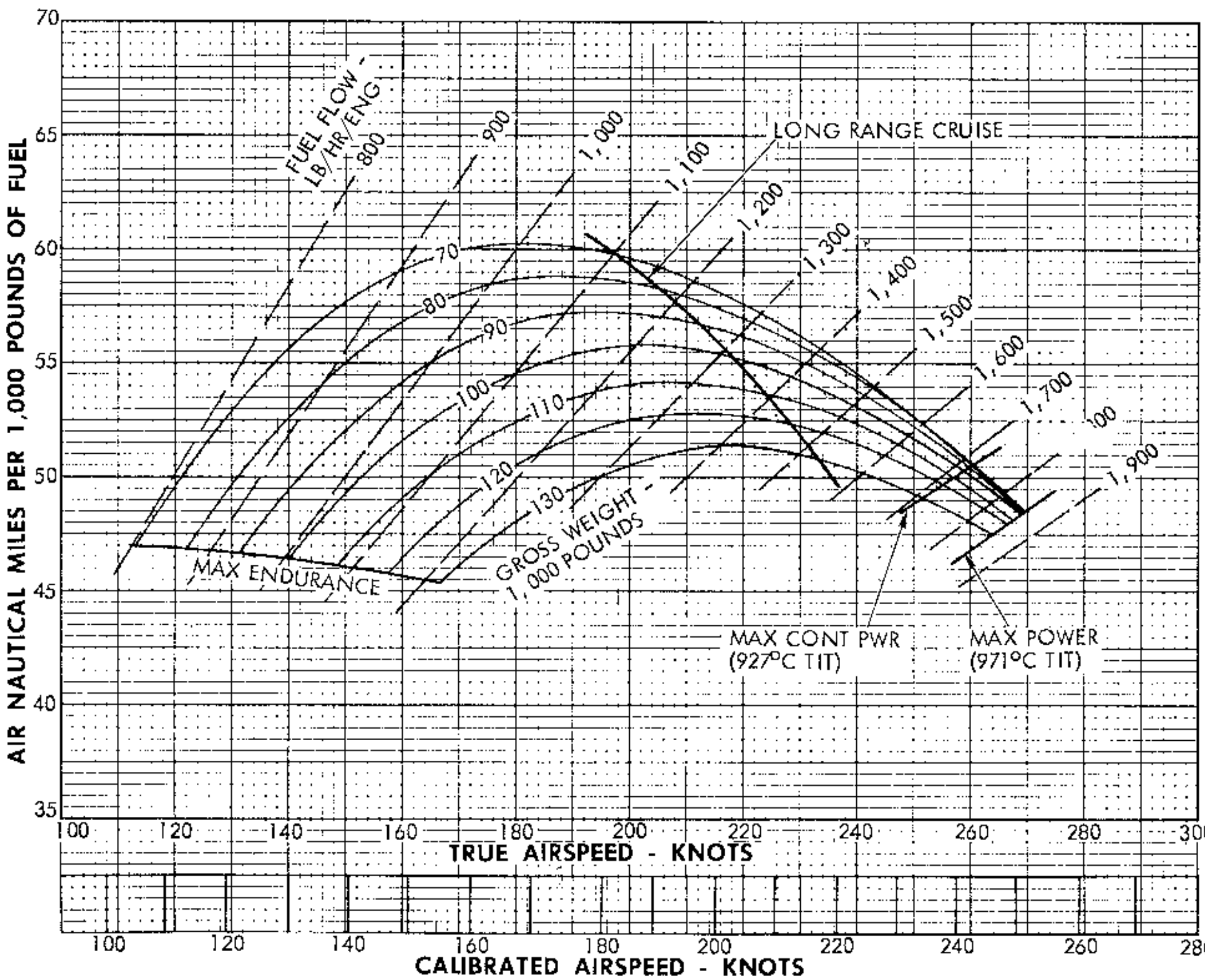


Figure A5-20.

SPECIFIC RANGE

3 ENGINES 10,000 FEET
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$
2. Propeller feathered on inoperative engine.
3. ICAO Standard Atmosphere.
4. $\sqrt{\sigma}$ = 1.1637.
5. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

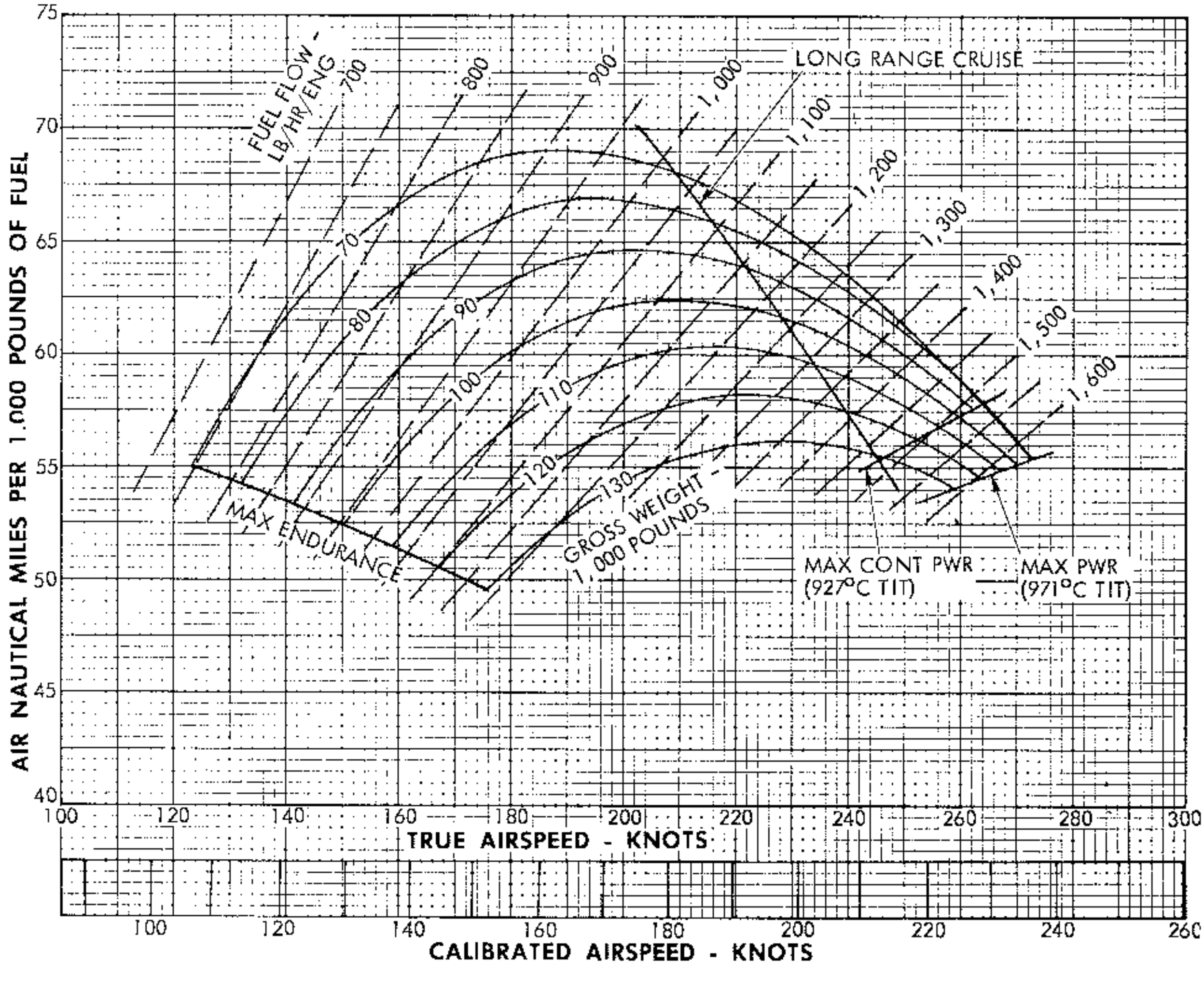


Figure A5-21.

SPECIFIC RANGE

3 ENGINES 15,000 FEET
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$
2. Propeller feathered on inoperative engine.
3. ICAO Standard Atmosphere.
4. $\frac{1}{\sqrt{\sigma}} = 1.2607$.
5. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

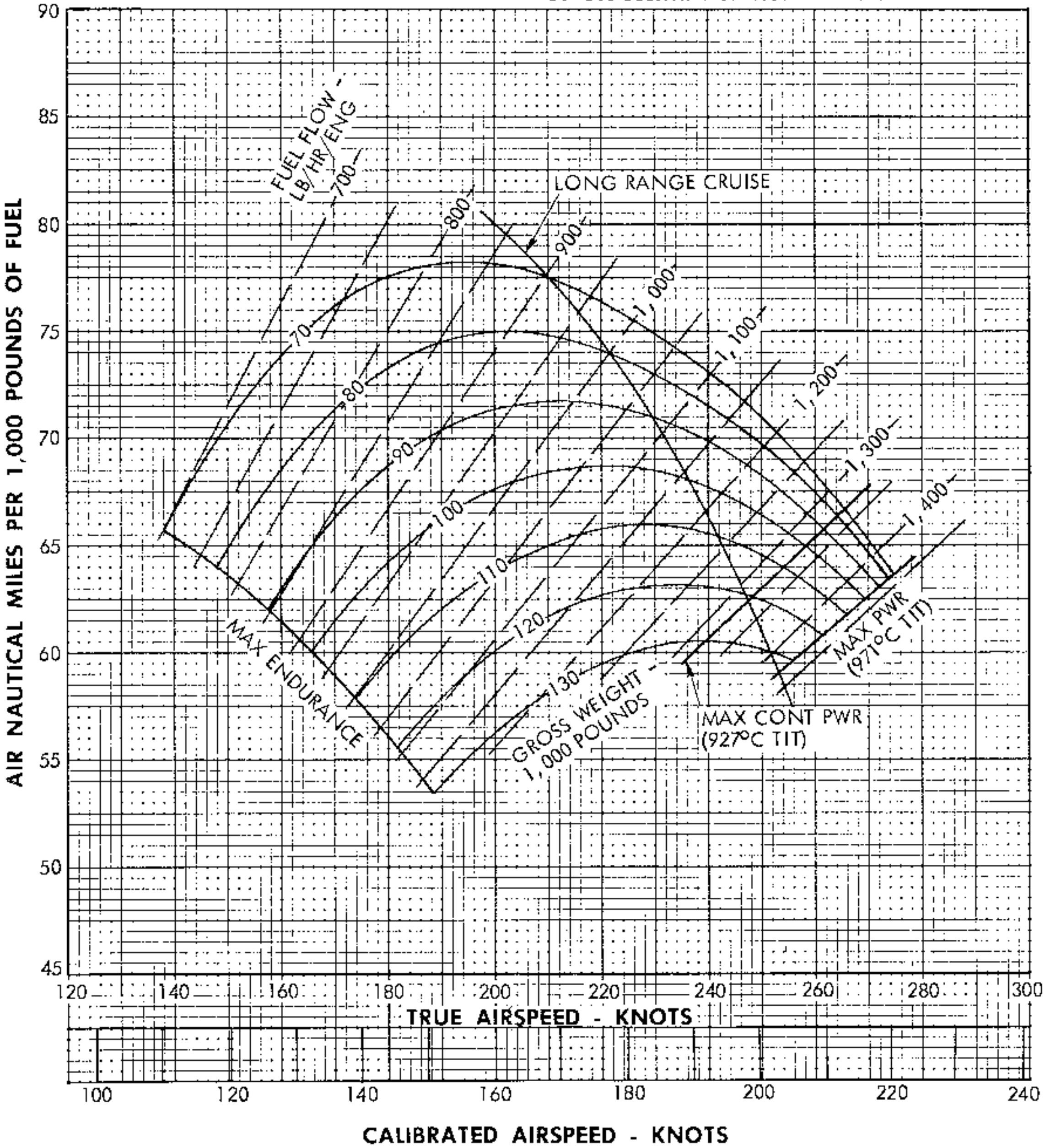


Figure A5-22.

SPECIFIC RANGE

3 ENGINES 20,000 FEET
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$.
2. Propeller feathered on inoperative engine.
3. ICAO Standard Atmosphere.
4. $\sqrt{\sigma} = 1.3701$.
5. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

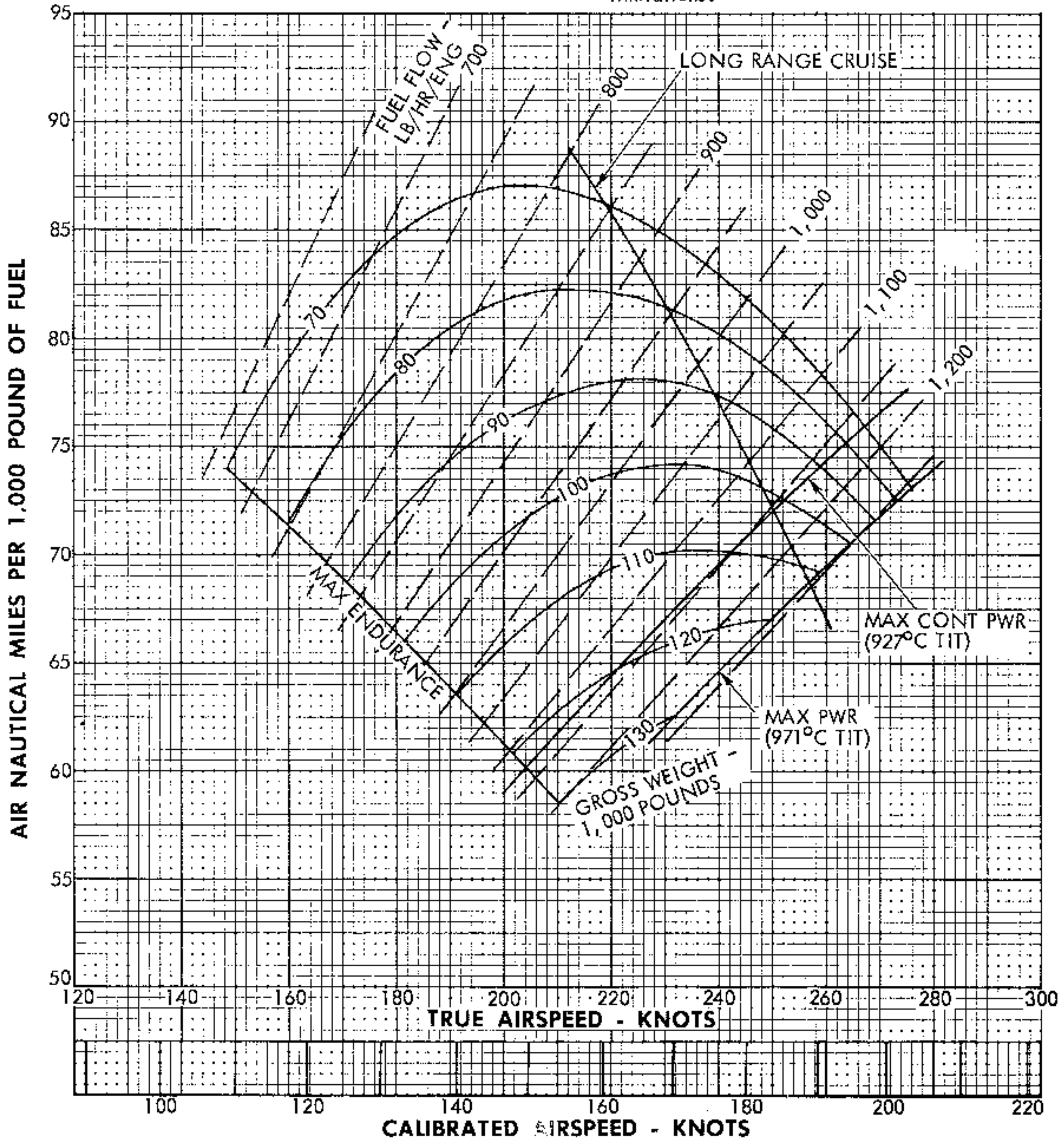


Figure A5-23.

SPECIFIC RANGE

3 ENGINES 25,000 FEET
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound= Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$.
2. Propeller feathered on inoperative engine.
3. ICAO standard atmosphere.
4. $\frac{1}{\sqrt{\sigma}} = 1.4939$.
5. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

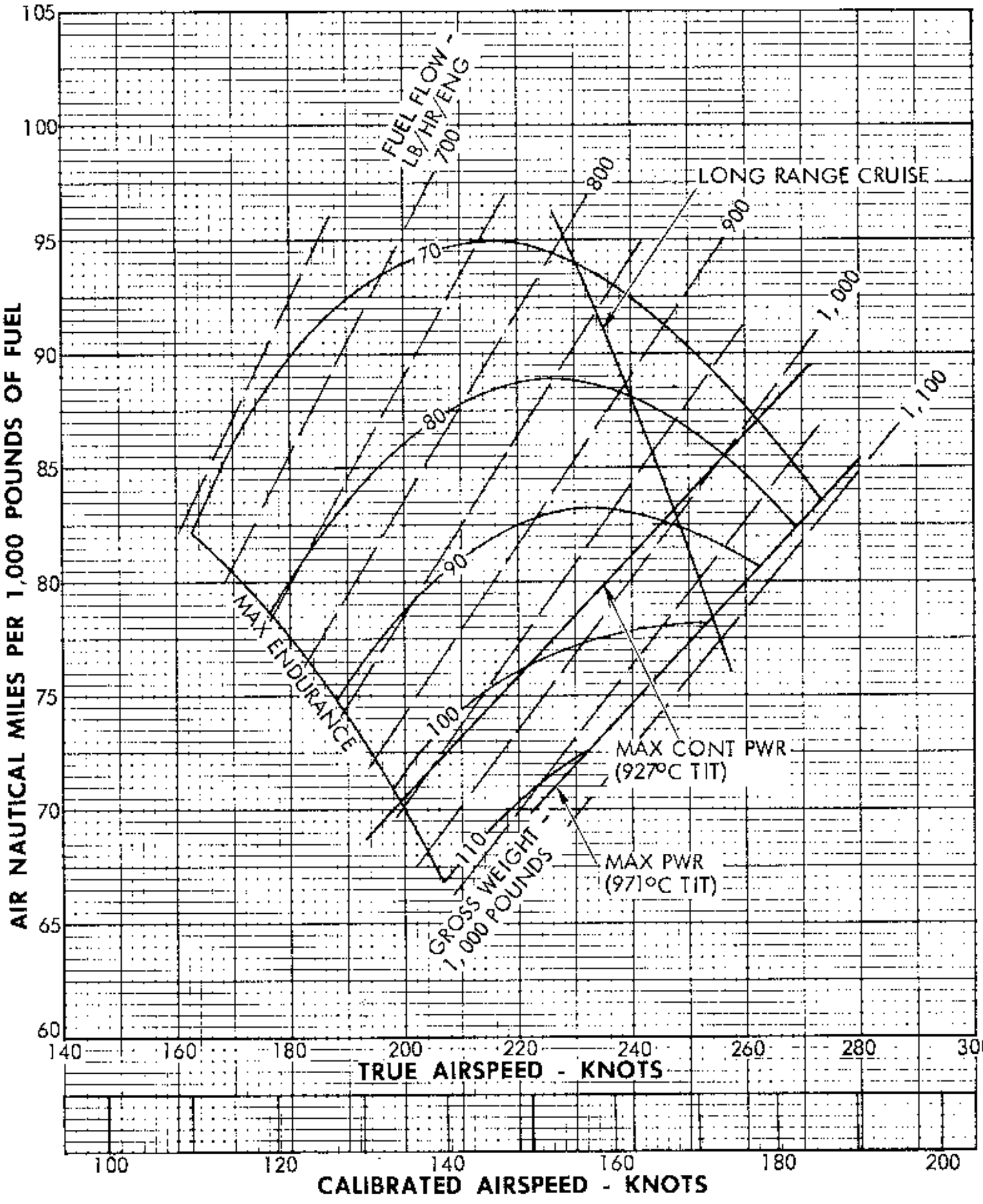


Figure A5-24.

TRUE AIRSPEED AT LONG RANGE CRUISE FOR VARIANT CONFIGURATION

3 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. Temperature effect is negligible.

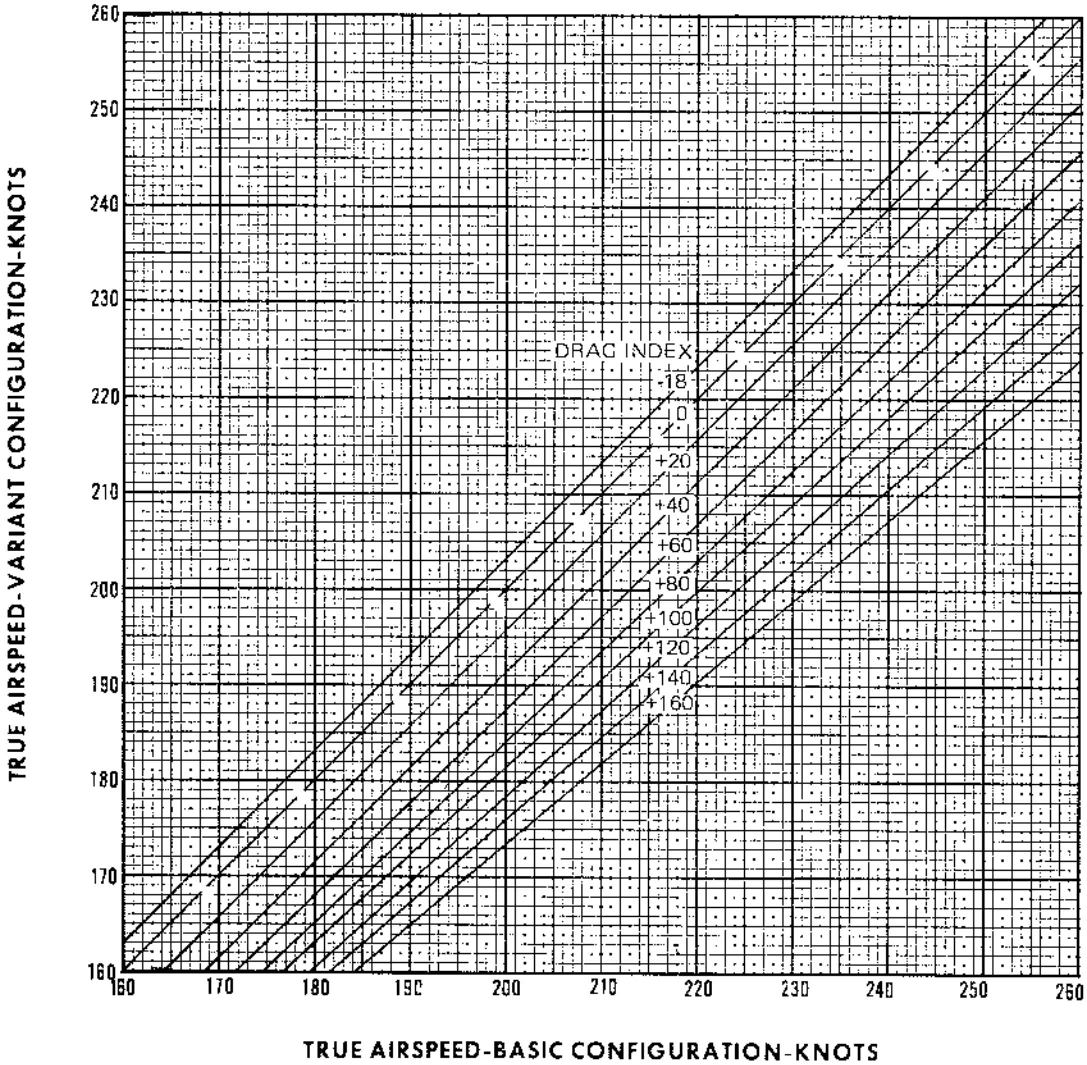


Figure A5-25.

SPECIFIC RANGE AT LONG RANGE CRUISE FOR VARIANT CONFIGURATION

3 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. Temperature effect is negligible.

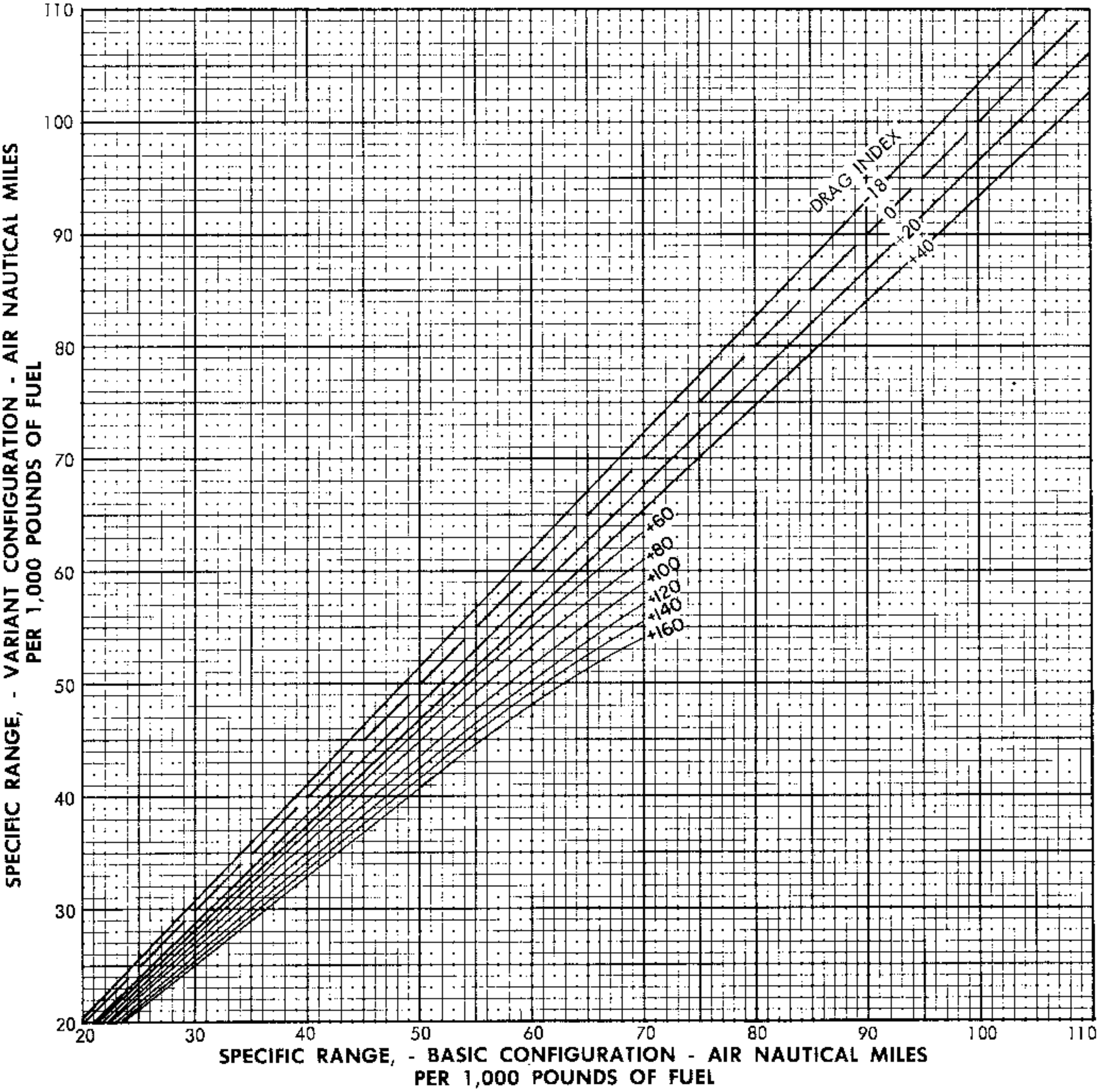


Figure A5-26.

SPECIFIC RANGE

ASYMMETRICAL POWER

2 ENGINES SEA LEVEL
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X Ground Speed / True Airspeed.
2. Propellers feathered on inoperative engines.
3. ICAO standard atmosphere.
4. $\sqrt{\sigma} = 1.000$.
5. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

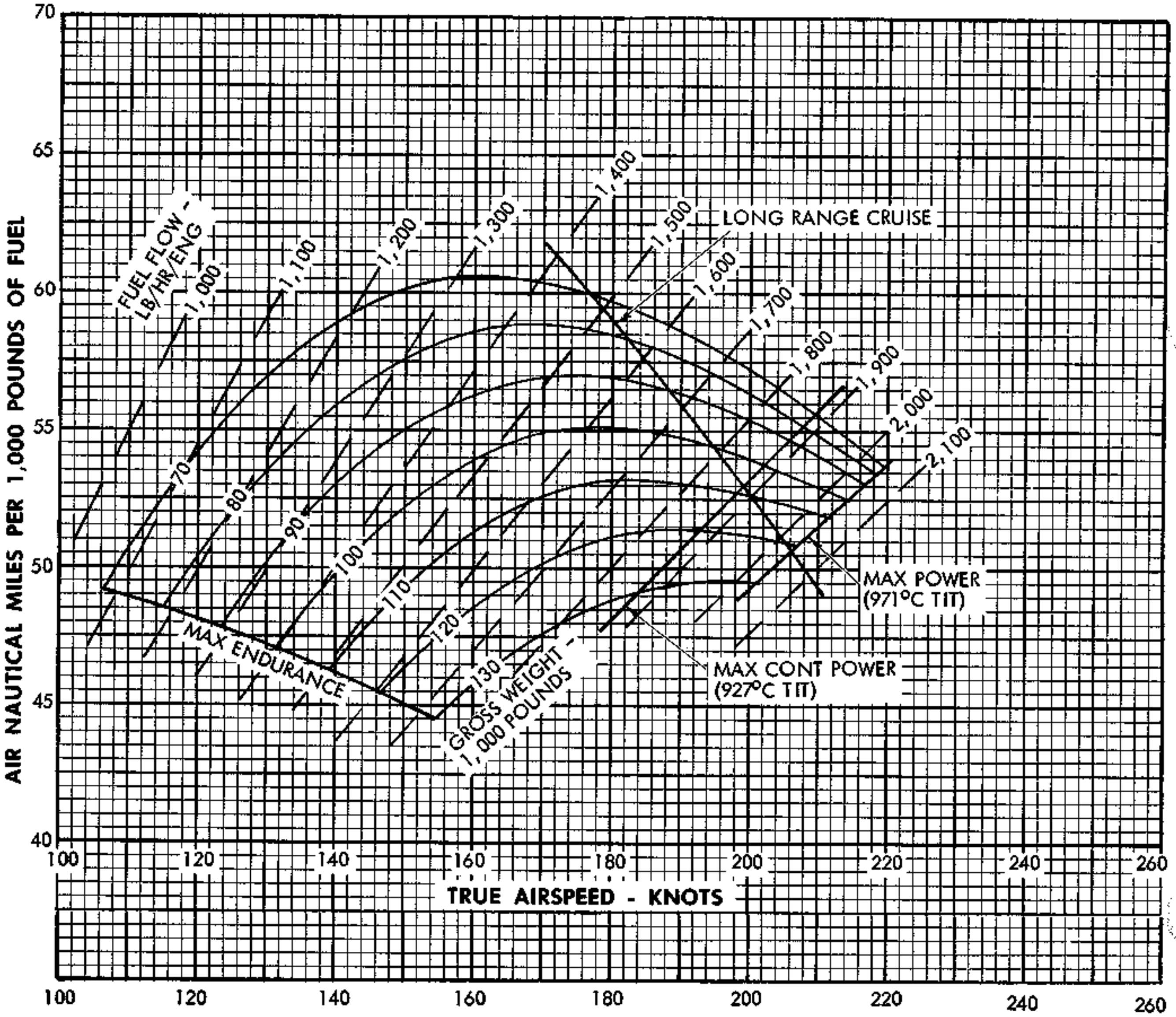


Figure A5-27.

SPECIFIC RANGE

ASYMMETRICAL POWER

2 ENGINES 5,000 FEET
ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$.
2. Propellers feathered on inoperative engines.
3. ICAO standard atmosphere.
4. $\sqrt{\sigma} = 1.0772$.
5. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

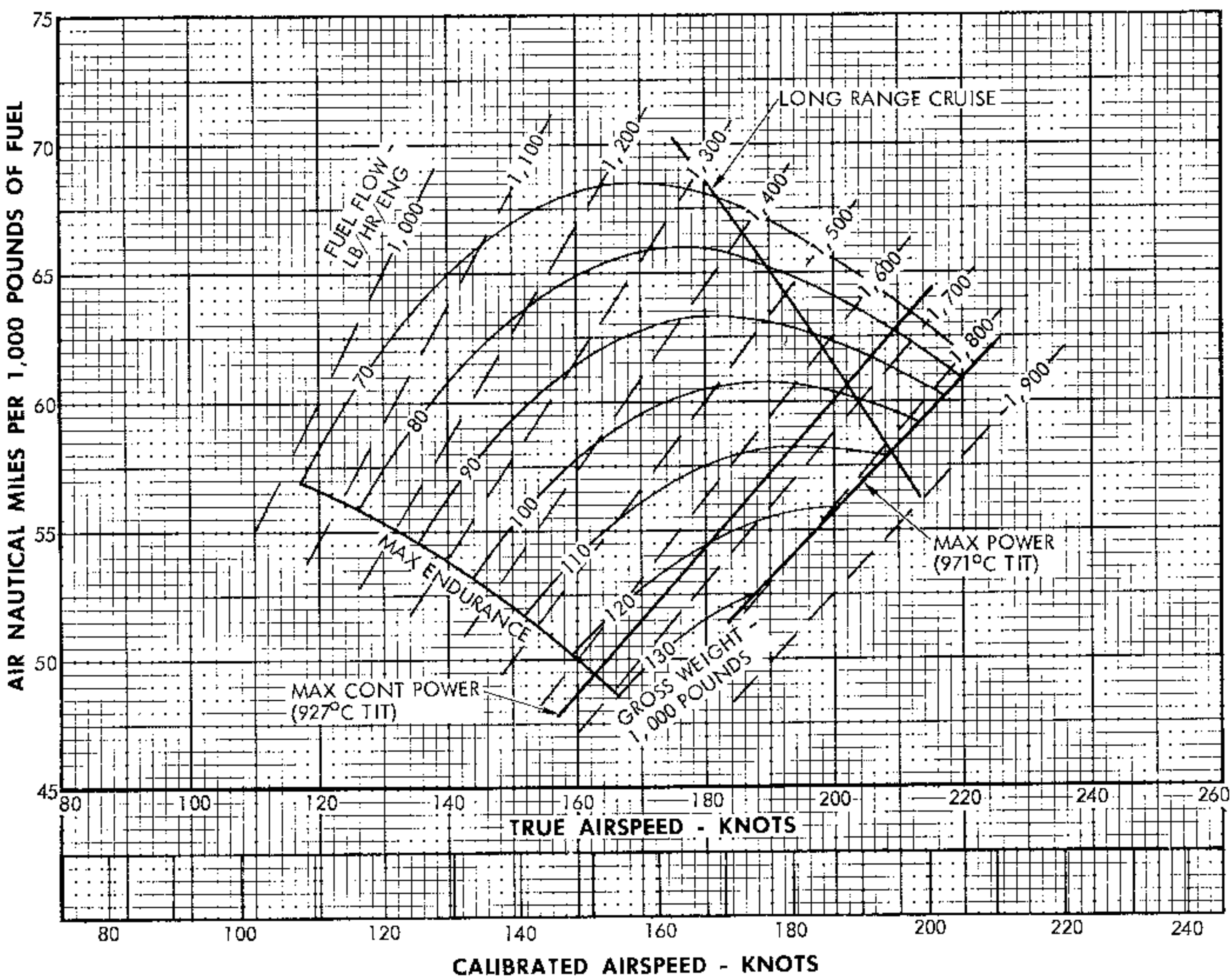


Figure A5-28.

SPECIFIC RANGE

ASYMMETRICAL POWER

2 ENGINES 10,000 FEET

ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound = Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$.
2. Propellers feathered on inoperative engines.
3. ICAO standard atmosphere.
4. $\frac{1}{\sqrt{\sigma}}$ 1.1637.
5. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

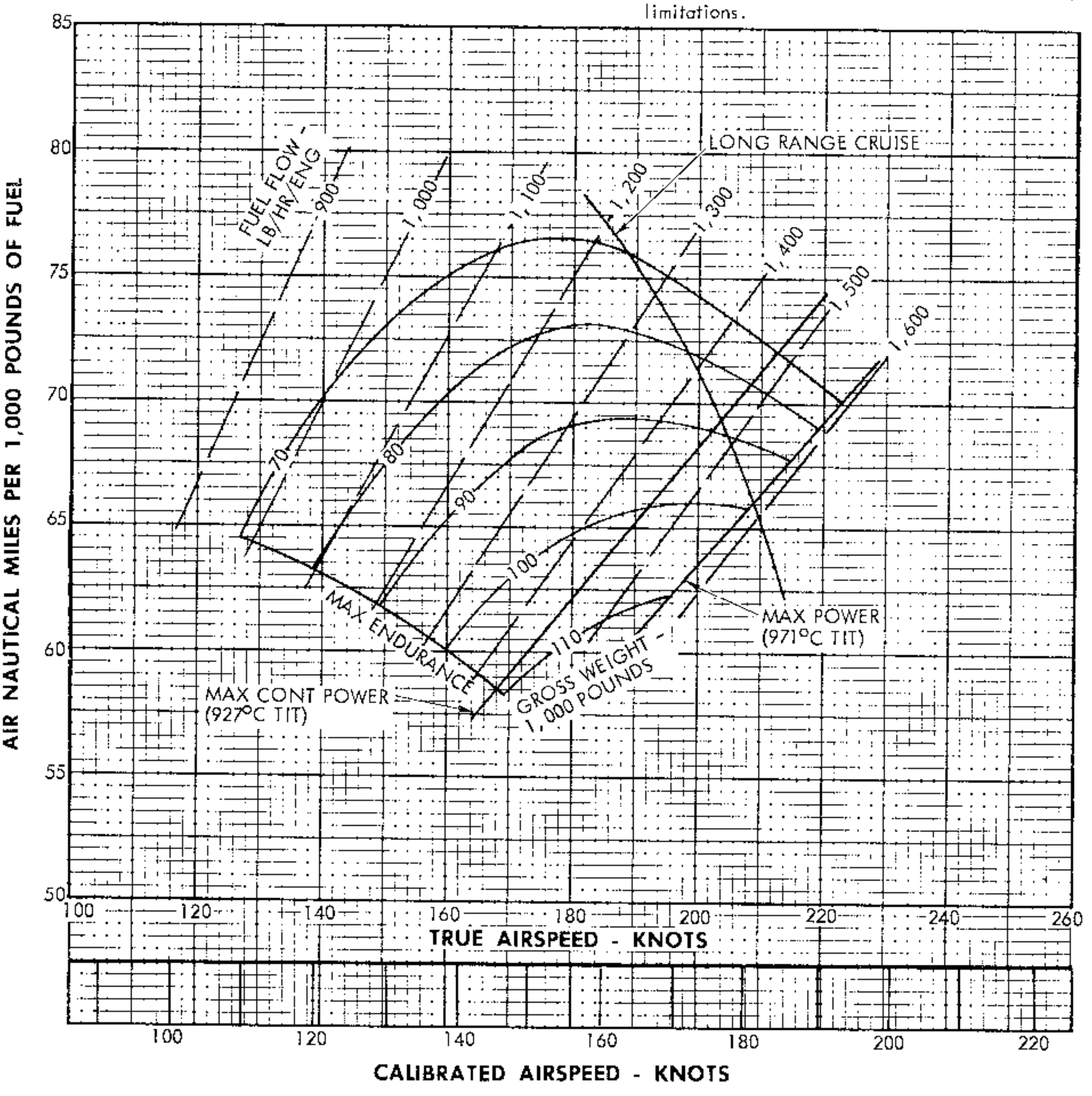


Figure A5-29.

SPECIFIC RANGE

ASYMMETRICAL POWER

2 ENGINES 15,000 FEET

ZERO DRAG INDEX

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Wind Correction: Ground Nautical Miles Per Pound= Air Nautical Miles Per Pound X $\frac{\text{Ground Speed}}{\text{True Airspeed}}$
2. Propellers feathered on inoperative engines.
3. ICAO Standard Atmosphere.
4. $\frac{1}{\sqrt{\sigma}}$ = 1.2607.
5. See Section V of T.O. 1C-130(A)A-1 for additional limitations.

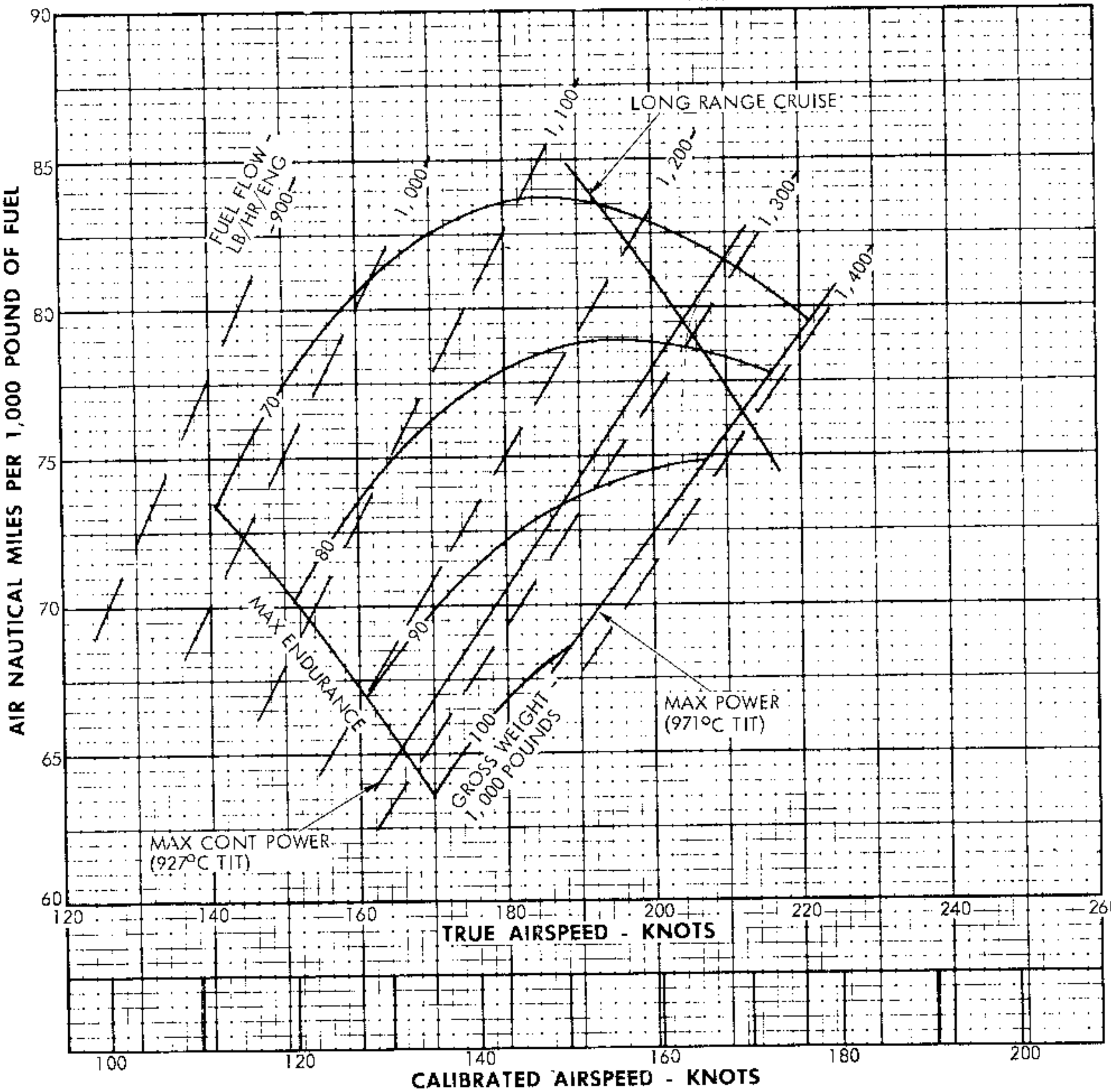


Figure A5-30.

TRUE AIRSPEED AT LONG RANGE CRUISE FOR VARIANT CONFIGURATION

2 ENGINES **ASYMMETRICAL POWER**

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engines.
2. Temperature effect is negligible.

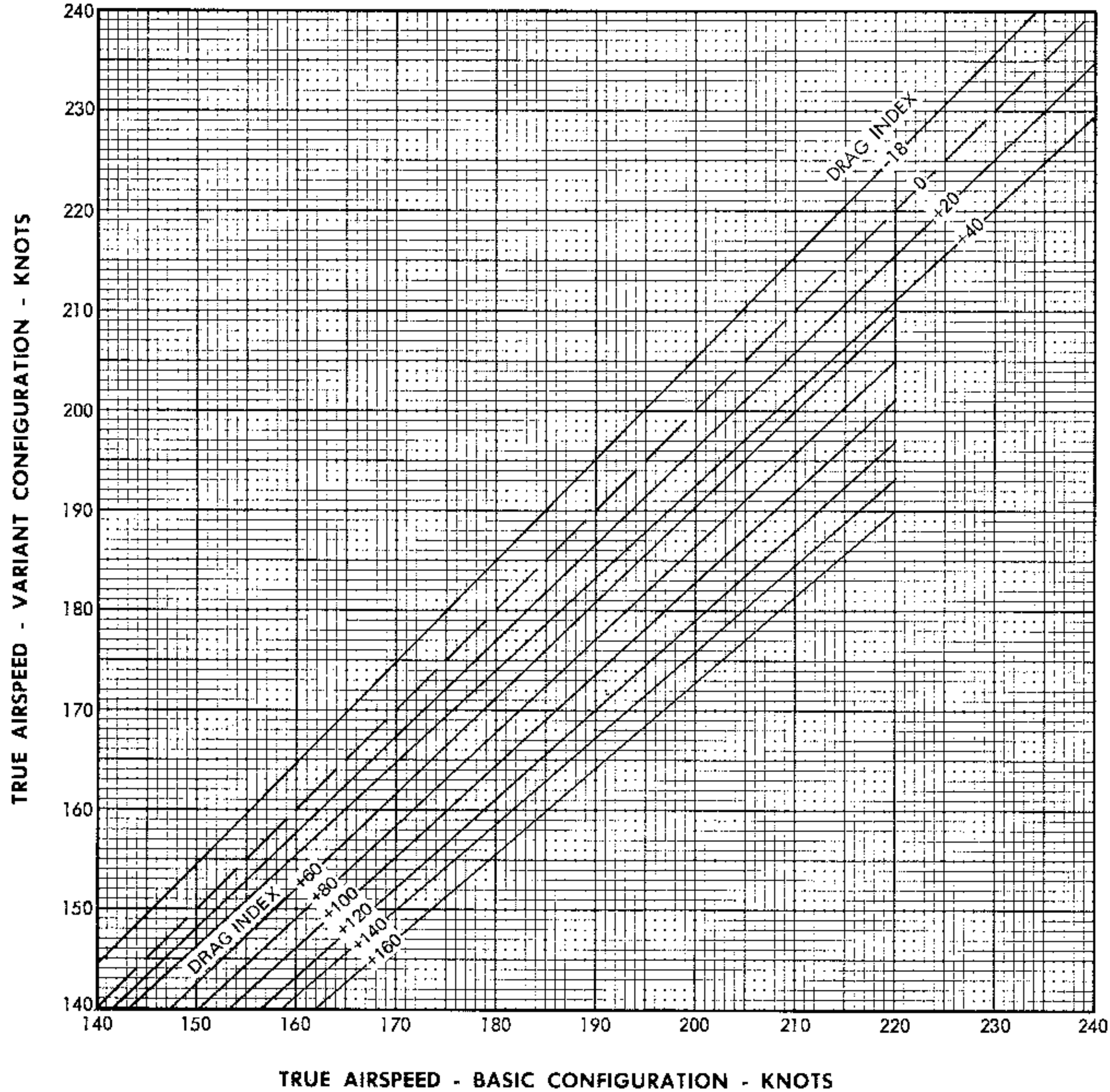


Figure A5-31.

SPECIFIC RANGE AT LONG RANGE CRUISE FOR VARIANT CONFIGURATION

2 ENGINES ASYMMETRICAL POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engines.
2. Temperature effect is negligible.

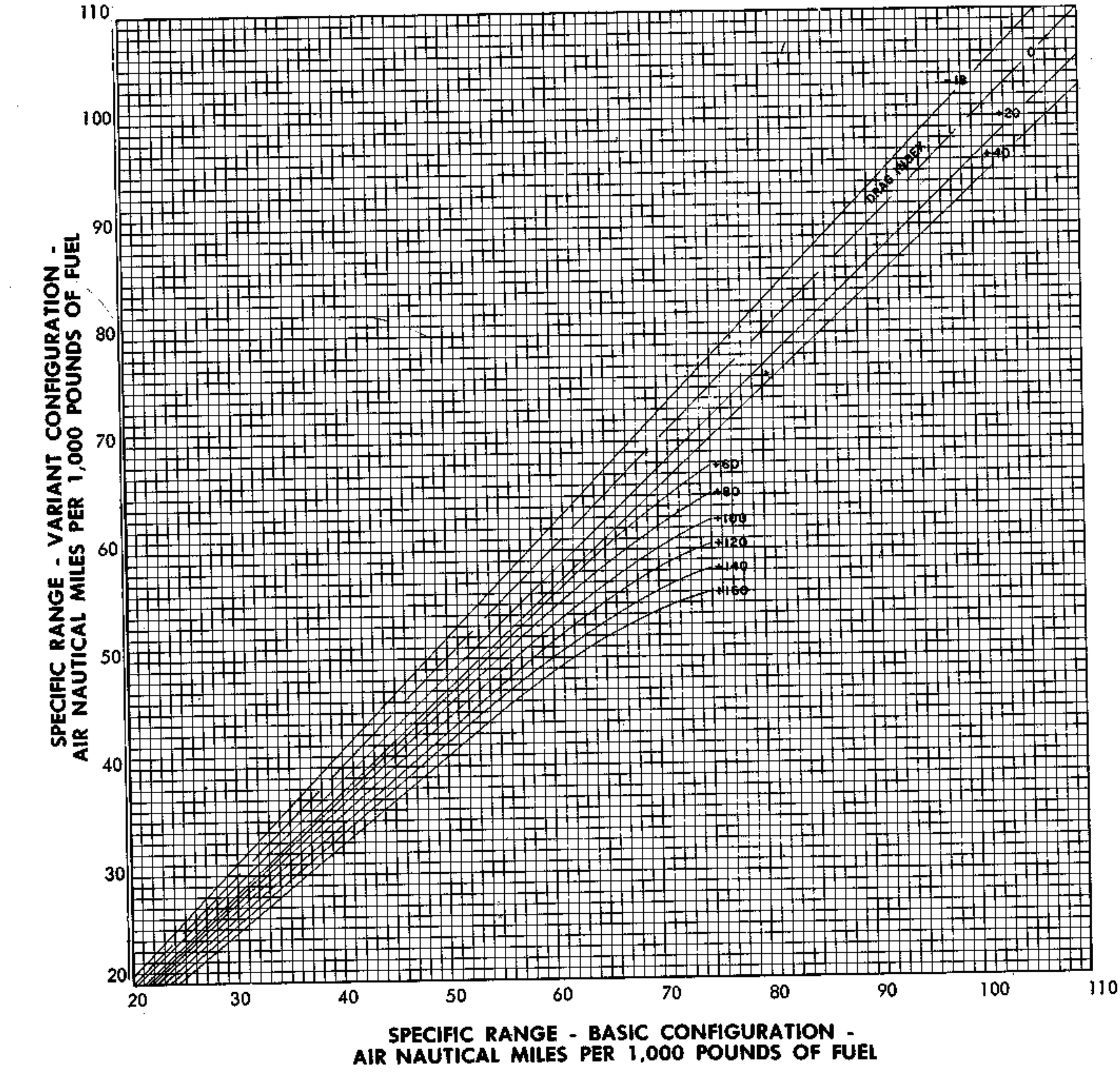


Figure A5-32.

RANGE SUMMARY
LONG RANGE CRUISE
4 ENGINES AIRSPEED

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

See Section V of T.O. 1C-130(A)A-1 for limitations.

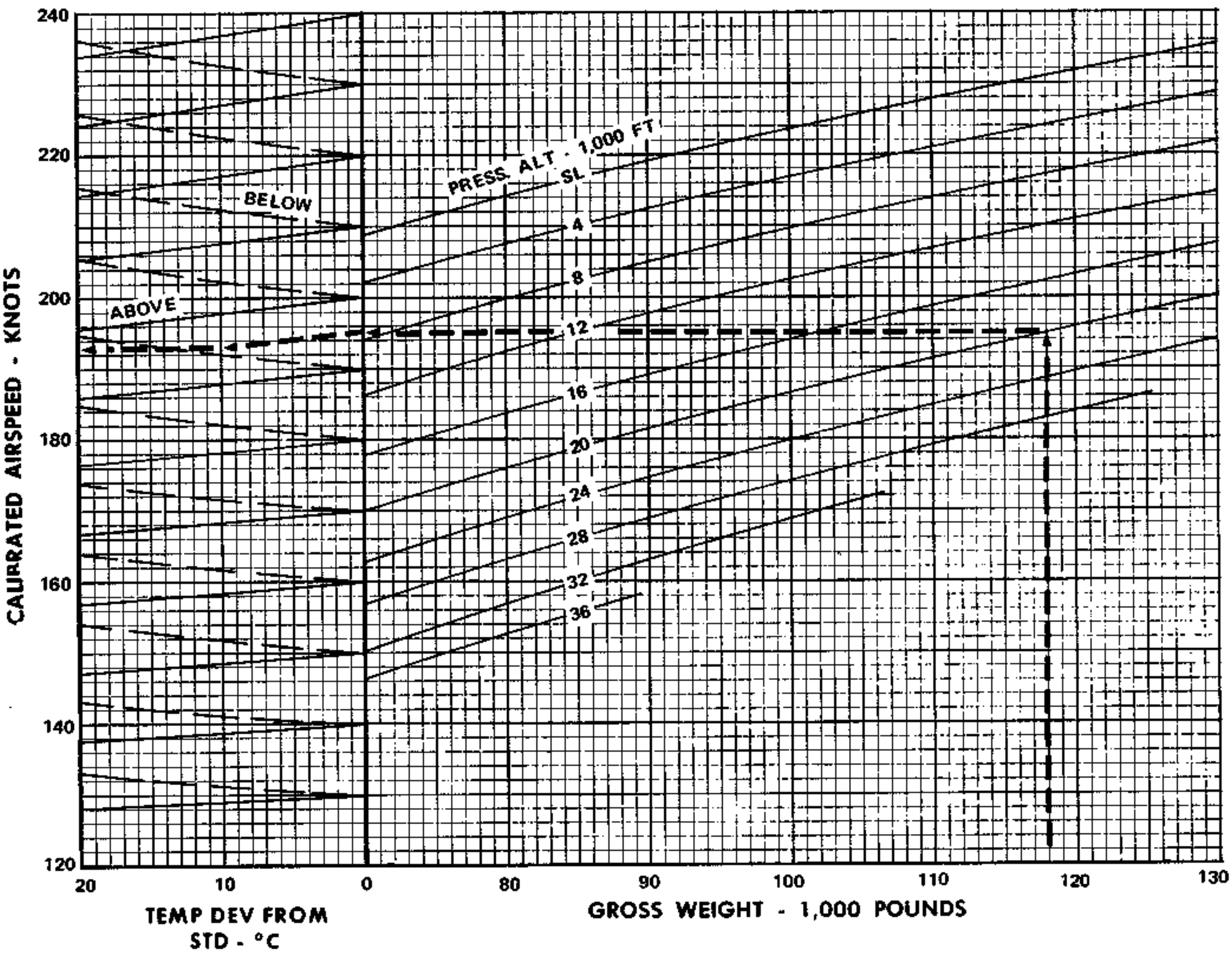


Figure A5-33.

RANGE SUMMARY
LONG RANGE CRUISE
4 ENGINES FUEL FLOW

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

See Section V of T.O. 1C-130(A)A-1 for Limitations.

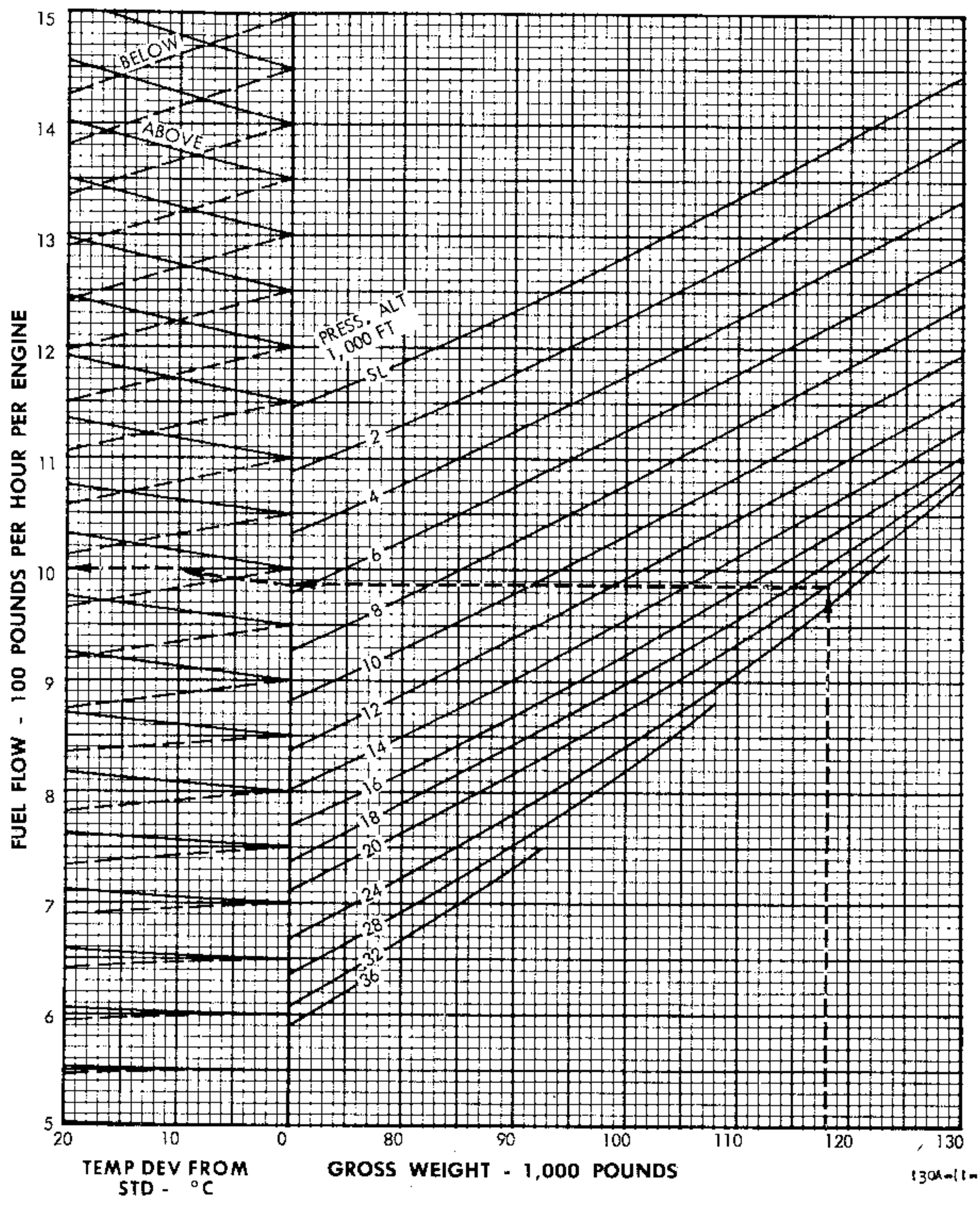


Figure A5-34.

RANGE SUMMARY
LONG RANGE CRUISE

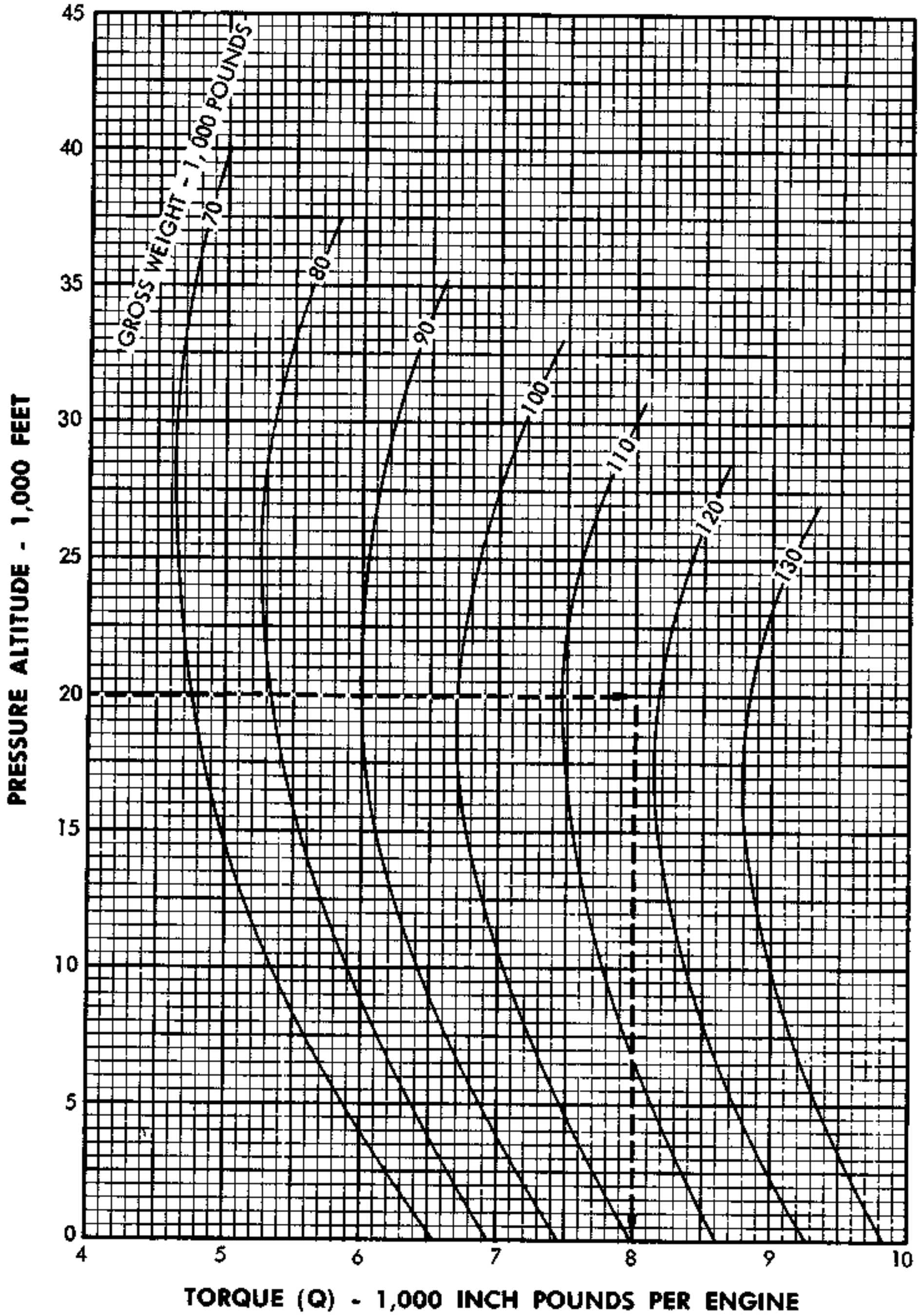
4 ENGINES TORQUE

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. See Section V of T. O. 1C-130(A)A-1 for limitations.
2. Torque values good for all ambient temperatures.



130A-(1-1)-0-060

Figure A5-35.

RANGE SUMMARY
LONG RANGE CRUISE TORQUE
FOR VARIANT CONFIGURATION
4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE DRAG INDEX 40

NOTE

1. Temperature effect is negligible.
2. See Section V of T.O. 1C-130(A)A-1 for limitations.

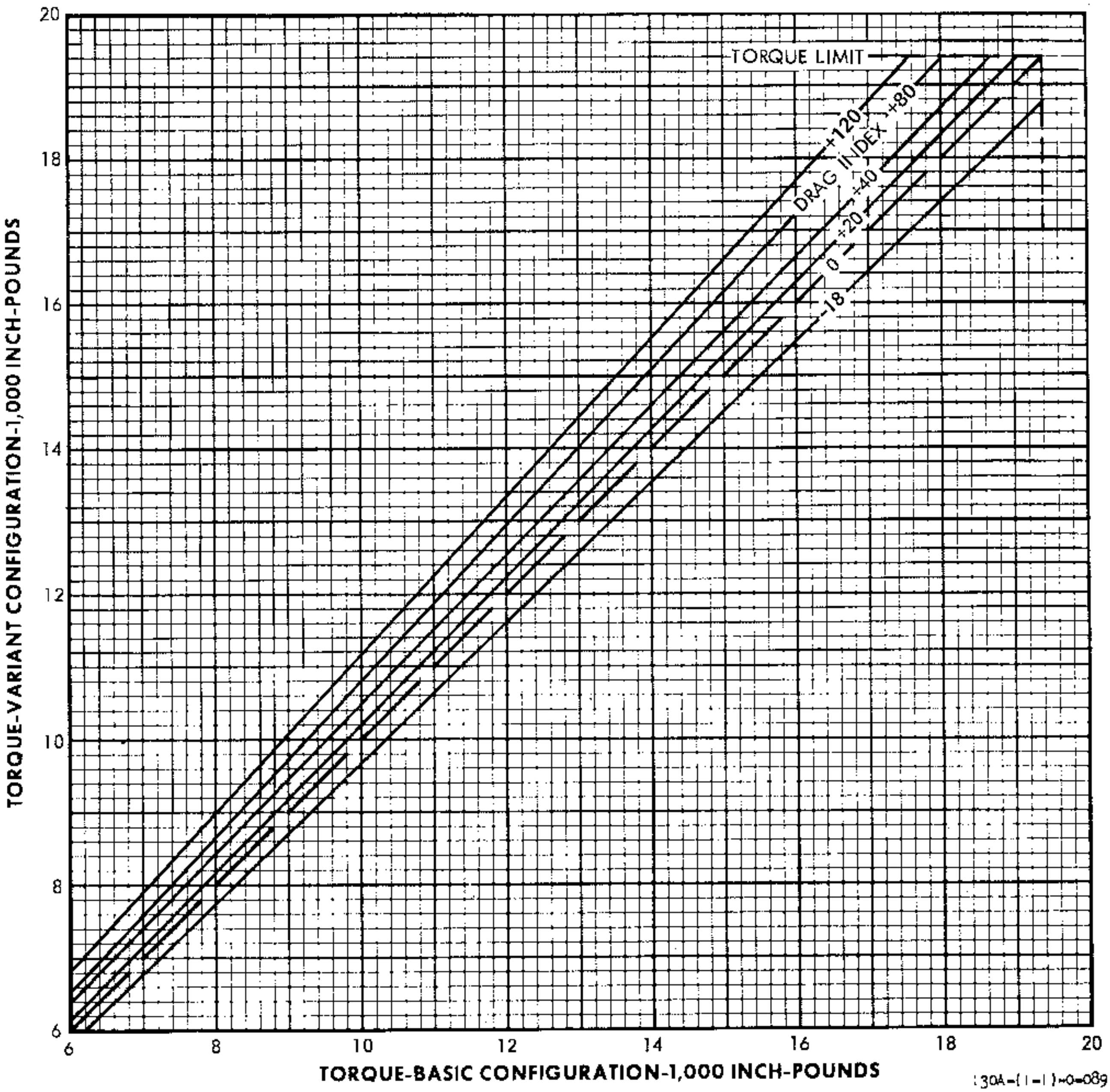


Figure A5-36.

RANGE SUMMARY
CONSTANT 290 KTAS

4 ENGINES INDICATED AIRSPEED

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

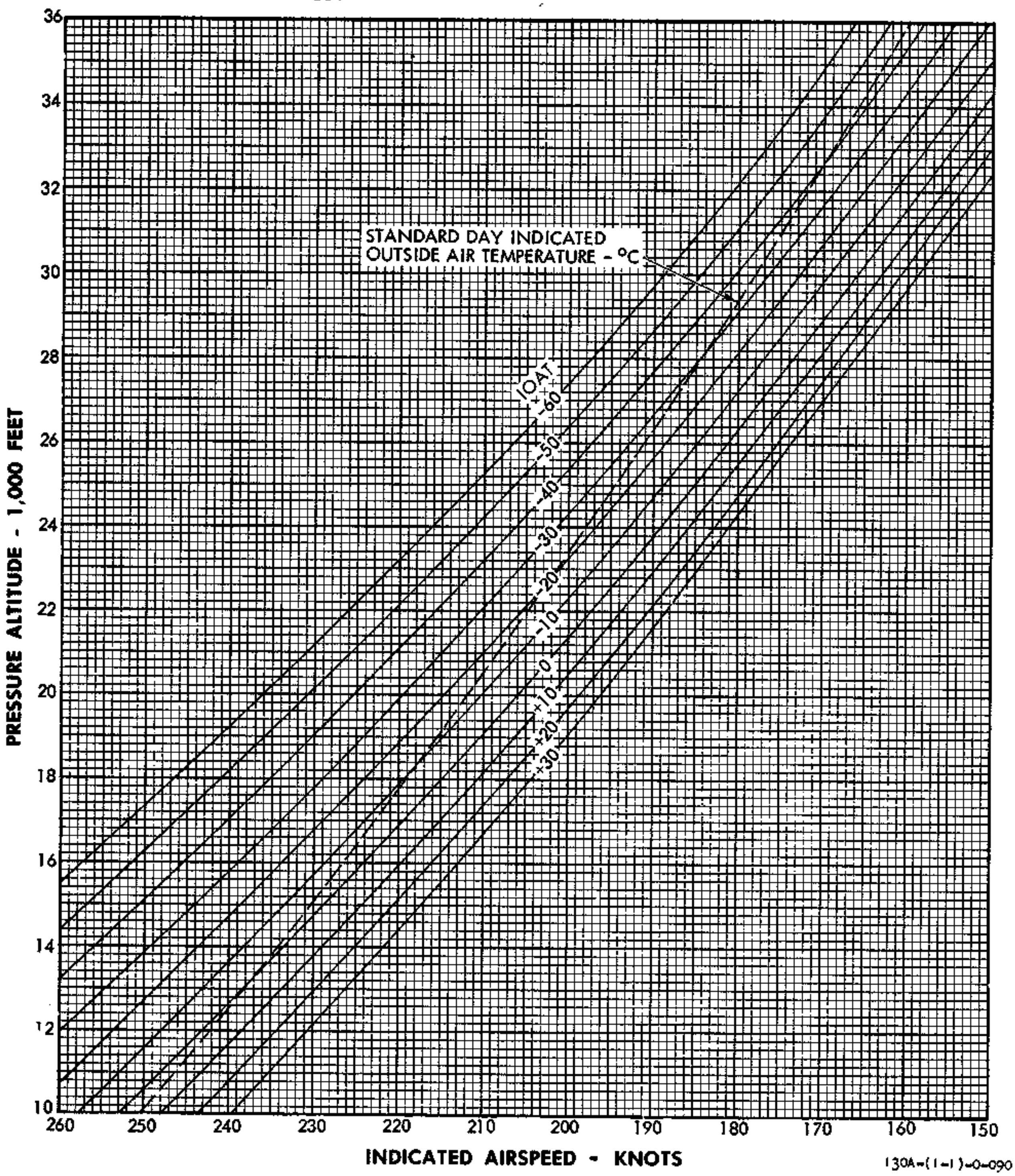


Figure A5-37.

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969.
DATA BASIS: PHASE IV FLIGHT TEST

RANGE SUMMARY - 290 KTAS CRUISE

4 ENGINES NORMAL BLEED

FUEL FLOW

NOTE

1. See Section V of T.O. 1C-130(A)A-1 for limitations.
2. 290 KTAS cruise cannot be flown for conditions that fall to the left of the V_h line. To the left of the V_h line, fly at V_h or Long Range Cruise.

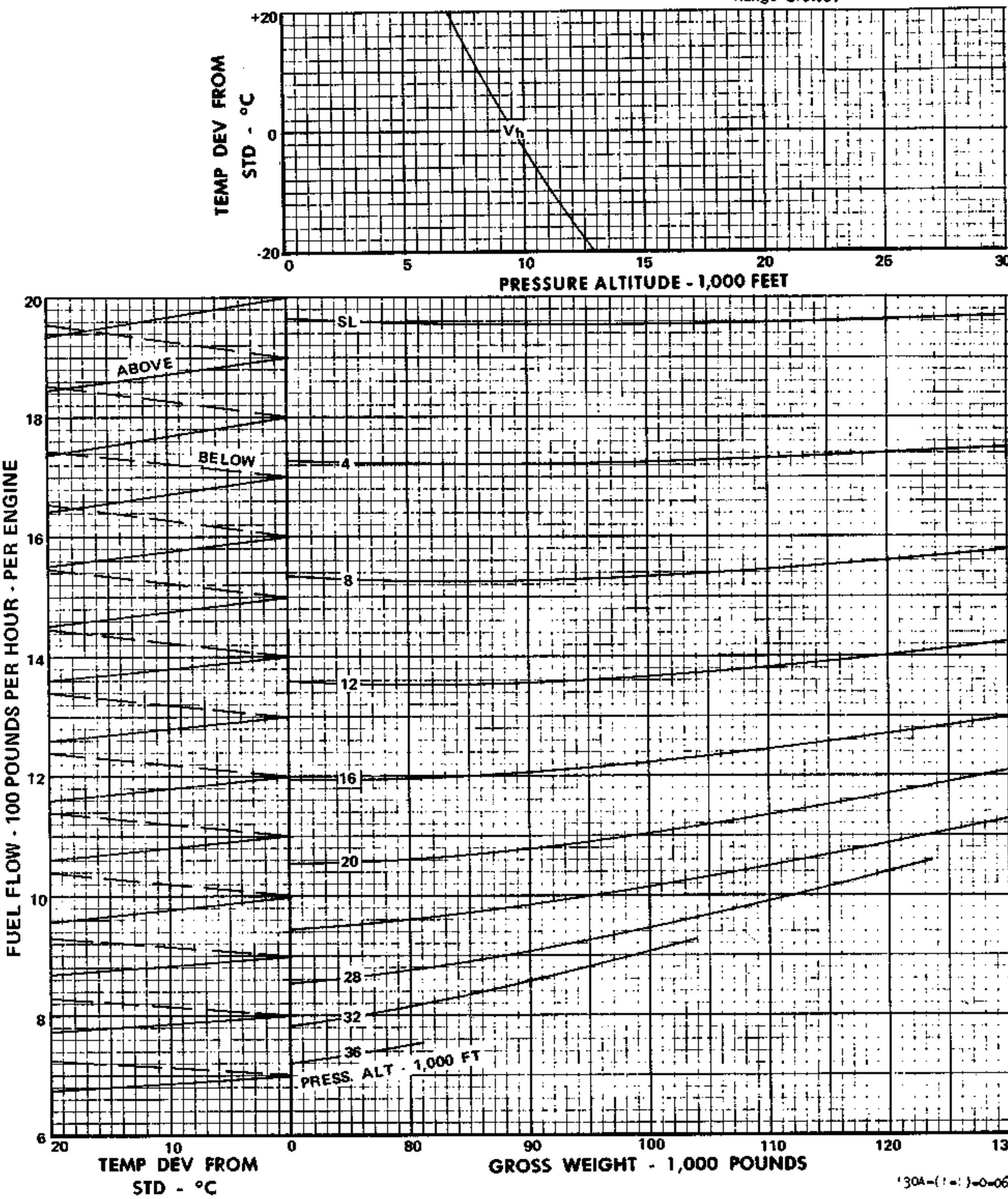


Figure A5-38.

RANGE SUMMARY - 290 KTAS CRUISE

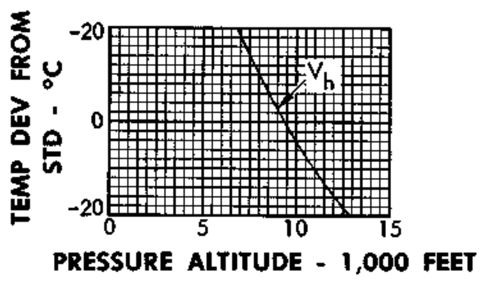
4 ENGINES TORQUE

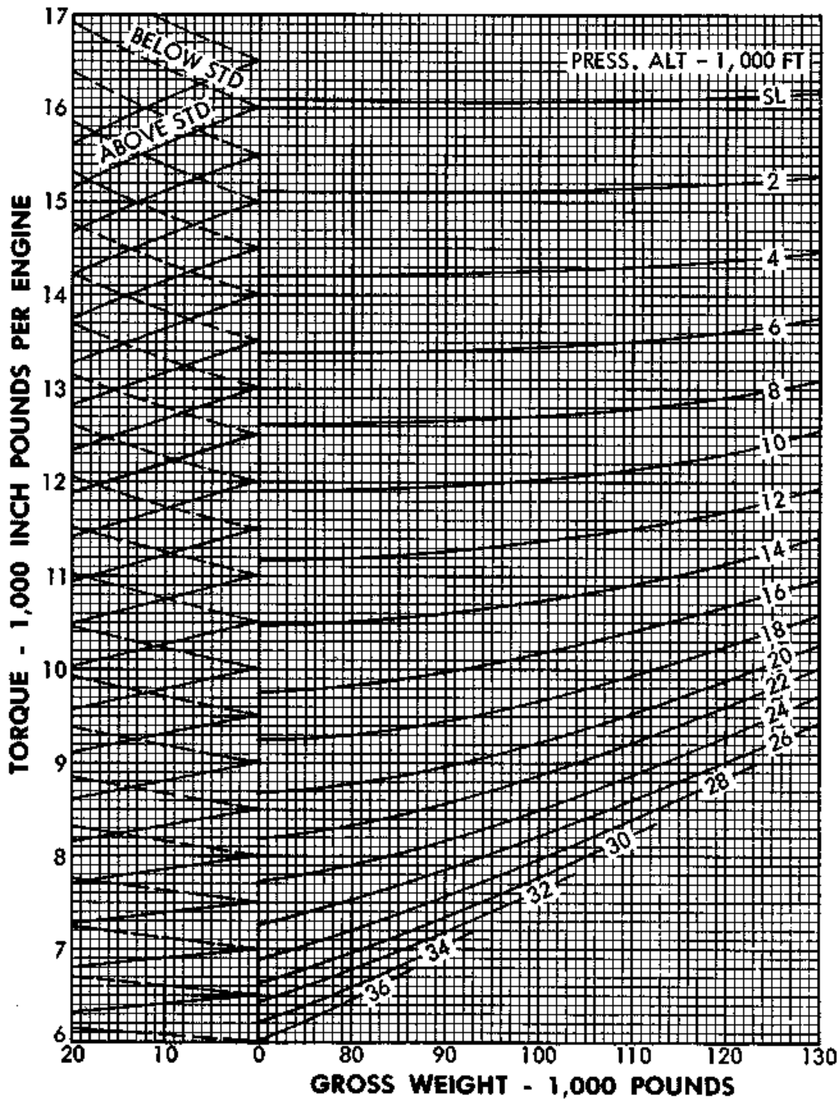
MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. See Section V of T.O. 1C-130(A)A-1 for limitations.
2. 290 KTAS cruise cannot be flown for conditions that fall to the left of the V_h line. To the left of the V_h line, fly at V_h or Long Range Cruise.





130A-(1-1)-0-062

Figure A5-39.

MODEL: AC-130A
T56-A-9 ENGINES

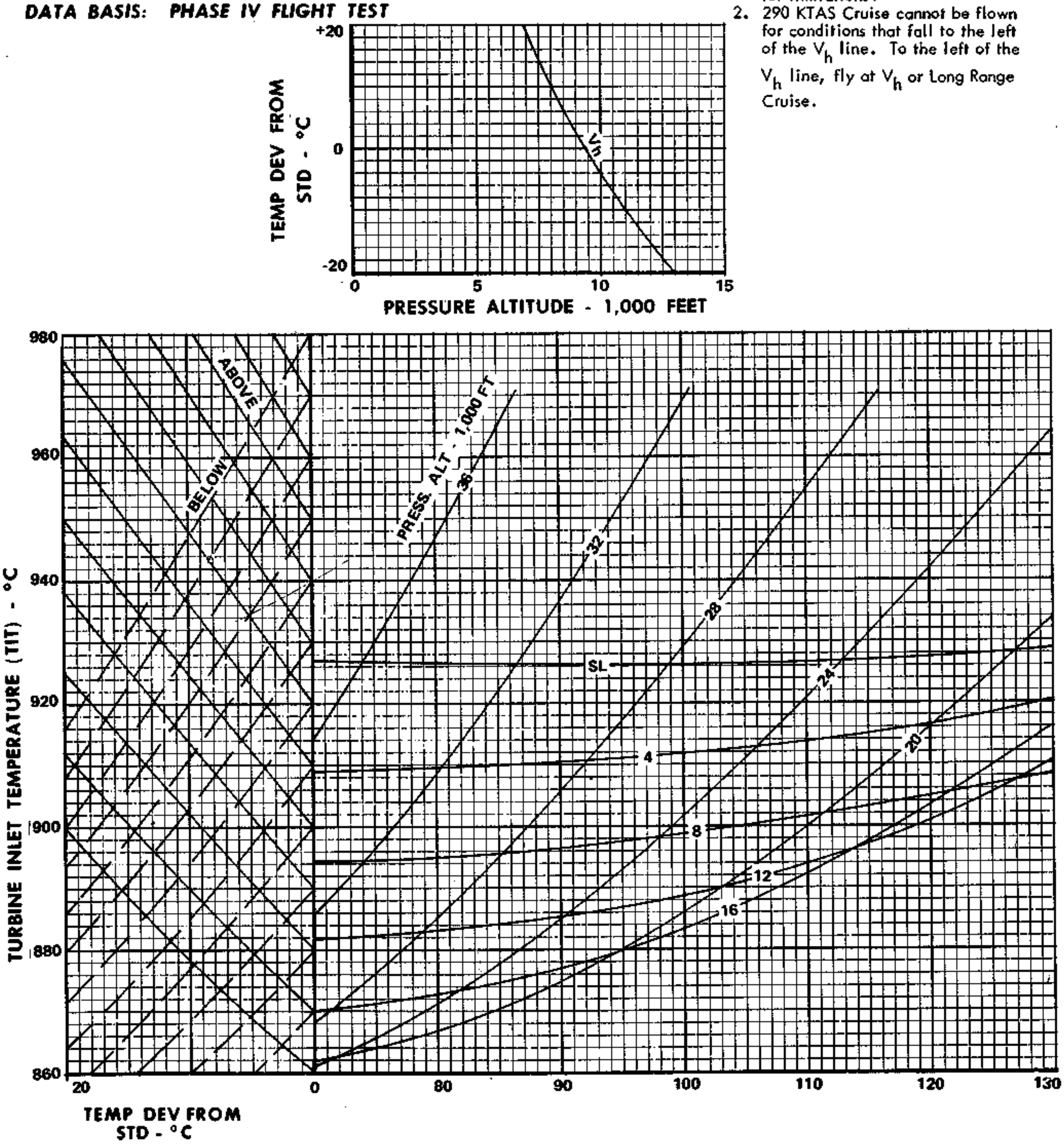
DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

RANGE SUMMARY - 290 KTAS CRUISE

4 ENGINES NORMAL BLEED
TURBINE INLET TEMPERATURE

NOTE

1. See Section V of T.O. 1C-130(A)A-1 for limitations.
2. 290 KTAS Cruise cannot be flown for conditions that fall to the left of the V_h line. To the left of the V_h line, fly at V_h or Long Range Cruise.



130A-(1-1)-0-091

Figure A5-40.

RANGE SUMMARY FUEL FLOW AT 290 KTAS CRUISE FOR VARIANT CONFIGURATION

4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

ESTIMATED ABOVE DRUG INDEX 40

NOTE

1. Temperature effect is negligible.
2. See Section V of T.O. 1C-130A-1 for limitations.

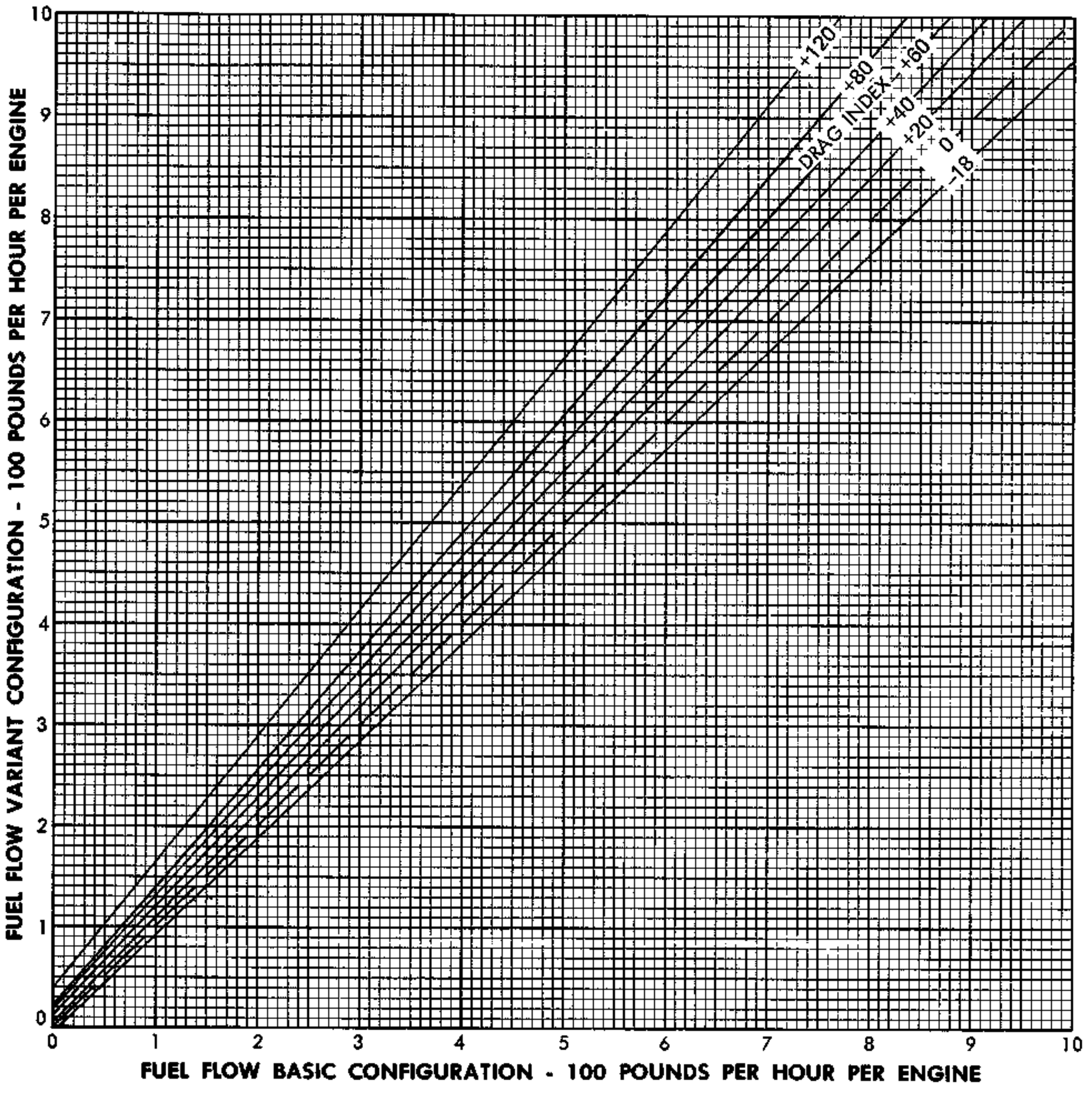


Figure A5-41.

RANGE SUMMARY TORQUE AT 290 KTAS CRUISE FOR VARIANT CONFIGURATION
4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE DRAG INDEX 40

NOTE

1. Temperature effects are negligible.
2. See Section V of T.O. 1C-130(A)A-1 for limitations.

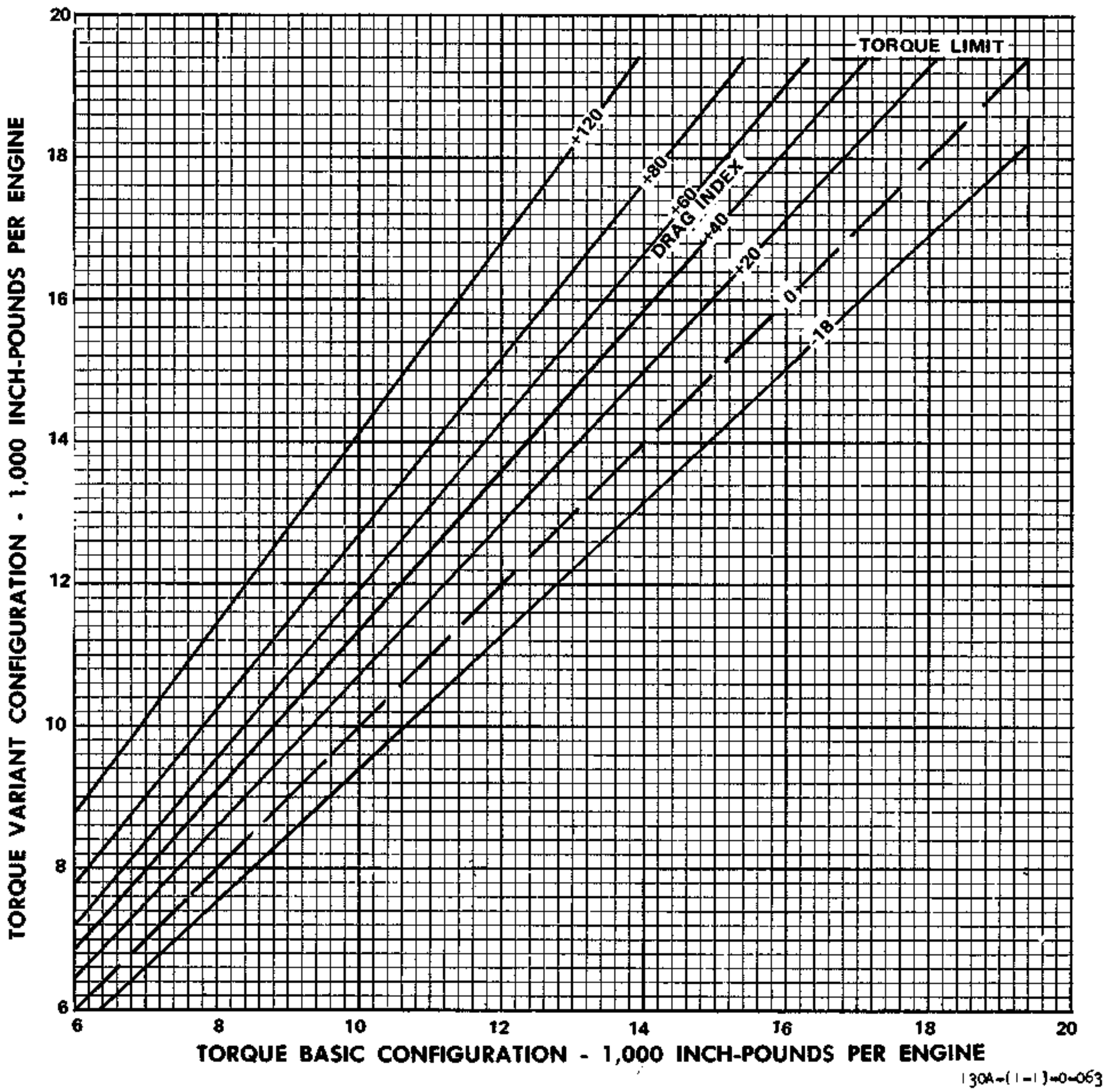


Figure A5-42.

RANGE SUMMARY TURBINE INLET TEMPERATURE AT 290 KTAS CRUISE FOR VARIANT CONFIGURATION

4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE DRAG INDEX 40

NOTE

1. Temperature effect is negligible.
2. See Section V of T.O. 1C-130(A)A-1 for limitations.

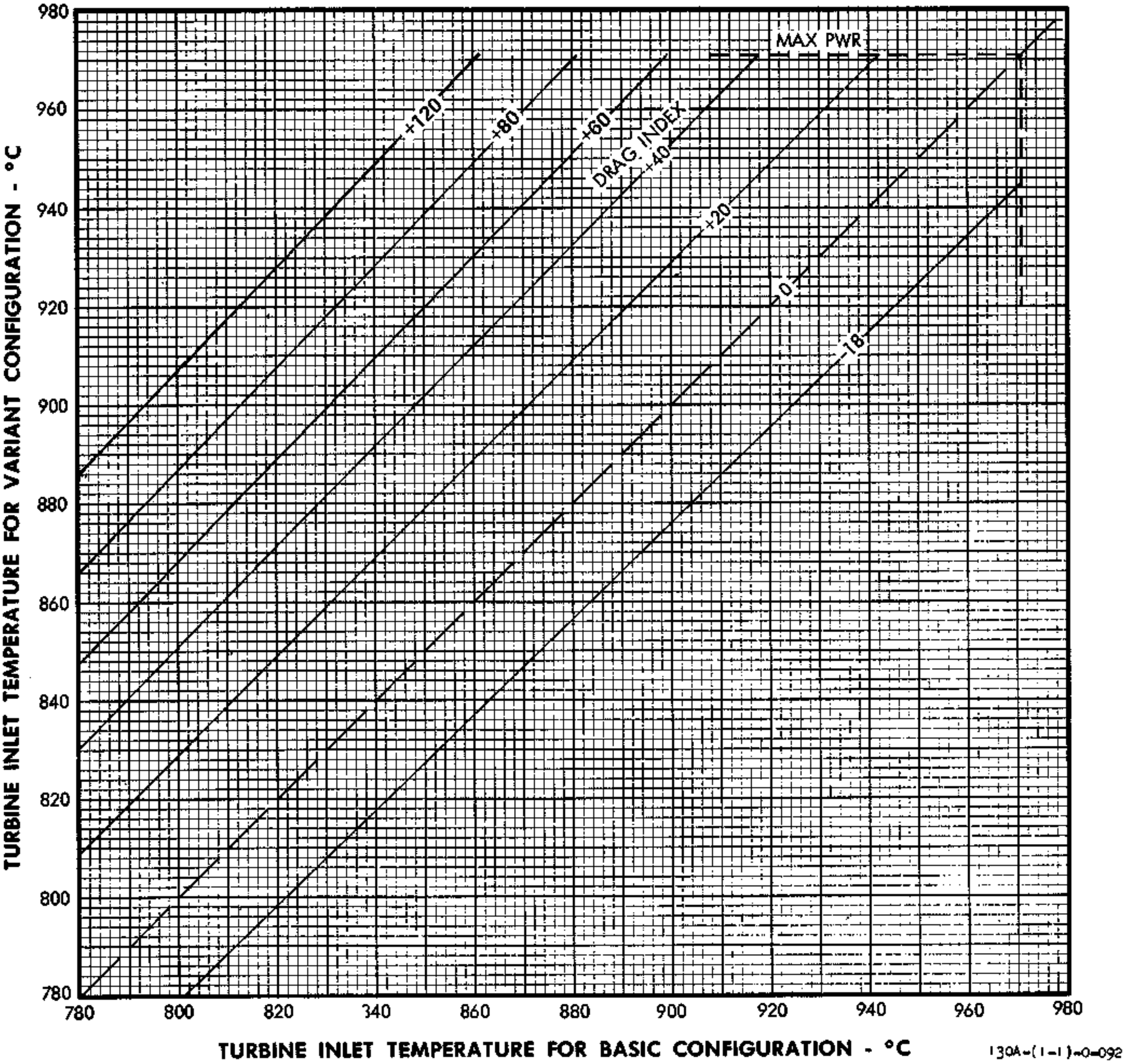


Figure A5-43.

RANGE SUMMARY - CONSTANT 270 KTAS

4 ENGINES INDICATED AIRSPEED

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

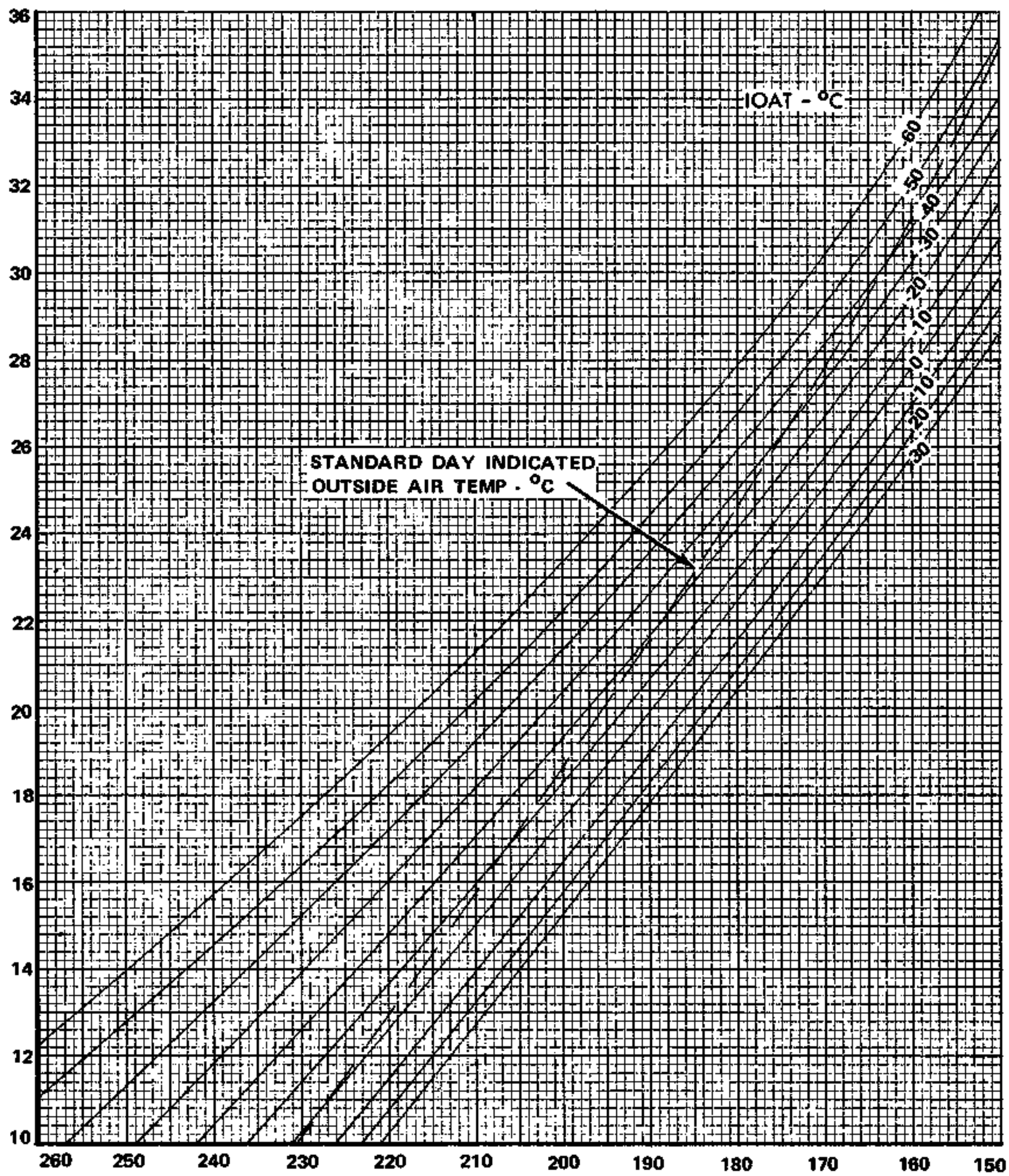


Figure A5-44.

RANGE SUMMARY
270 KTAS CRUISE

4 ENGINES FUEL FLOW

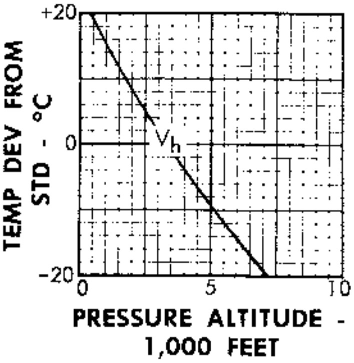
MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. See Section V of T.O. 1C-130(A)A-1 for limitations.
2. 270 KTAS cruise cannot be flown for conditions that fall to the left of the V_h line. To the left of the V_h line, fly V_h on Long Range Cruise.



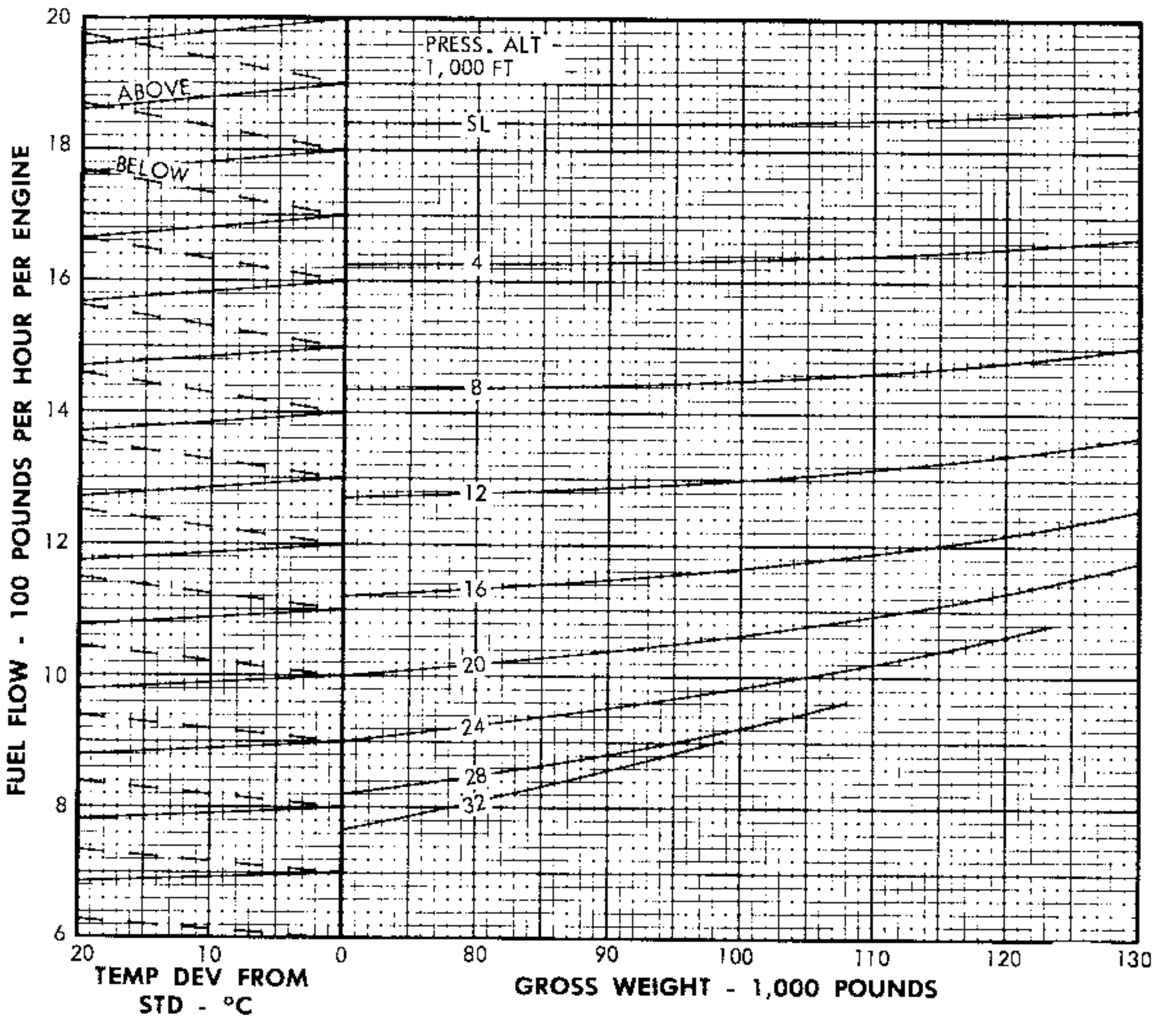


Figure A5-45.

FUEL FLOW AT 270 KTAS CRUISE FOR VARIANT CONFIGURATION

4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE:
DATA BASIS: ESTIMATED

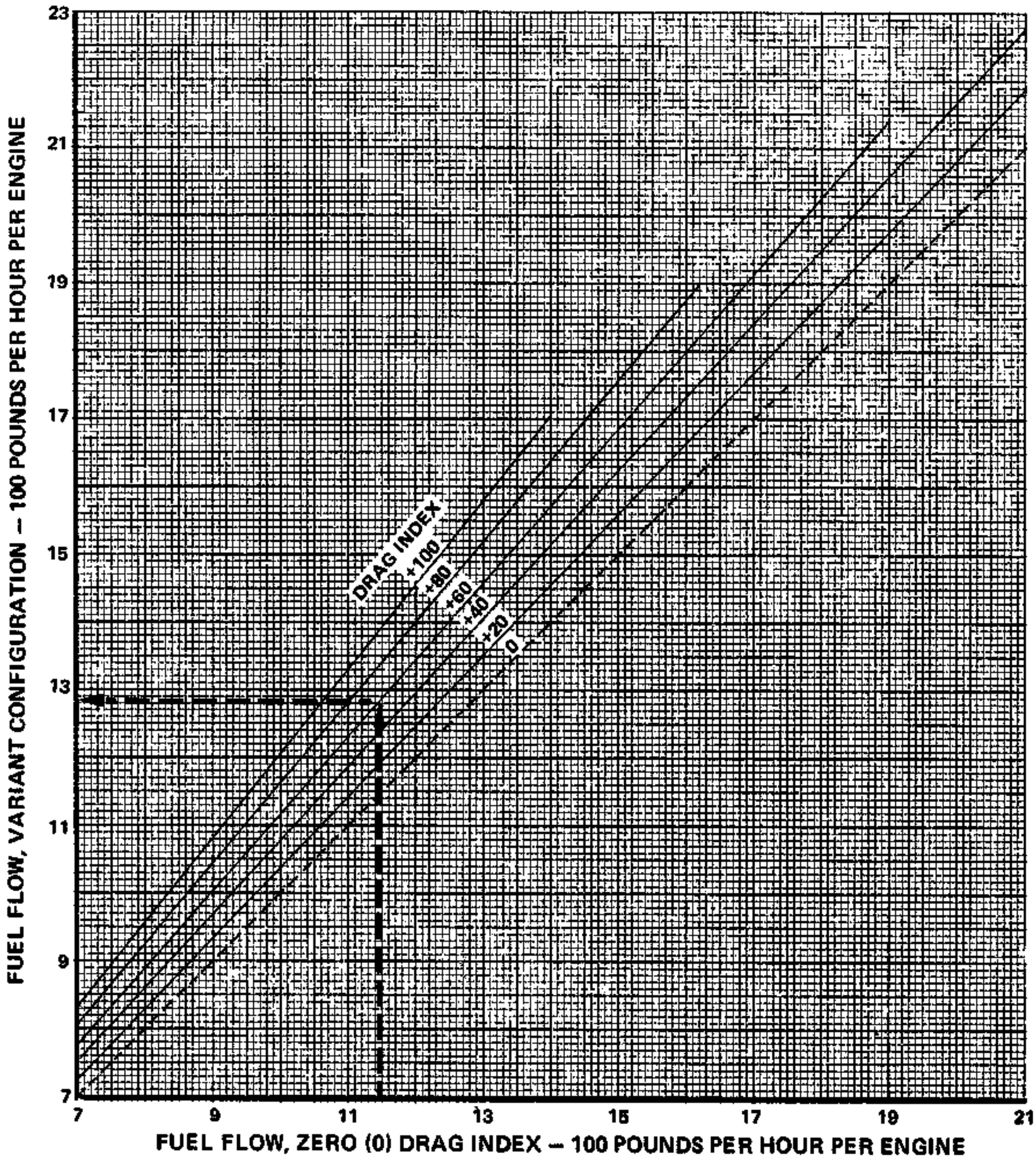


Figure A5-46.

RANGE SUMMARY - 270 KTAS CRUISE

4 ENGINES TORQUE

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. See Section V of T.O. 1C-130(A)A-1 for limitations.
2. 270 KTAS Cruise cannot be flown for conditions to the left of the V_h line. To the left of the V_h fly at V_h or Long Range Cruise.

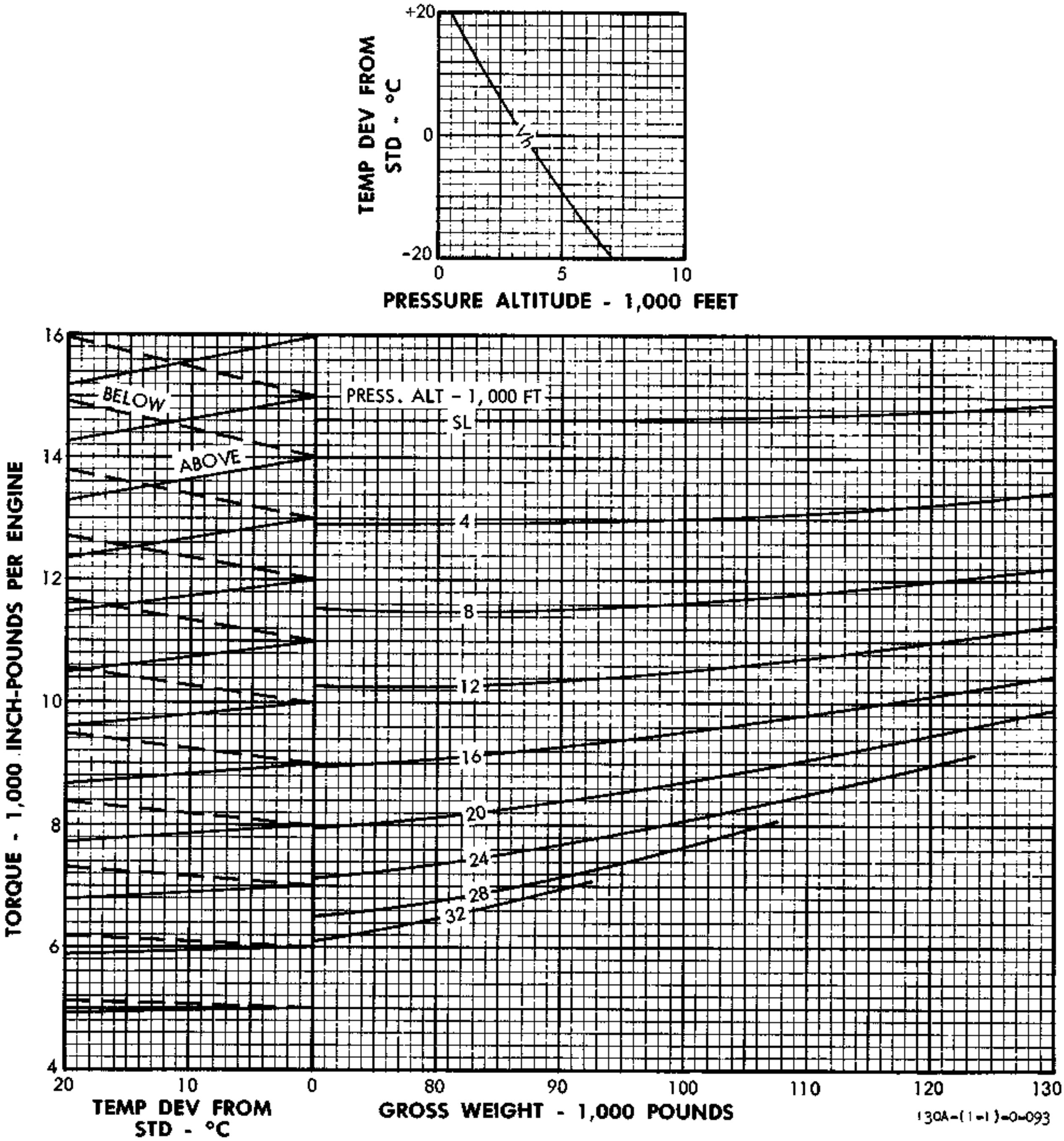


Figure A5-47.

RANGE SUMMARY - 270 KTAS CRUISE

4 ENGINES
TURBINE INLET TEMPERATURE

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. See Section V of T.O. 1C-130(A)A-1 for limitations.
2. 270 KTAS cruise cannot be flown for conditions that fall to the left of the V_h line. To the left of the V_h line, fly V_h on Long Range Cruise.

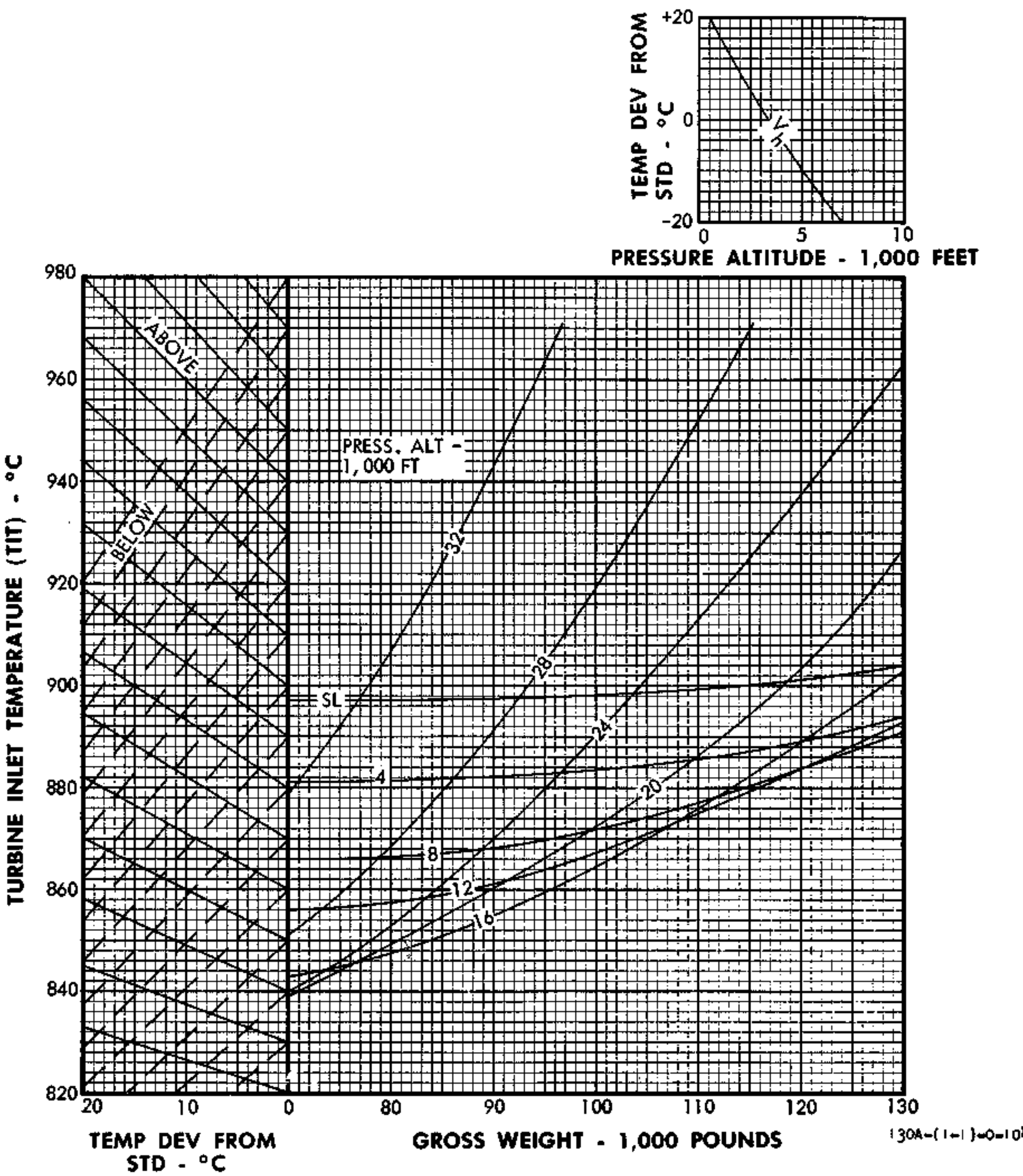


Figure A5-48.

MODEL AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1975
DATA BASIS: FLIGHT TEST

RANGE SUMMARY
CONSTANT 260 KTAS

4 ENGINES　　INDICATED AIRSPEED

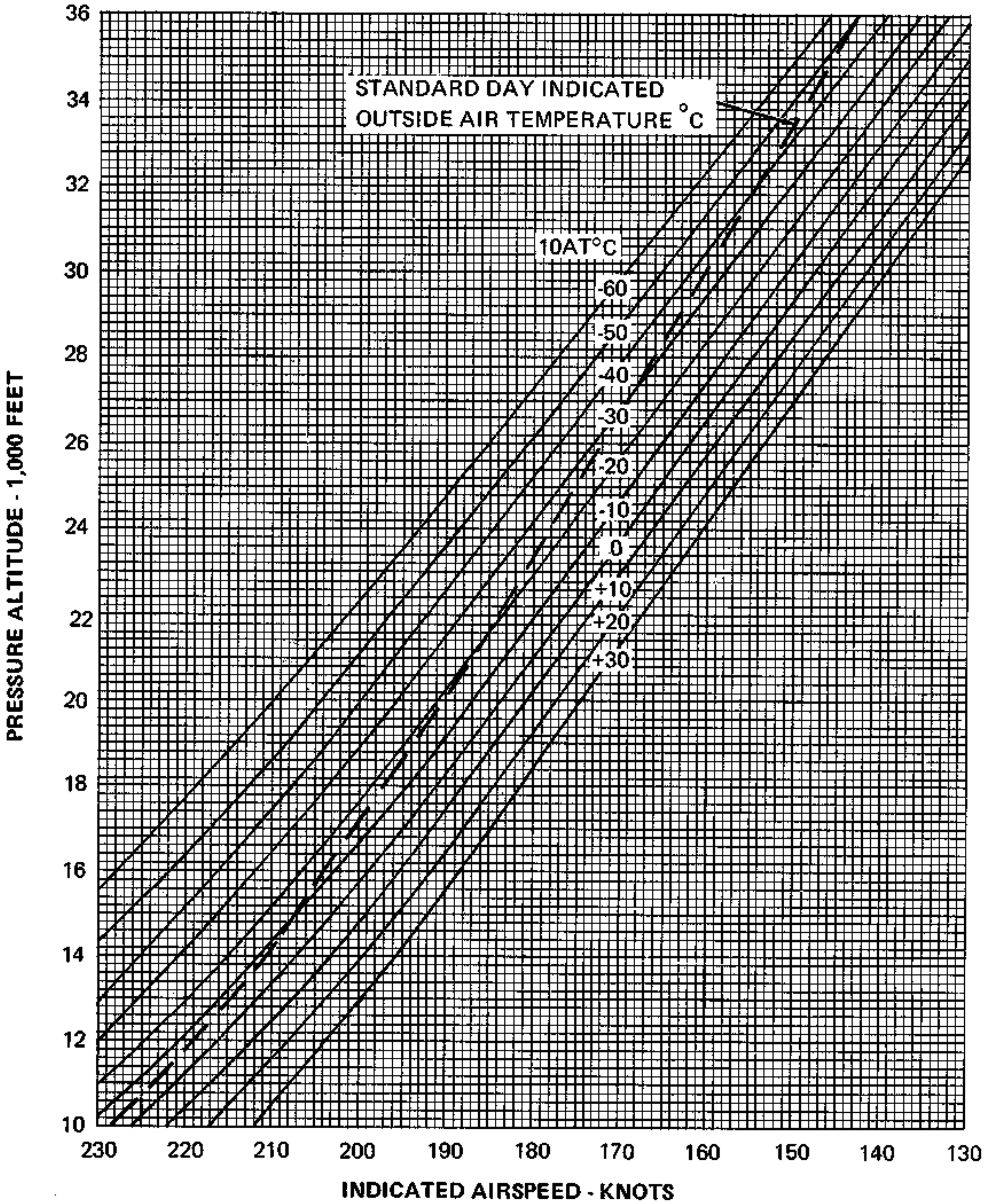


Figure A5-49.

RANGE SUMMARY - 260 KTAS CRUISE

4 ENGINES FUEL FLOW

MODEL AC-130A
T56-A-9 ENGINES
DATE: DECEMBER 1975
DATA BASIS: ESTIMATED

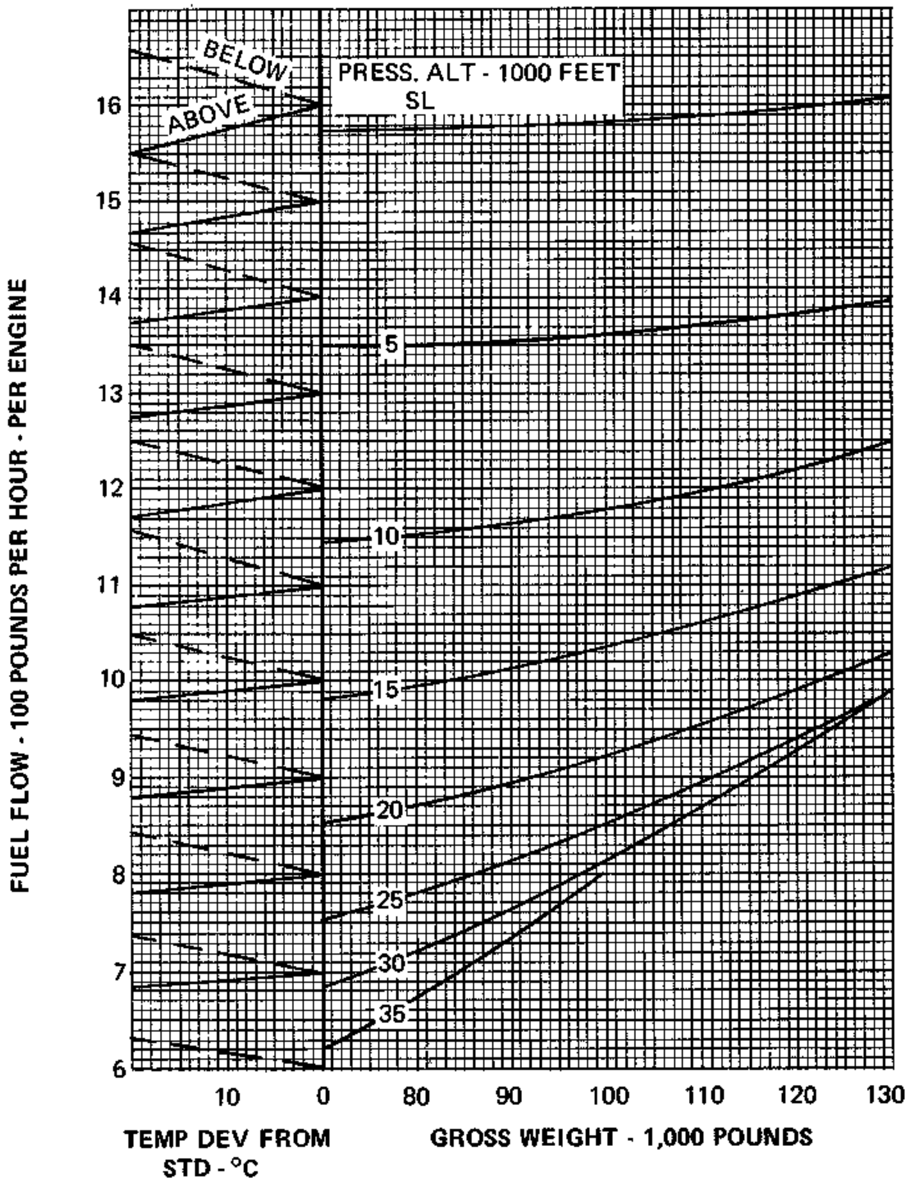


Figure A5-50.

FUEL FLOW AT
260 KTAS
CRUISE FOR VARIANT CONFIGURATION
4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE:

DATA BASIS: ESTIMATED

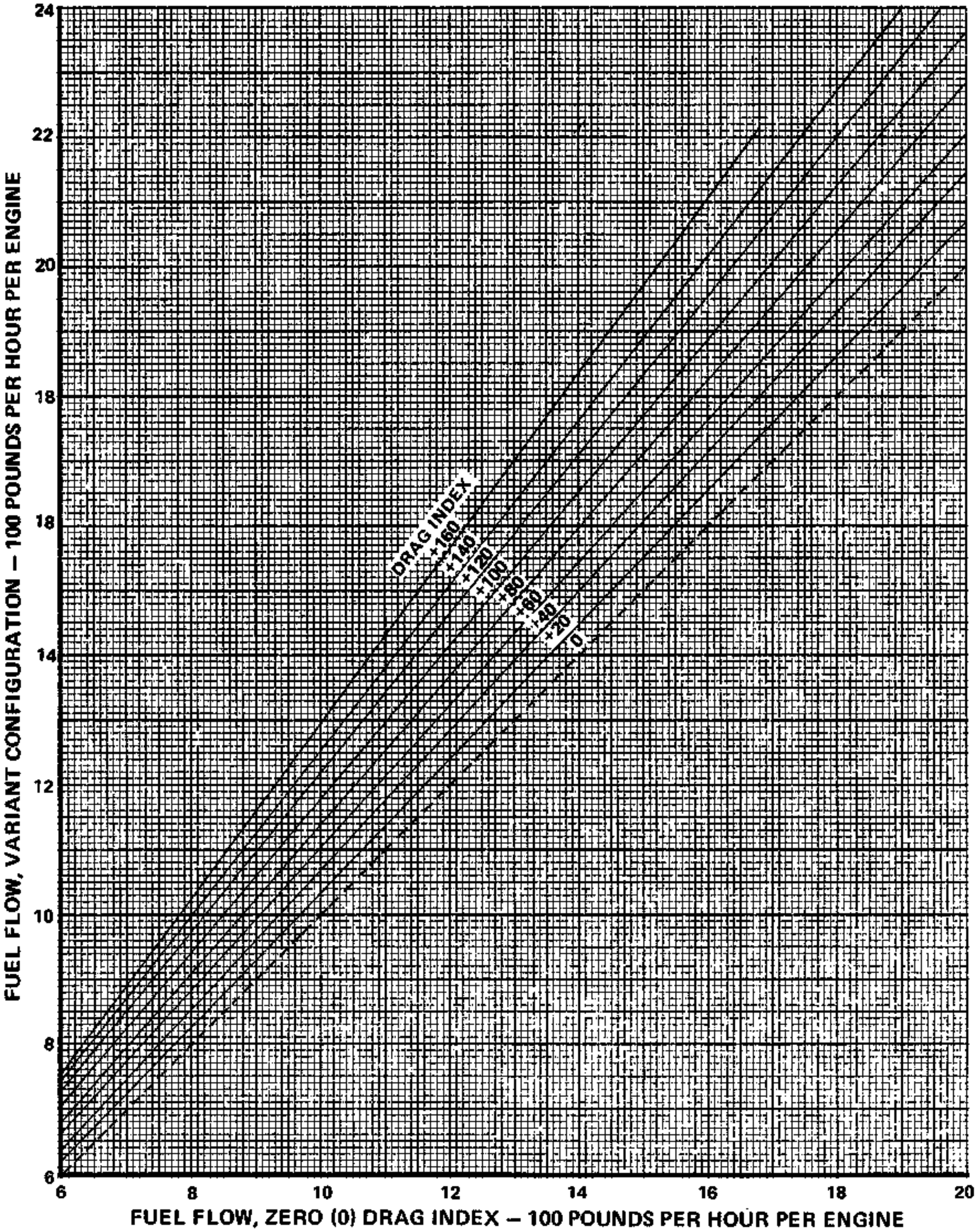


Figure A5-51.

MODEL AC-130A
T56-A-9 ENGINES

RANGE SUMMARY - 260 KTAS CRUISE

4 ENGINES

TURBINE INLET TEMPERATURE

DATE: DECEMBER 1975
DATA BASIS: ESTIMATED

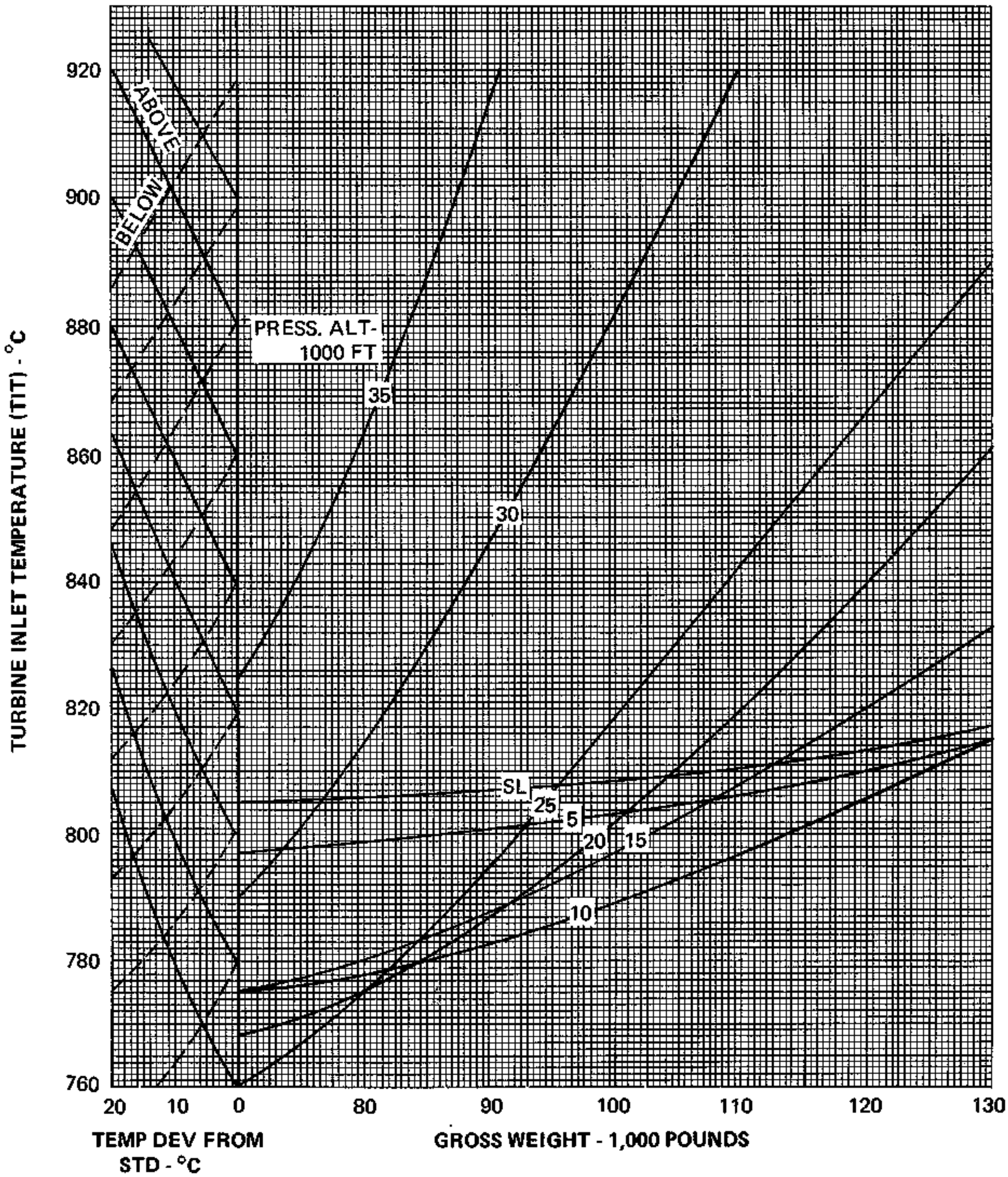


Figure A5-52.

RANGE SUMMARY - 260 KTAS CRUISE

4 ENGINES TORQUE

MODEL AC-130A
T56-A-9 ENGINES

DATED: DECEMBER 1975
DATA BASIS: ESTIMATED

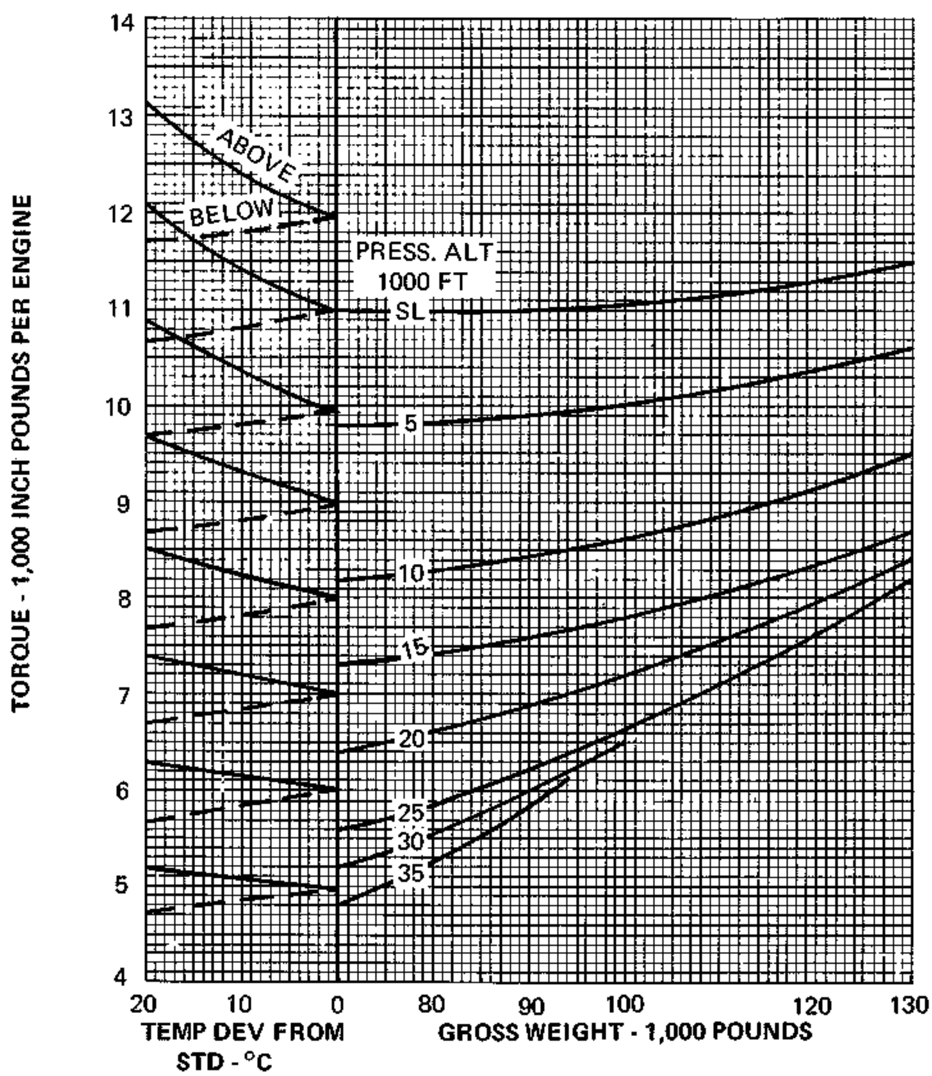


Figure A5-53.

RANGE SUMMARY
LONG RANGE CRUISE

3 ENGINES AIRSPEED

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. See Section V of T.O. 1C-130(A)A-1 for limitations.

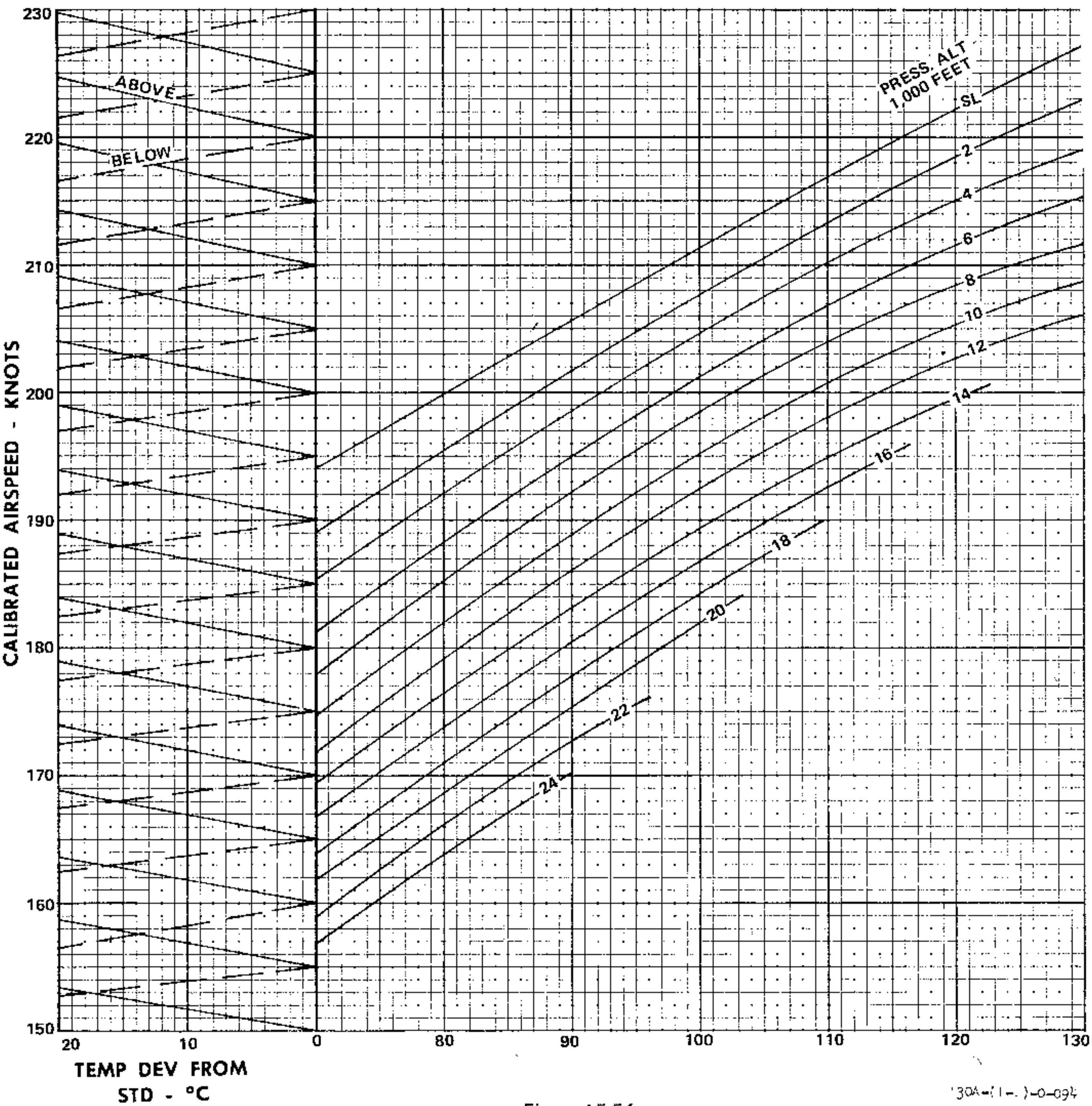


Figure A5-54.

RANGE SUMMARY
LONG RANGE CRUISE

3 ENGINES FUEL FLOW

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. See Section V of T.O. 1C-130(A)A-1 for limitations.

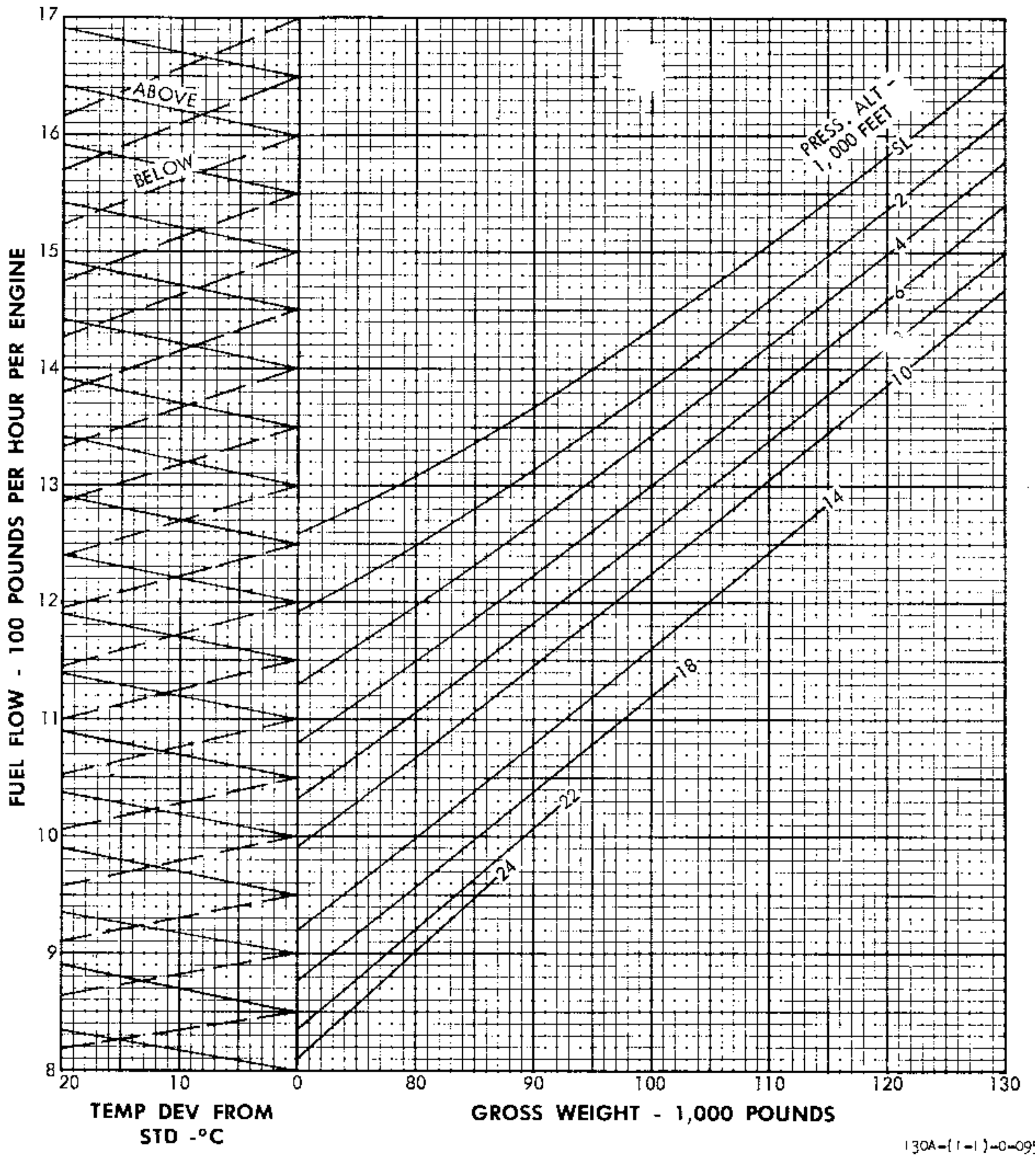


Figure A5-55.

RANGE SUMMARY
LONG RANGE CRUISE

3 ENGINES TORQUE

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. See Section V of T.O. 1C-130(A)A-1 for limitations.

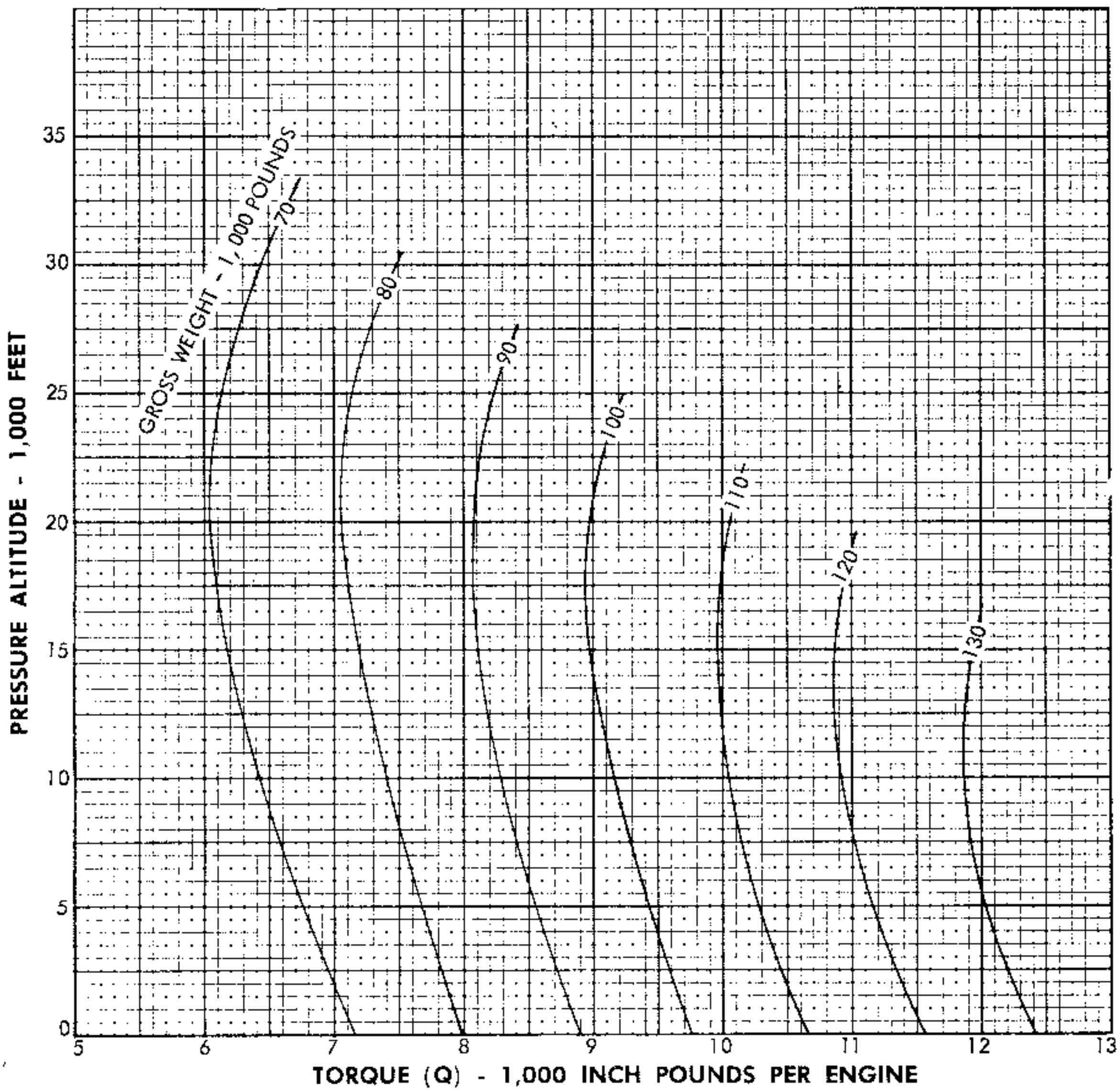


Figure A5-56.

130A-(1-1)-0-064

RANGE SUMMARY
LONG RANGE CRUISE
TORQUE FOR
VARIANT CONFIGURATION

3 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE DRAG INDEX 40

NOTE

1. Propeller feather on inoperative engine.
2. See Section V of T.O. 1C-130(A)A-1 for limitations.
3. Temperature effect is negligible.

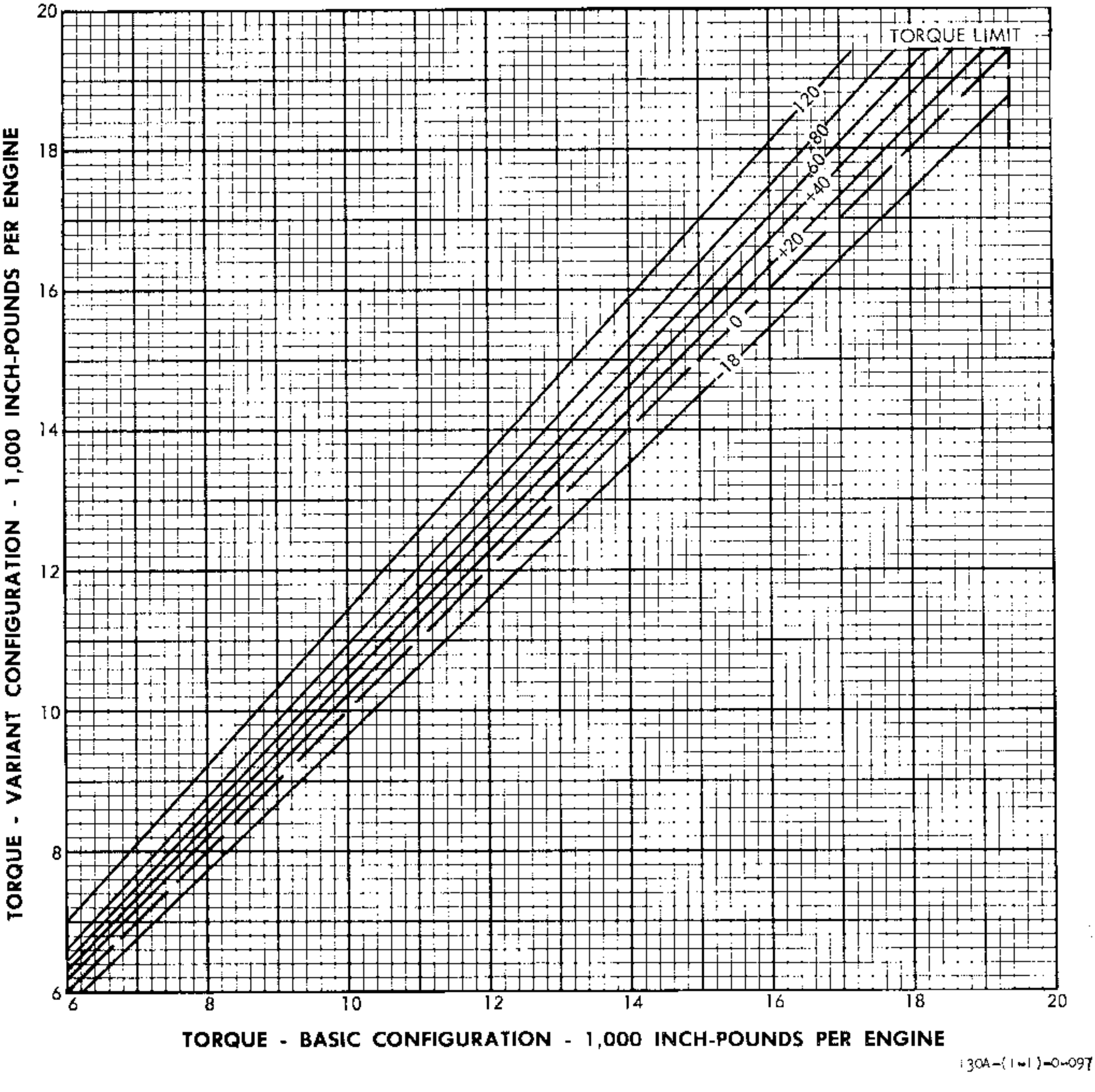


Figure A5-57.

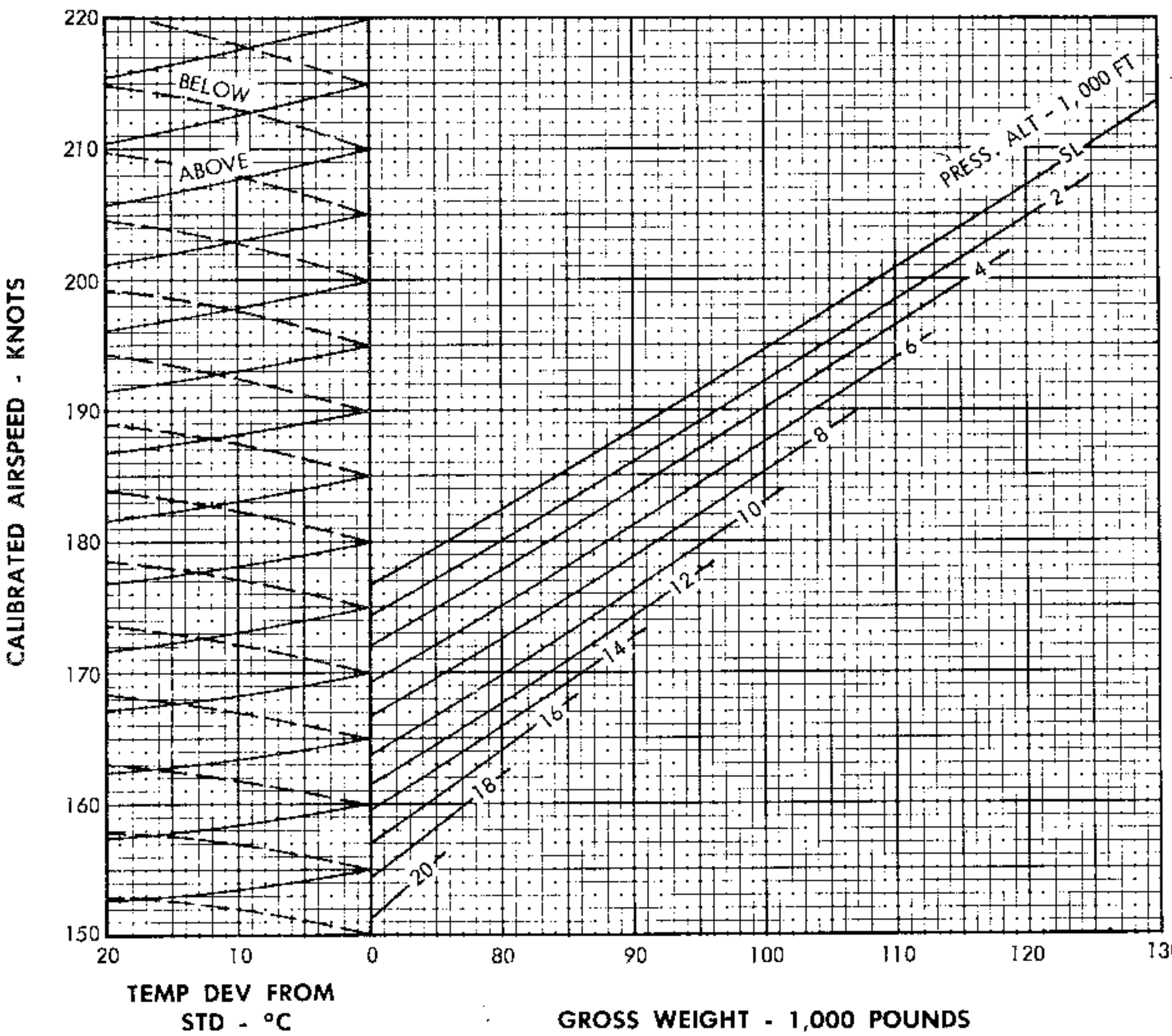
RANGE SUMMARY
LONG RANGE CRUISE

2 ENGINES AIRSPEED
ASYMMETRICAL POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE
Propeller feathered on inoperative engines.



130A-(1-1)-0-065

Figure A5-58.

RANGE SUMMARY
LONG RANGE CRUISE

2 ENGINES — FUEL FLOW

ASYMMETRICAL POWER

NOTE

Propellers feathered on inoperative engines

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

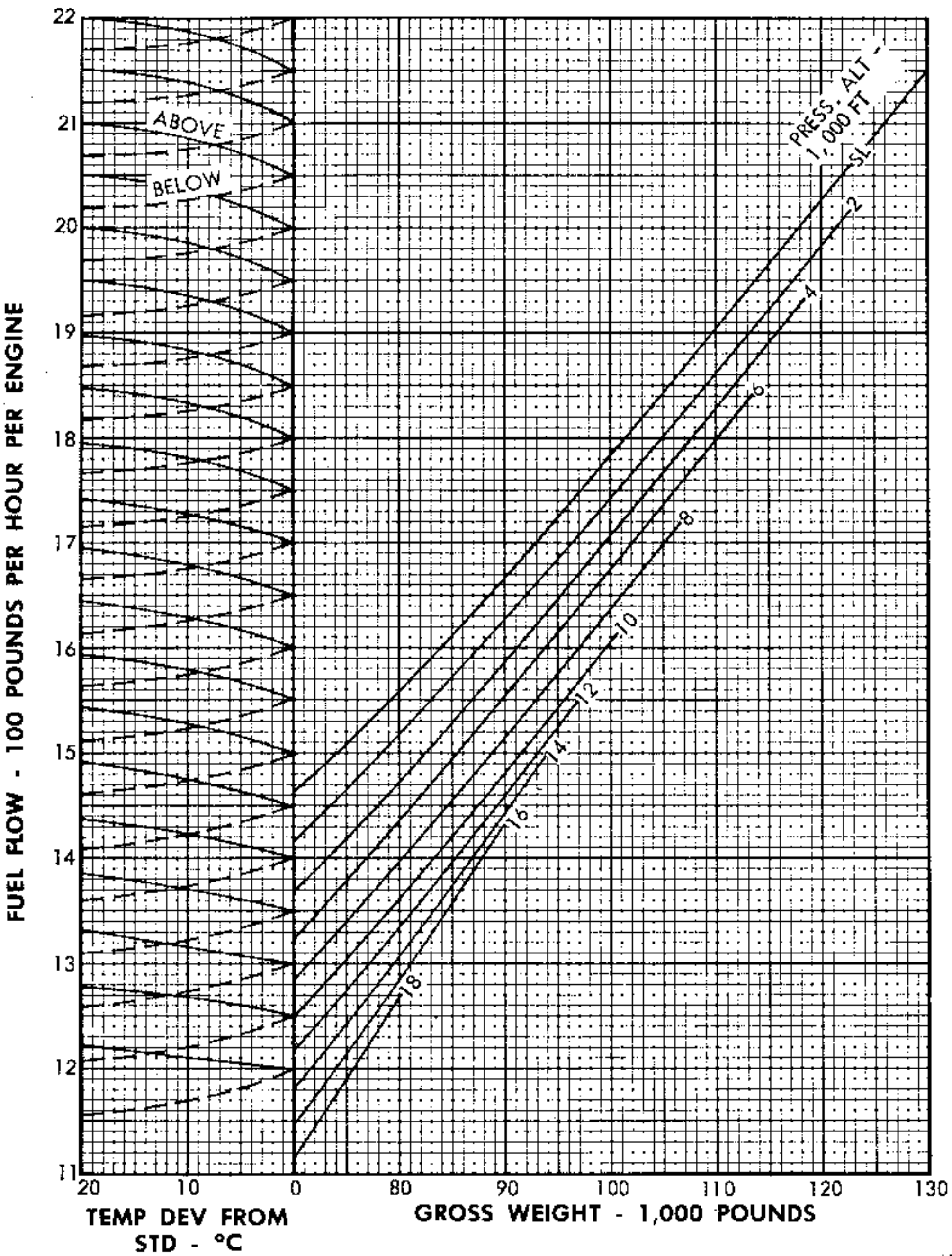


Figure A5-59.

RANGE SUMMARY - LONG RANGE CRUISE

2 ENGINES TORQUE

ASYMMETRICAL POWER

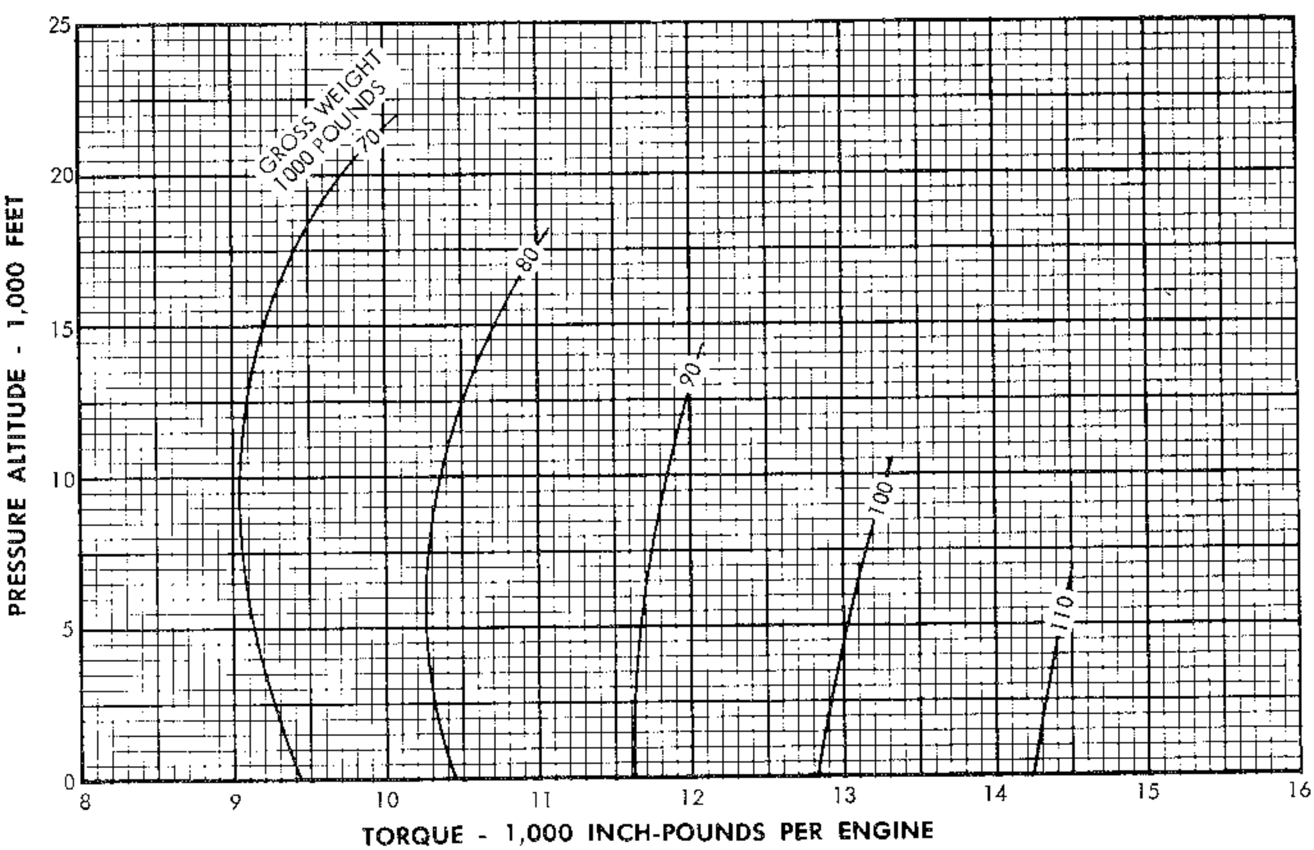
MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propellers feathered on inoperative engines.
2. Temperature effect on torque is negligible.



130A-(1-:)-0-066

Figure A5-60.

RANGE SUMMARY LONG RANGE CRUISE TORQUE FOR VARIANT CONFIGURATION

2 ENGINES ASYMMETRICAL POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE DRAG INDEX 40

NOTE

1. Propellers feathered on inoperative engines.
2. Temperature effect is negligible.

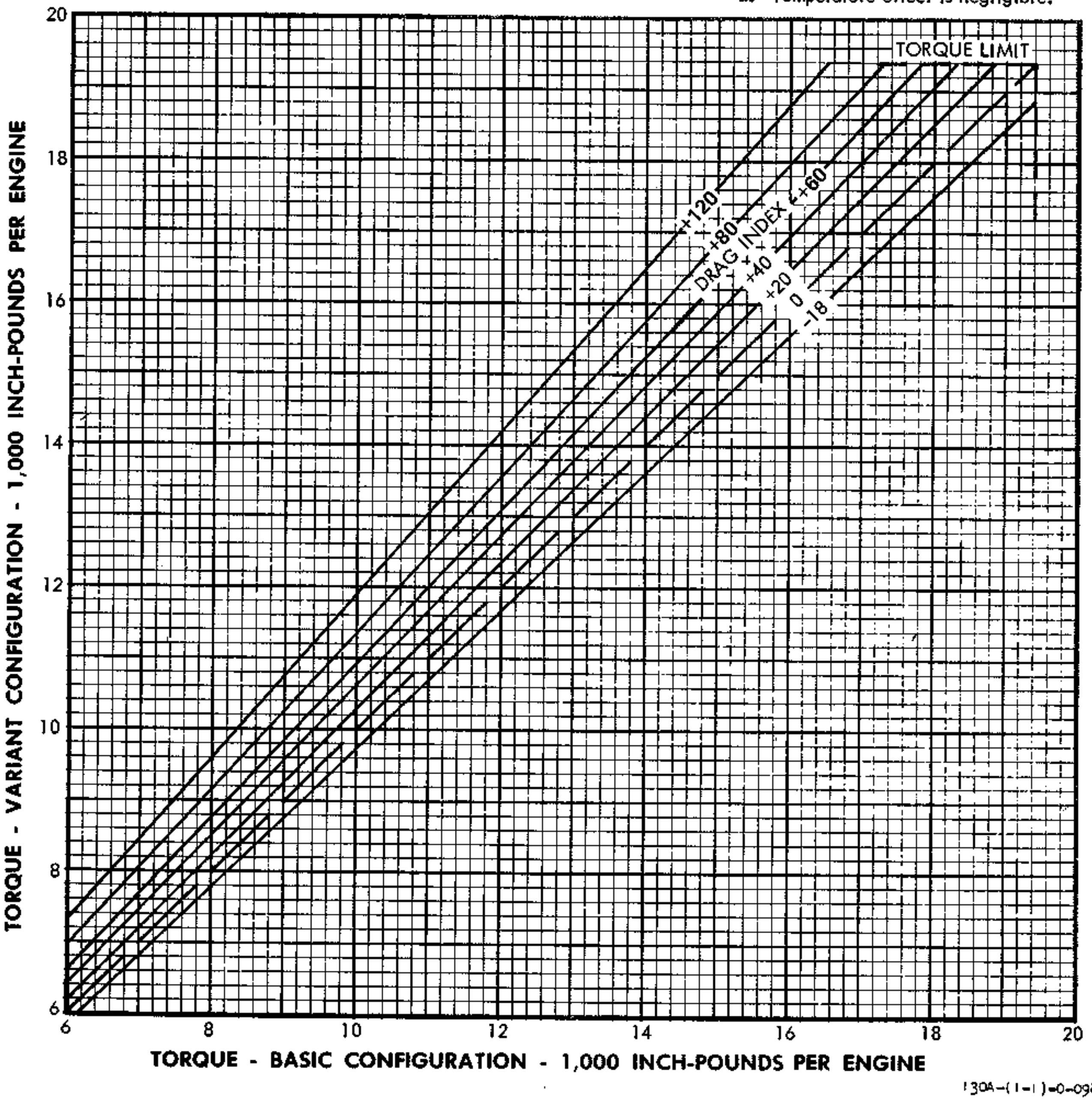


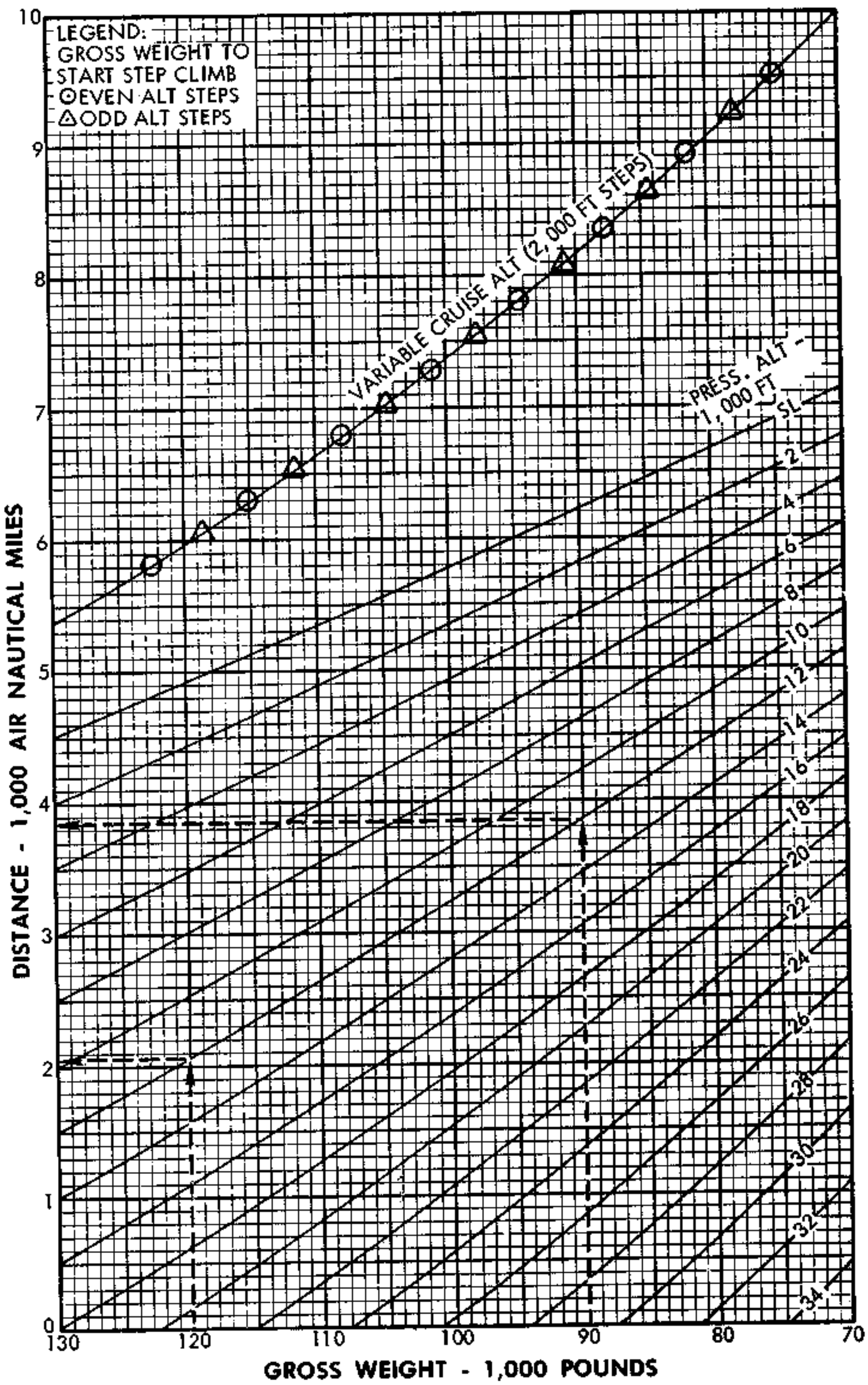
Figure A5-61.

RANGE PREDICTION - DISTANCE

4 ENGINES LONG RANGE CRUISE
STANDARD DAY +20°C

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST



130A-(1-1)-0-072

Figure A5-62.

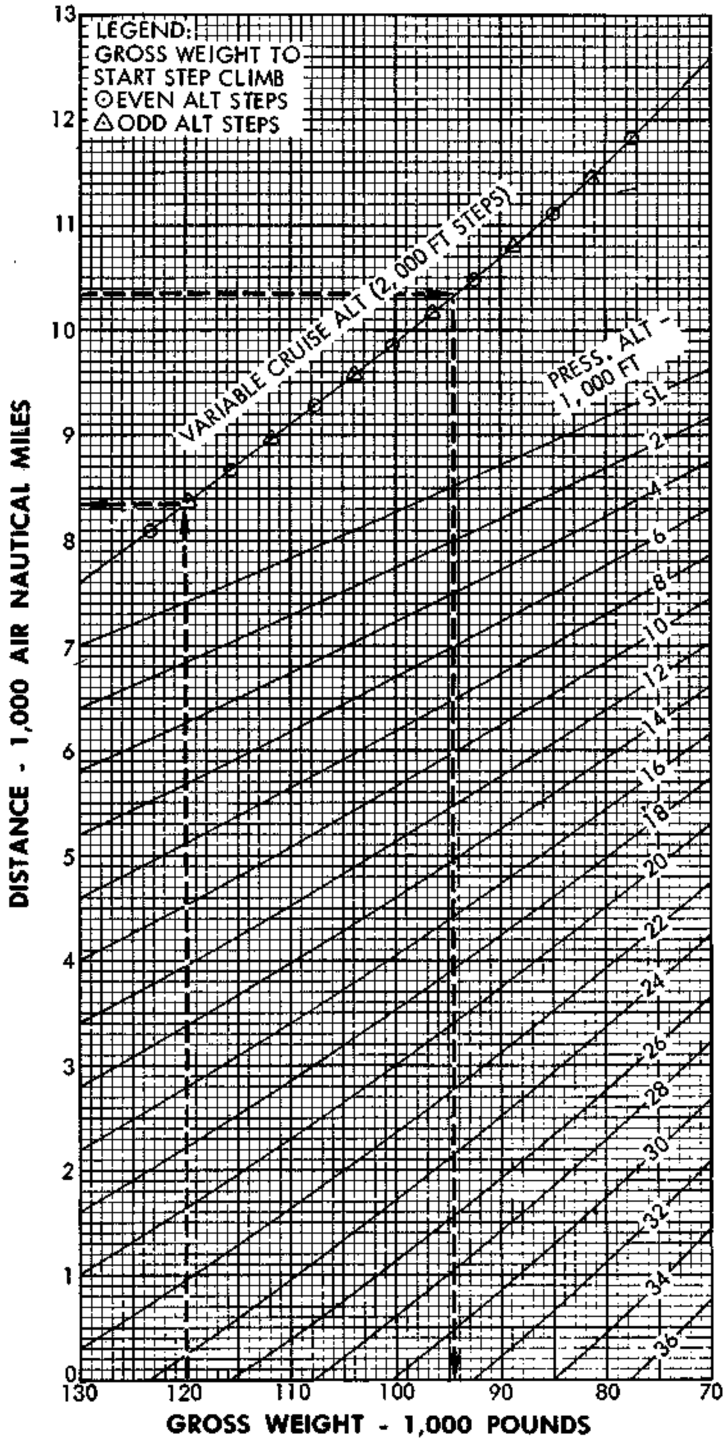
RANGE PREDICTION - DISTANCE

4 ENGINES LONG RANGE CRUISE

STANDARD DAY

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST



130A-(1-1)-0-073

Figure A5-63.

RANGE PREDICTION - DISTANCE

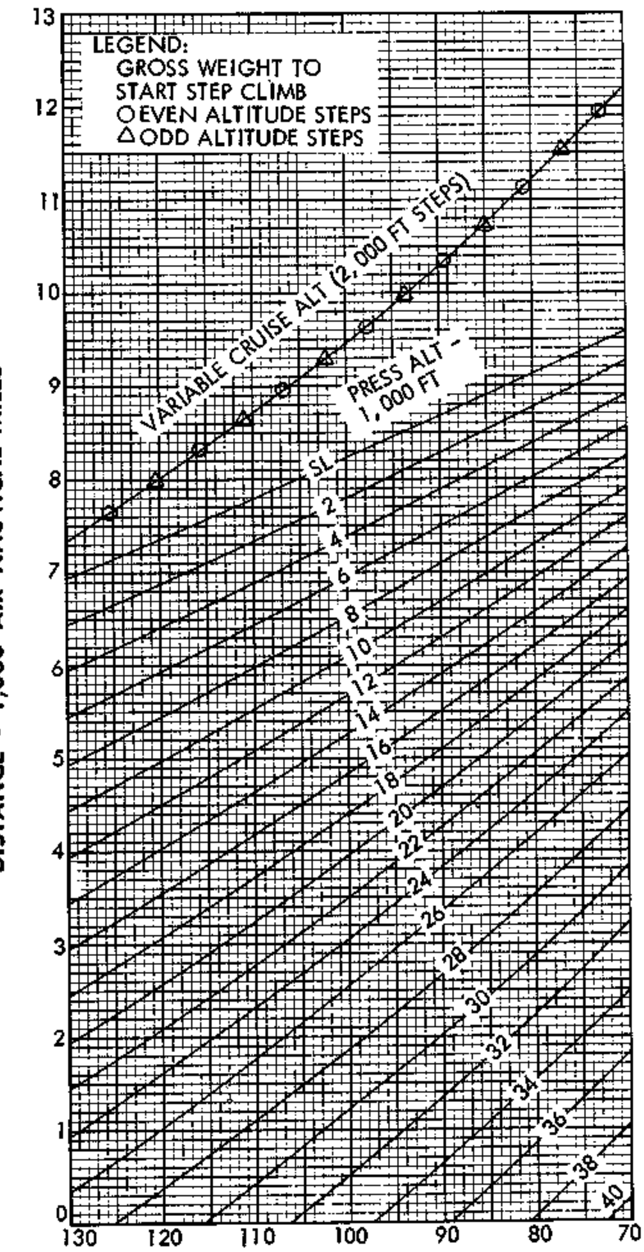
4 ENGINES LONG RANGE CRUISE

STANDARD DAY - 20°C

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST



130A-(1-1)-0-147

Figure A5-64.

RANGE PREDICTION-DISTANCE LONG RANGE CRUISE VARIANT CONFIGURATION VARIABLE CRUISE ALTITUDE

4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES
DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Temperature effect is negligible.

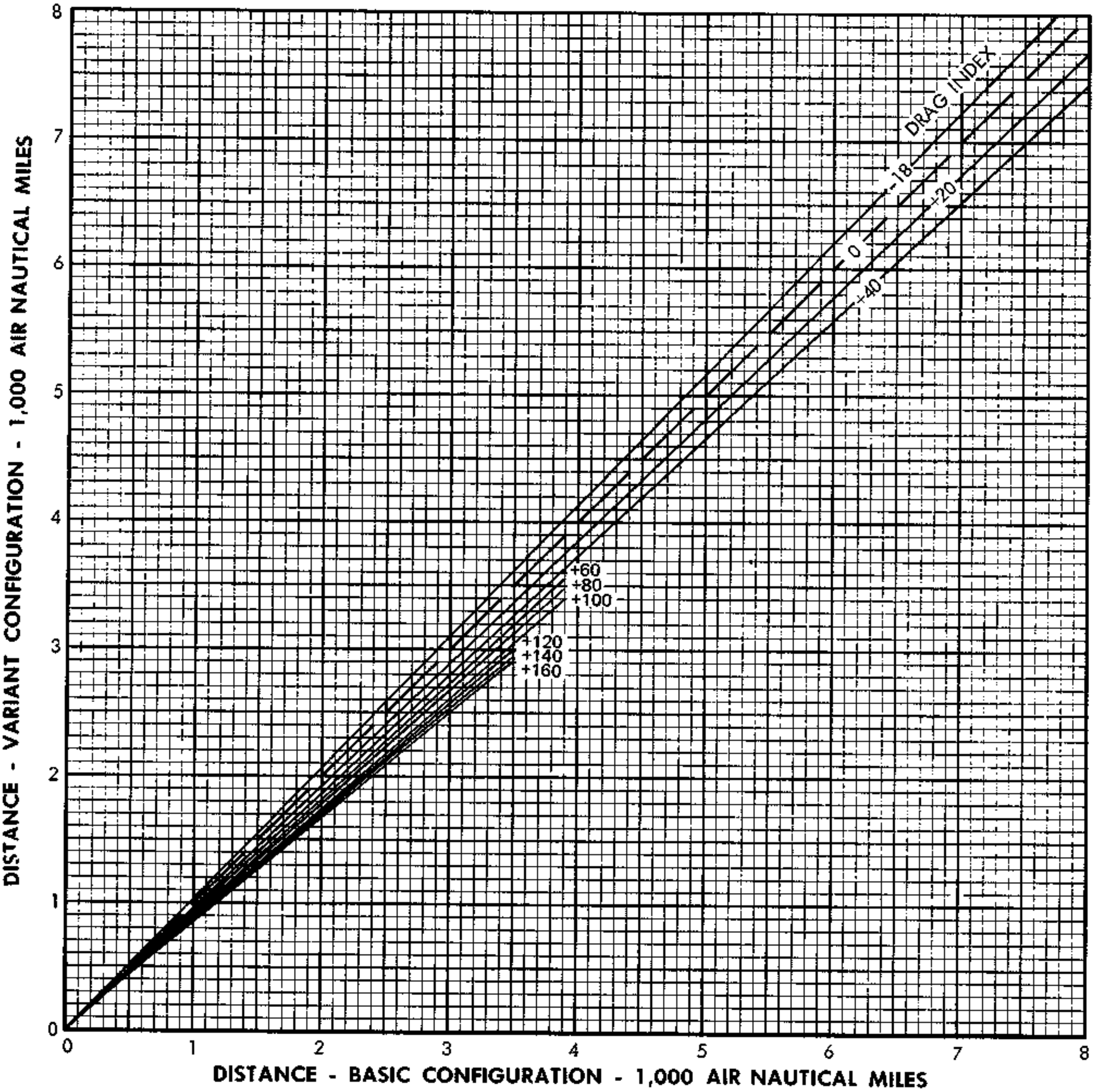


Figure A5-65.

RANGE PREDICTION–DISTANCE
LONG RANGE CRUISE
VARIANT CONFIGURATION

4 ENGINES CONSTANT ALTITUDE CRUISE

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Temperature effect is negligible.

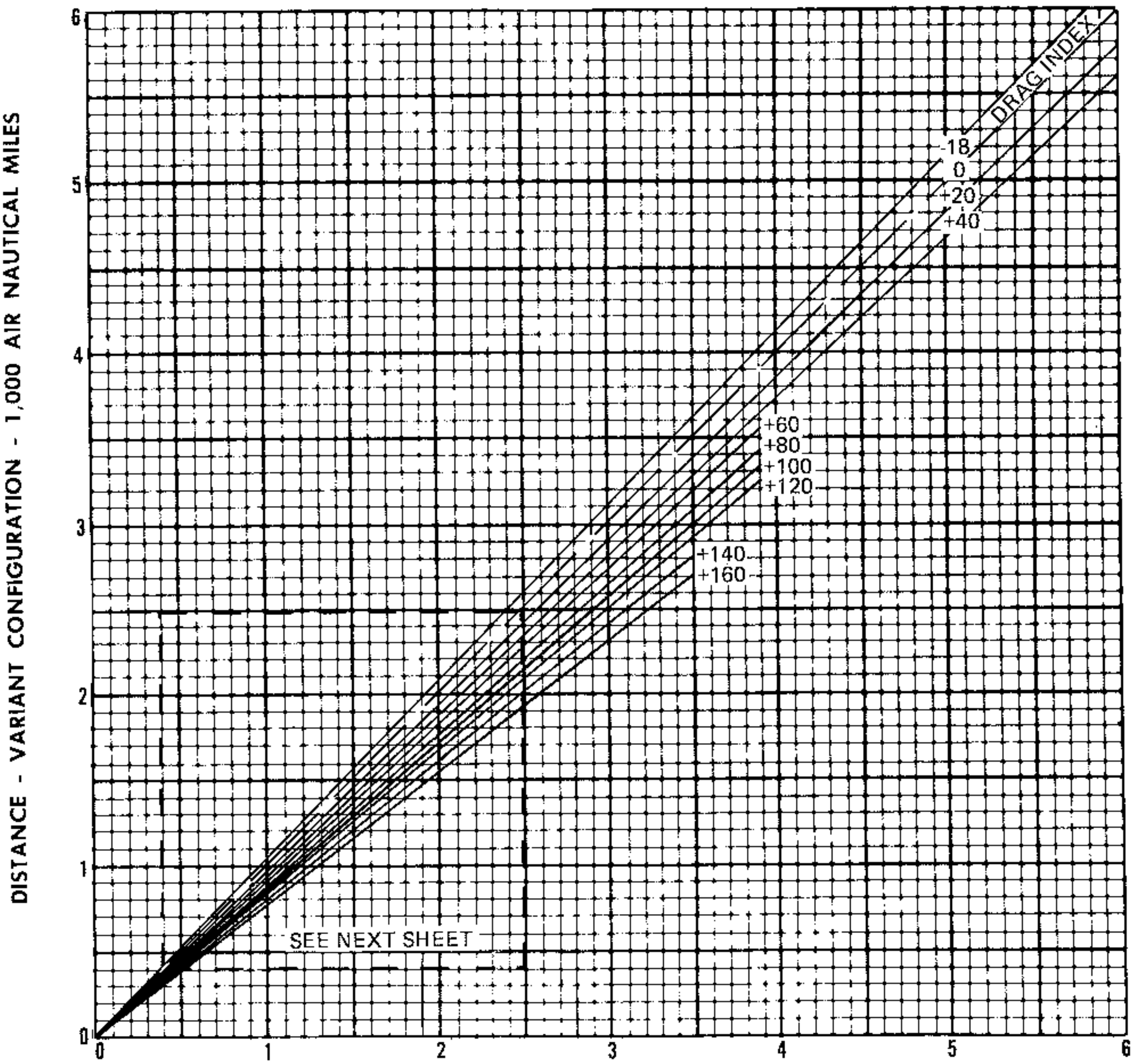


Figure A5-66. (Sheet 1 of 2)

RANGE PREDICTION–DISTANCE
LONG RANGE CRUISE
VARIANT CONFIGURATION

4 ENGINES CONSTANT ALTITUDE CRUISE

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Temperature effect is negligible.

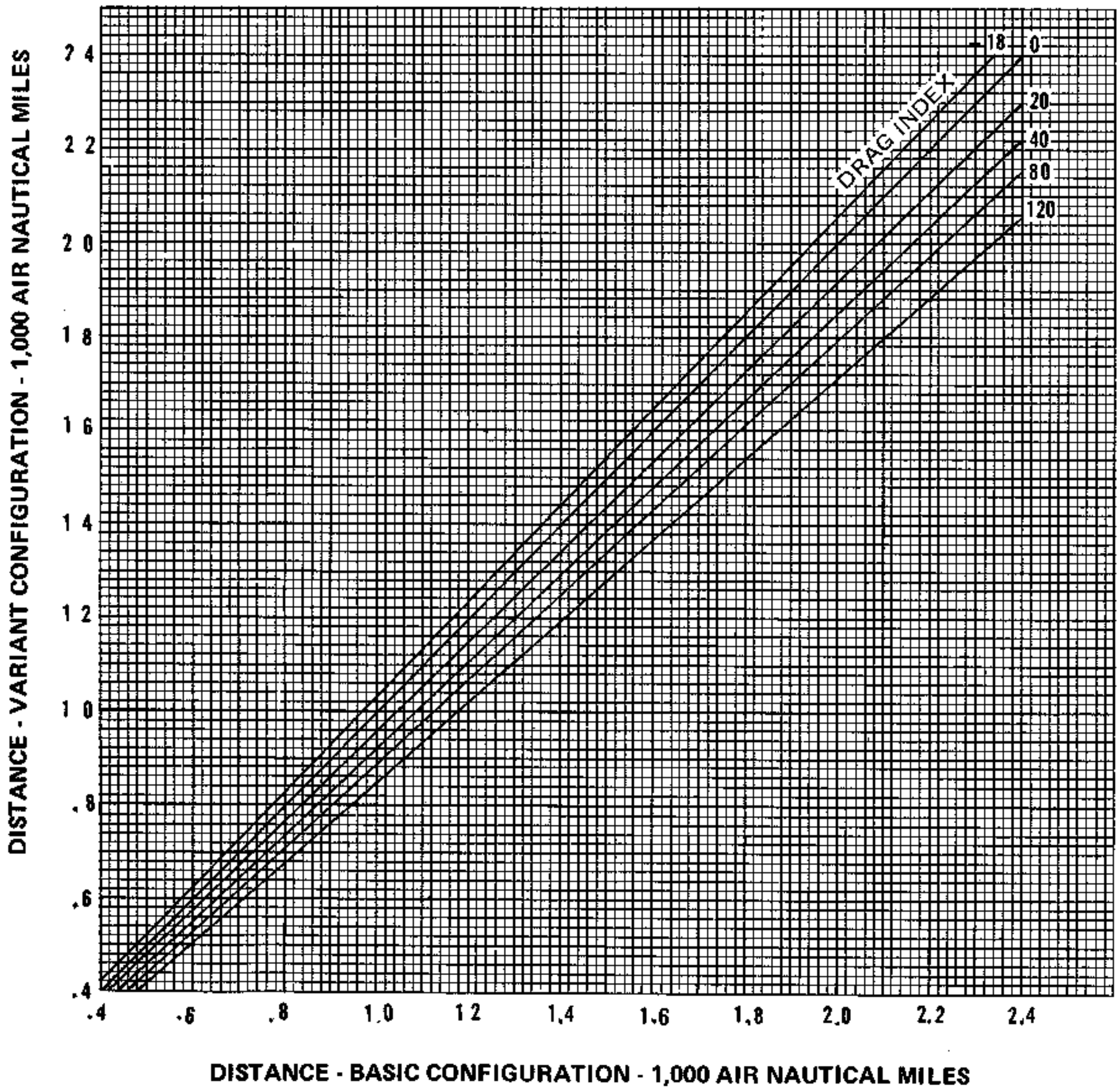


Figure A5-66. (Sheet 2 of 2)

RANGE PREDICTION - DISTANCE AT LESS THAN MAXIMUM CONTINUOUS POWER

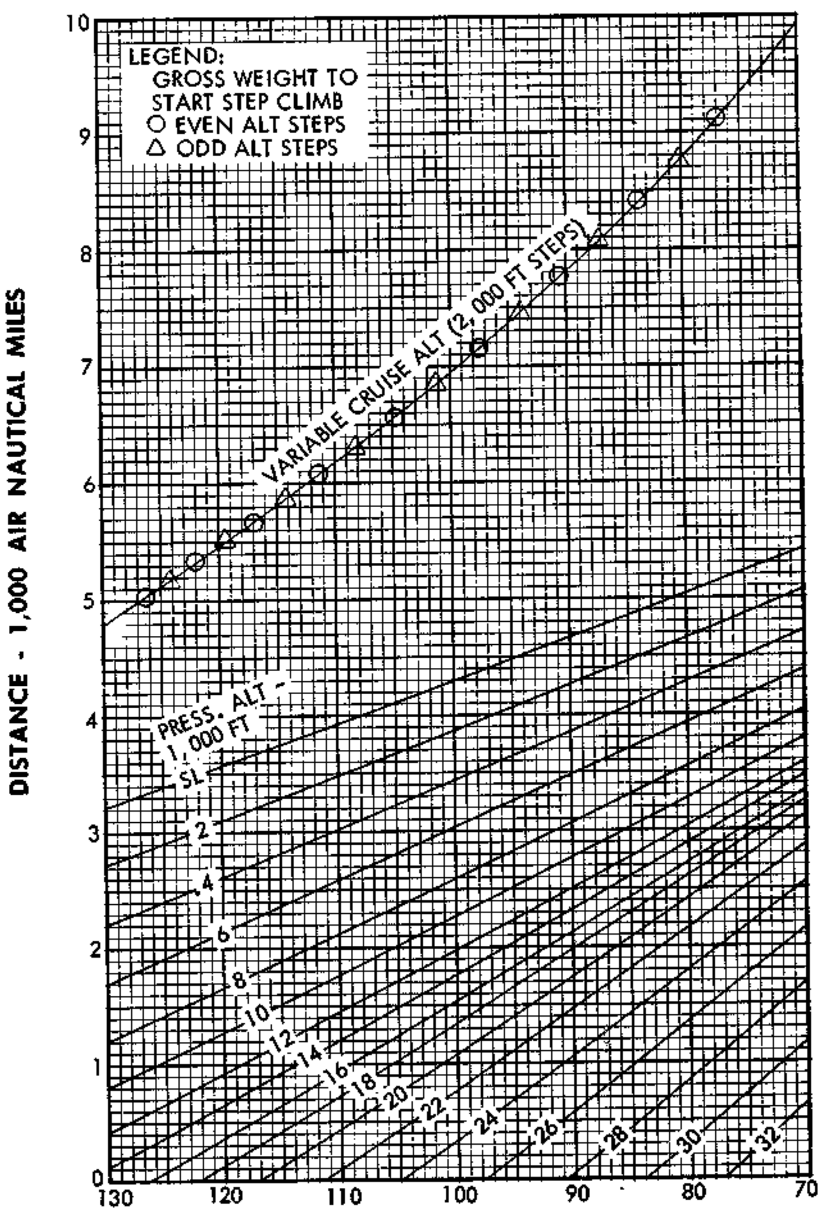
4 ENGINES **290 KTAS CRUISE**

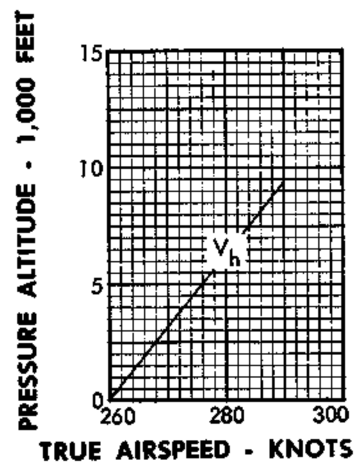
STANDARD DAY

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE
Cruise at 910°C TIT or less





130A-(1-1)-0-119

Figure A5-67.

RANGE PREDICTION - DISTANCE AT LESS THAN MAXIMUM CONTINUOUS POWER

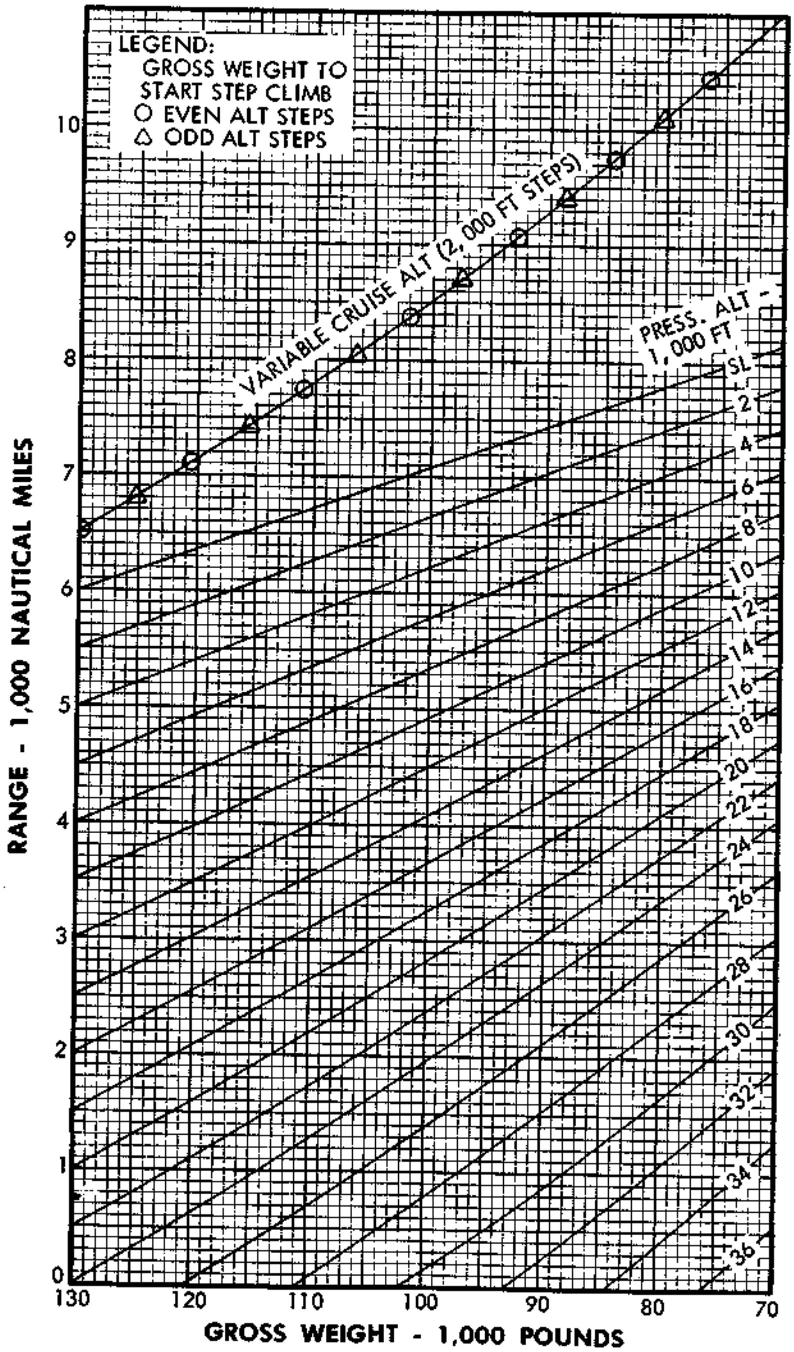
4 ENGINES STANDARD DAY −20°C 290 KTAS CRUISE

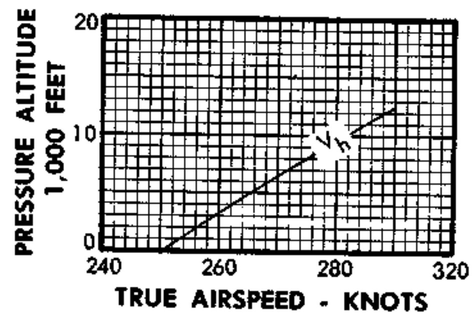
MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Cruise at 910°C TIT or less.





130A-(1-1)-0-120

Figure A5-68.

RANGE PREDICTION - DISTANCE AT LESS THAN MAXIMUM CONTINUOUS POWER CONSTANT ALTITUDE VARIANT CONFIGURATION

4 ENGINES

290 KTAS CRUISE

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE DRAG INDEX 40

NOTE

Temperature effect is negligible.

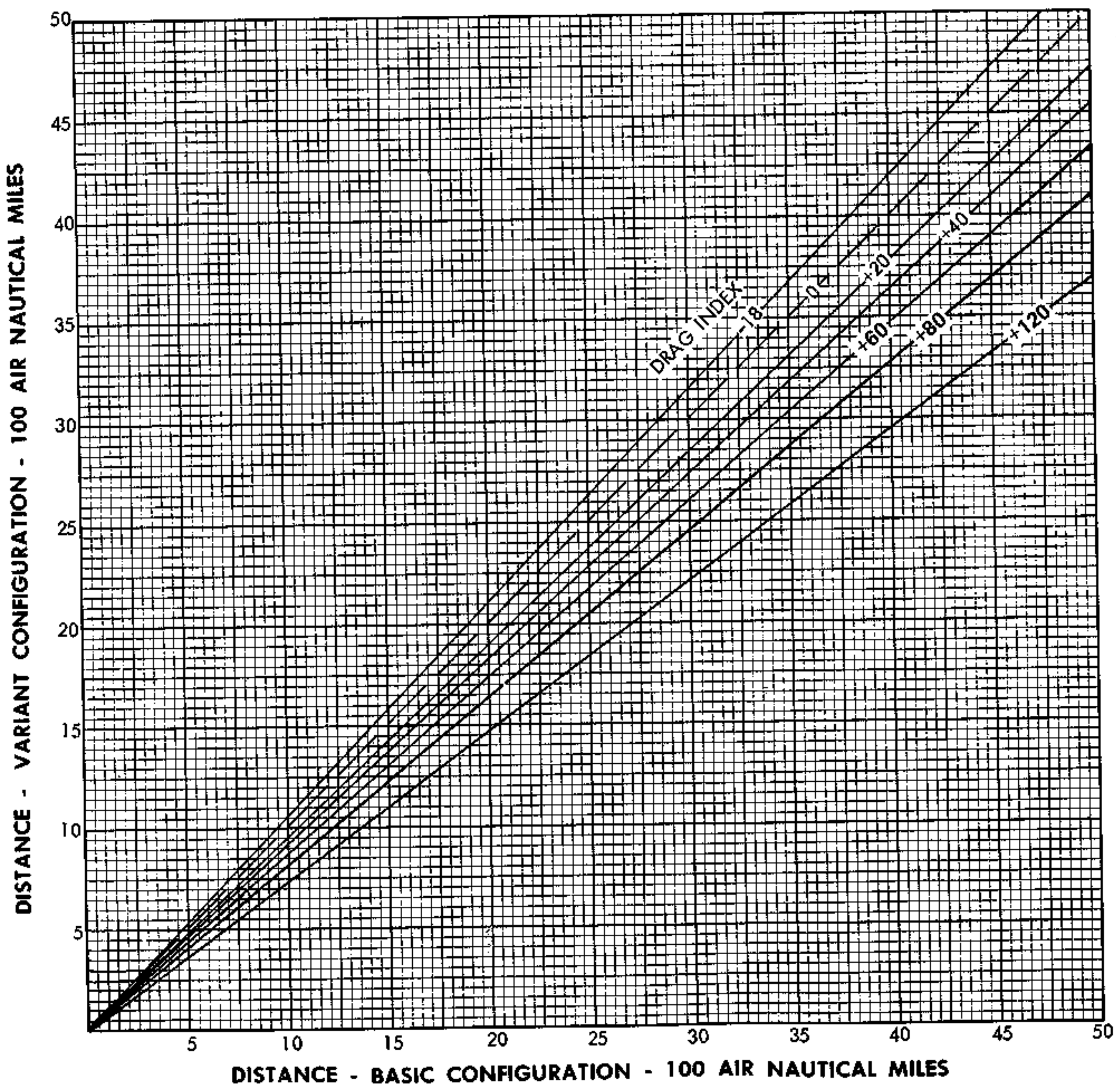


Figure A5-69.

RANGE PREDICTION - DISTANCE AT LESS THAN MAXIMUM CONTINUOUS POWER VARIABLE ALTITUDE VARIANT CONFIGURATION

4 ENGINES

290 KTAS

MODEL: AC-130A
T56-A-9 ENGINES

NOTE

Temperature effect is negligible.

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE DRAG INDEX 40

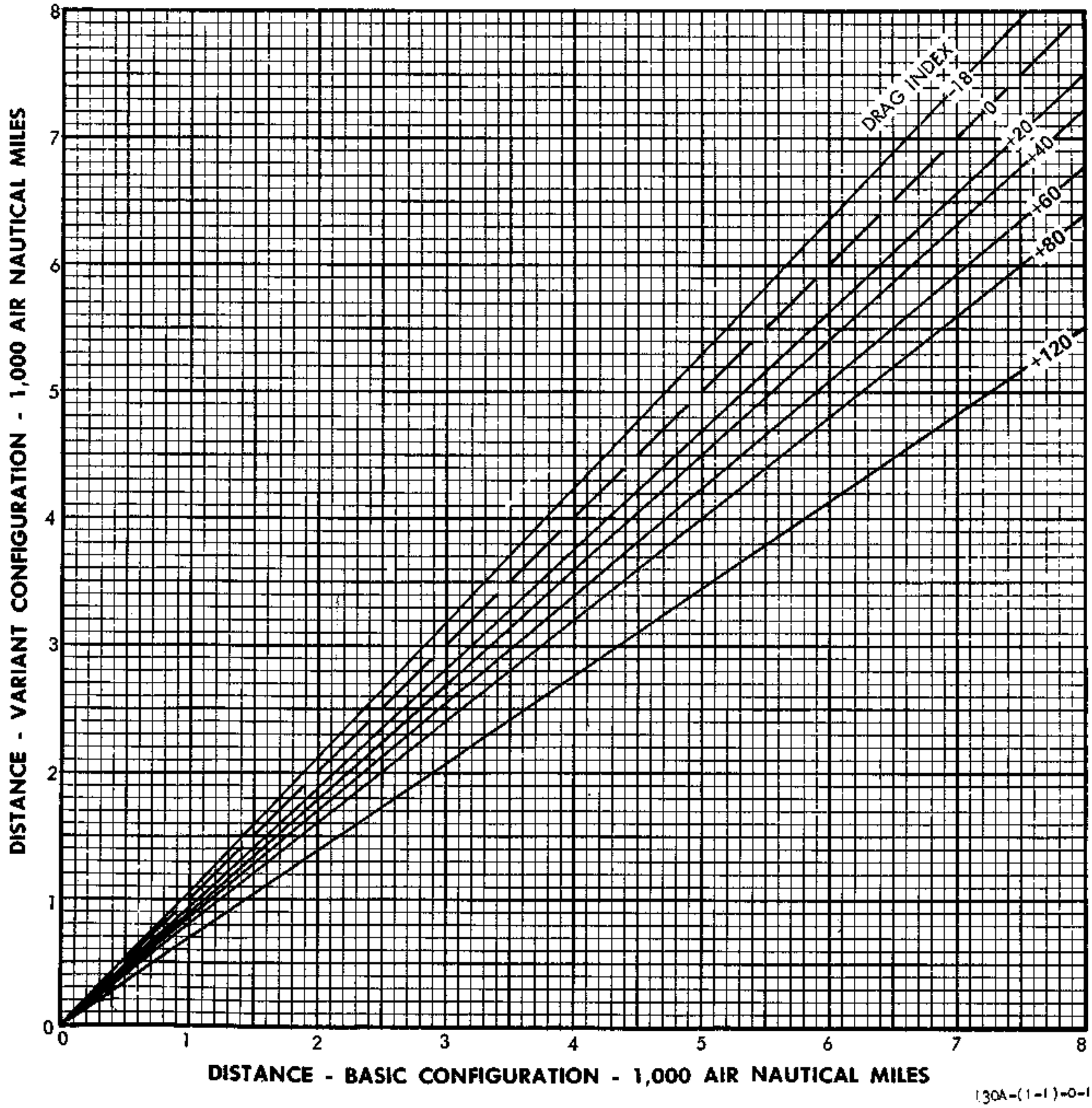


Figure A5-70.

RANGE PREDICTION - DISTANCE AT LESS THAN MAXIMUM CONTINUOUS POWER

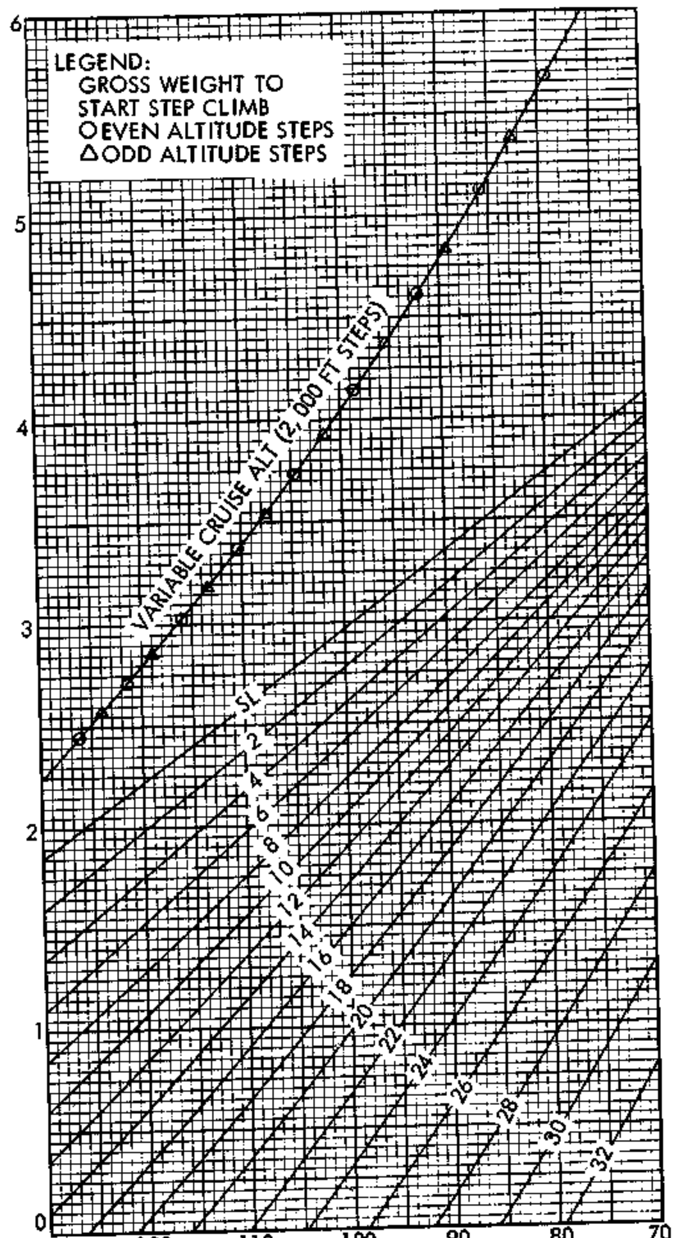
4 ENGINES 270 KTAS CRUISE

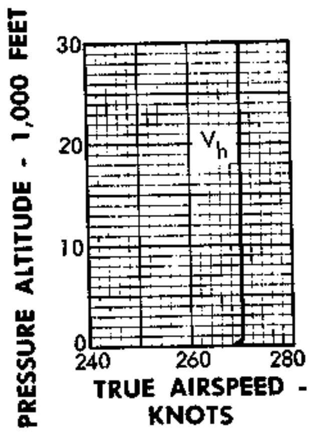
STANDARD DAY +20°C

MODEL: AC-130A
T56-A-9 ENGINES
DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Cruise at 910°C TIT or less.





130A-(1-1)-0-149

Figure A5-71.

RANGE PREDICTION - DISTANCE AT LESS THAN MAXIMUM CONTINUOUS POWER

4 ENGINES — 270 KTAS CRUISE

STANDARD DAY

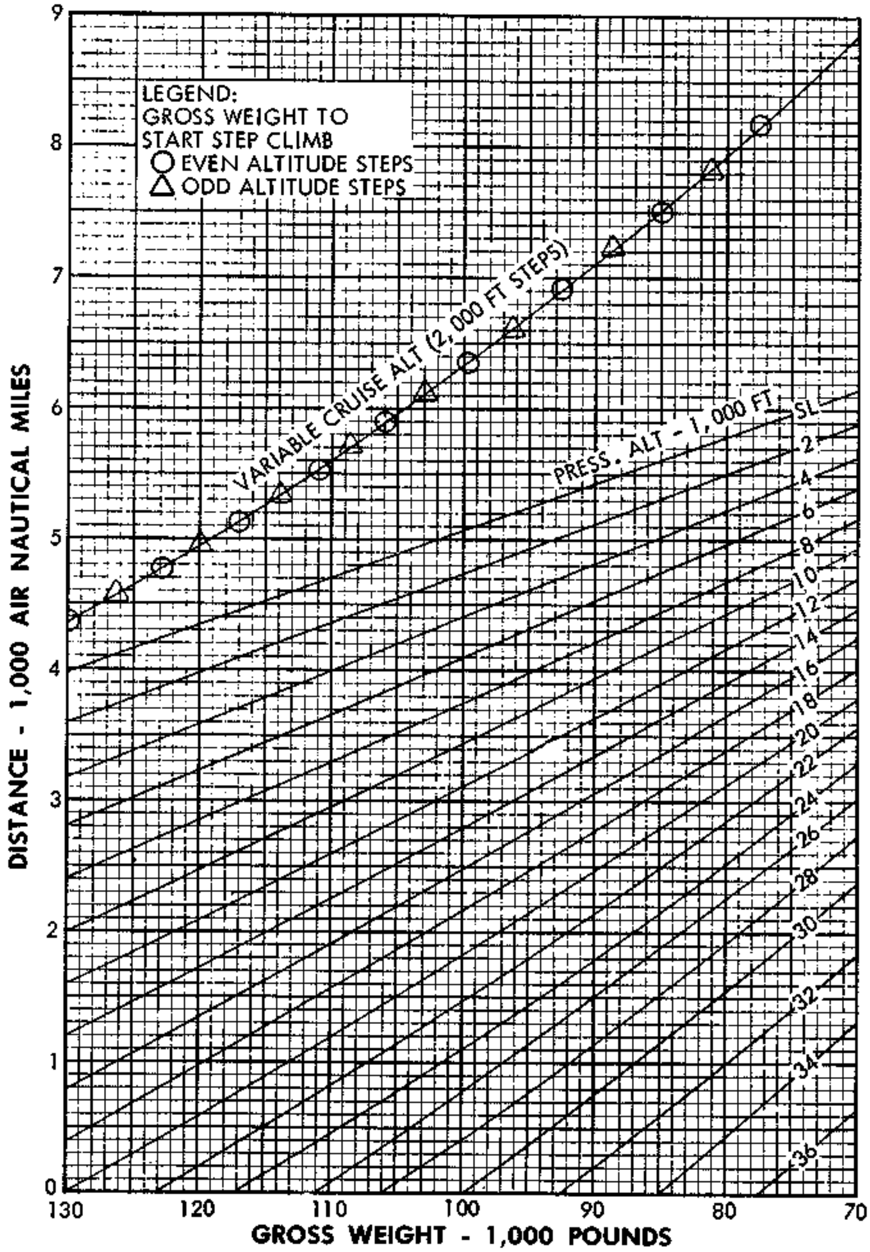
MODEL: AC-130A
T56-A-9 ENGINES

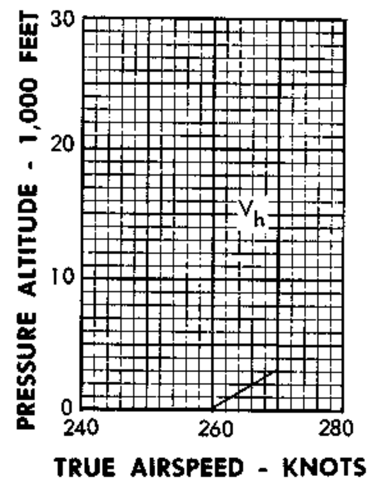
DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Cruise at 910°C TIT or less.





130A-(1-1)-0-106

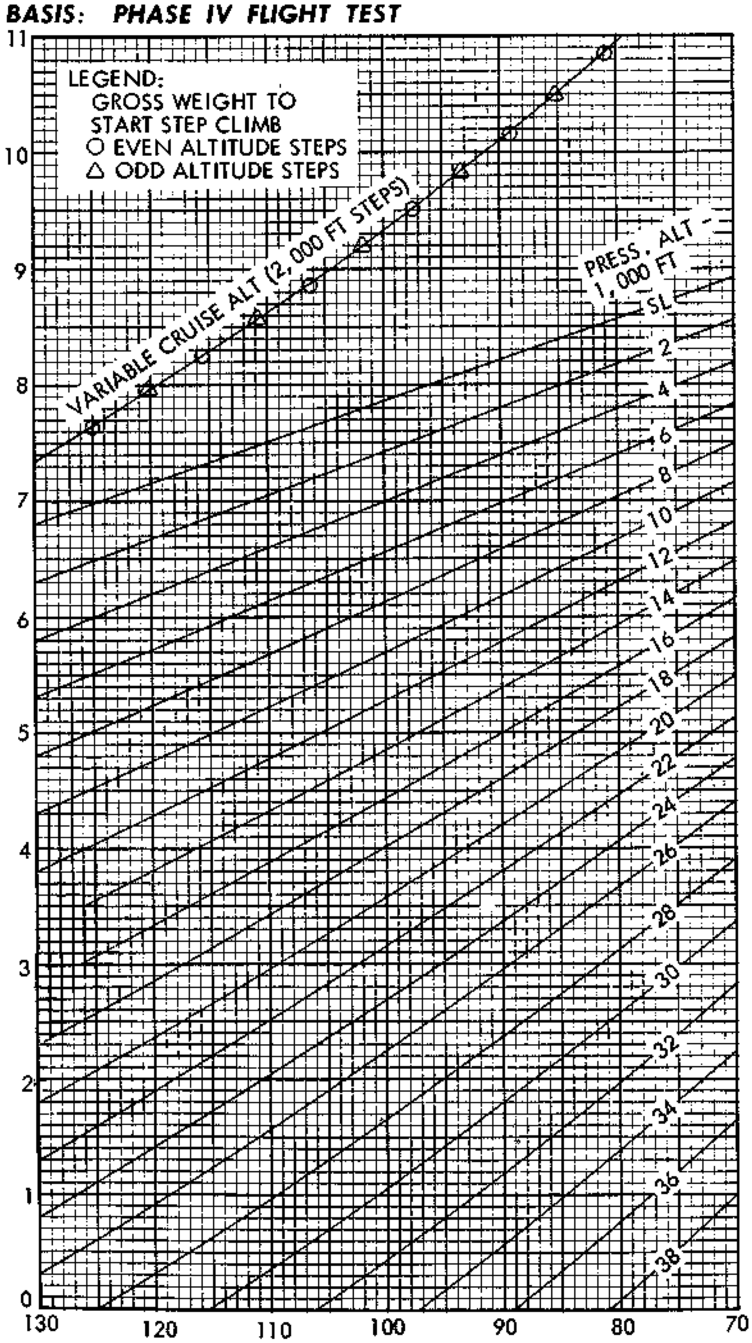
Figure A5-72.

RANGE PREDICTION - DISTANCE AT LESS THAN MAXIMUM CONTINUOUS POWER

4 ENGINES STANDARD DAY −20°C 270 KTAS CRUISE

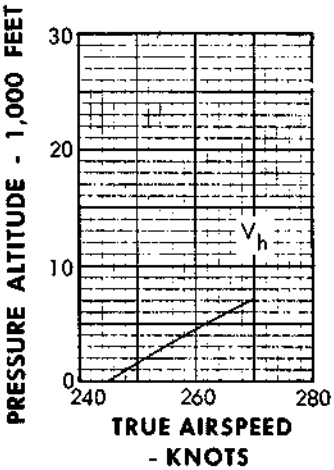
MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST



NOTE

Cruise at 910°C TIT or less.



130A-(1-1)-0-150

Figure A5-73.

RANGE PREDICTION - DISTANCE

3 ENGINES LONG RANGE CRUISE

STANDARD DAY +20°C

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Propeller feathered on inoperative engine.

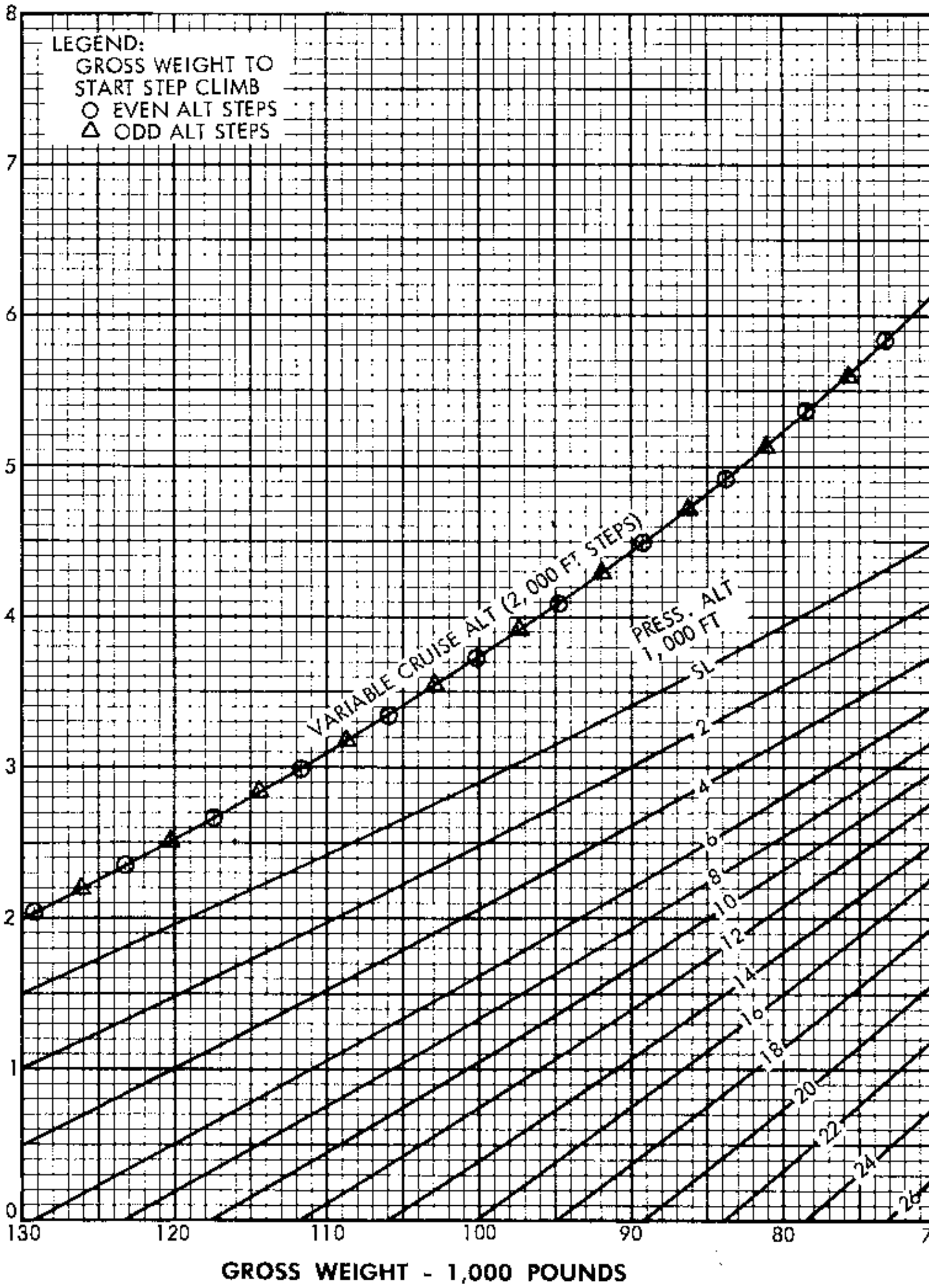


Figure A5-74.

RANGE PREDICTION - DISTANCE

3 ENGINES LONG RANGE CRUISE

STANDARD DAY

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Propeller feathered on inoperative engine.

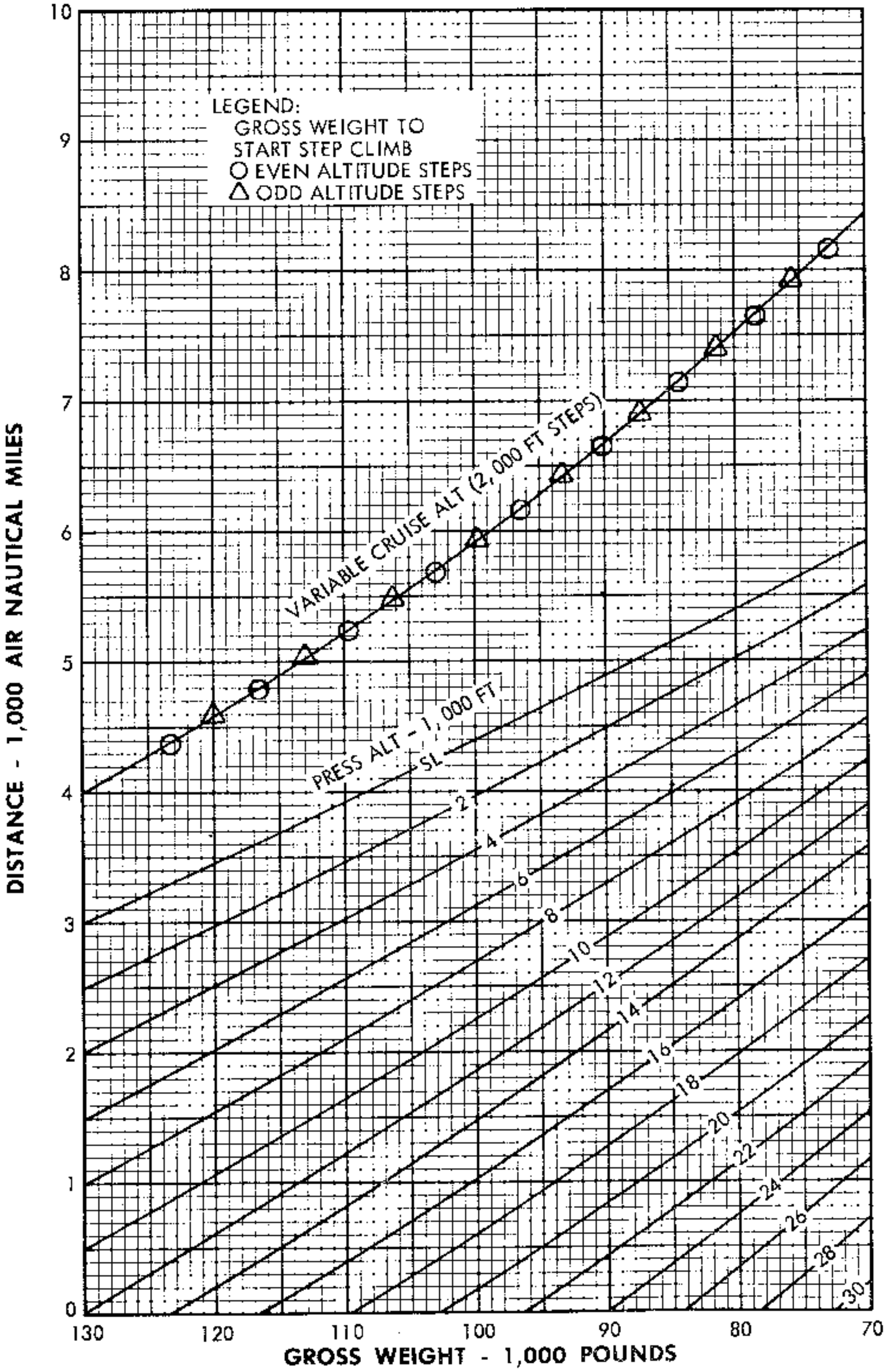


Figure A5-75.

RANGE PREDICTION - DISTANCE

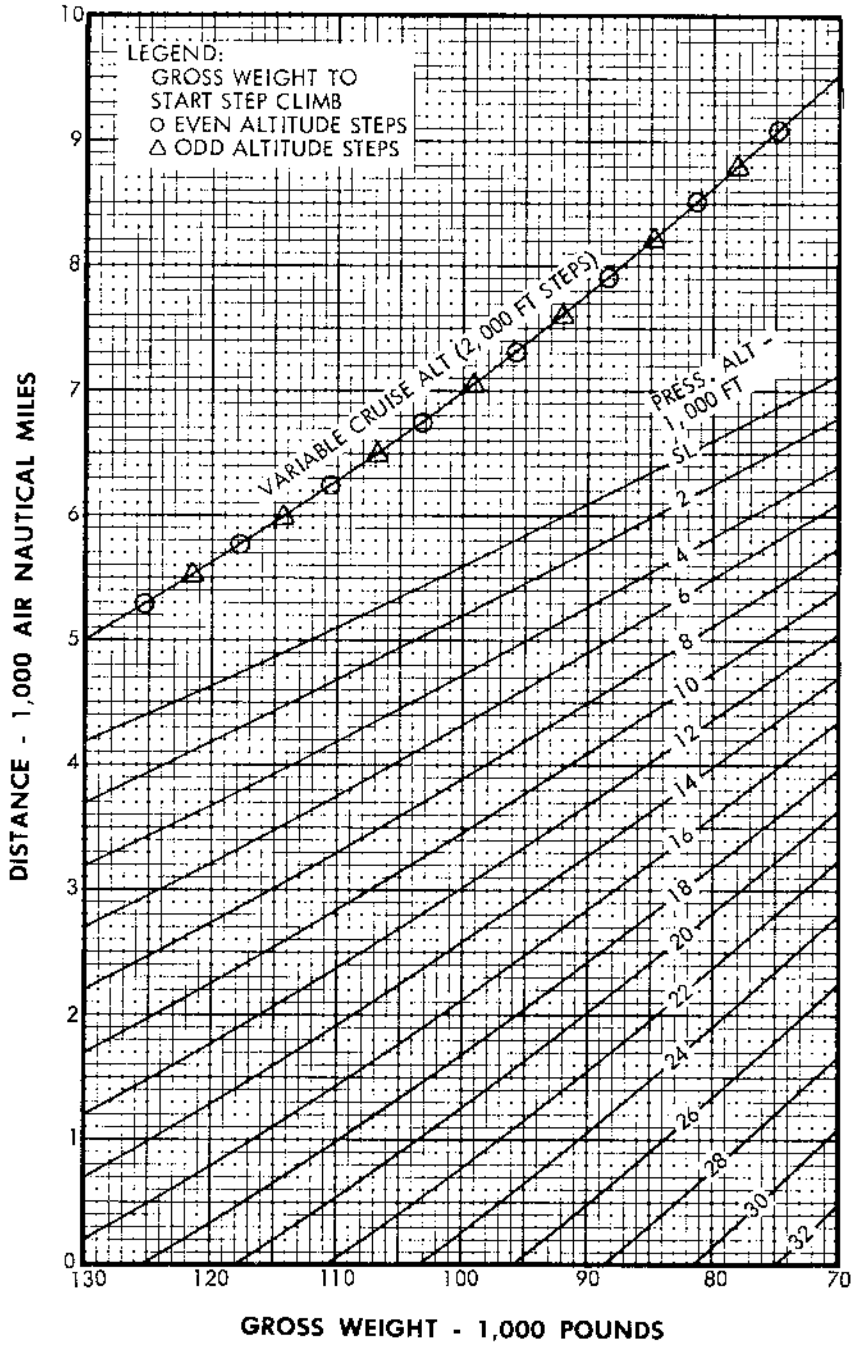
3 ENGINES LONG RANGE CRUISE

STANDARD DAY - 20°C

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE
Propeller feathered on inoperative engine.



130A-(1-1)-0-108

Figure A5-76.

RANGE PREDICTION-DISTANCE LONG RANGE CRUISE VARIANT CONFIGURATION VARIABLE CRUISE ALTITUDE

3 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. Temperature effect is negligible.

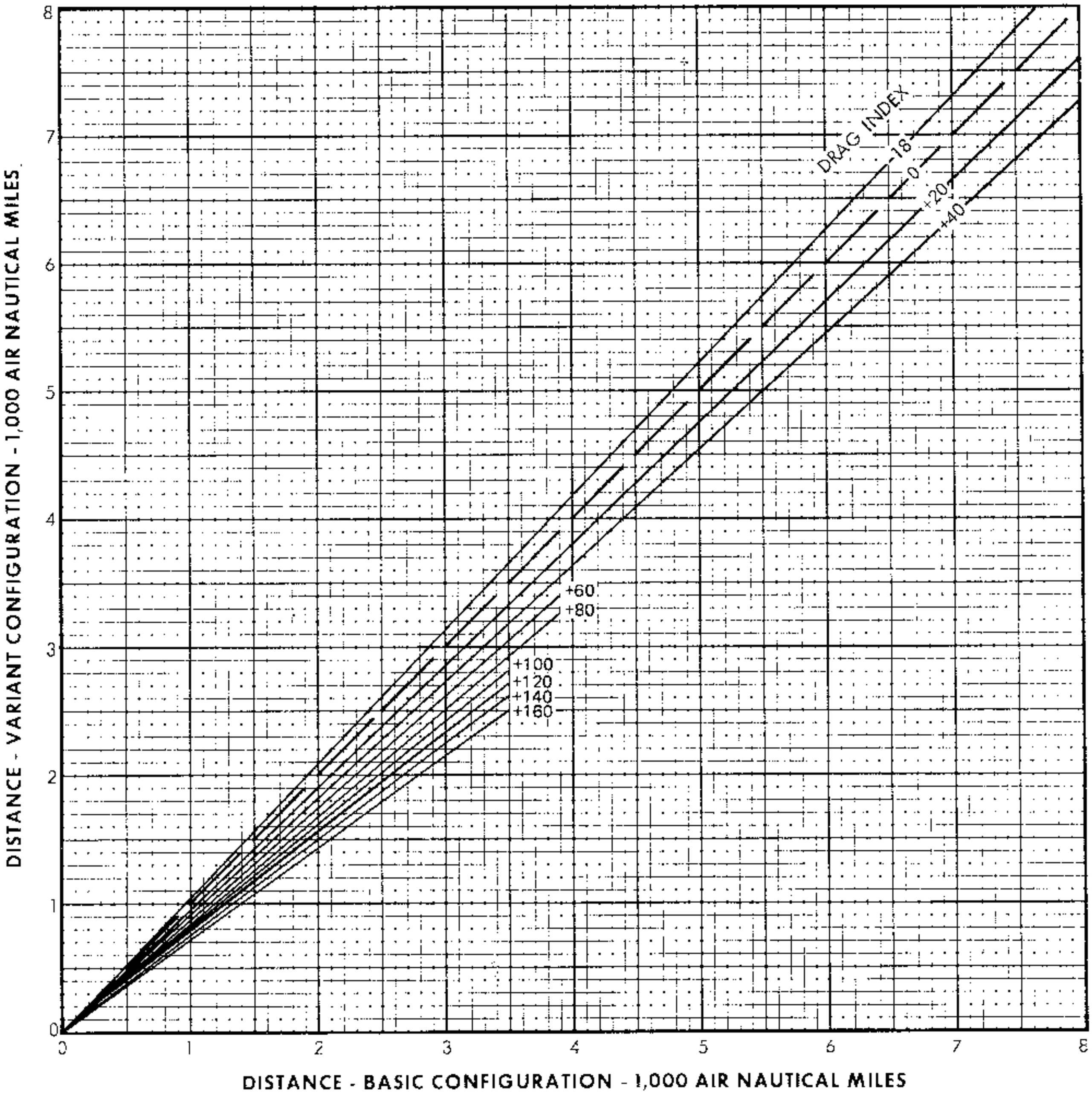


Figure A5-77.

RANGE PREDICTION–DISTANCE
LONG RANGE CRUISE
VARIANT CONFIGURATION
CONSTANT ALTITUDE CRUISE
3 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES
DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. Temperature effect is negligible.

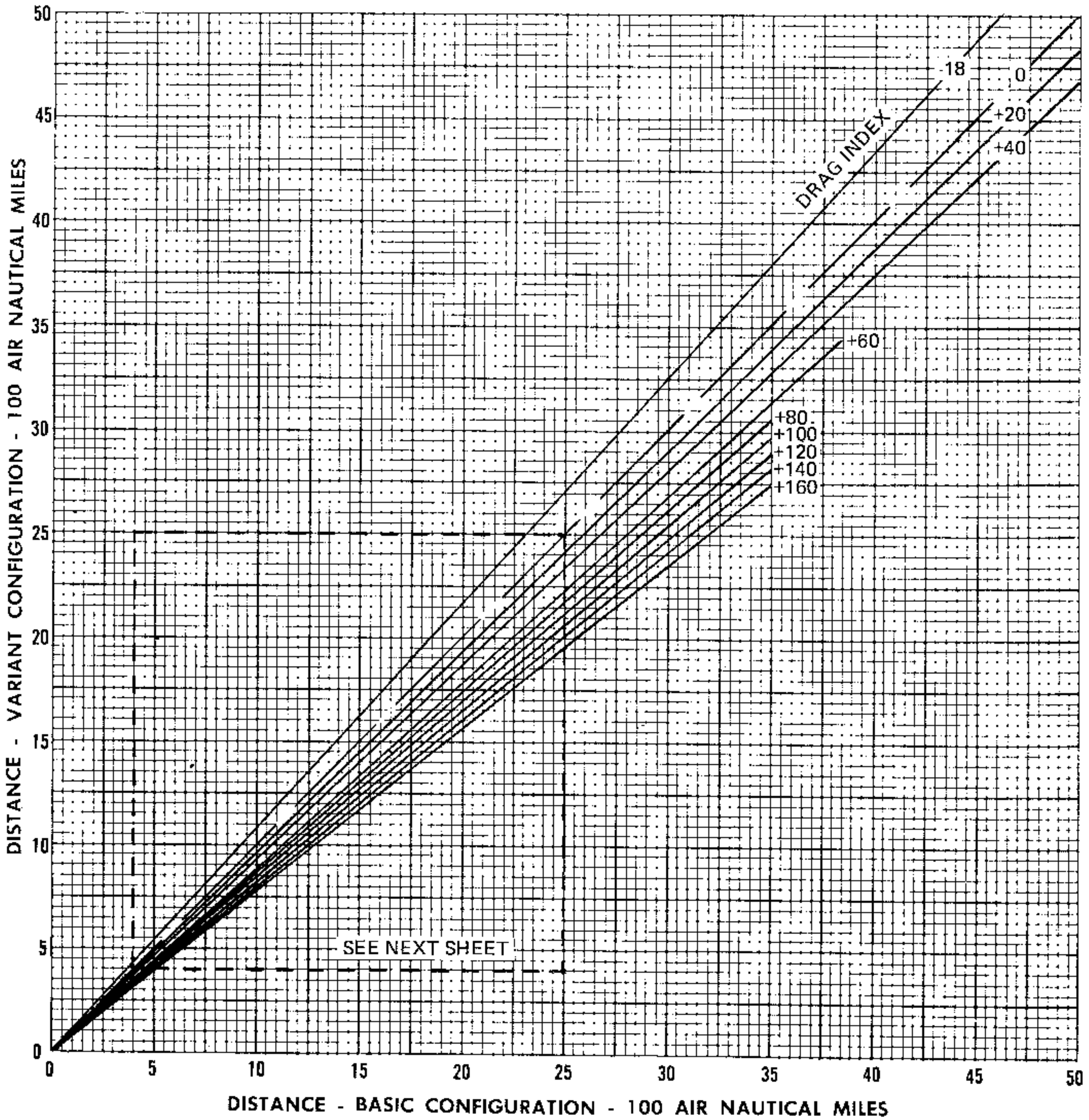


Figure A5-78. (Sheet 1 of 2)

RANGE PREDICTION—DISTANCE
LONG RANGE CRUISE
VARIANT CONFIGURATION
CONSTANT ALTITUDE CRUISE
3 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES
DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. Temperature effect is negligible.

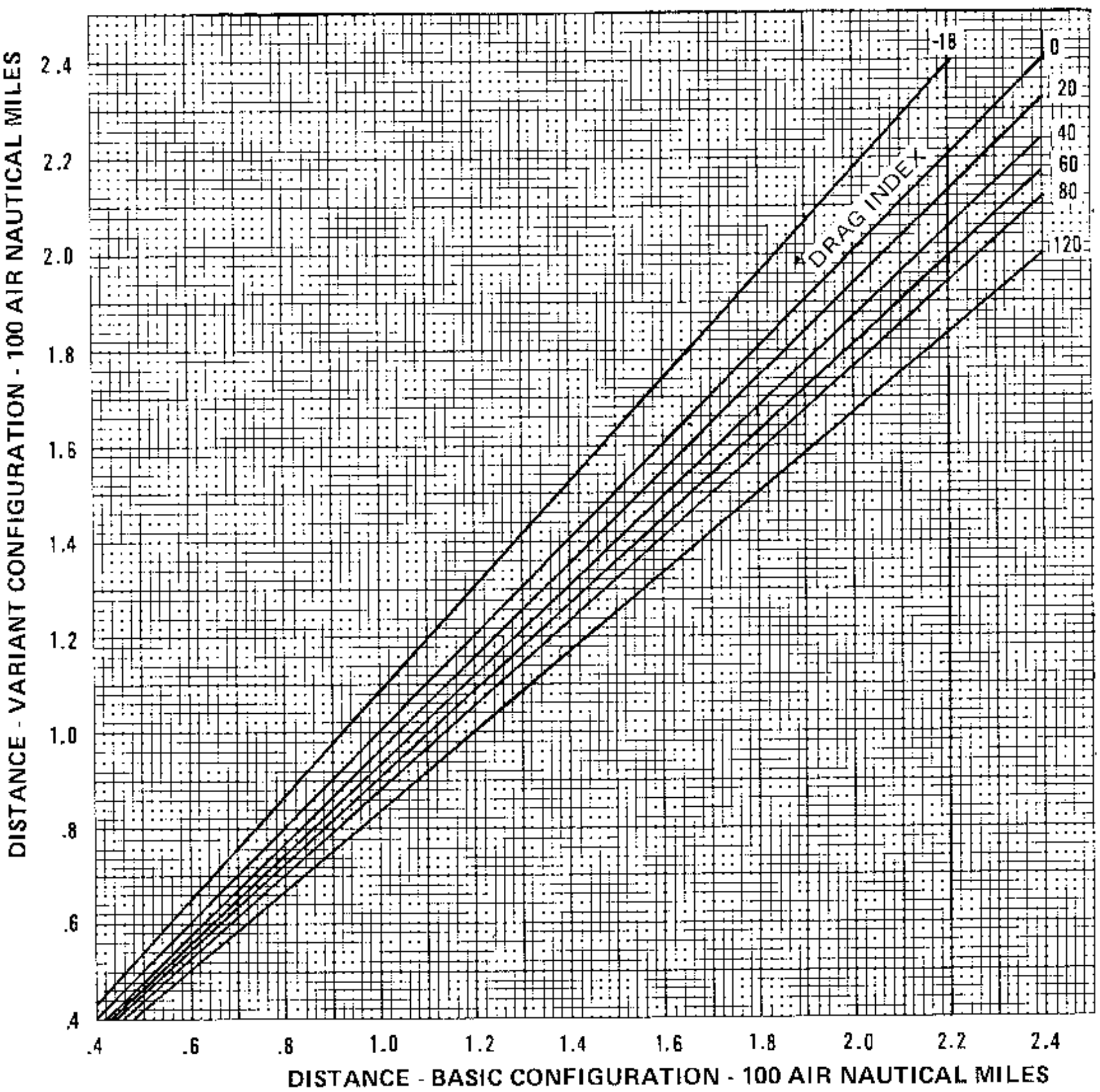


Figure A5-78. (Sheet 2 of 2)

RANGE PREDICTION - TIME

4 ENGINES LONG RANGE CRUISE
STANDARD DAY +20°C

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

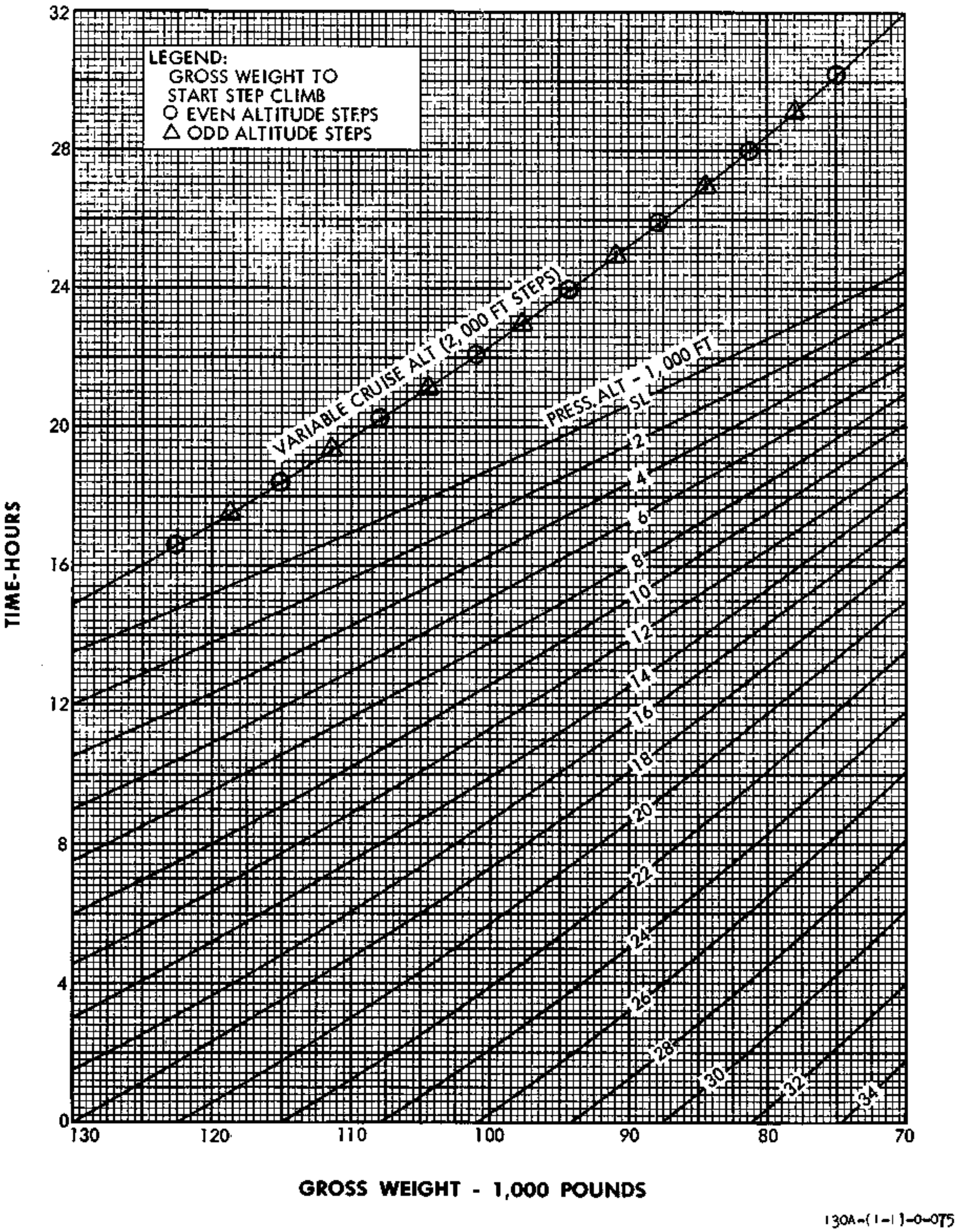


Figure A5-79.

RANGE PREDICTION - TIME

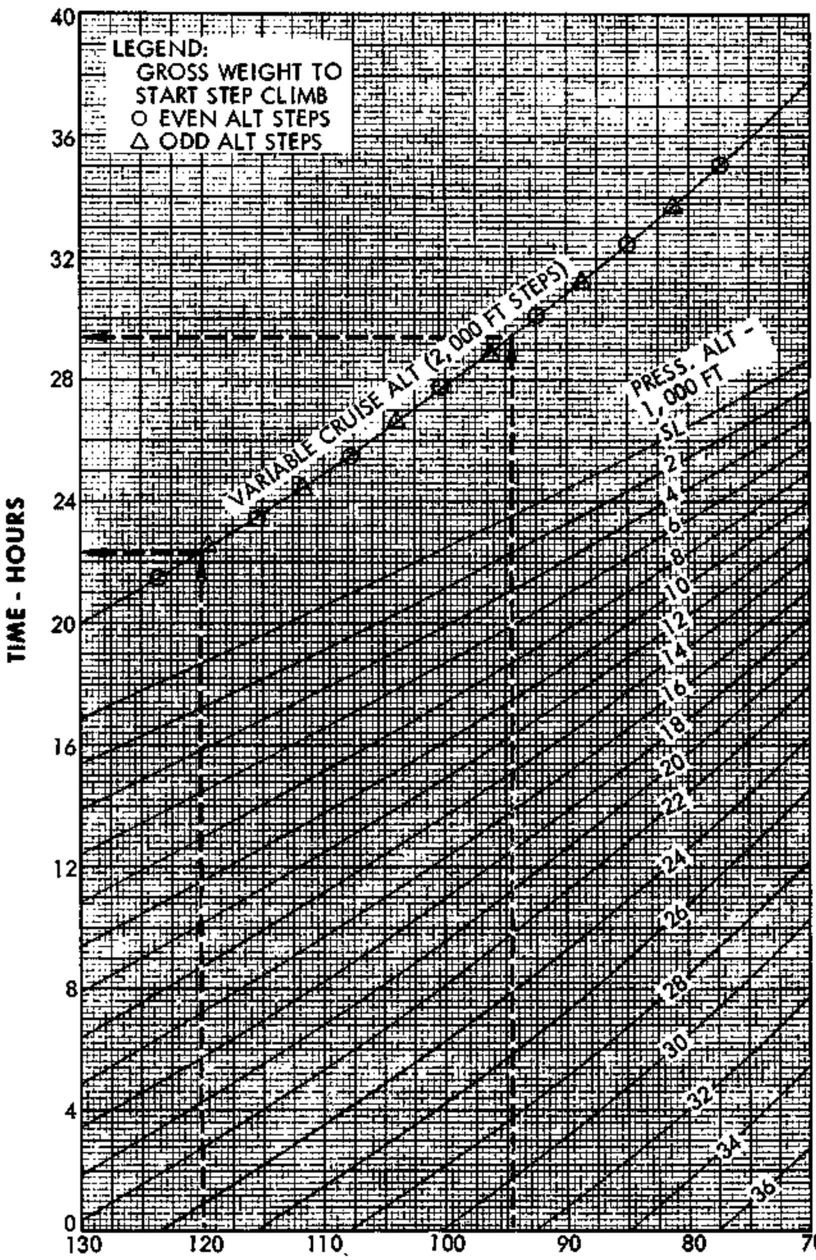
4 ENGINES LONG RANGE CRUISE

STANDARD DAY

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST



130A-(1-1)-0-109

Figure A5-80.

RANGE PREDICTION - TIME

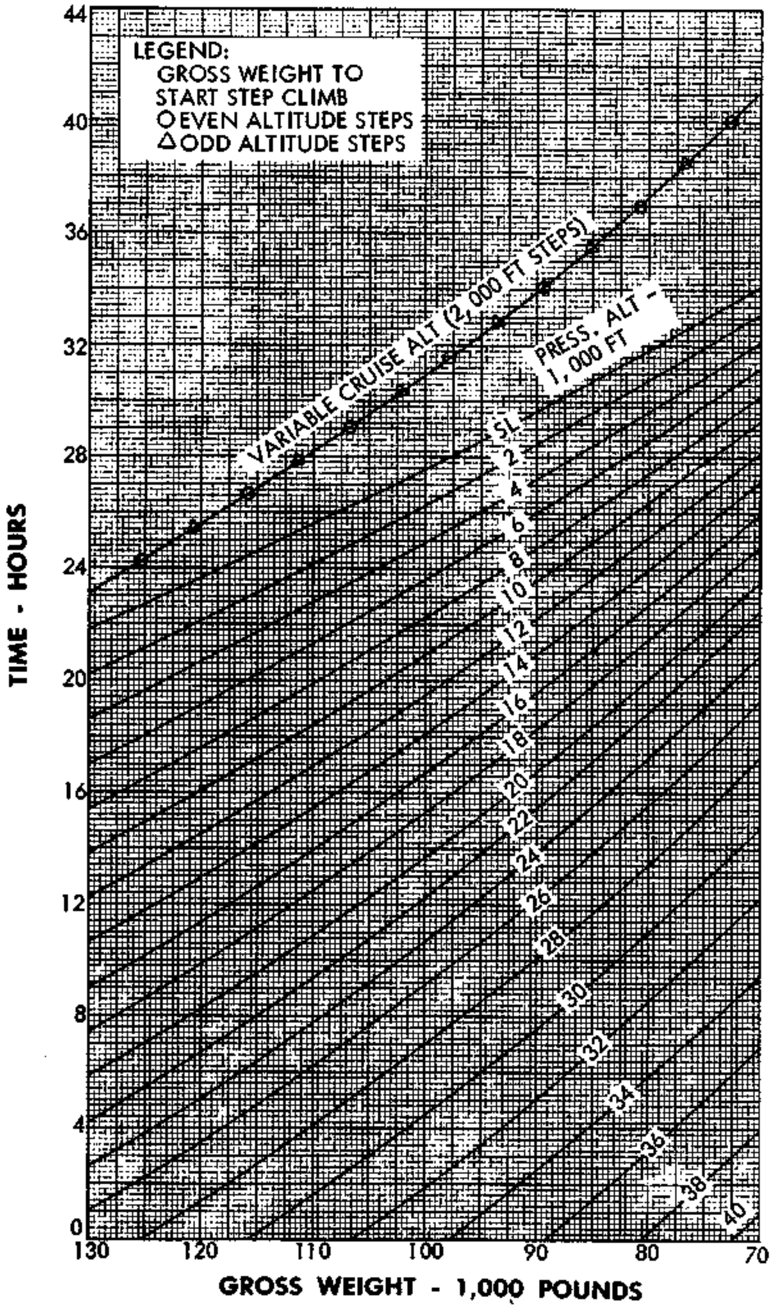
4 ENGINES LONG RANGE CRUISE

STANDARD DAY - 20°C

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST



130A-(1-1)-0-152

Figure A5-81.

RANGE PREDICTION-TIME
LONG RANGE CRUISE
VARIANT CONFIGURATION
VARIABLE ALTITUDE CRUISE
4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE
Temperature effect is negligible.

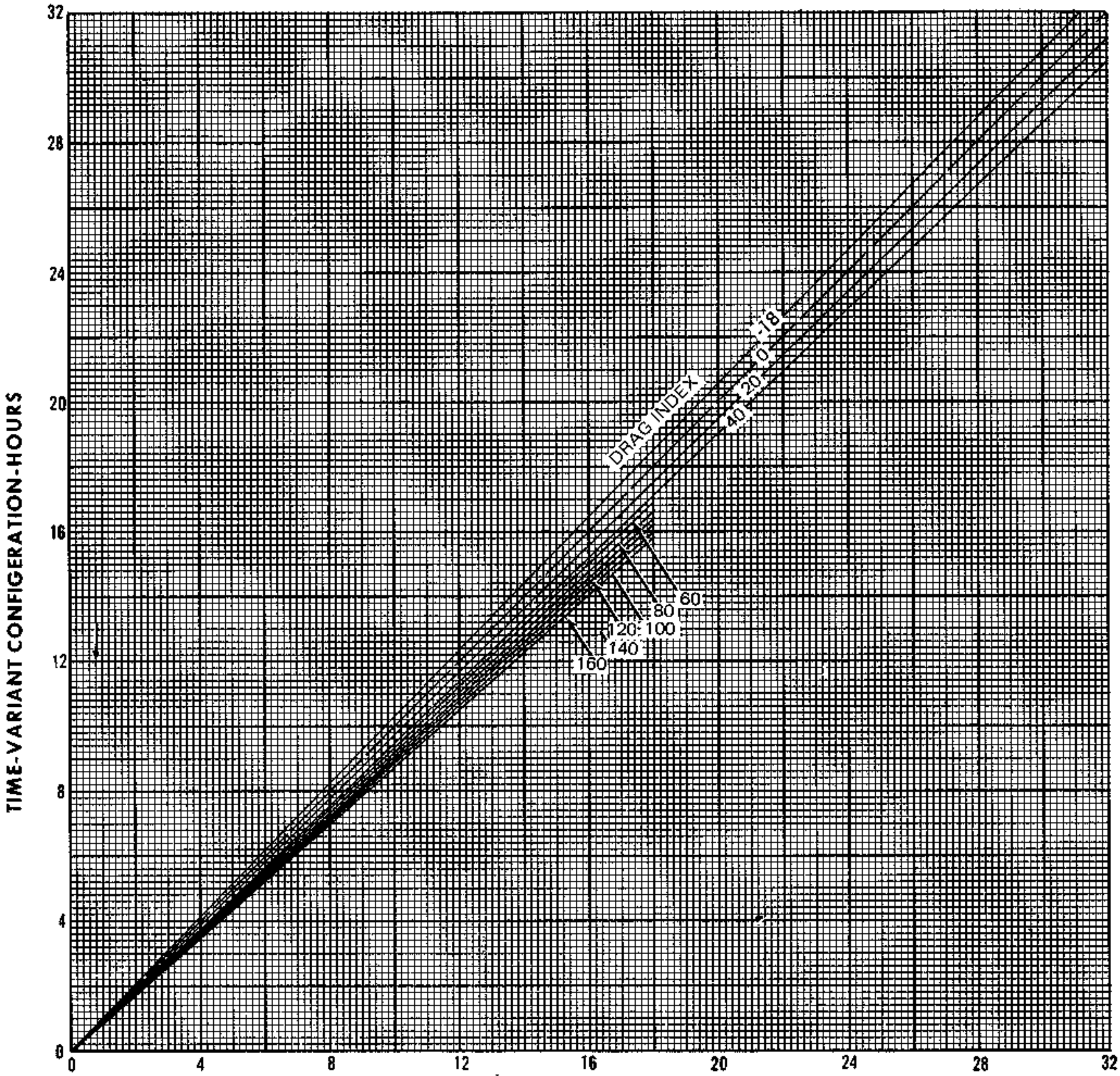


Figure A5-82.

RANGE PREDICTION - TIME
LONG RANGE CRUISE
VARIANT CONFIGURATION
CONSTANT ALTITUDE CRUISE
4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Temperature effect is negligible.

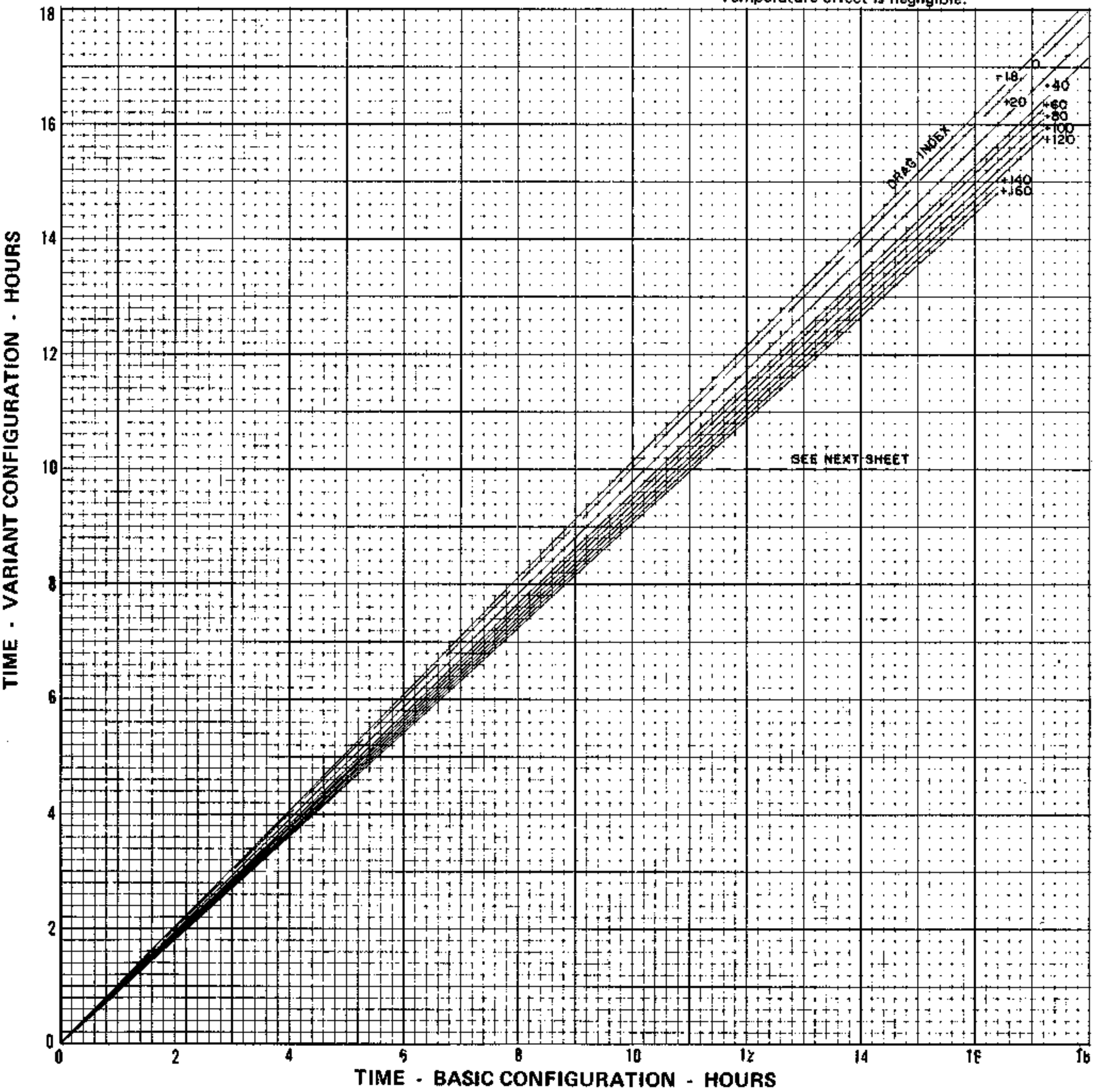


Figure A5-83. (Sheet 1 of 2)

RANGE PREDICTION - TIME
LONG RANGE CRUISE
VARIANT CONFIGURATION
CONSTANT ALTITUDE CRUISE
4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Temperature effect is negligible.

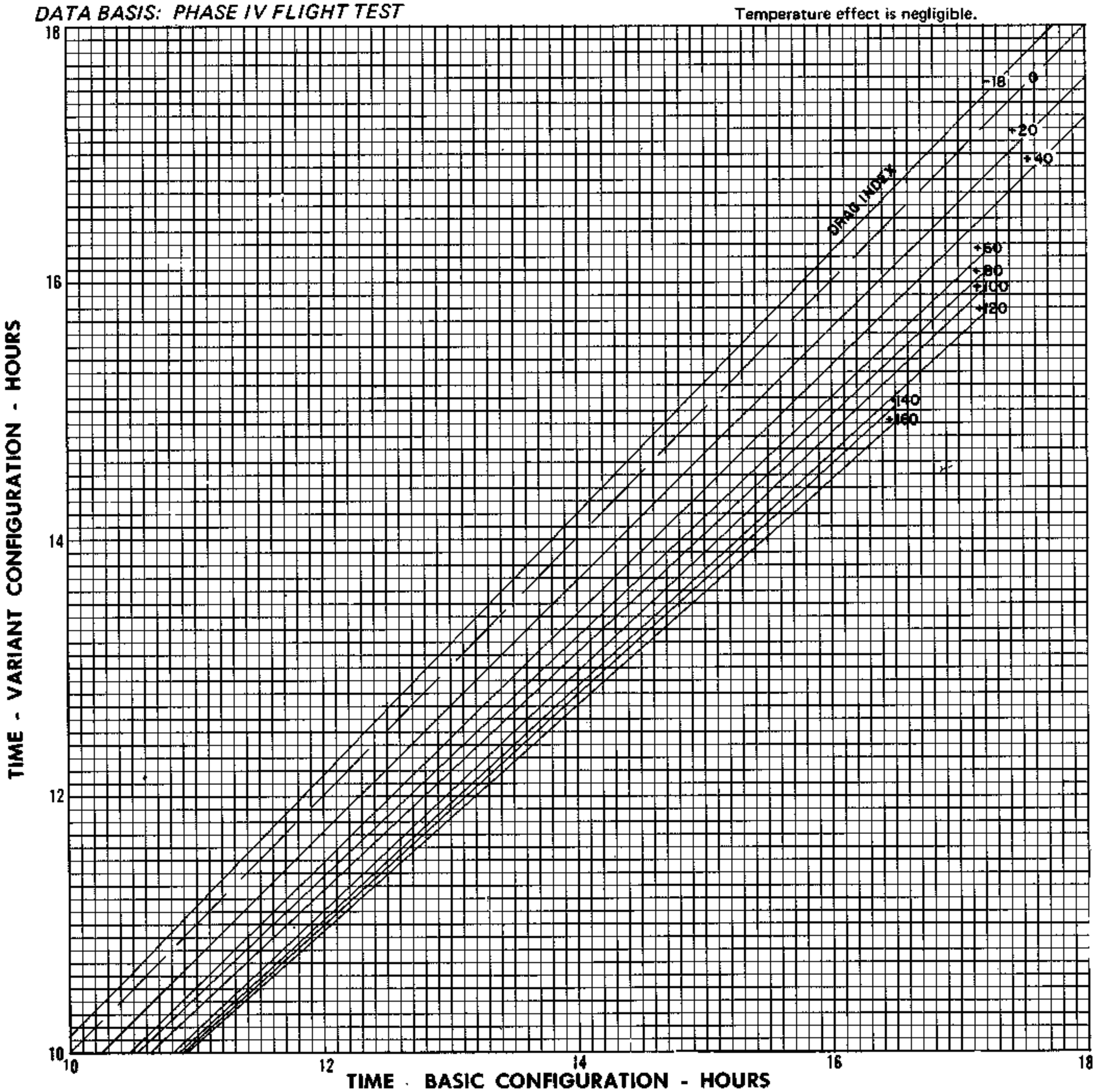


Figure A5-83. (Sheet 2 of 2)

RANGE PREDICTION - TIME

3 ENGINES LONG RANGE CRUISE

STANDARD DAY +20°C

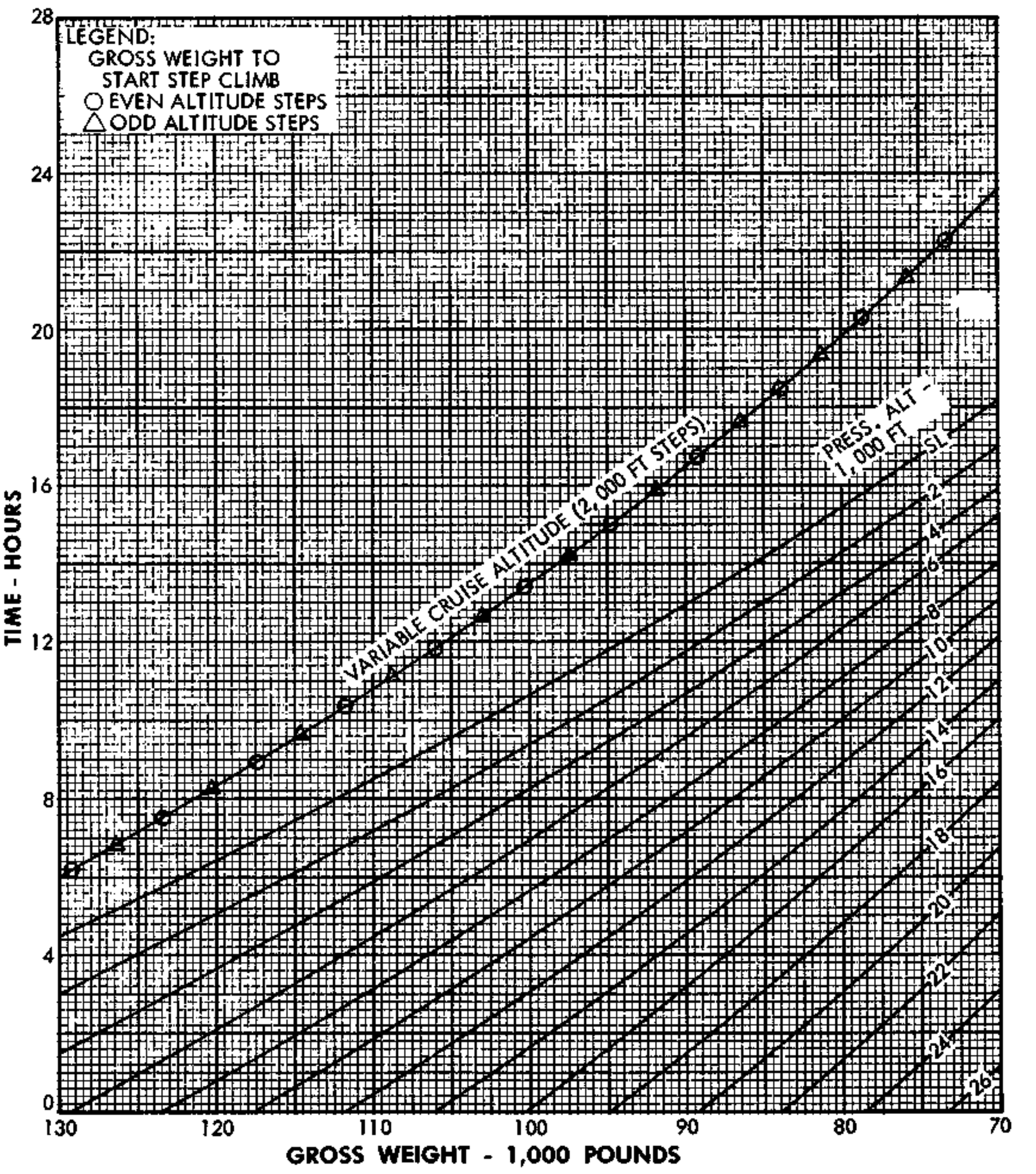
NOTE

1. Propeller feathered on inoperative engine.

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST



130A-(1-1)-0-110

Figure A5-84.

RANGE PREDICTION - TIME

3 ENGINES LONG RANGE CRUISE
STANDARD DAY

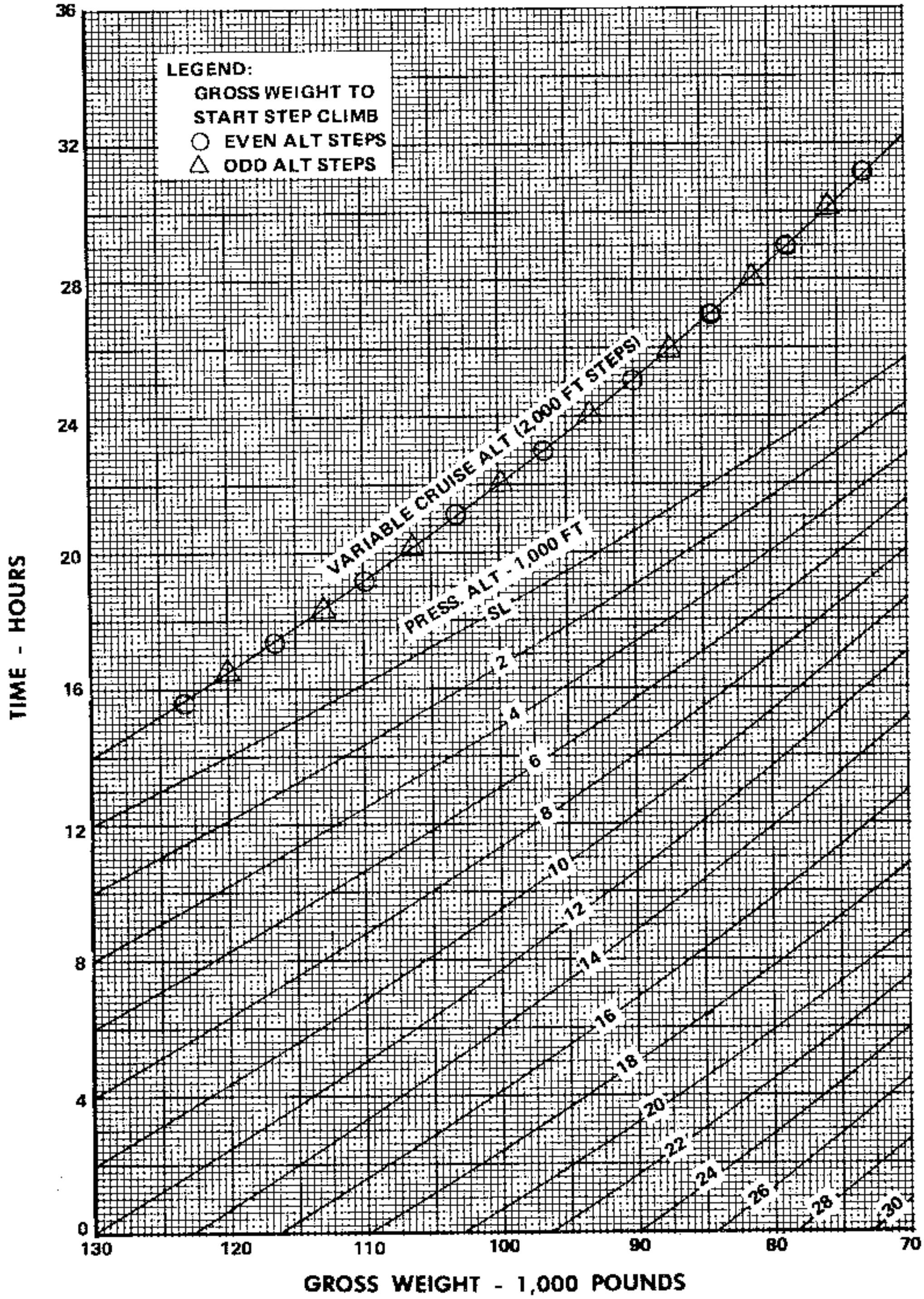
MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Propeller feathered on inoperative engine.



130A-(-1)-0-076

Figure A5-85.

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

RANGE PREDICTION - TIME

3 ENGINES LONG RANGE CRUISE

STANDARD DAY - 20°C

NOTE

1. Propeller feathered on inoperative engine.

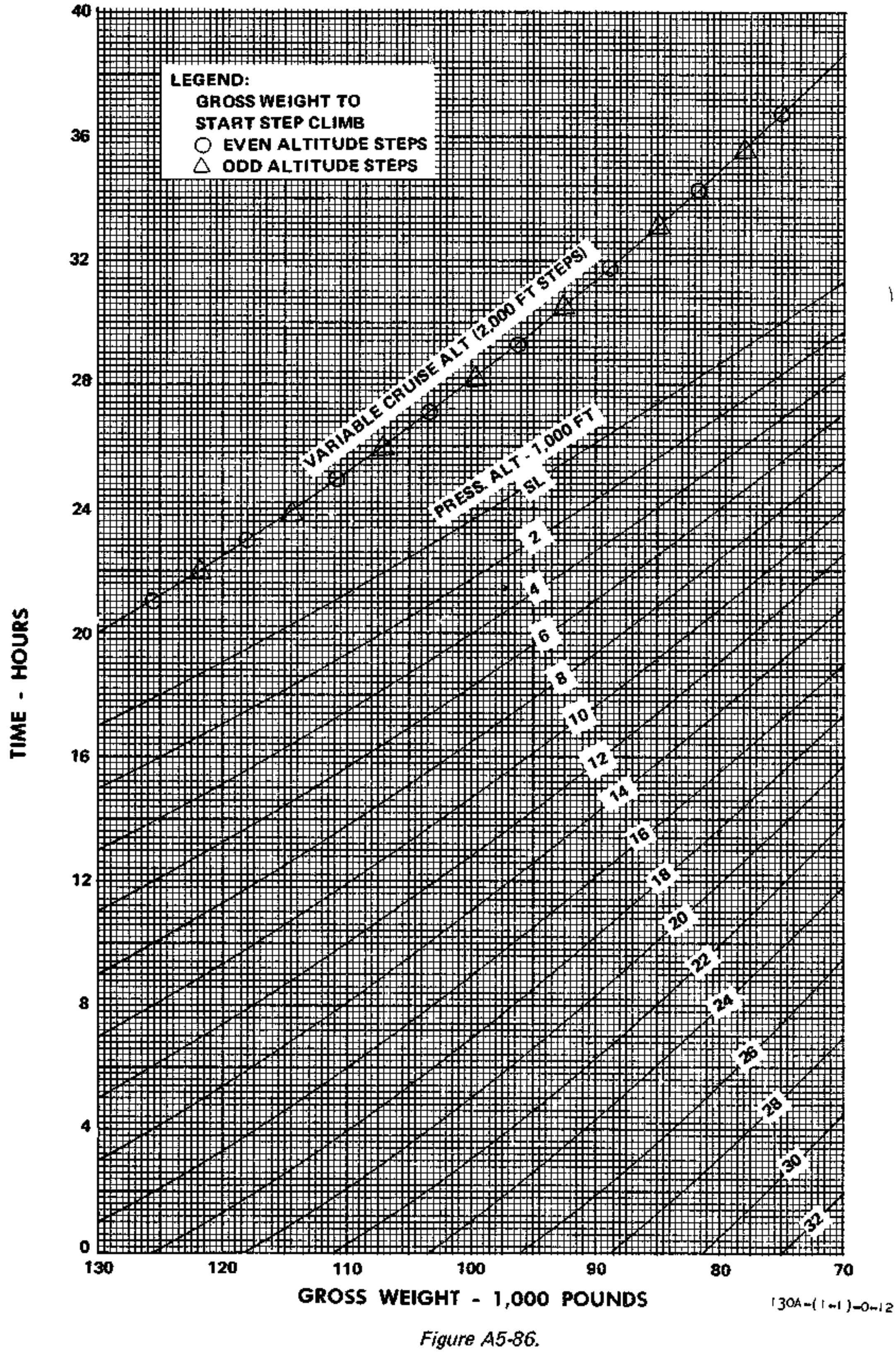


Figure A5-86.

RANGE PREDICTION- TIME
LONG RANGE CRUISE
VARIANT CONFIGURATION
VARIABLE CRUISE ALTITUDE
3 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. Temperature effect is negligible.

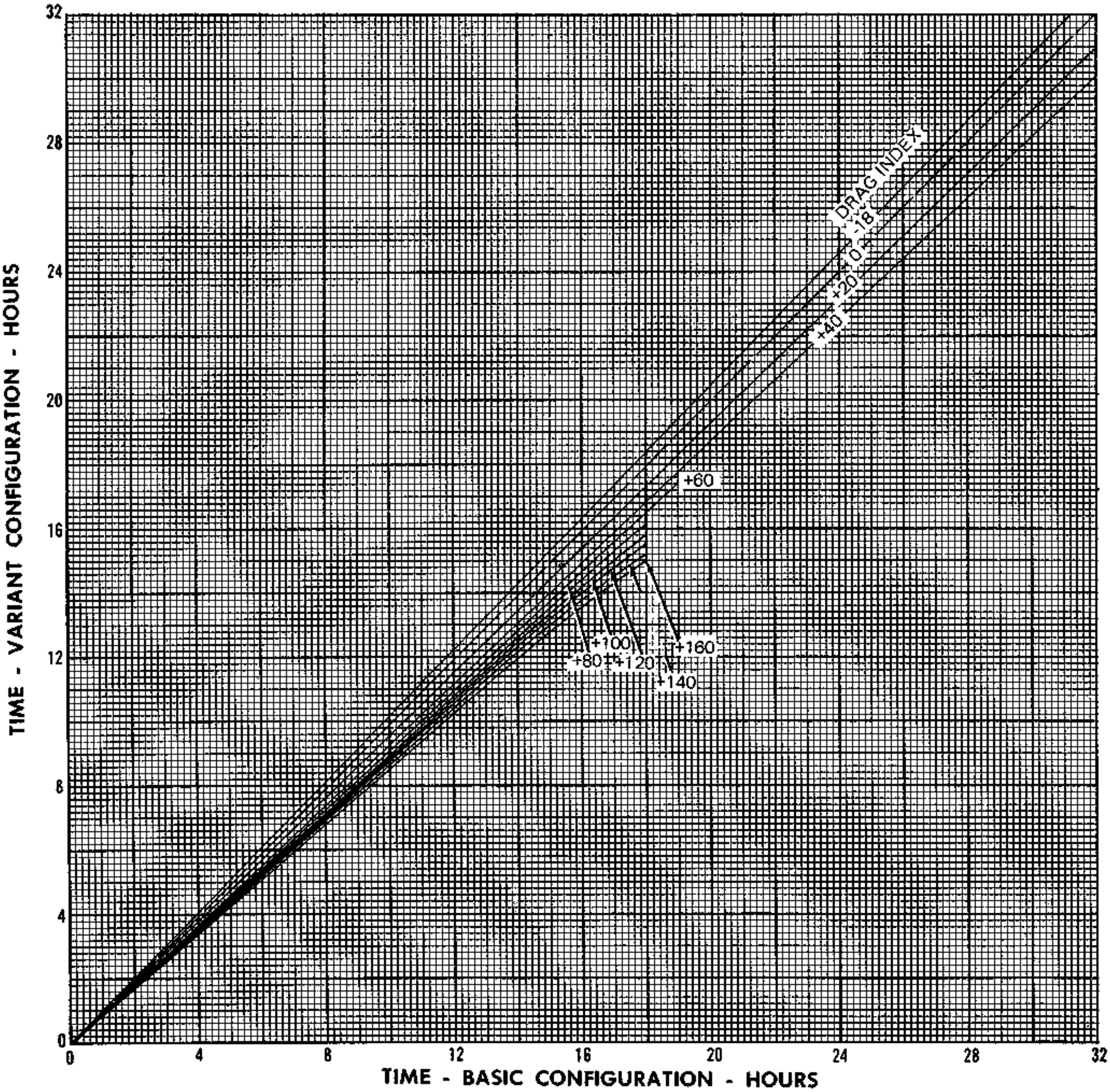


Figure A5-87.

RANGE PREDICTION—TIME
LONG RANGE CRUISE
VARIANT CONFIGURATION
CONSTANT ALTITUDE CRUISE
3 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. Temperature effect is negligible.

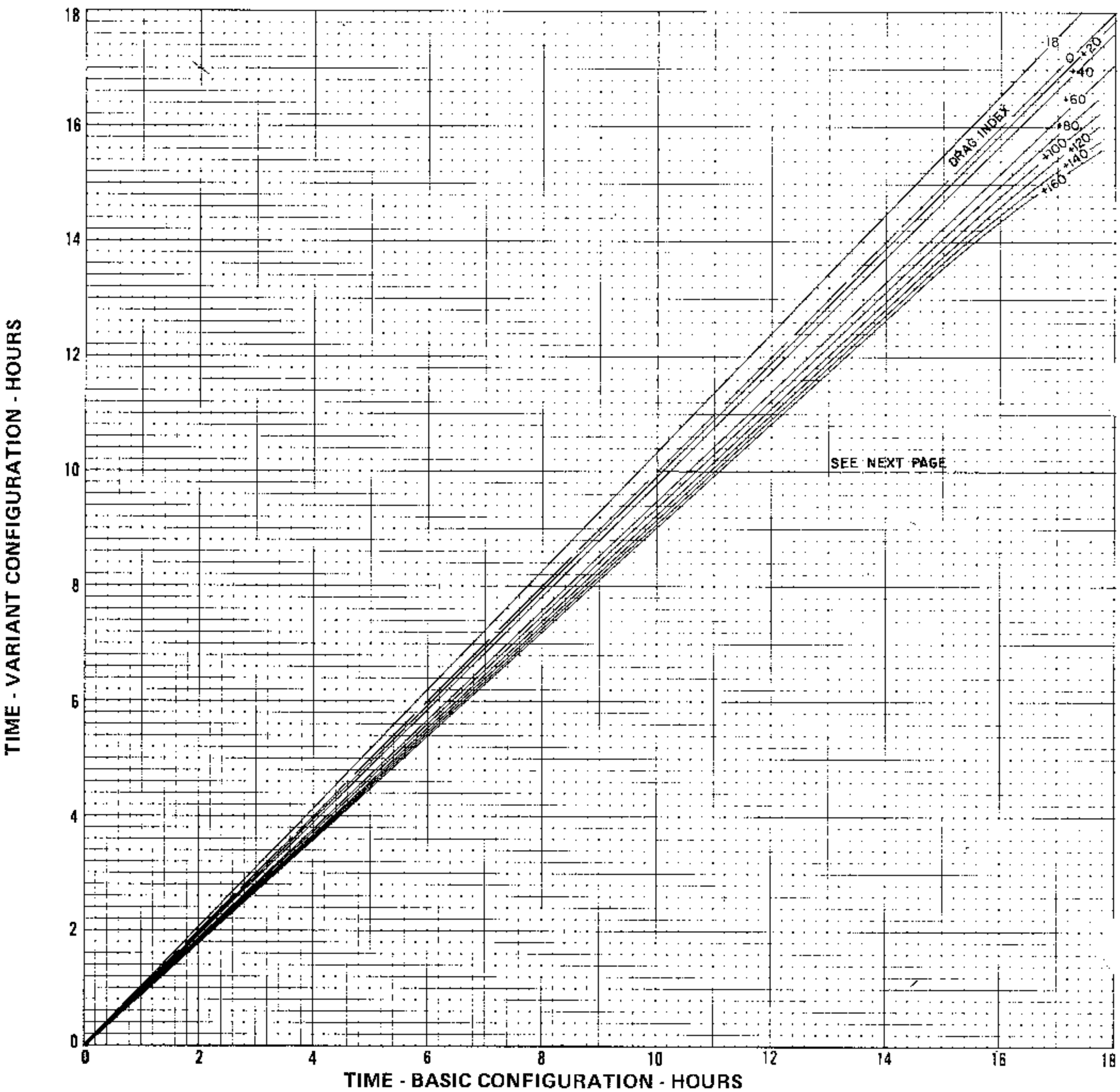


Figure A5-88. (Sheet 1 of 2)

RANGE PREDICTION—TIME
LONG RANGE CRUISE
VARIANT CONFIGURATION
CONSTANT ALTITUDE CRUISE

3 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. Temperature effect is negligible.

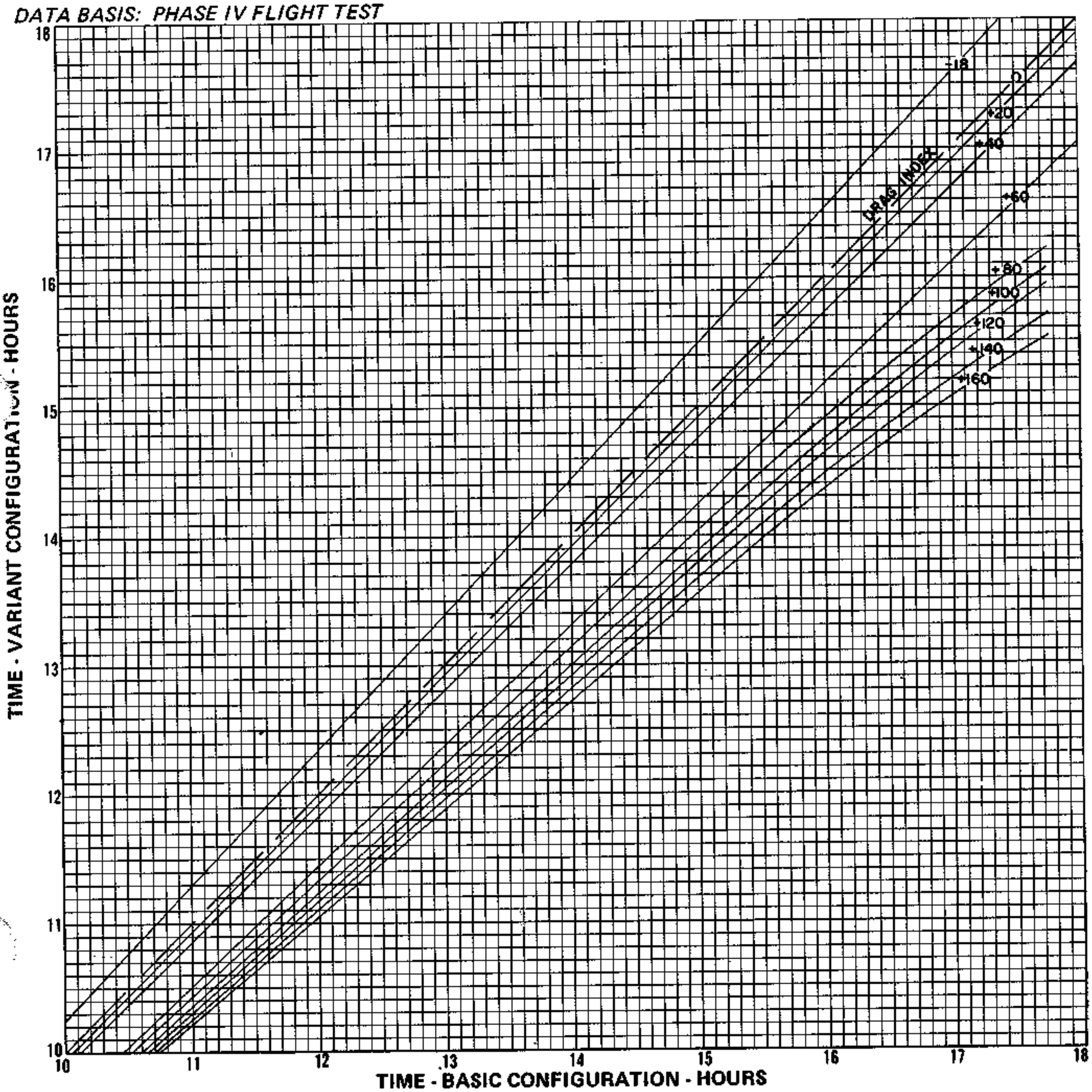


Figure A5-88. (Sheet 2 of 2)

RANGE CORRECTION DUE TO ALL BLEED ON

4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Based on long range cruise speeds.
2. Multiply normal bleed range or air nautical miles per pound by correction factor to obtain all bleed on values.

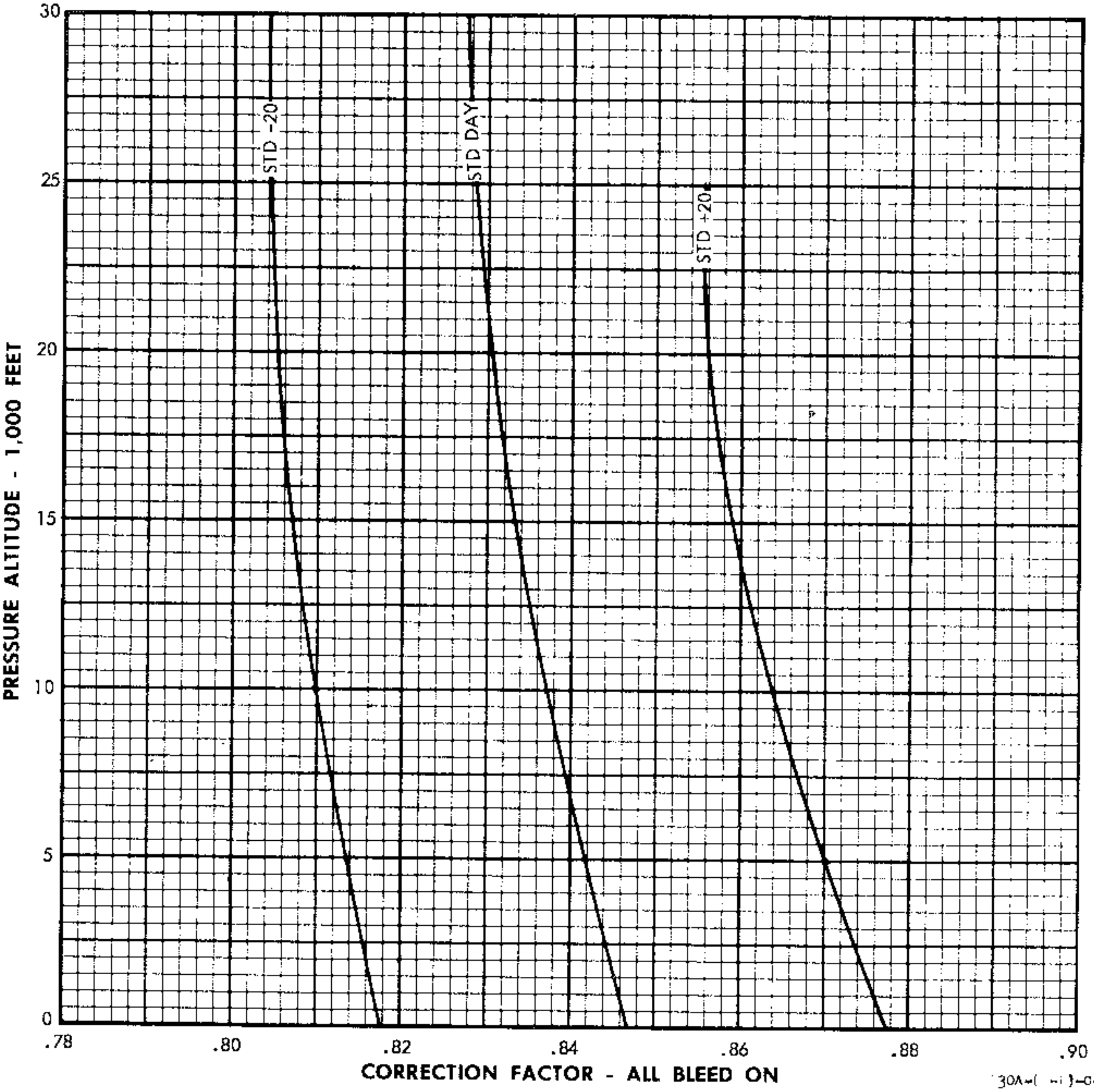


Figure A5-89.

OPTIMUM ENGINE CONFIGURATION

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Do not exceed cruise ceiling for each engine configuration.
2. Cruise at constant altitude and recommended long range cruise.
3. See Part 5 - Range Text - for non-standard day cruise control.
4. See part 5 - Range Text - for effects of anti-icing operation on cruise performance.
5. Propeller(s) on inoperative engine(s) feathered.

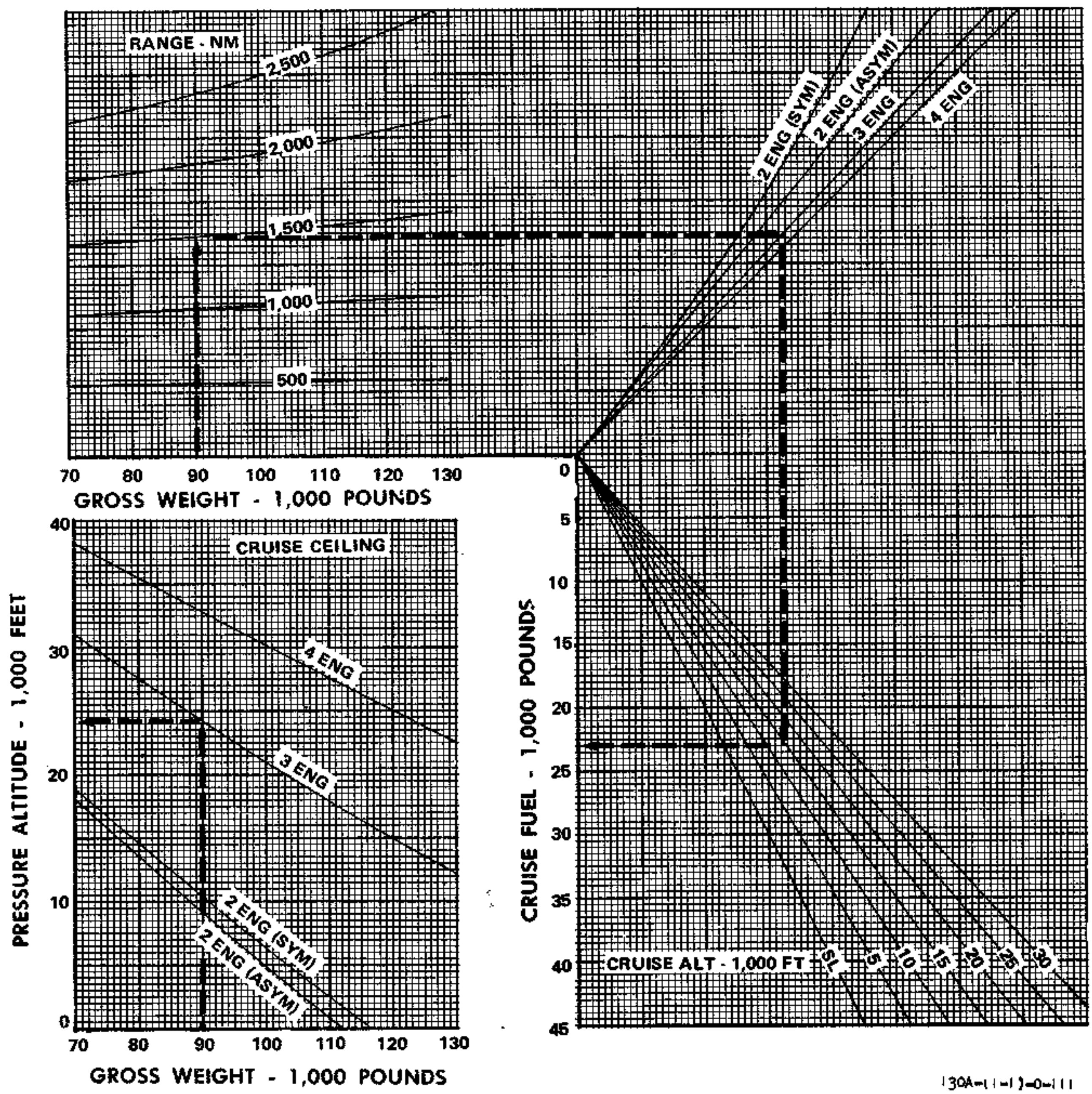


Figure A5-90.

SERVICE CEILING

4, 3, and 2 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Propeller(s) feathered on inoperative engine(s).

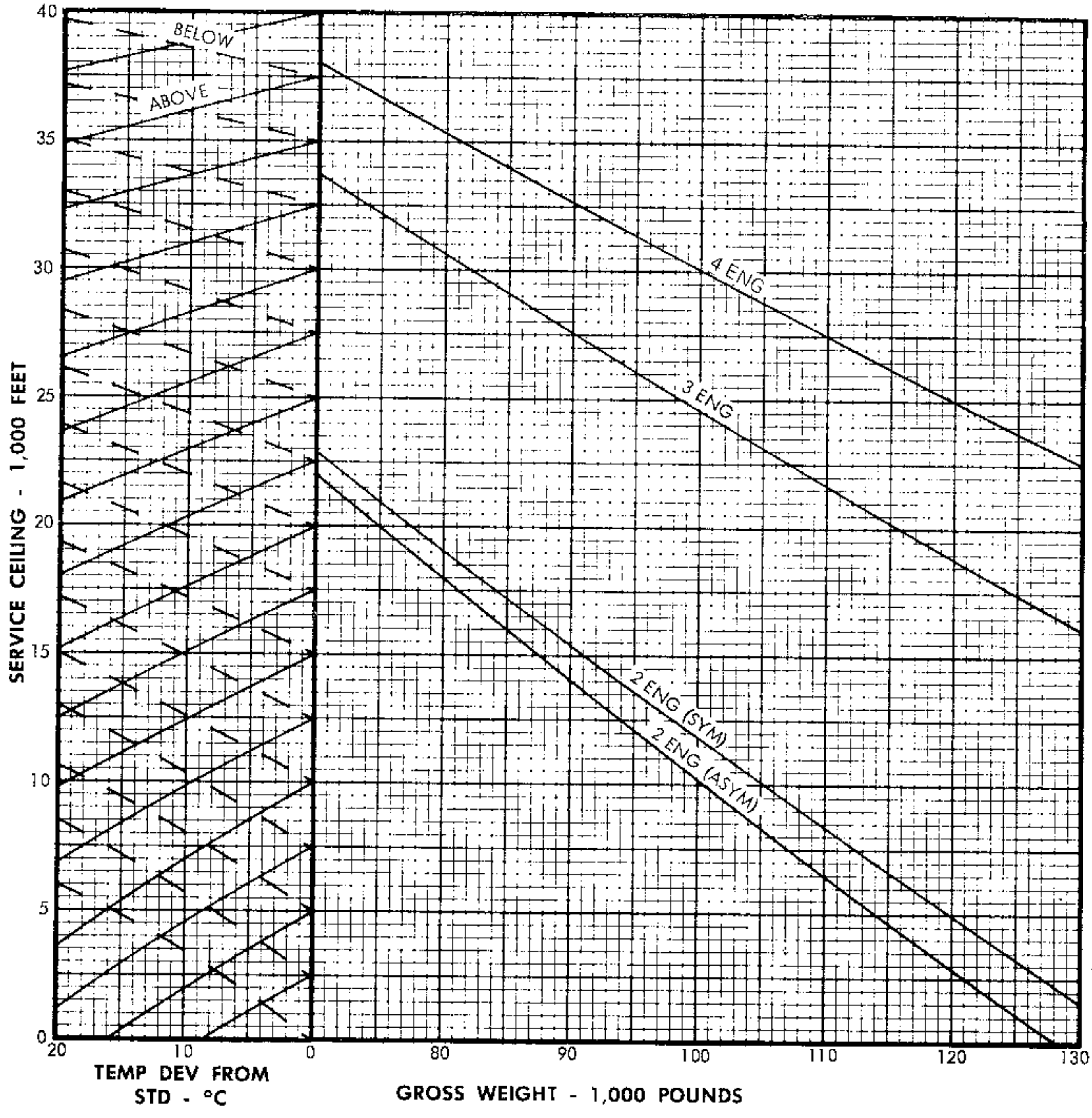


Figure A5-91.

SERVICE CEILING FOR VARIANT CONFIGURATION

4 ENGINES MAXIMUM CONTINUOUS POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. TEMPERATURE EFFECT IS NEGLIGIBLE

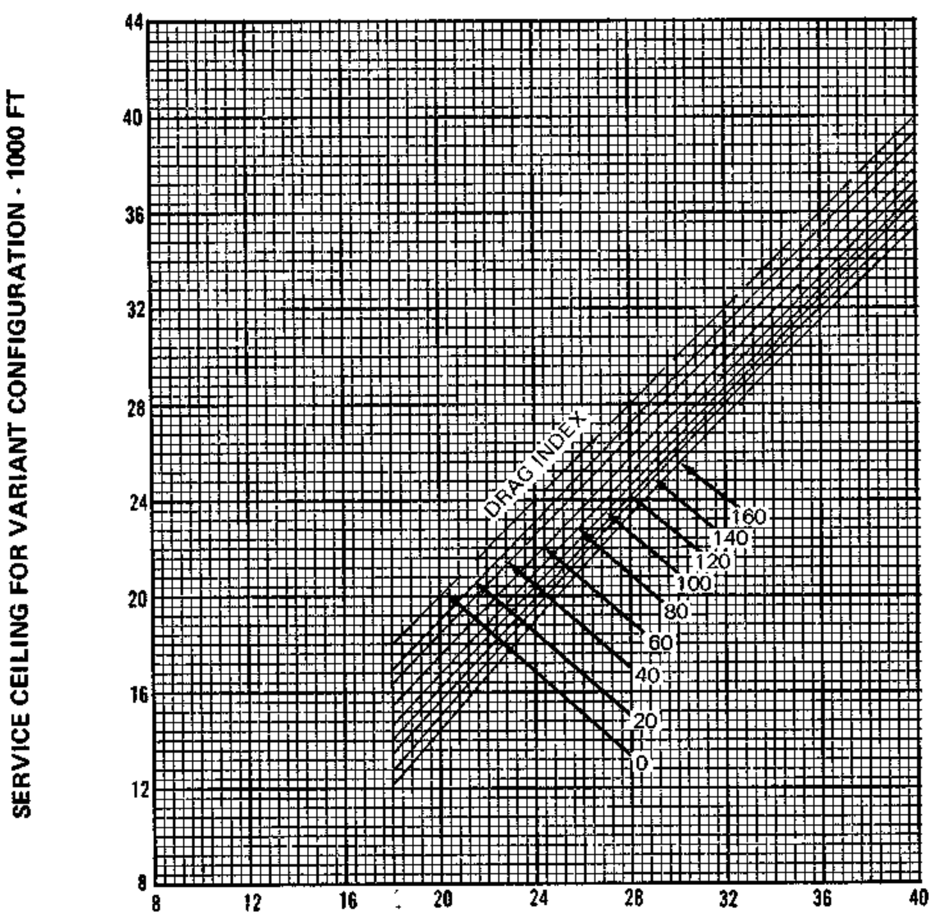


Figure A5-92.

SERVICE CEILING FOR VARIANT CONFIGURATION

MAXIMUM CONTINUOUS POWER 3 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine
2. Temperature effect is negligible

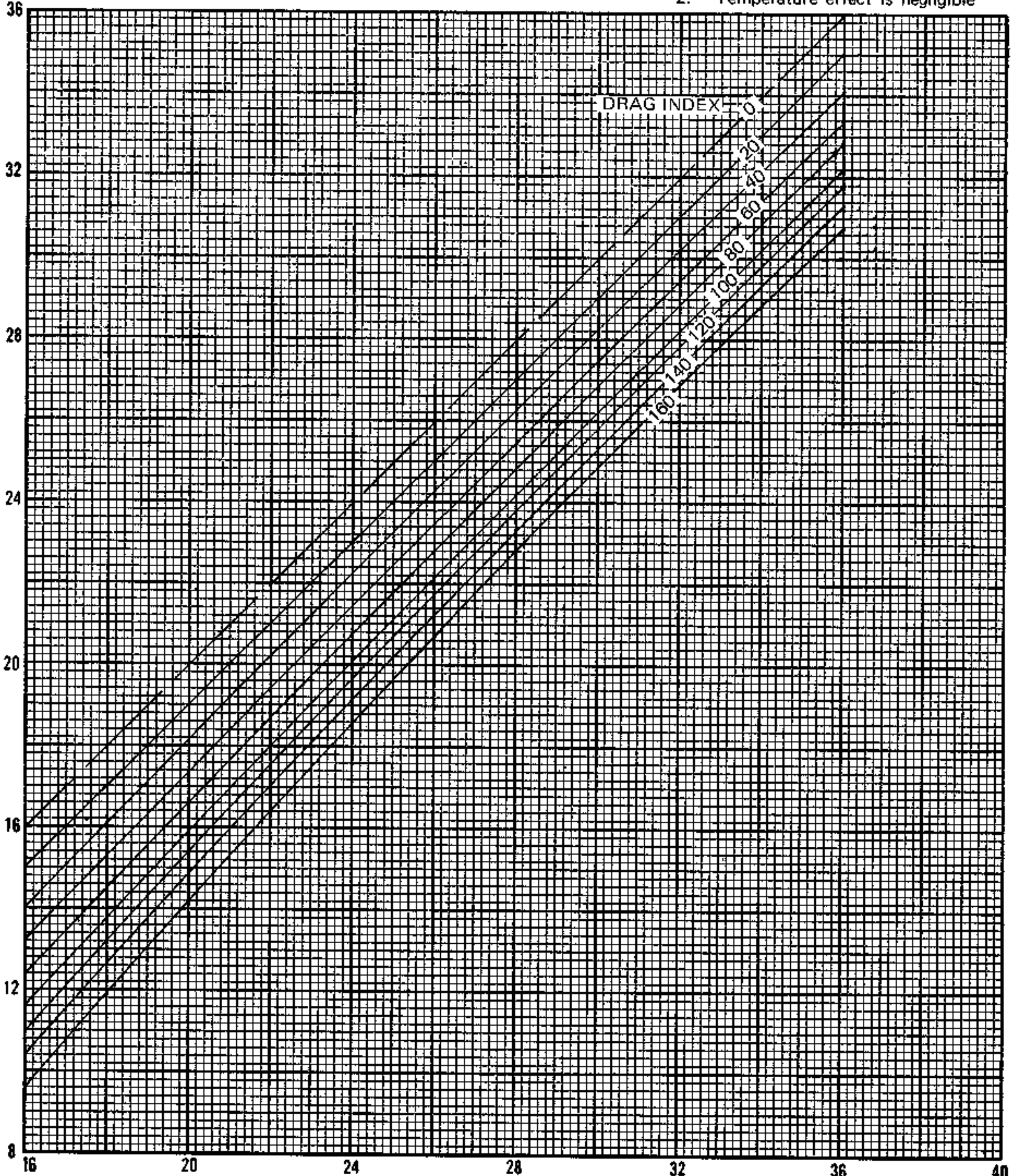


Figure A5-93.

SERVICE CEILING
FOR VARIANT CONFIGURATION

MAXIMUM CONTINUOUS POWER FOR SYMMETRICAL ENGINES OUT
ASYMMETRICAL POWER FOR TWO ENGINES OUT ON ONE SIDE
2 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES
DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine
2. Temperature effect is negligible

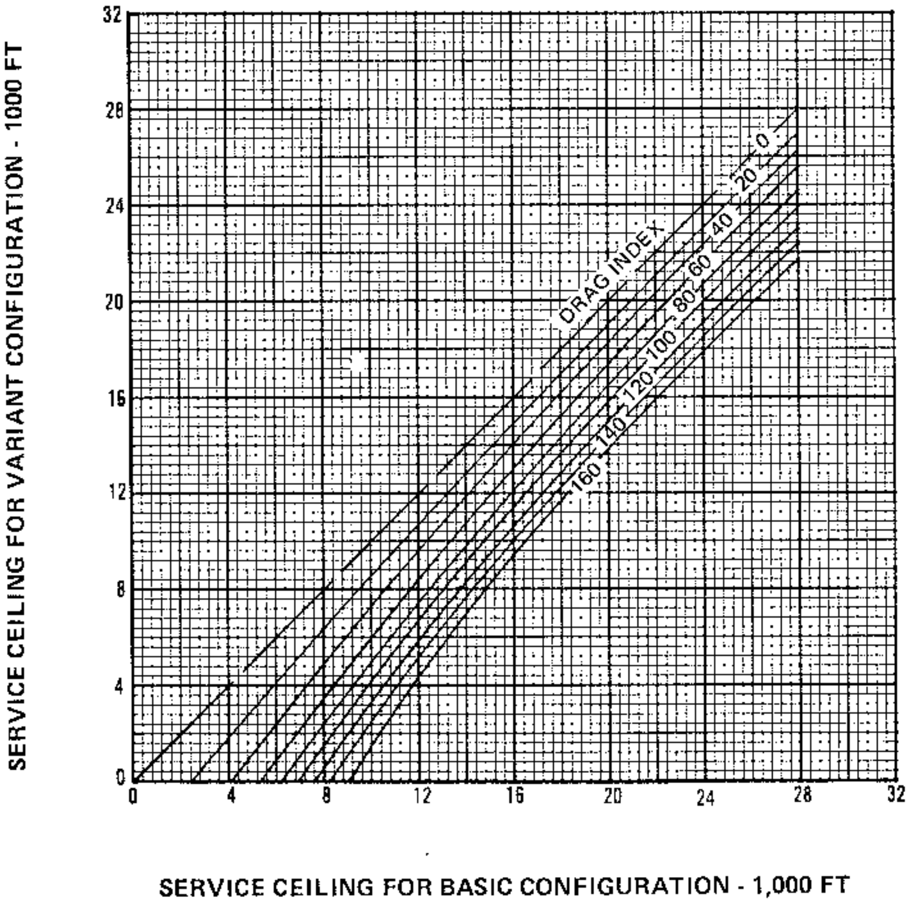


Figure A5-94.

DRIFTDOWN
MAXIMUM CONTINUOUS POWER

FLAPS UP **3 ENGINES** **GEAR UP**

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.

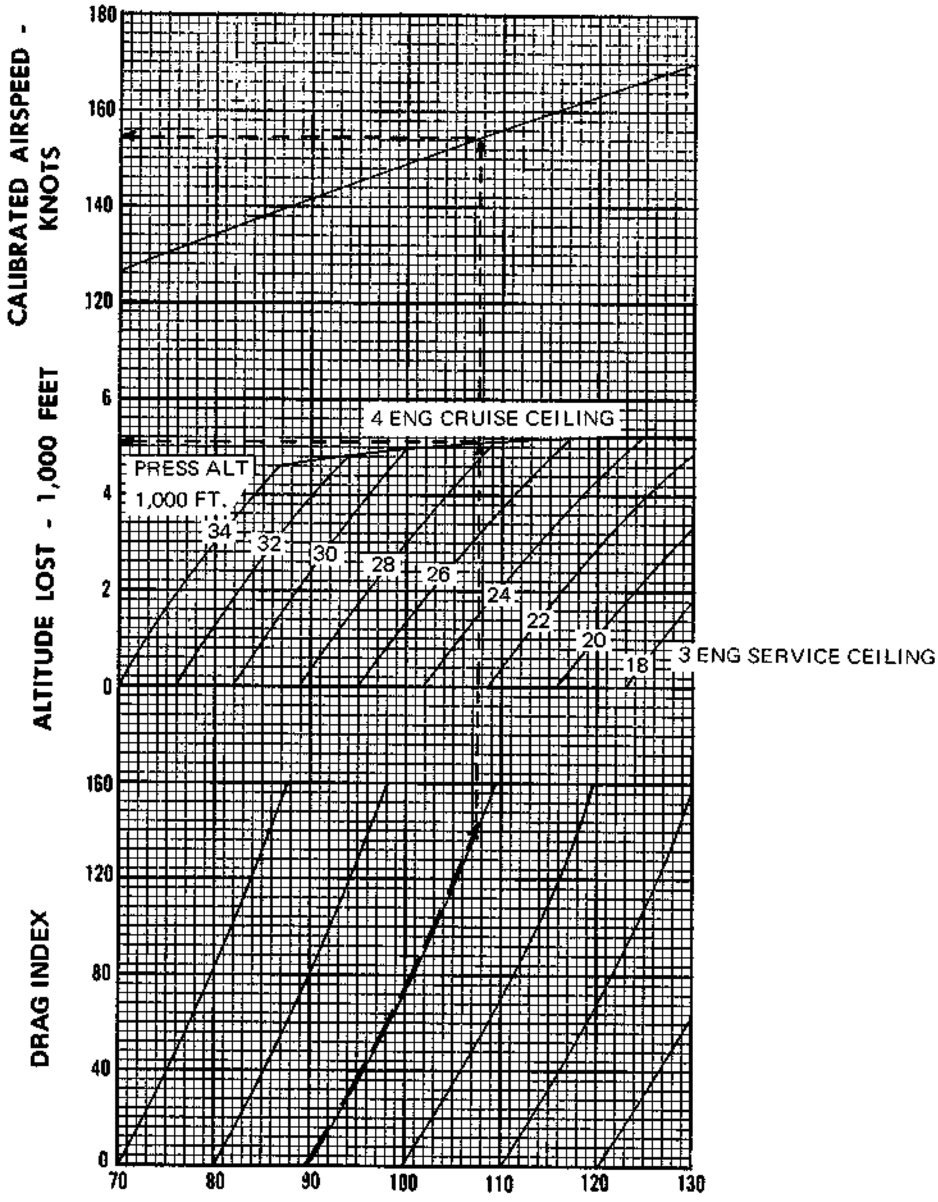


Figure A5-95. (Sheet 1 of 2)

DRIFTDOWN
MAXIMUM CONTINUOUS POWER

FLAPS UP 3 ENGINES GEAR UP

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.

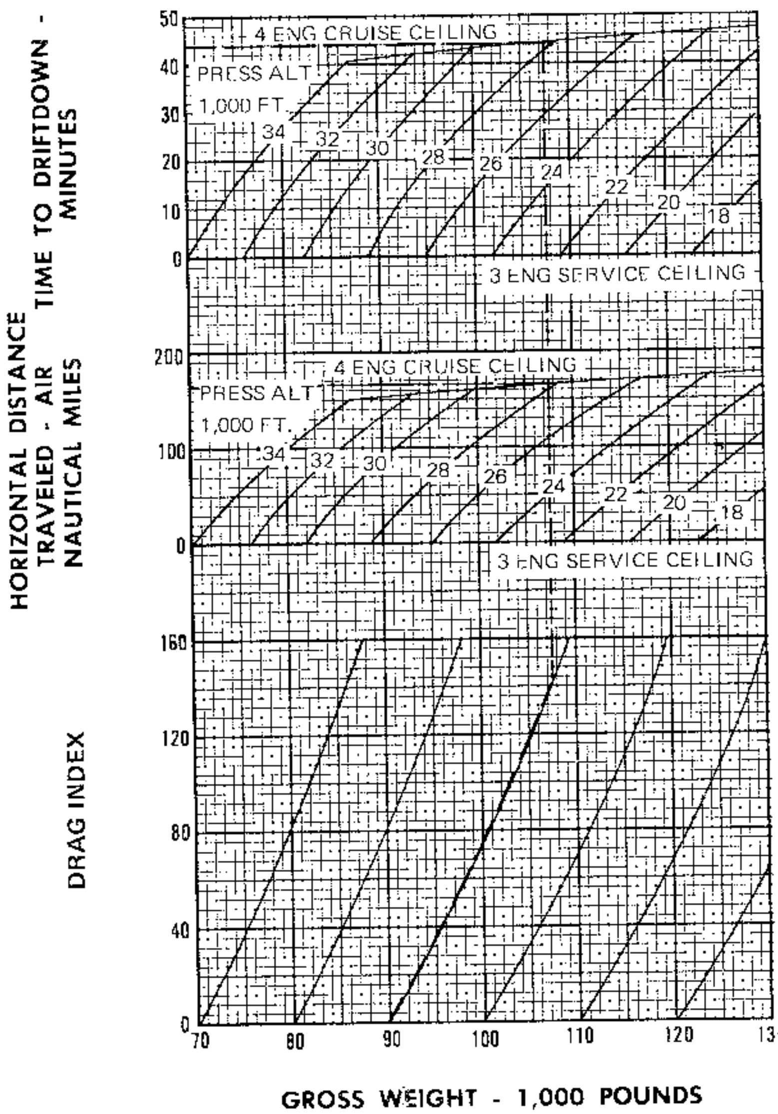


Figure A5-95. (Sheet 2 of 2)

DRIFTDOWN
MAXIMUM CONTINUOUS POWER

FLAPS UP 2 ENGINES GEAR UP

MODEL: AC-130A
T56-A-9 ENGINES

DATE:
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propellers feathered on inoperative engines.

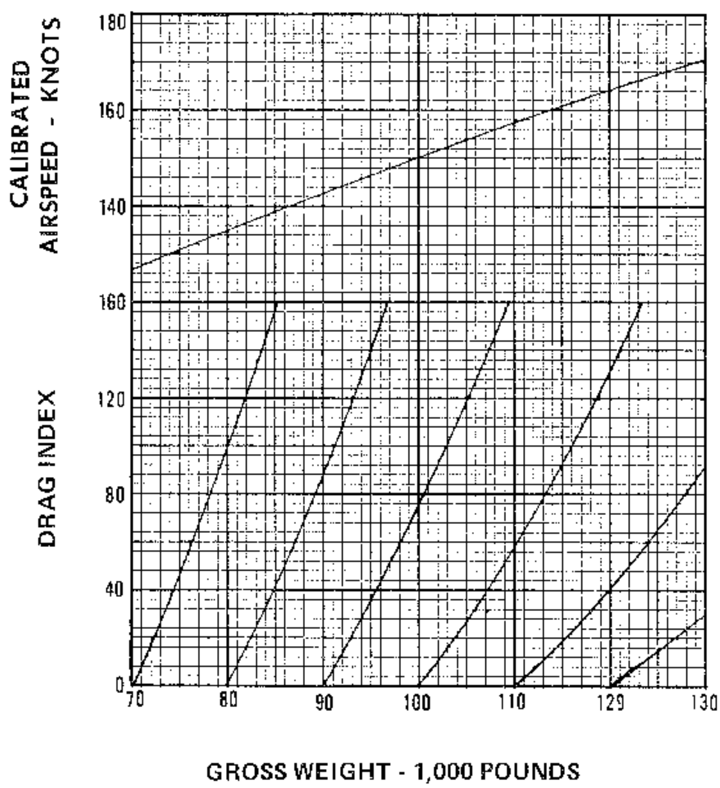


Figure A5-96. (Sheet 1 of 4)

MODEL: AC-130A
T56-A-9 ENGINES

DRIFTDOWN
MAXIMUM CONTINUOUS POWER
FLAPS UP 2 ENGINES GEAR UP

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

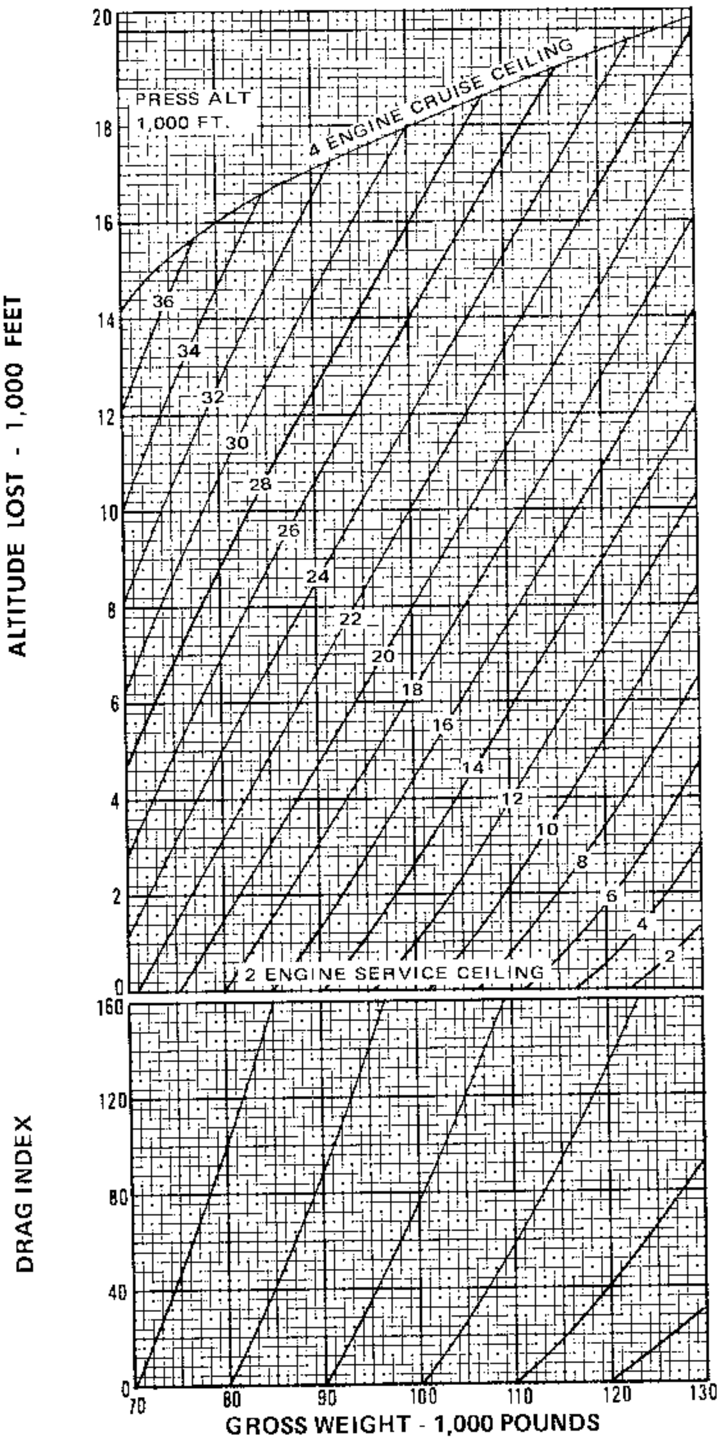


Figure A5-96. (Sheet 2 of 4)

DRIFTDOWN
MAXIMUM CONTINUOUS POWER
FLAPS UP 2 ENGINES GEAR UP

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

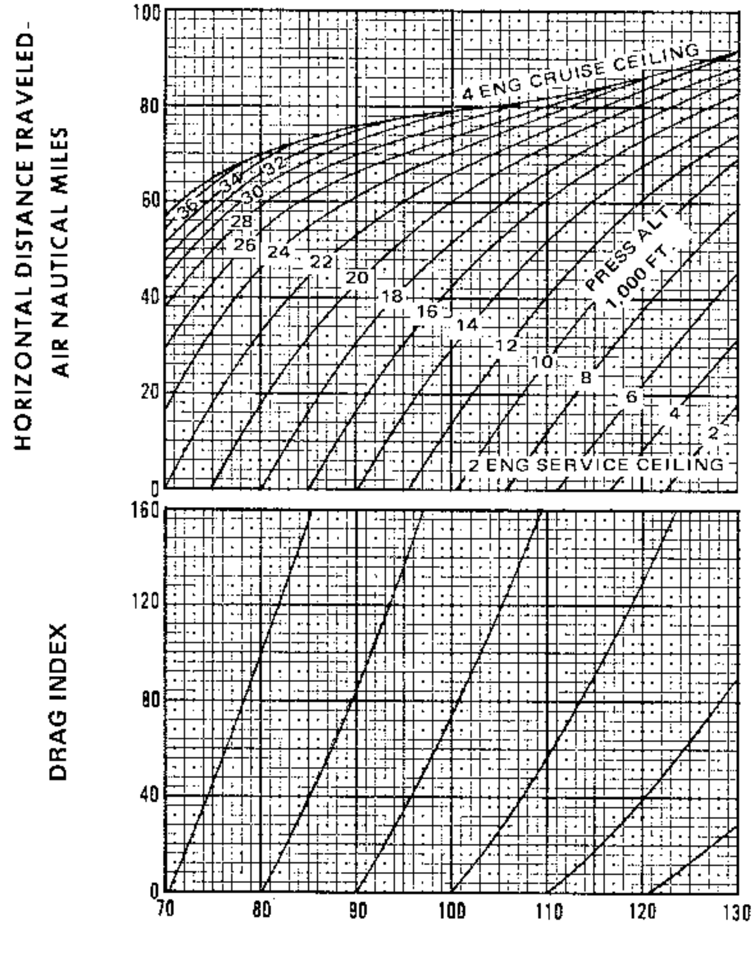


Figure A5-96. (Sheet 3 of 4)

DRIFTDOWN
MAXIMUM CONTINUOUS POWER
FLAPS UP 2 ENGINES GEAR UP

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

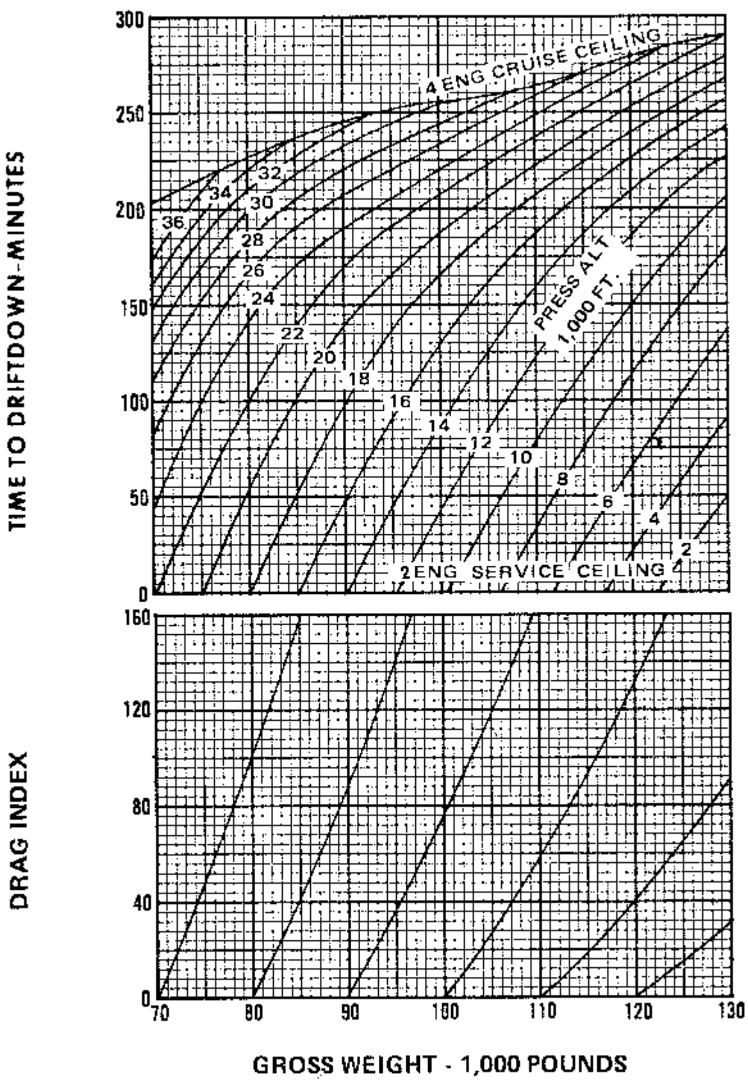


Figure A5-96. (Sheet 4 of 4)

PART 6. ENDURANCE

TABLE OF CONTENTS

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LIST OF CHARTS

LIST OF CHARTS (Cont)

INTRODUCTION.

Endurance operation is flight at conditions which result in minimum fuel used for a given time; it is used for holding patterns, rendezvous, search, and loiter. In some cases, such as loiter, the speeds, altitudes, and engine configuration may be selected to give the optimum endurance. In other cases, such as rendezvous, an altitude is specified and the speed may be selected to give the maximum endurance for a given engine configuration. This part of the Appendix contains charts of maximum endurance with the standard-day optimum endurance line superimposed. The following nomenclature is used to describe the two types of endurance operation described above:

Maximum endurance - operation at the speed which results in the minimum fuel flow for the given engine configuration and atmospheric conditions at a given altitude and gross weight.

Optimum endurance - operation at the speed and altitude which results in the minimum fuel flow for the given engine configuration, atmospheric conditions, and gross weight.

For holding patterns, both the speed and altitude may be specified and, therefore, neither maximun endurance nor optimum endurance operation is permitted. If this is the case, the endurance can be determined from the specific range charts in Part 5. Temperature has a negligible effect on endurance at a given calibrated airspeed and altitude.

Variant configuration charts applicable to the AC-130A aircraft are presented for fuel flow, specific endurance, and true airspeed at maximum endurance flight conditions for 4-, 3-, and 2-engine operation. Specific endurance (minutes per 100 pounds of fuel) for Combat Loiter flight conditions for the AC-130A aircraft is presented for altitudes to 20,000 feet at true airspeeds from 150 knots to 260 knots. The Combat Loiter data are for flaps up and 50% flaps. Specific endurance charts for variant configurations of the AC-130A aircraft are given for the Combat Loiter flight conditions.

FACTORS AFFECTING ENDURANCE.

AIRSPEED AND ALTITUDE.

The most economical endurance operation can be achieved only when the recommended flight techniques are used. However, some variations may be permitted with a small effect. The airspeed may be allowed to vary by ±10 knots IAS, and the altitude may be allowed to vary by ±1,000 feet without affecting endurance appreciably.

NUMBER OF OPERATING ENGINES.

Endurance may be increased by shutting down one or two engines at the lower altitudes. This increase results because specific fuel consumption is lower and propeller efficiencies are higher at the higher power settings. However, operation with engines shut down is dependent on the gross weight, atmospheric conditions, and altitude; therefore, the number of operating engines must be selected for existing conditions.

BANK ANGLE.

When holding or conducting search operation over a limited area, it may be necessary to fly a fairly large bank angle. This kind of flight pattern will reduce the endurance time as shown on figure A6-1 for a constant airspeed.

MAXIMUM ENDURANCE

Variant configuration charts of fuel flow (pounds of fuel per hour per engine) at maximum endurance conditions for the AC-130A aircraft are given in Figures A6-3, A6-6 and A6-9 for 4-, 3-, and 2-engine operation. Specific endurance (minutes per 100 pounds of fuel) at maximum endurance for the basic C-130A are presented in Figures A6-10 through A6-15 for 4-, 3-, and 2-engine operation. True airspeeds at maximum endurance for variant configurations of the AC-130A are given in Figures A6-16, A6-17 and A6-18 for 4-, 3-, and 2-engine operation.

Example:

Given:

Begin holding weight: 100,00 lb

Holding Time on Station: 8 hours

Holding Altitude: 20,000 ft.

OAT: Standard minus 5° C

Drag Index of +80

Find:

Fuel for 8 hours holding time at 20,000 ft. OAT

Standard minus 5°C and calibrated Airspeed for holding time

Procedure:

The first step is to determine the approximate average holding weight. This weight is found by entering Figure A6-10 of this manual with 20,000 feet altitude and 100,000 pounds holding weight for an OAT of standard minus 5°C. By using this Specific Endurance in the following equation, the average holding is found.

Avg Hold St. = Begin Hold Wt. -

$$1/2 \left(\frac{\text{Hold Time x 60 min}}{\text{Specific Endurance}}\right)$$

$$GW_{AVE} = 100{,}000 - \left(\frac{8 \times 60}{6 \times 21.2}\right)$$

$$GW_{AVE} = 100{,}000 - 11{,}320$$

$$GW_{AVE} = 88{,}680 \text{ pounds}$$

The average holding weight is used to find the airspeed and Specific Endurance for the approximate average holding weight. Enter Figure A6-10 of this manual and read 121 CAS and .0235 min/lb Specific Endurance for the Basic AC-130A aircraft.

Calibrated airspeed (Basic) = 121 CAS
Specific Endurance (Basic) = .0235 min/lb of fuel

Enter Figure A6-11 of this manual with the basic Specific Endurance of .0235 min/lb of fuel and read upward to the drag index line +80. Then move horizontally and read .0219 min/lb fuel Specific Endurance for the variant configuration. Fuel used for 8 hours holding at 20,000 ft, minus 5°C from standard day and drag index of +80 is then:

$$\text{Fuel} = \frac{\text{(No. of Hours) x (60 min.)}}{\text{(Specific Endurance for Variant)}}$$

$$\text{Fuel} = \frac{(8) \quad (60)}{.0219} = 21{,}900 \text{ lb}$$

Calibrated airspeed must be converted to True airspeed. This is determined by using Figure A1-4 and A1-6 in the following equation.

$$V_{TRUE} = \frac{1}{\sqrt{\sigma}} (V_{CAS} + \Delta V_C)$$

$$V_{TRUE} = 1.355\ [121 + (-.6)]$$

$$V_{TRUE} = 163.5 \text{ KTS}$$

To find the holding speed for a drag index +80 use Figure A6-16 of this manual. Read upward to the drag index line of +80. Then move horizontally and read True velocity for the variant configuration of 153 knots. The calibrated airspeed is:

$$V_{CAS} = \frac{V_{TRUE} + \Delta V_C}{\frac{1}{\sqrt{\sigma}}} \qquad \Delta V_C \approx .5 \text{ KTS}$$

$$V_{CAS} = \frac{153 + .5}{1.355}$$

$$V_{CAS} = 113.5 \text{ KNOTS}$$

COMBAT LOITER

Combat Loiter is used to describe the AC-130A mission segments of search, target acquisition, and attack. Combat Loiter differs from Maximum Endurance in that Loiter airspeeds and atitudes will not give optimum conditions for endurance. Also, the combat loiter mission segment is often flown with partial flap settings. This part of the appendix includes charts for determining Gunship time at combat loiter as a function of airspeed, altitude and flap settings.

Example:

Pressure Altitude = 10,000 ft. std. day

Begin Loiter Gross Weight = 110,000 lb.

Drag Index = +70

True Airspeed - Knots = 160 KTS

Flaps Up

Find:

Loiter Time on Station for 20,000 lb. of fuel

Procedure:

Determine the approximate Average Loiter Weight

GW_{ave} = GW -1/2 (fuel to loiter) = 110,000 lb -1/2 (20,000 lb.)

GW_{ave} = 100,000 lb

The specific endurance is found by entering figure A6-21 of this manual with a true velocity of 160 kts and an average gross weight of 100,000 lb. (interpolate when necessary).

Specific Endurance = 19.1 min/1000 lb.

Combat loiter specific endurance variant is determined by interpolating between the drag indexes of 60 and 80 for 70. (Figure A6-24.)

Specific Endurance Variant = 17.80 min/1,000 lb.

Loiter Time on Station

Time = Fuel X (Specific Endurance Variant)

$$\text{Time} = 20{,}000 \text{ lb.} \times \left(\frac{17.80 \text{ min.}}{1{,}000 \text{ lb.}}\right) \times \frac{\text{hr.}}{60 \text{ min}}$$

Time = 5.94 hours

CHART DESCRIPTION.

Endurance data for all engines operating are shown on figure A6-2 with normal bleed, and on figure A6-4 with all bleed systems operating. Normal bleed condition data for three and two engines operating, respectively, are shown on figures A6-5 and A6-7 Torque values for maximum endurance may be derived through the procedure in Part 2, using figures A2-2 and A2-1. Figure A2-2 is entered first with the endurance parameters to obtain TIT, which then may be entered on figure A2-1 to obtain four-engine normal bleed torque. Torque values for three- and two-engine endurance are found by using the same procedure, entering figure A2-2 with the appropriate flight conditions and the fuel flow from the three-engine or the two-engine endurance charts. Torque values obtained by this process should be increased by 150 inch-pounds for three-engine conditions and 600 inch-pounds for two-engine conditions.

To find the endurance for the variant configuration, determine the values for the basic configuration. Enter figures A6-3, A6-6, A6-9, A6-11, A6-13, A6-15 and A6-16 thru A6-18 with these values and read the variant configuration for the given drag level.

Example.

GIVEN:

Pressure altitude: 20,000 feet.

Begin holding weight: 90,000 pounds.

Holding time: One hour.

OAT: Standard plus 10° C.

Drag Index +0

Find:

Holding speed.

Fuel used.

Procedure:

The first step is to determine the approximate average holding weight. This weight is found by entering figure A6-2 with 20,000 feet altitude and 90,000 pounds holding weight, and reading a fuel flow of 670 pounds per hour per engine for an OAT of standard plus 10° C. By using this fuel flow in the following equation, the average holding weight is found.

$$\text{Avg Hold Wt} = \text{Begin Hold Wt} - \frac{(\text{No. Operating Eng} \times \text{Fuel Flow} \times \text{Hold Time})}{2}$$

$$= 90{,}000 - \frac{(4 \times 670 \times 1)}{2}$$

$$= 88{,}660 \text{ pounds}$$

This average holding weight is used to find the airspeed and fuel flow for the approximate average holding weight. Enter figure A6-2 with 88,660, and read 121 knots CAS and 660 pounds per hour per engine fuel flow. The fuel used will be:

$$\text{Fuel Used} = \text{No. Operating Eng} \times \text{Fuel Flow} \times \text{Hold Time}$$

$$= 4 \times 660 \times 1$$

$$= 2{,}640 \text{ pounds}$$

EFFECT OF BANK ANGLE ON ENDURANCE

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

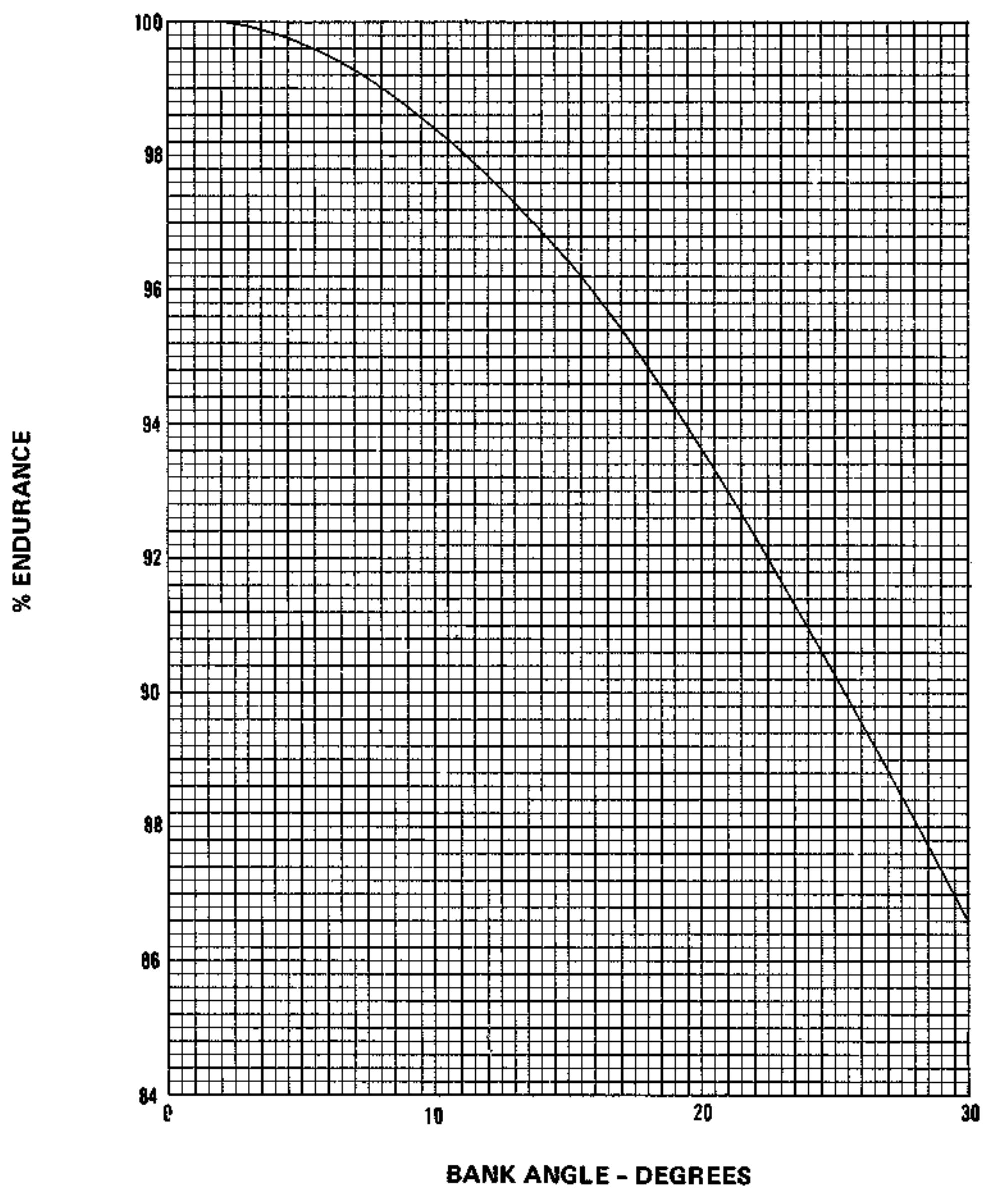


Figure A6-1

MAXIMUM ENDURANCE

4 ENGINES NORMAL BLEED

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

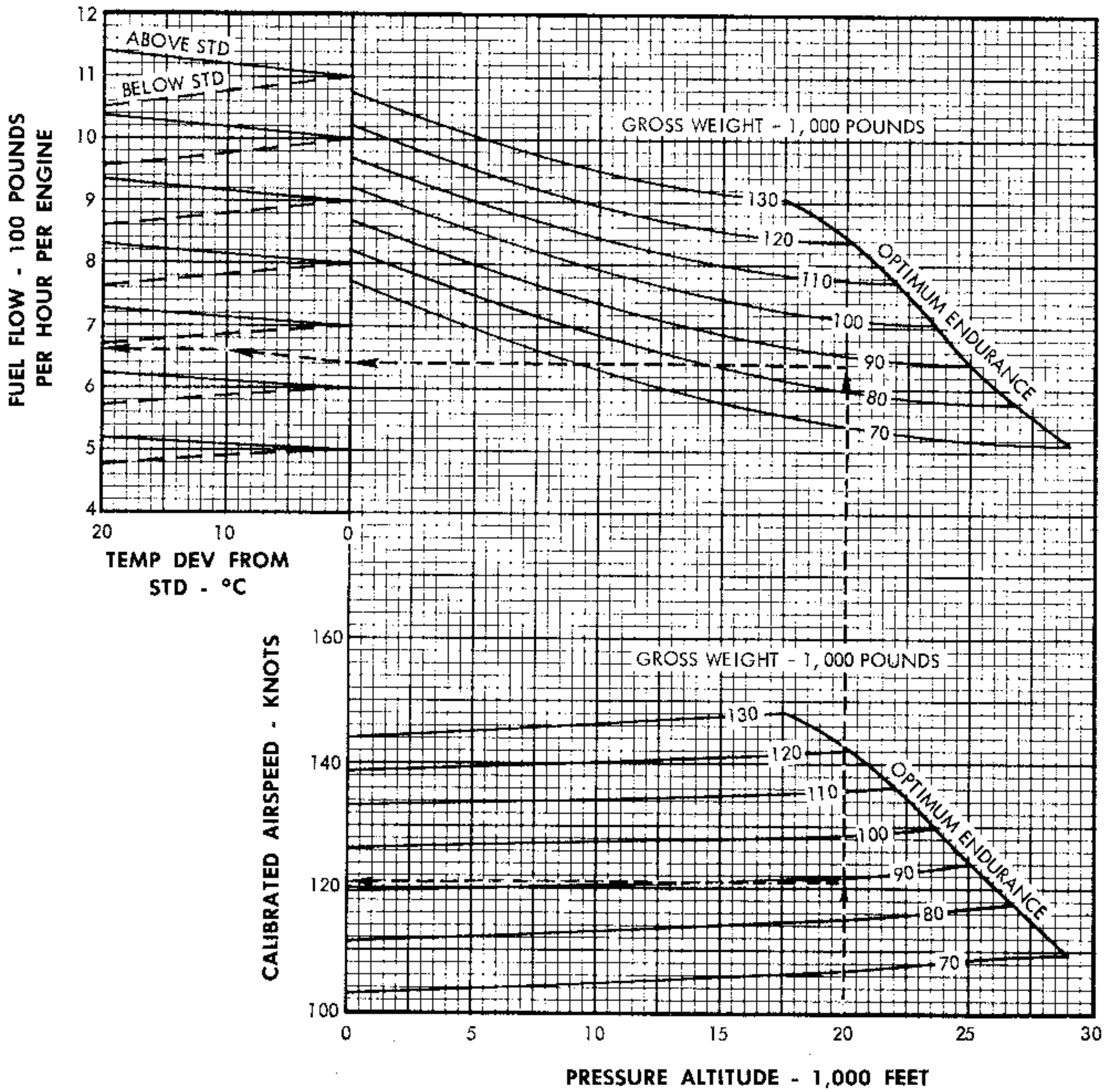


Figure A6-2

FUEL FLOW AT MAXIMUM ENDURANCE FOR VARIANT CONFIGURATION

4 ENGINES **ALL ALTITUDES**

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

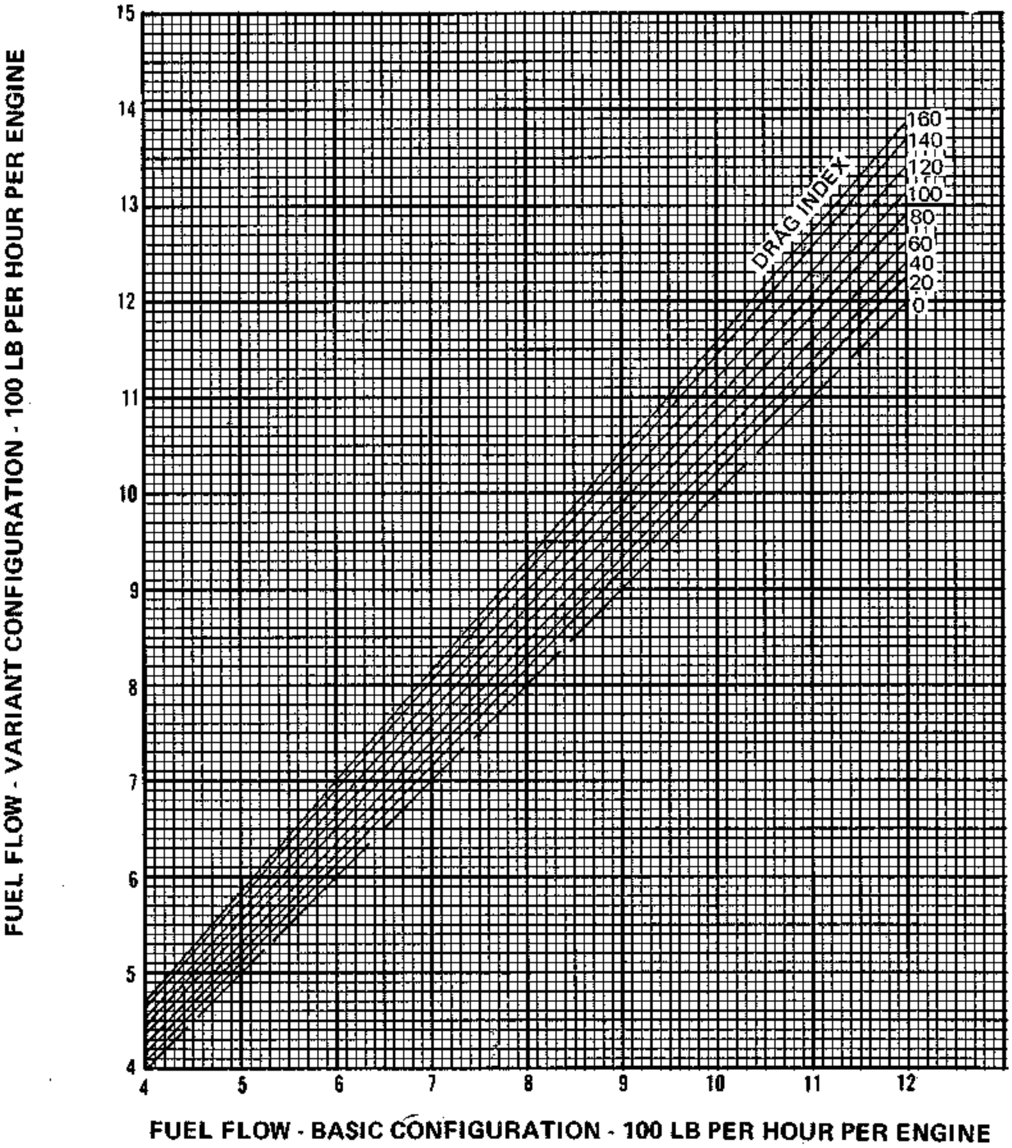


Figure A6-3

MAXIMUM ENDURANCE

4 ENGINES ALL BLEED ON

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

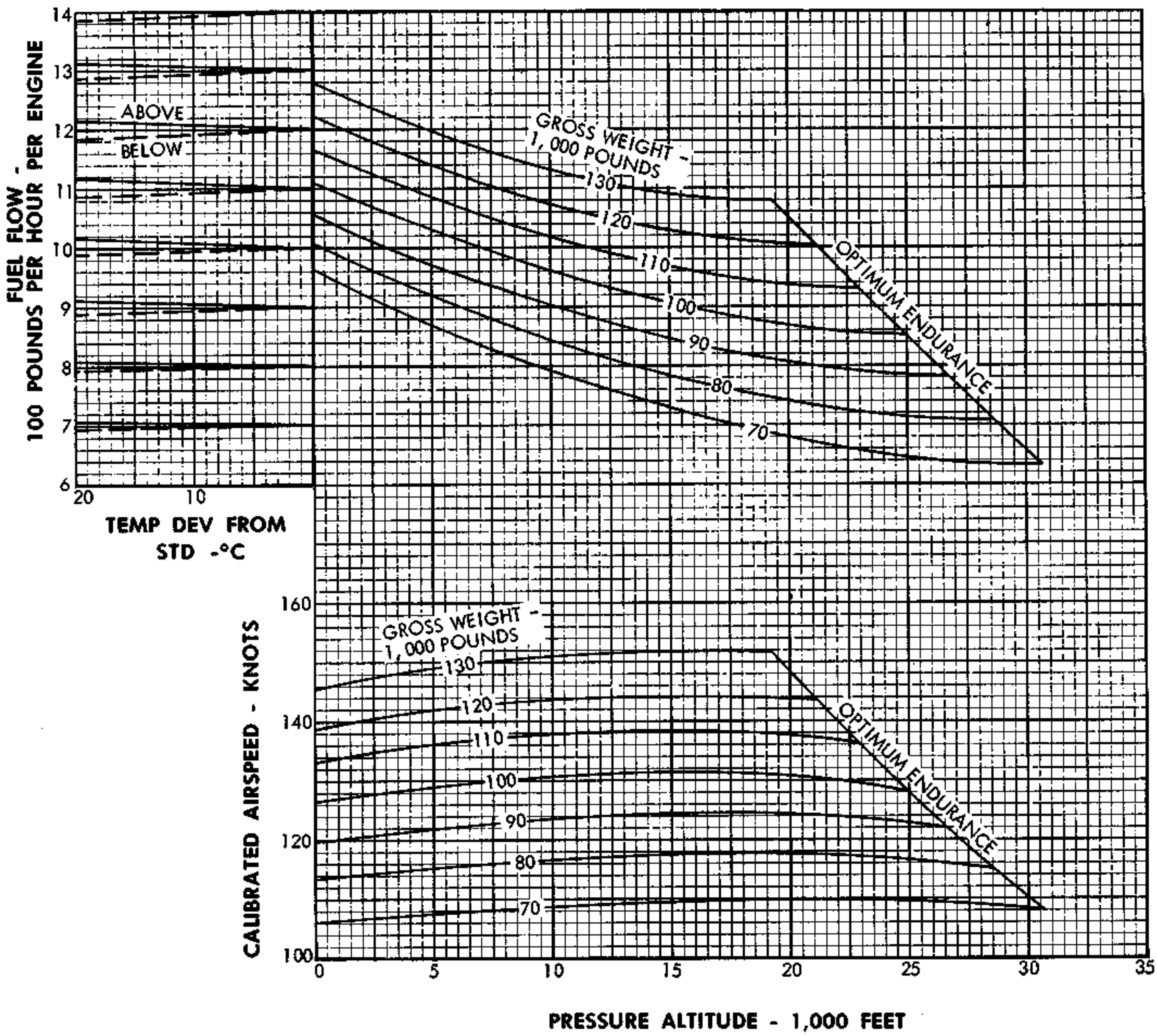


Figure A6-4.

MAXIMUM ENDURANCE

3 ENGINES NORMAL BLEED

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

Propeller feathered on inoperative engine.

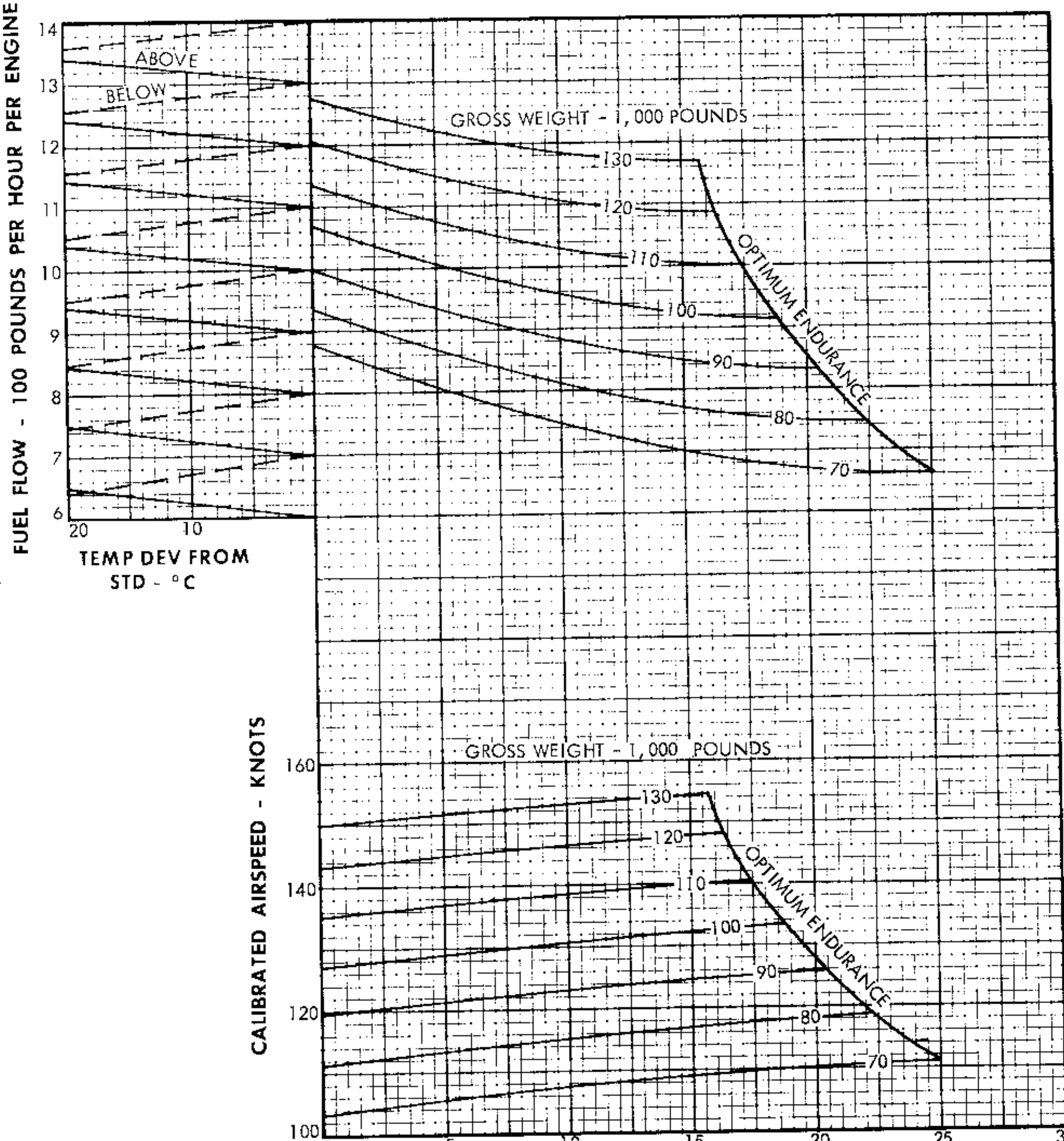


Figure A6-5.

FUEL FLOW AT MAXIMUM ENDURANCE FOR VARIANT CONFIGURATION

3 ENGINES **ALL ALTITUDES**

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine

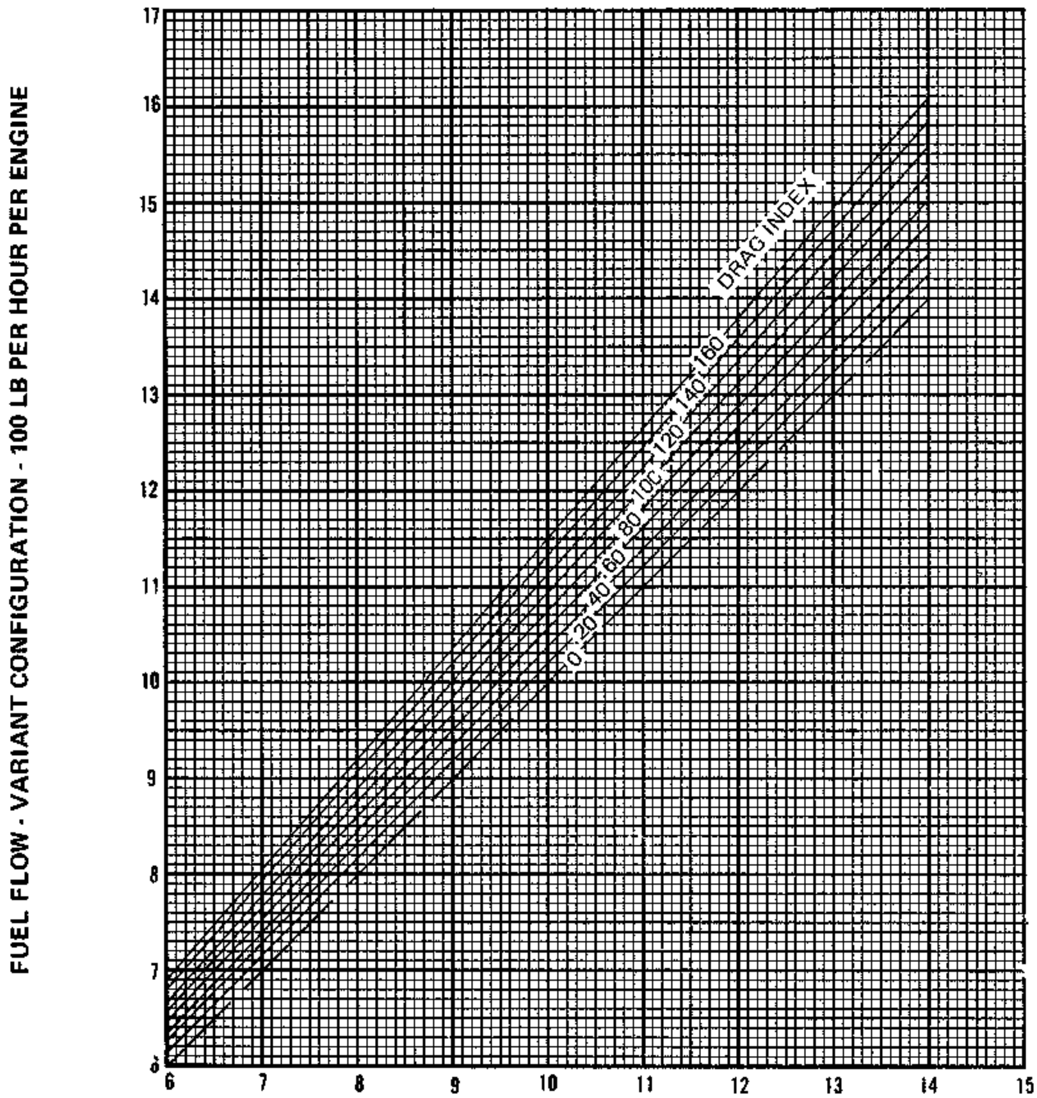


Figure A6-6.

MAXIMUM ENDURANCE

2 ENGINES NORMAL BLEED

ASYMMETRICAL POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engines.

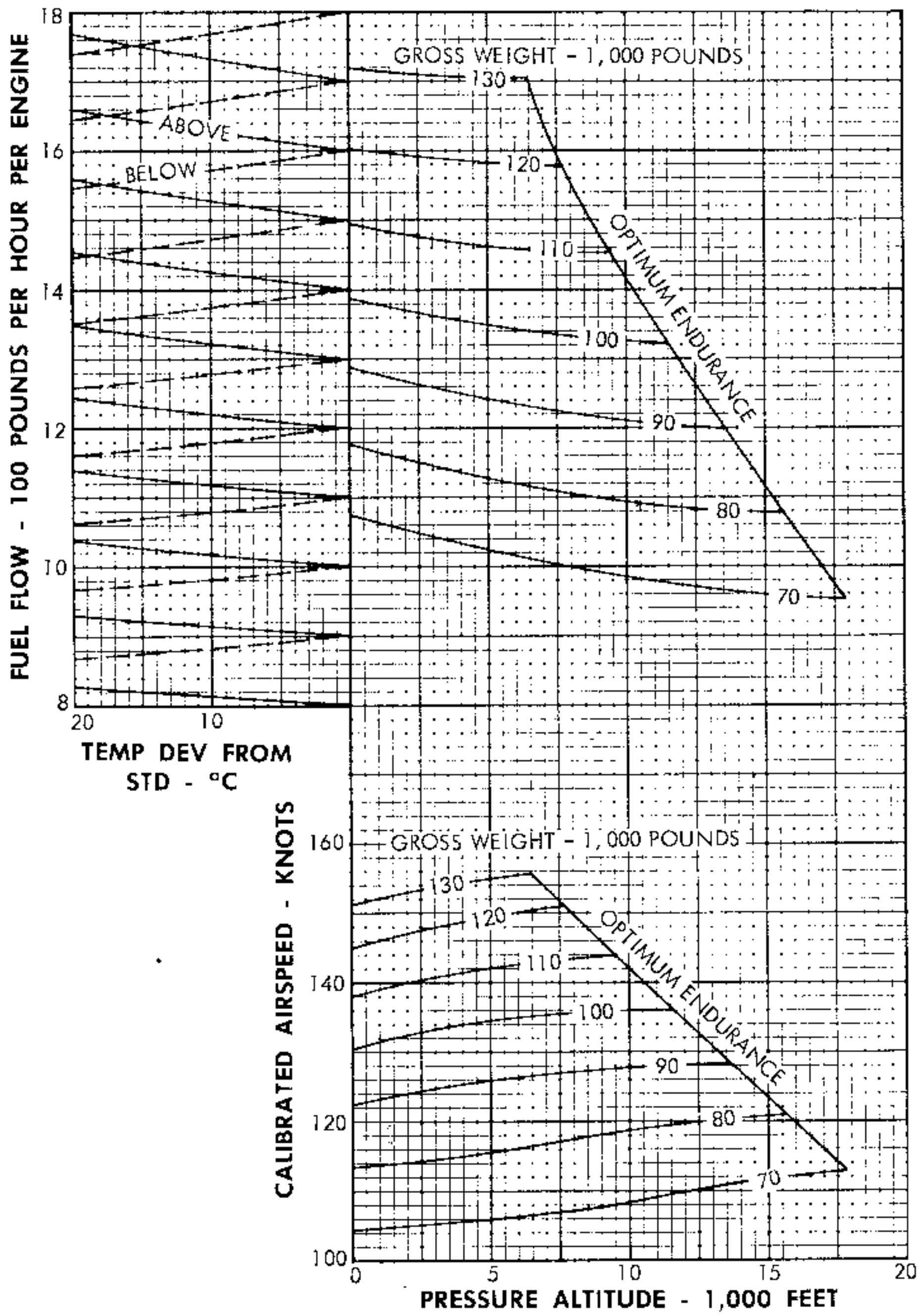


Figure A6-7.

MAXIMUM ENDURANCE

2 ENGINES

SYMMETRICAL POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE
Propellers feathered on inoperative engines.

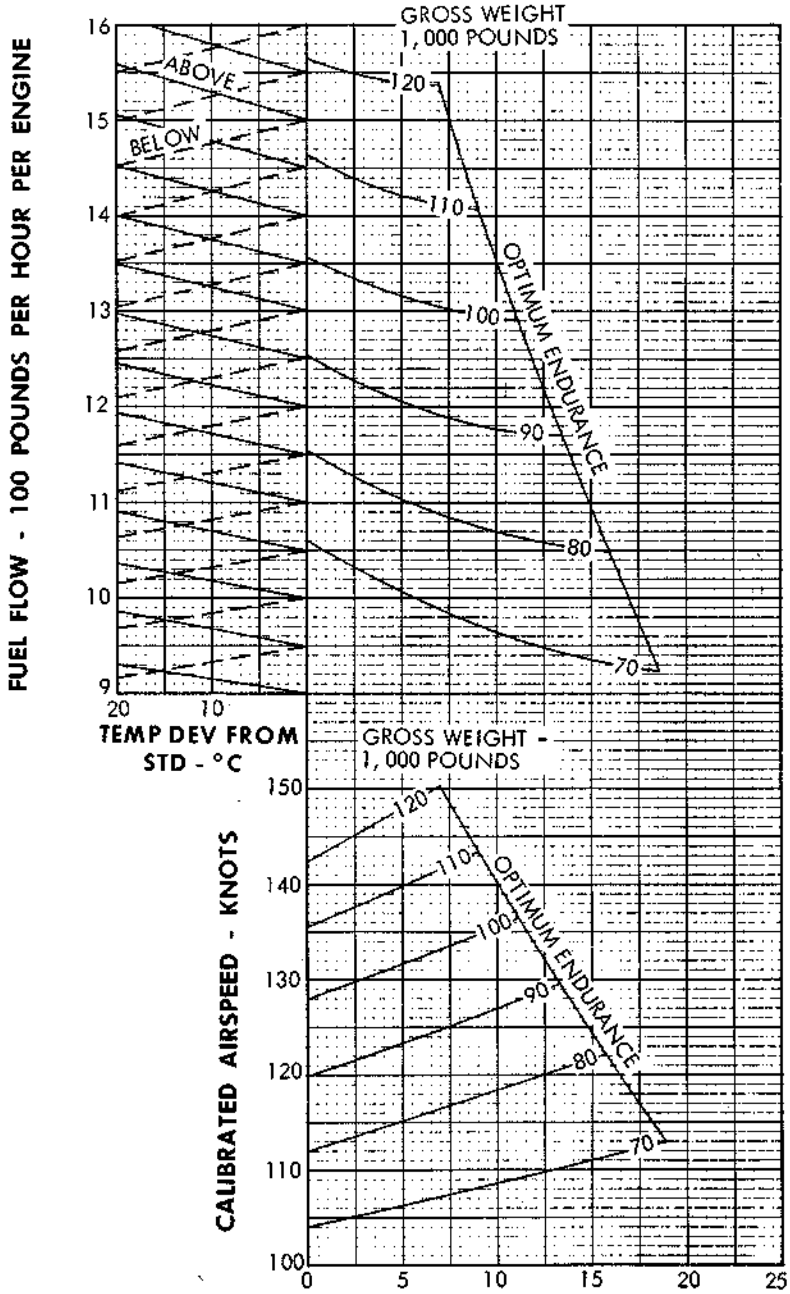


Figure A6-8.

FUEL FLOW AT MAXIMUM ENDURANCE FOR VARIANT CONFIGURATION

ASYMMETRICAL AND SYMMETRICAL POWER

2 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES
DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine

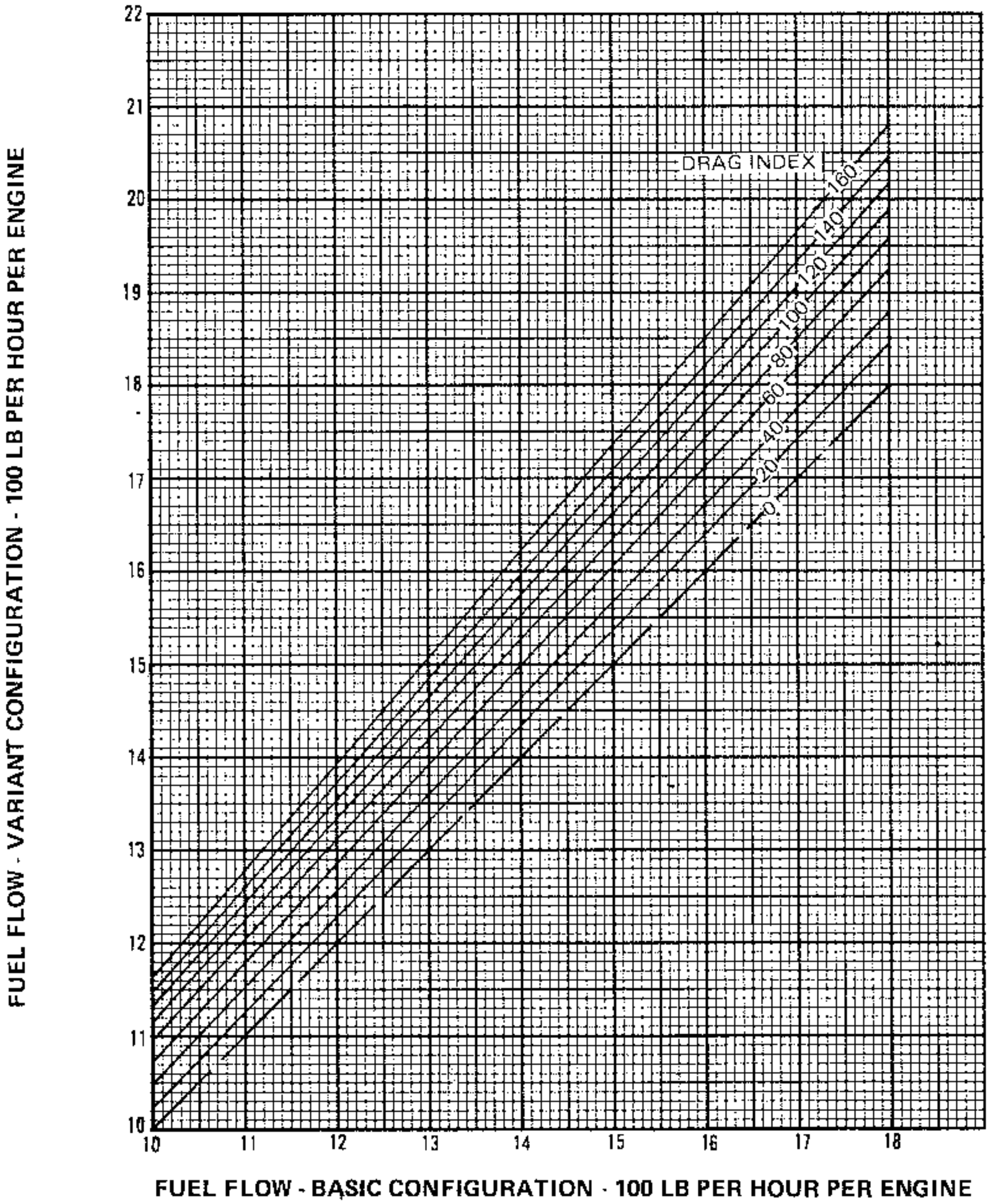


Figure A6-9.

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

SPECIFIC ENDURANCE FOR MAXIMUM ENDURANCE

4 ENGINES GEAR UP

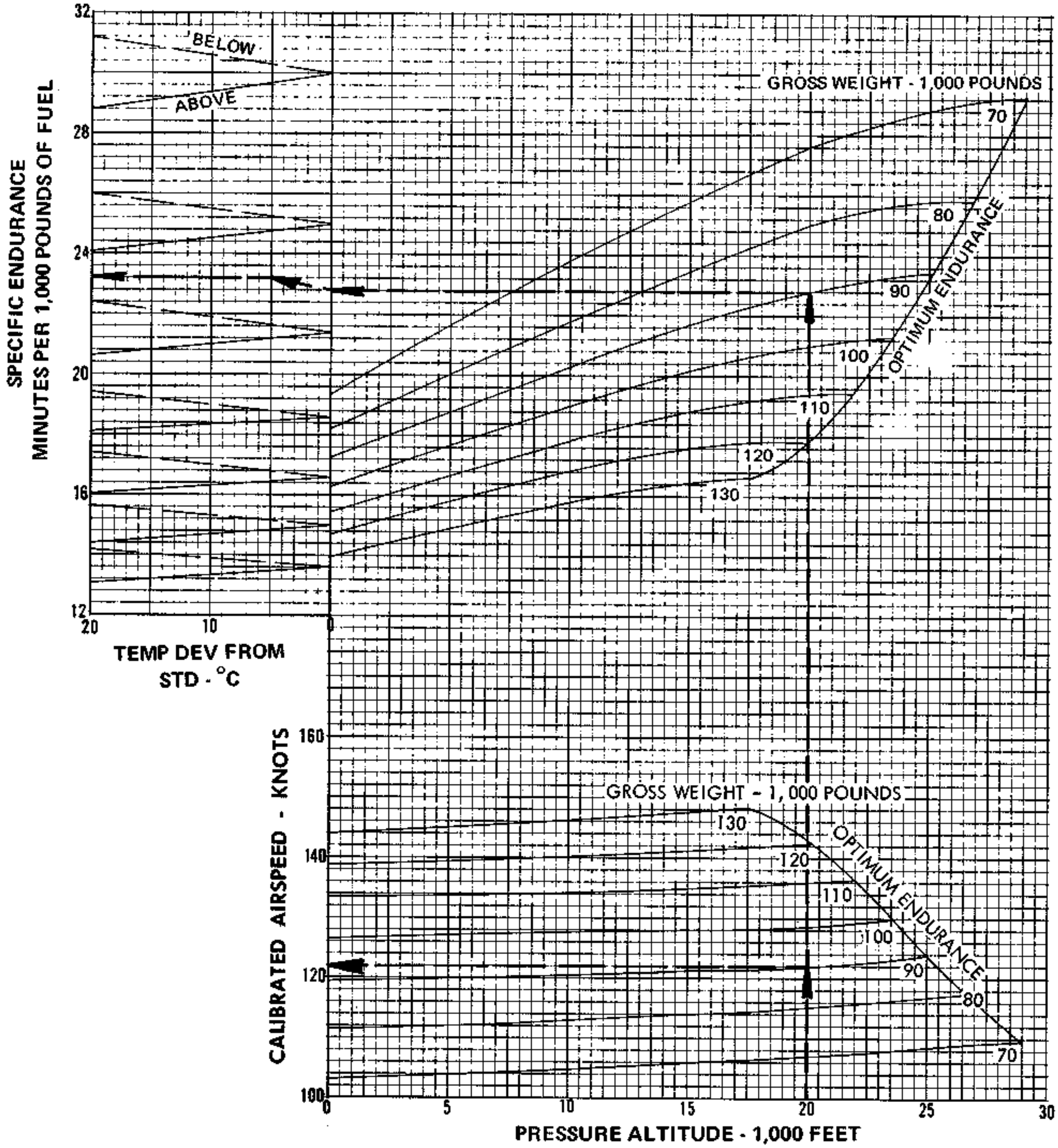


Figure A6-10.

SPECIFIC ENDURANCE FOR VARIANT CONFIGURATION FOR MAXIMUM ENDURANCE

4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

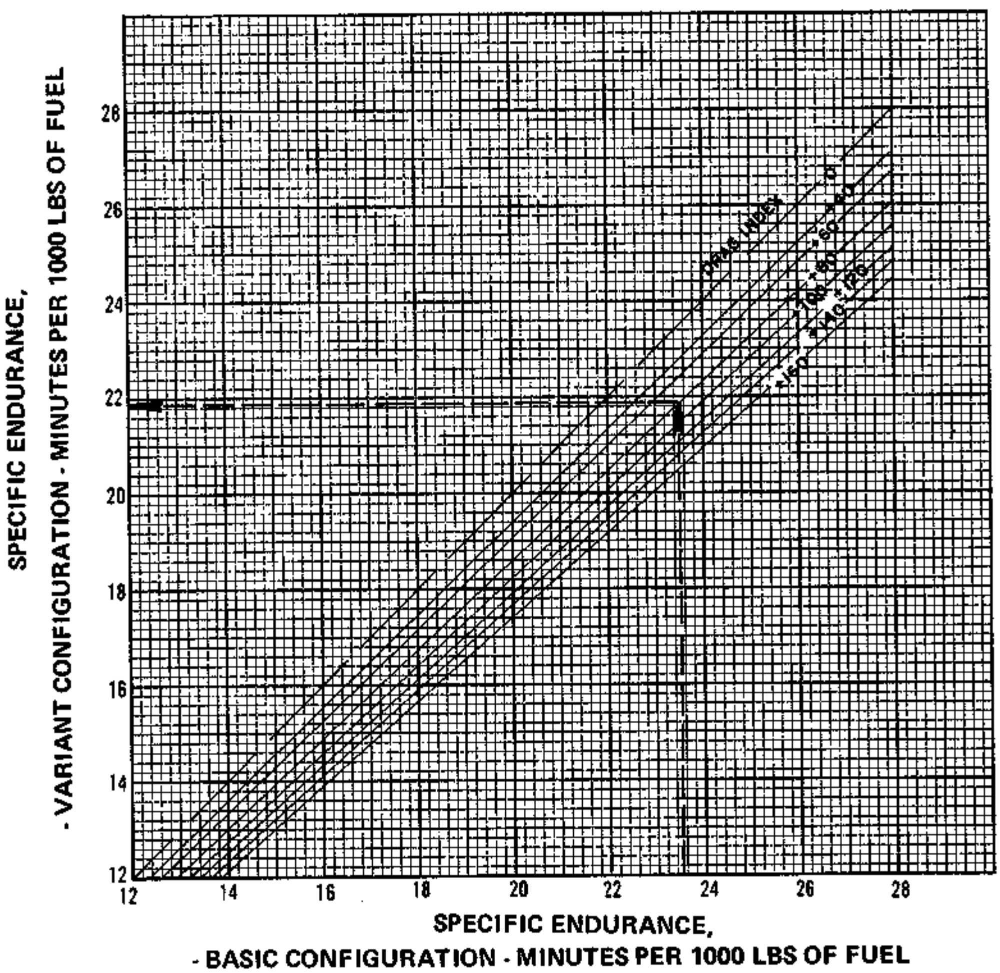


Figure A6-11.

MODEL: AC-130A
T56-A-9 ENGINES

SPECIFIC ENDURANCE FOR MAXIMUM ENDURANCE

3 ENGINES GEAR UP

NOTE

Propeller feathered on inoperative engine.

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

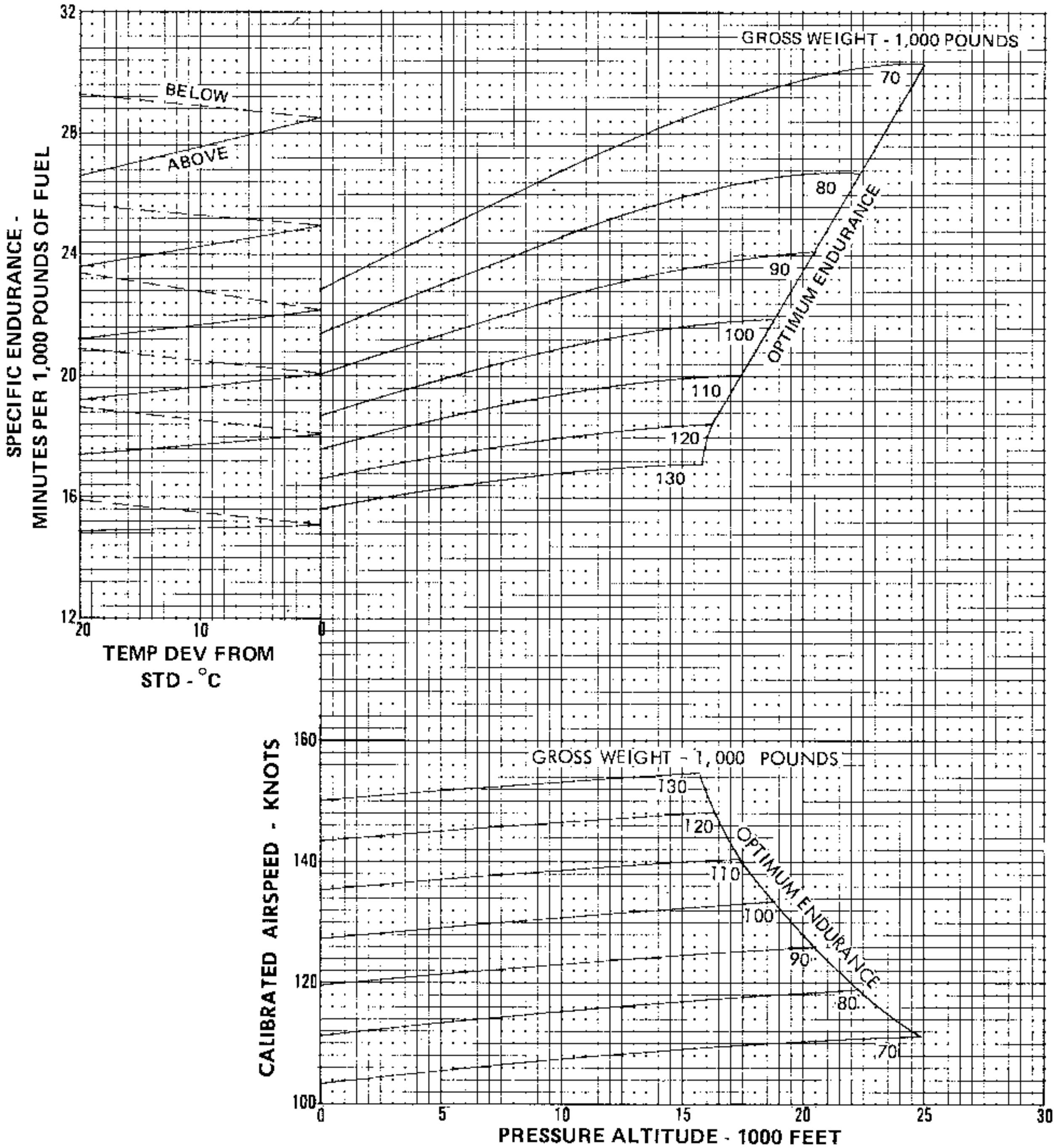


Figure A6-12.

SPECIFIC ENDURANCE FOR VARIANT CONFIGURATION FOR MAXIMUM ENDURANCE

3 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

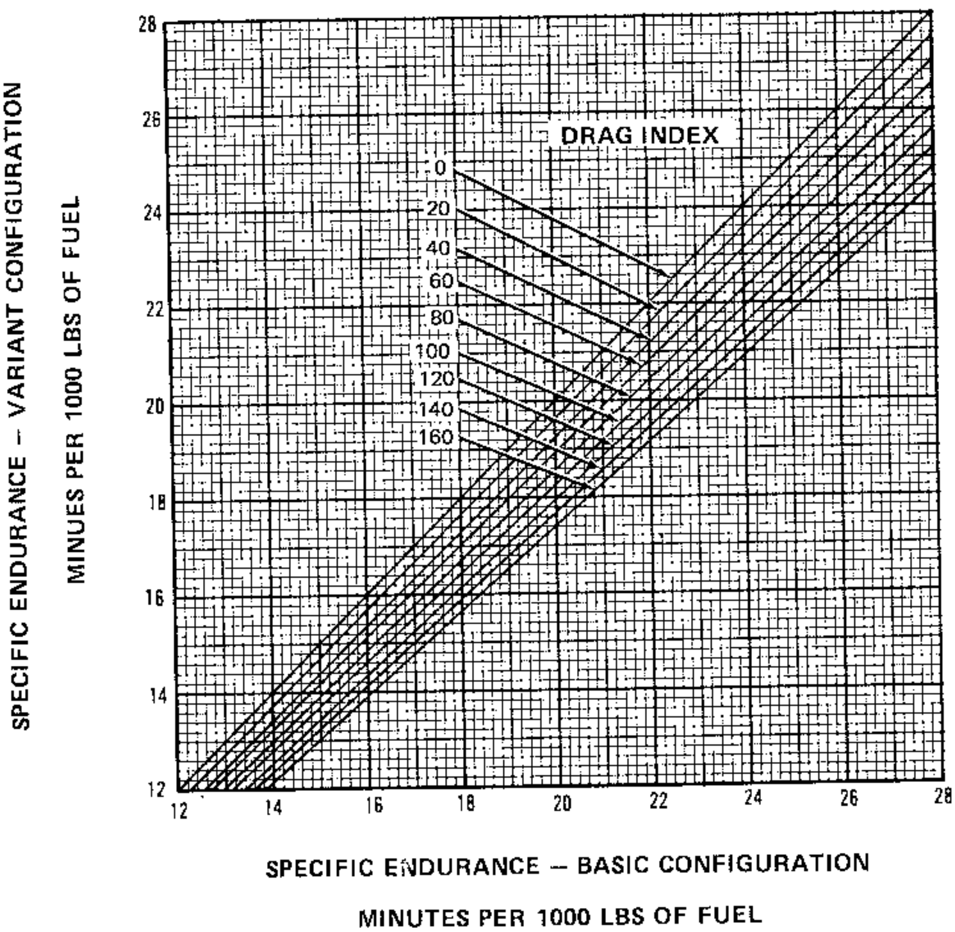


Figure A6-13.

SPECIFIC ENDURANCE FOR MAXIMUM ENDURANCE

2 ENGINES GEAR UP

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engines.

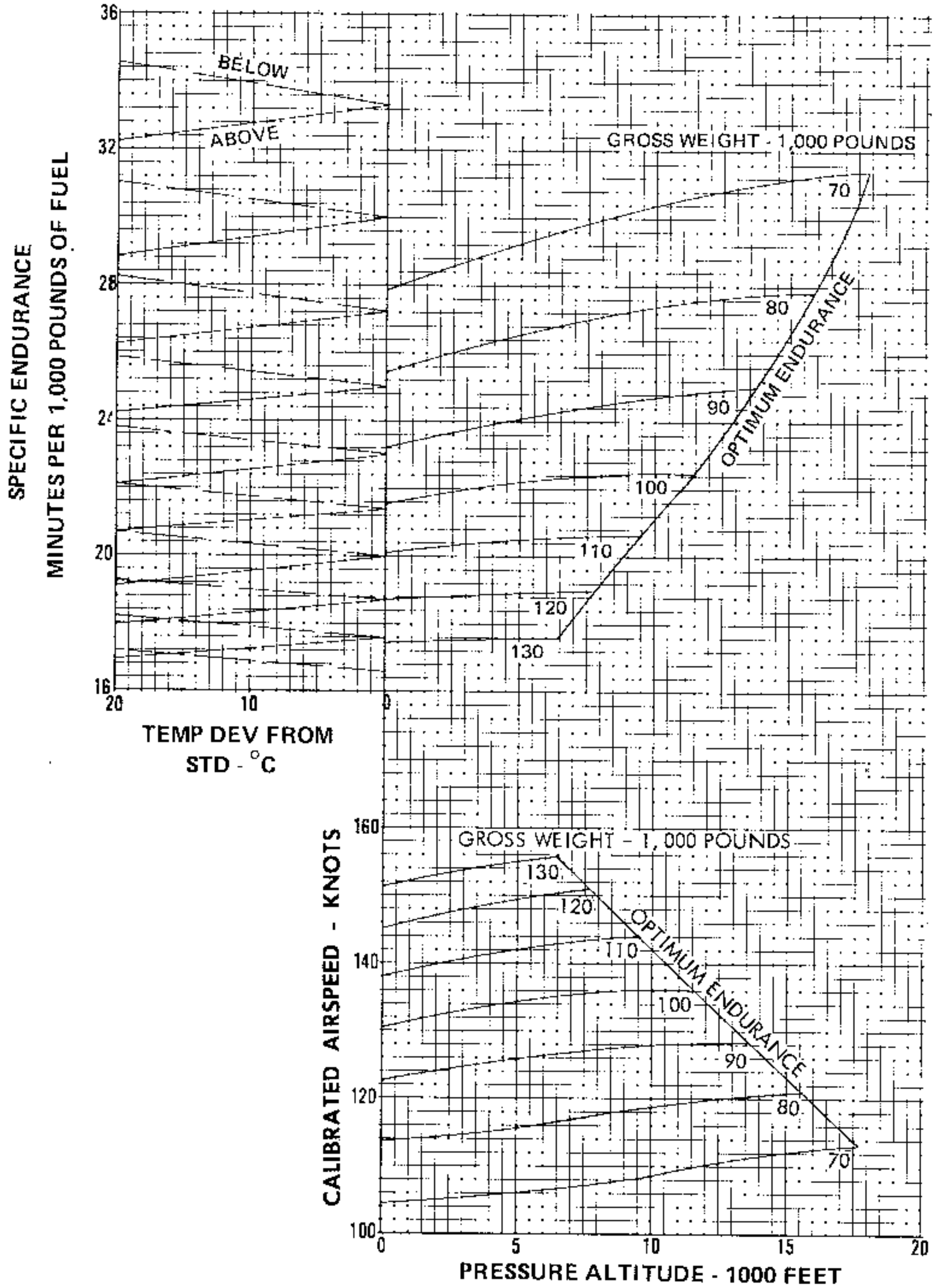


Figure A6-14.

SPECIFIC ENDURANCE FOR VARIANT CONFIGURATION FOR MAXIMUM ENDURANCE

2 ENGINES
ASYMMETRICAL POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

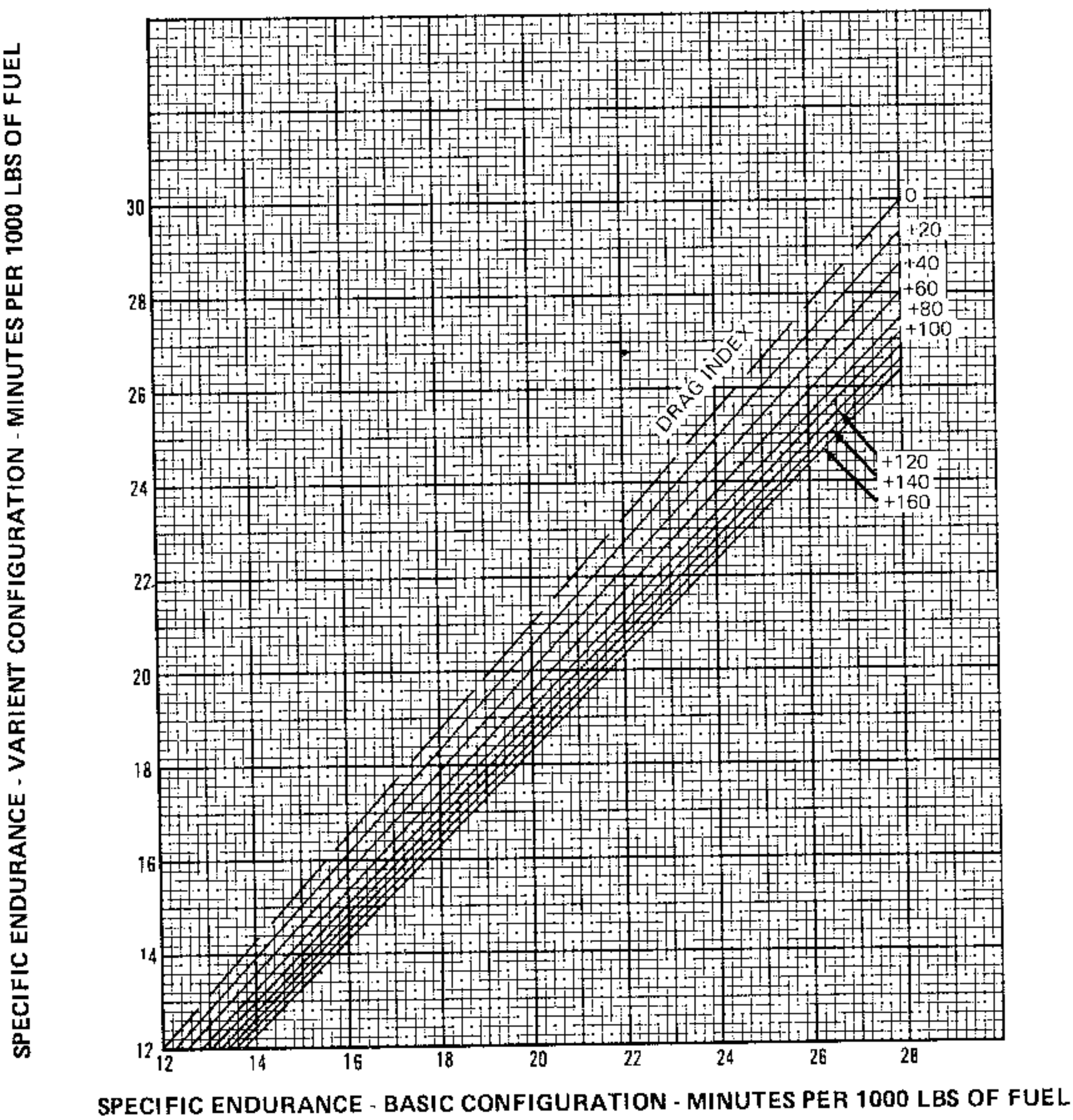


Figure A6-15.

TRUE AIRSPEED AT MAXIMUM ENDURANCE FOR VARIANT CONFIGURATION

4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE
Temperature effect is negligible.

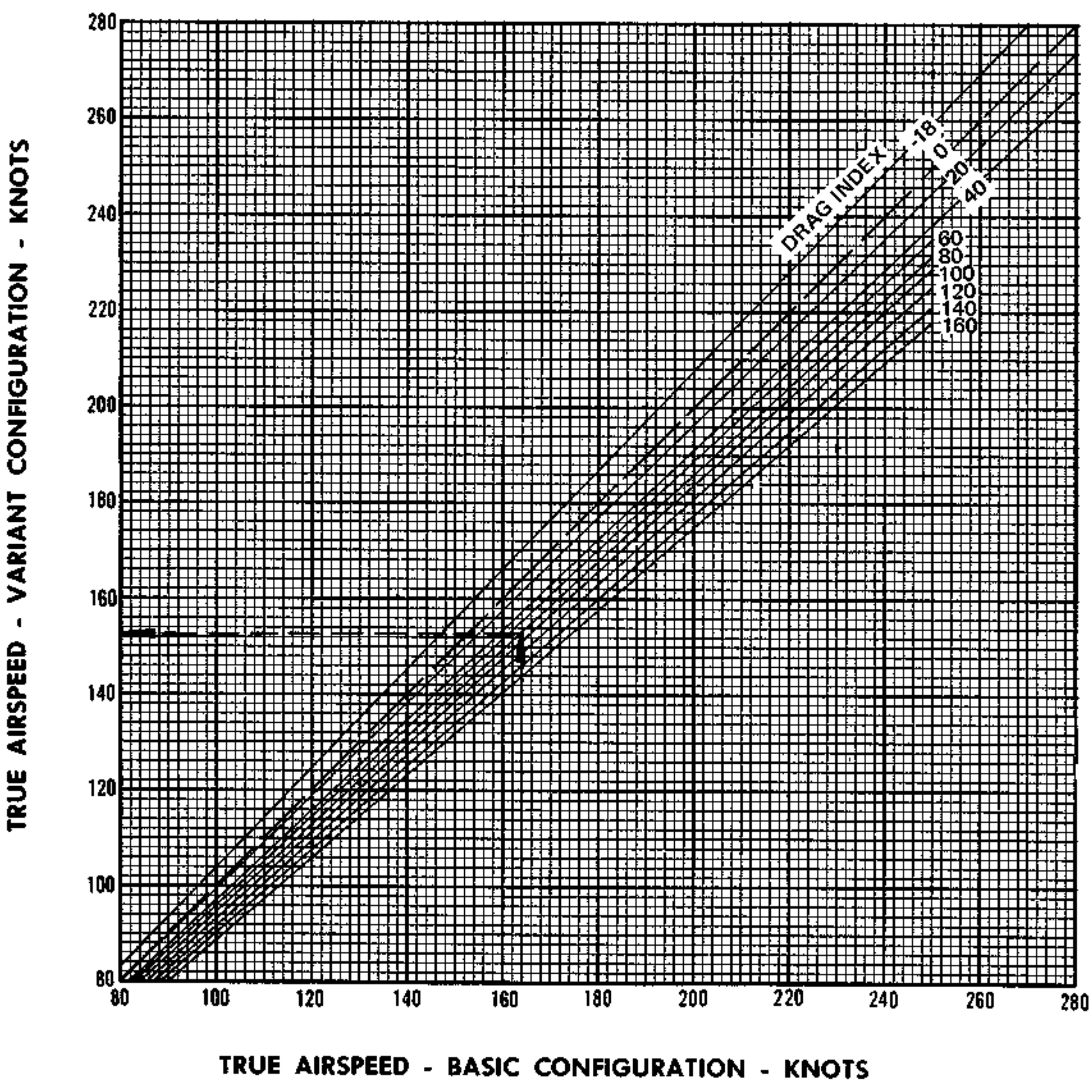


Figure A6-16.

TRUE AIRSPEED AT MAXIMUM ENDURANCE FOR VARIANT CONFIGURATION
3 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engine.
2. Temperature effect is negligible

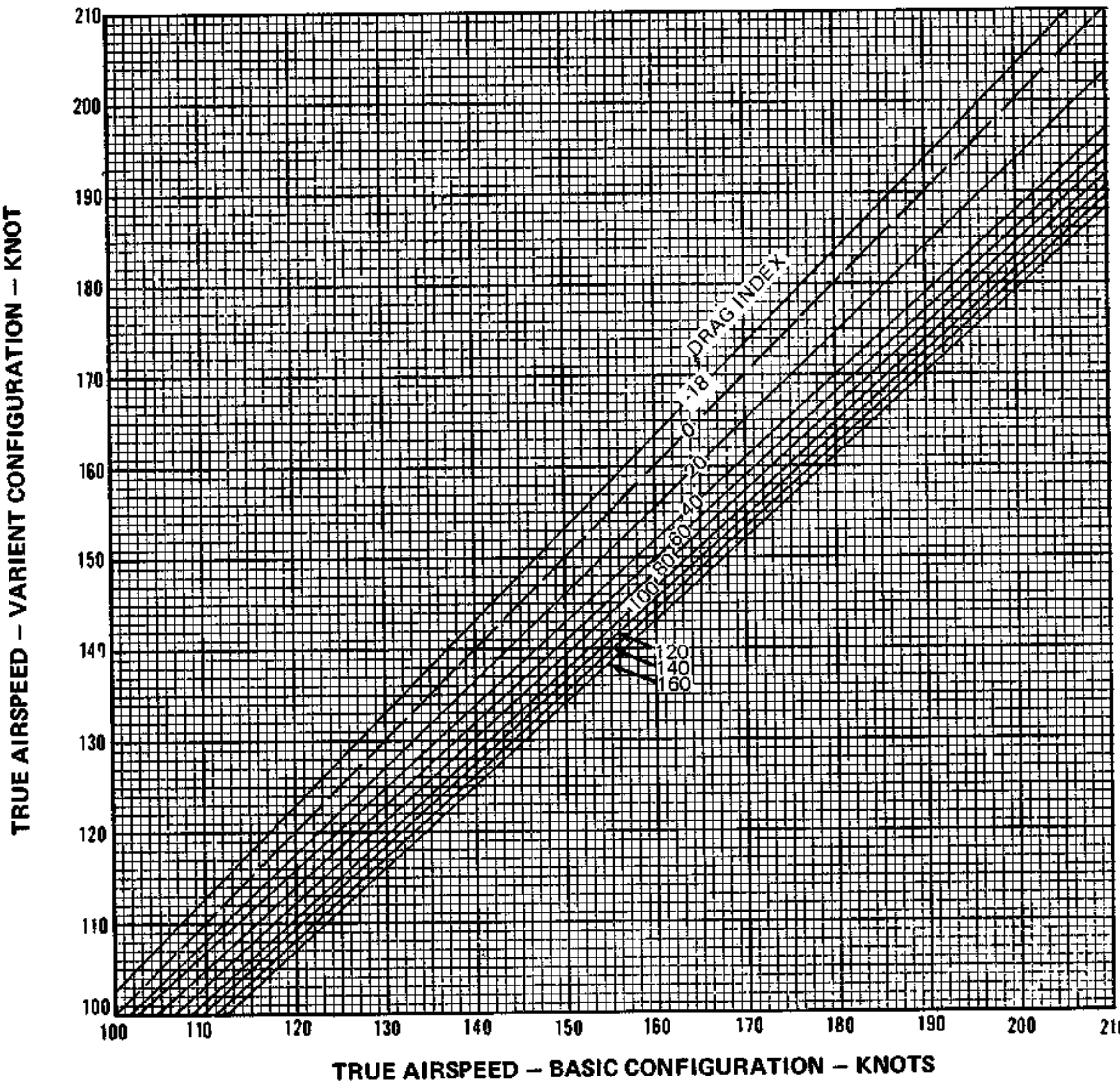


Figure A6-17.

TRUE AIRSPEED AT MAXIMUM ENDURANCE FOR VARIANT CONFIGURATION

2 ENGINES ASYMMETRICAL POWER

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Propeller feathered on inoperative engines
2. Temperature effect is negligible

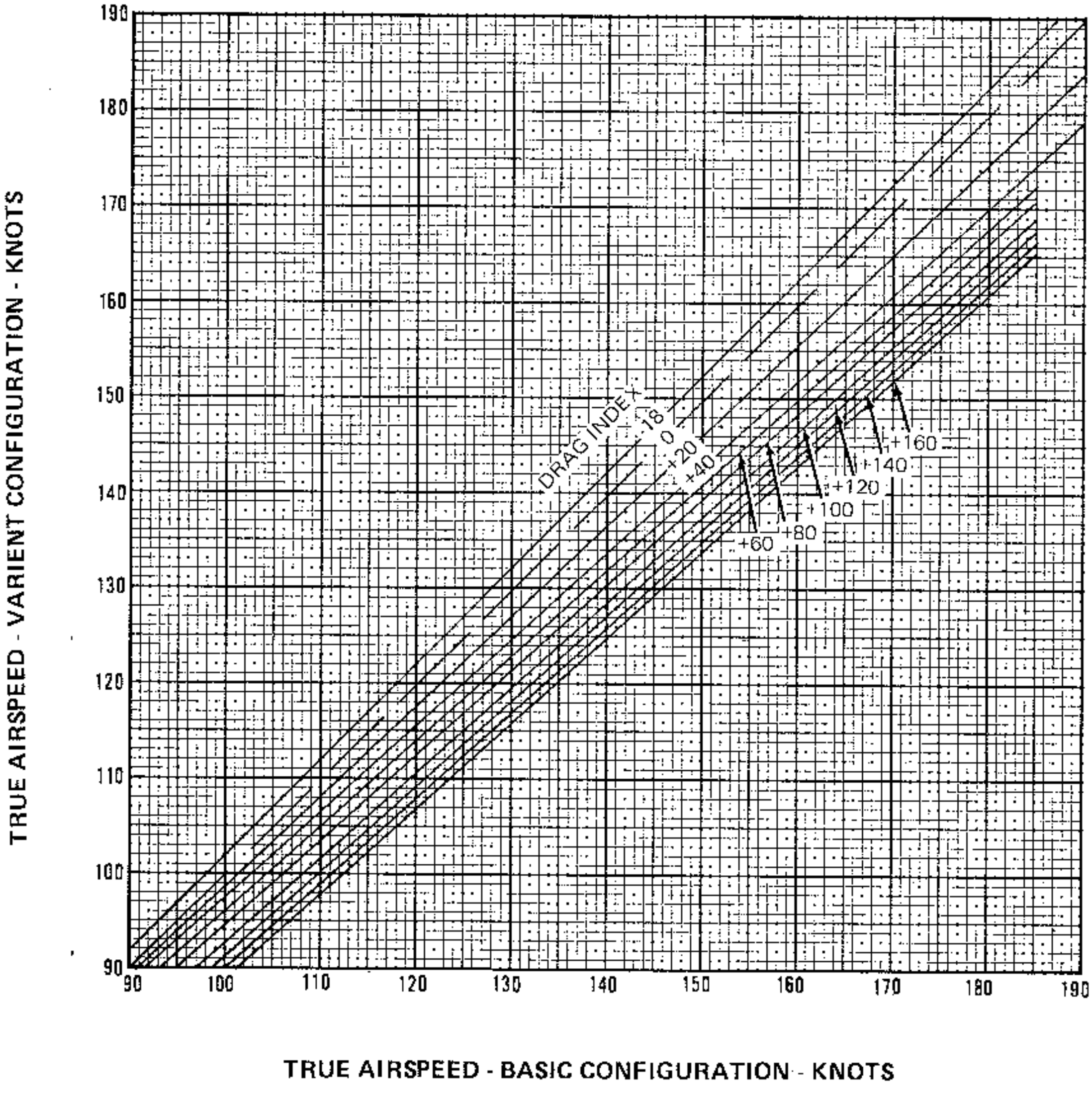


Figure A6-18.

SPECIFIC ENDURANCE
COMBAT LOITER

4 ENGINES FLAPS UP

MODEL: AC-130A
T56-A-9 ENGINES

ALTITUDE SEA LEVEL
DRAG INDEX 0

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE 220 KTAS

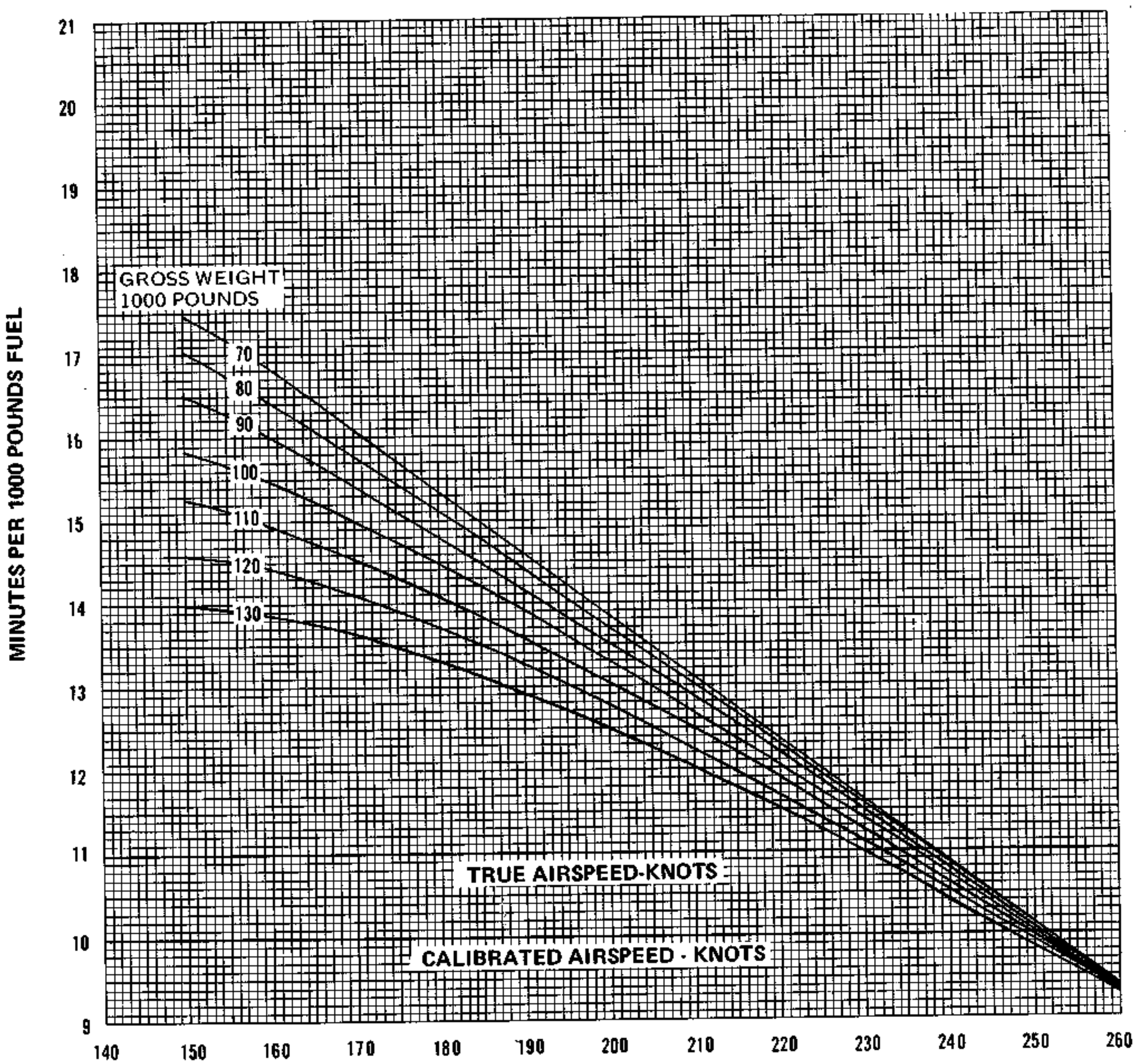


Figure A6-19.

SPECIFIC ENDURANCE
COMBAT LOITER

4 ENGINES FLAPS UP

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE 220 KTAS

ALTITUDE 5000 FT.
DRAG INDEX 0

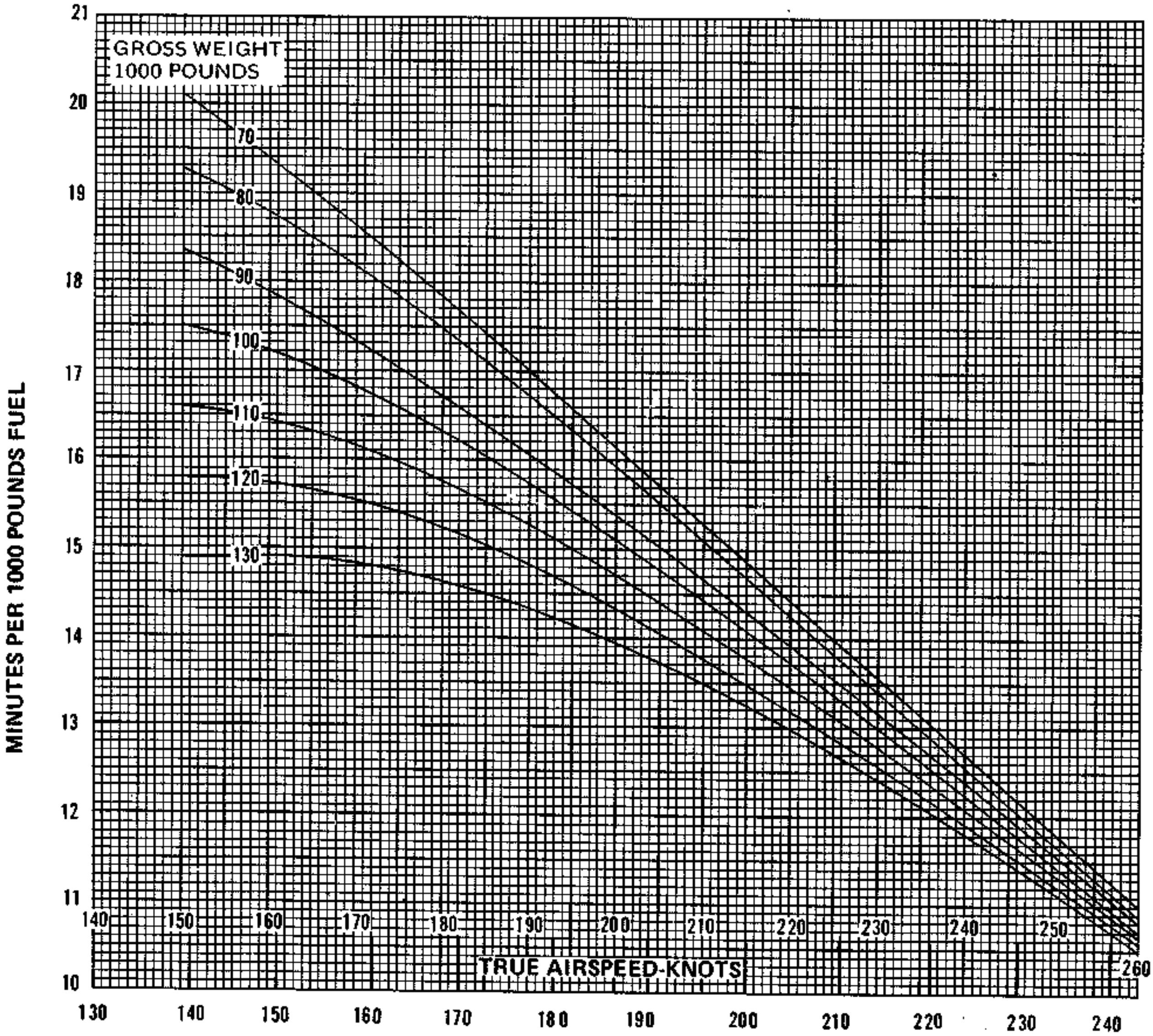


Figure A6-20.

SPECIFIC ENDURANCE COMBAT LOITER

4 ENGINES FLAPS UP

MODEL: AC-130A
T56-A-9 ENGINES

ALTITUDE 10000 FT.
DRAG INDEX 0

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE 220 KTAS

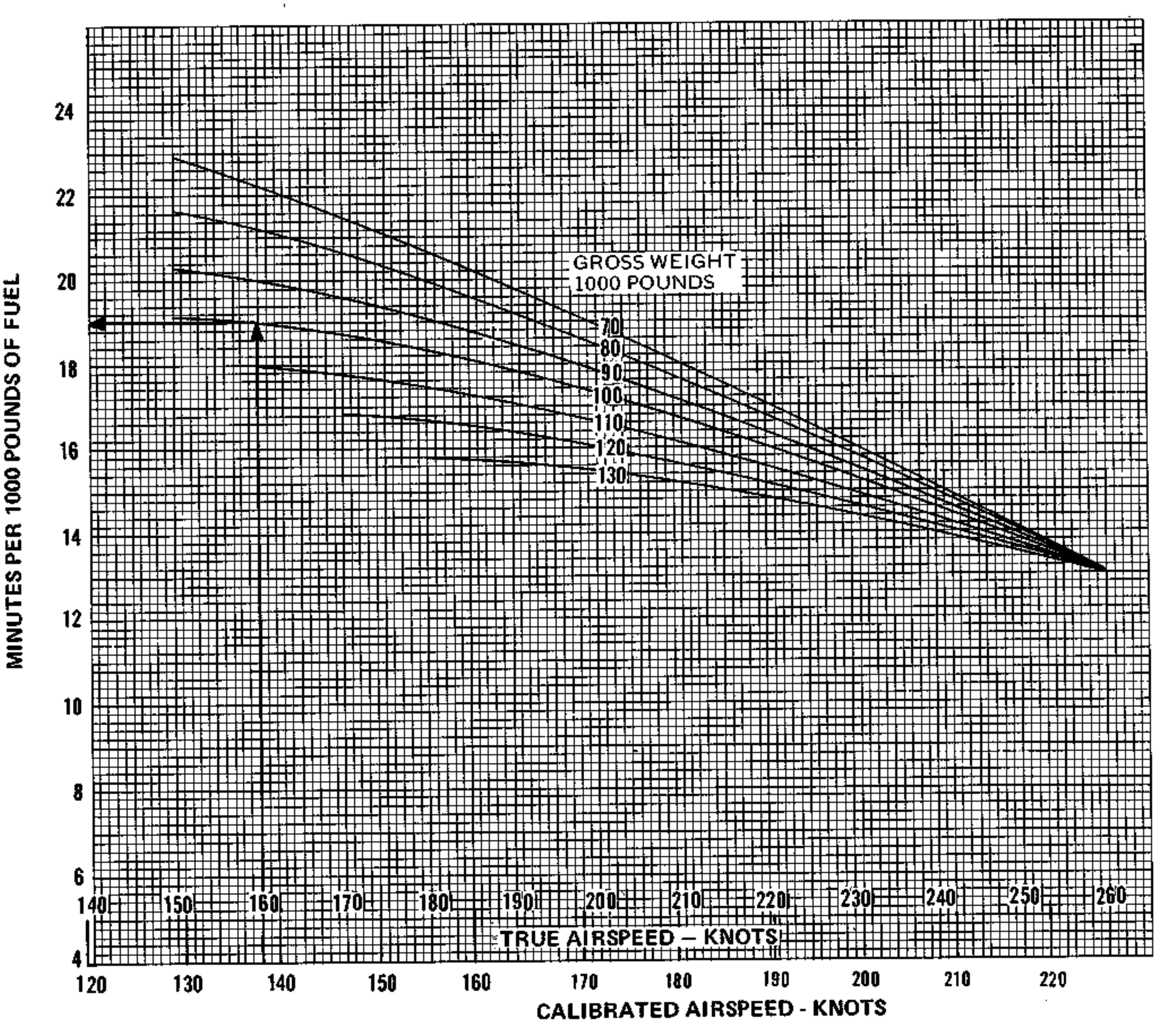


Figure A6-21.

SPECIFIC ENDURANCE
COMBAT LOITER

4 ENGINES FLAPS UP

MODEL: AC-130A
T56-A-9 ENGINES

ALTITUDE 15000 FT.
DRAG INDEX 0

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATES ABOVE 220 KTAS

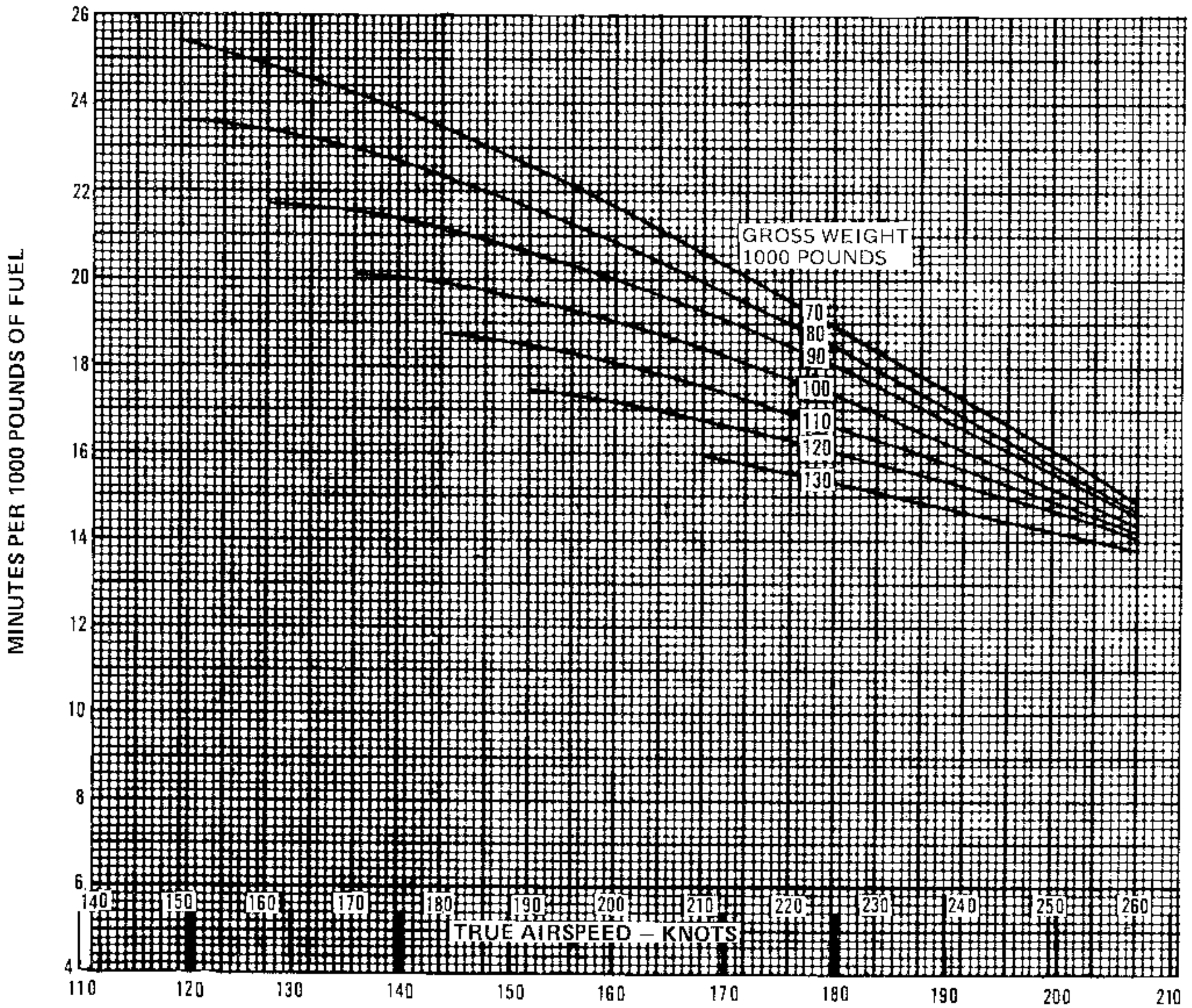


Figure A6-22.

SPECIFIC ENDURANCE
COMBAT LOITER

4 ENGINES FLAPS UP

MODEL: AC-130A
T56-A-9 ENGINES

ALTITUDE 20000 FT.
DRAG INDEX 0

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE 220 KTAS

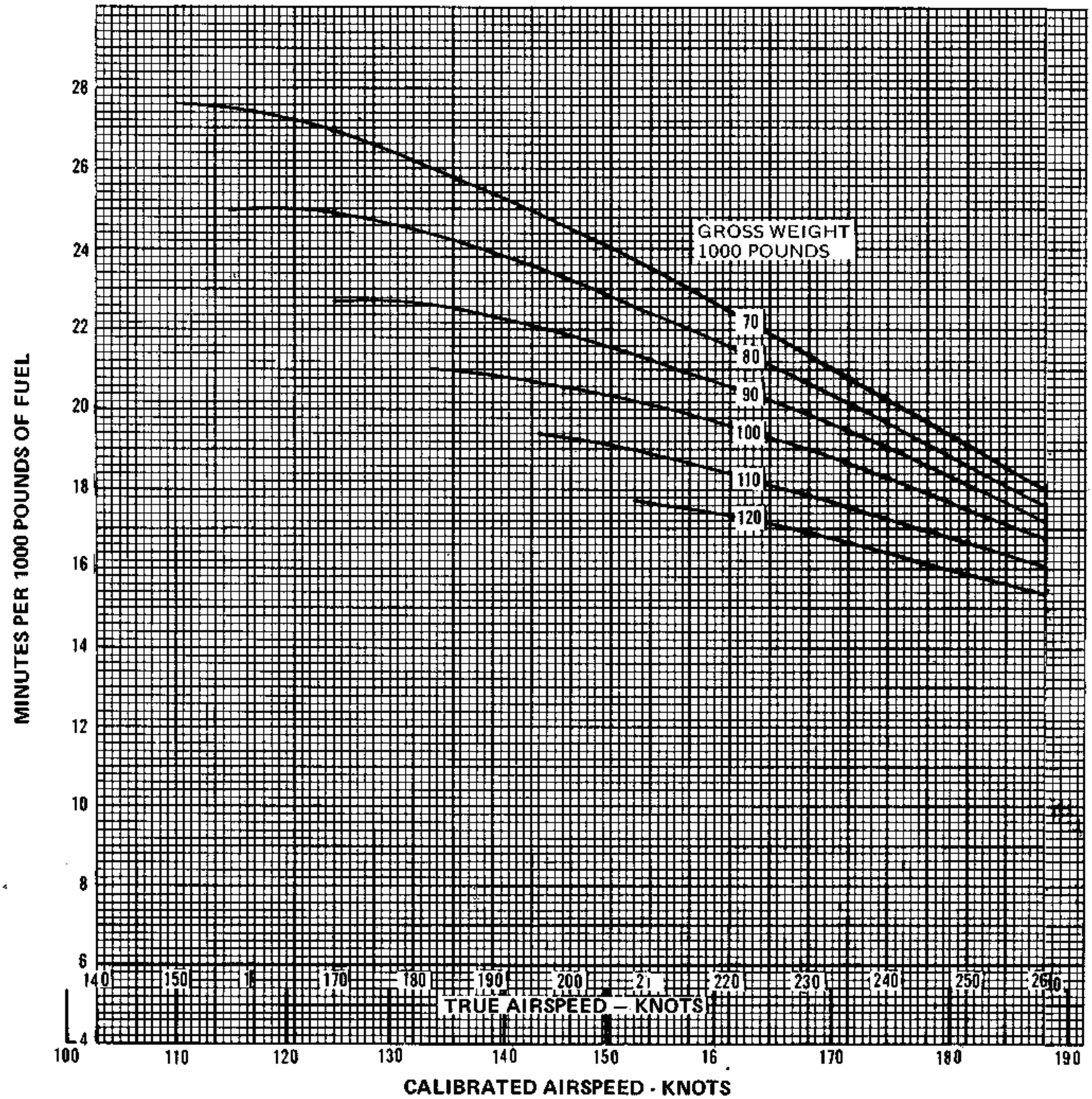


Figure A6-23.

SPECIFIC ENDURANCE - COMBAT LOITER FLAPS UP FOR VARIANT CONFIGURATION

4 ENGINES

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

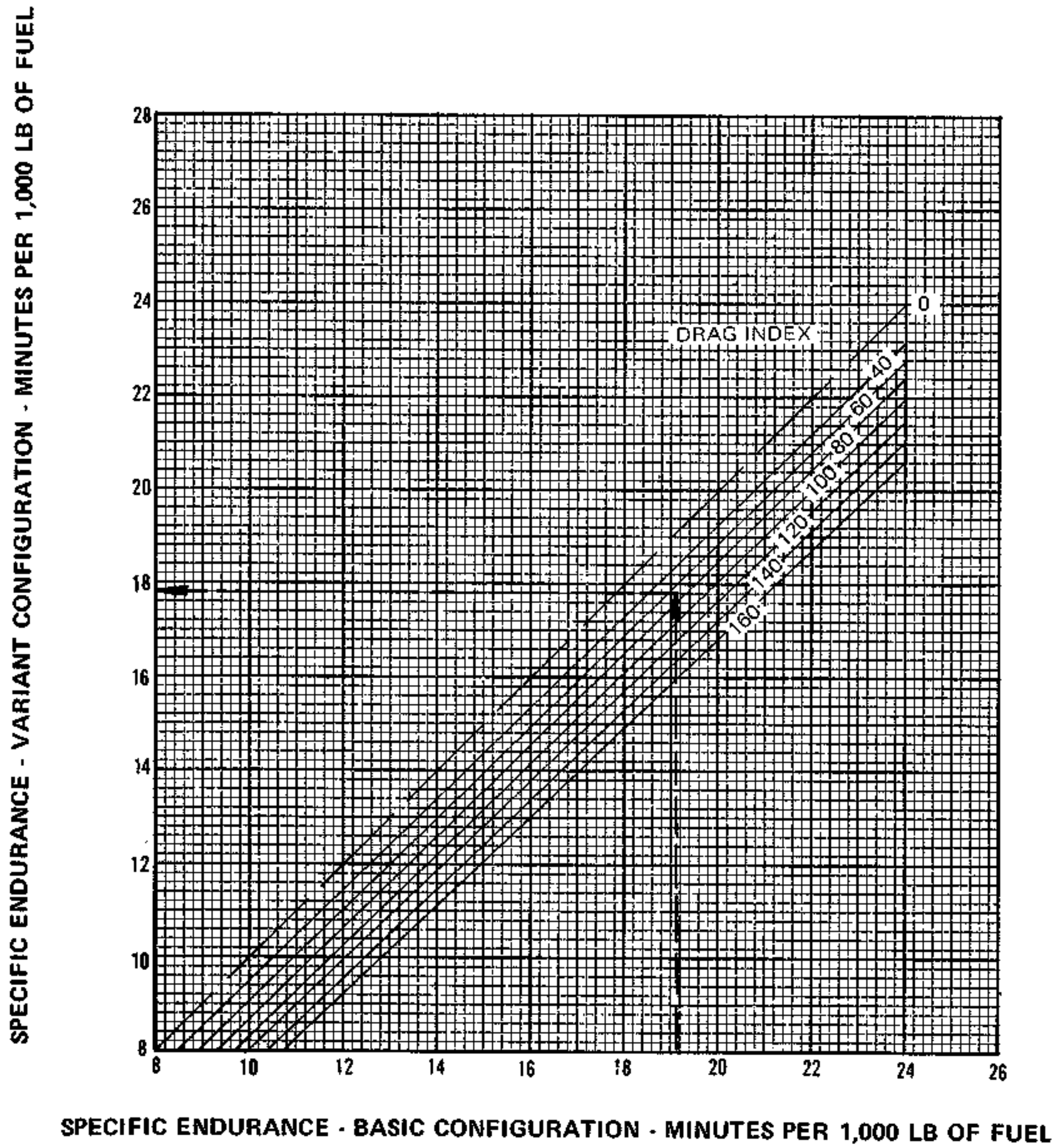


Figure A6-24.

SPECIFIC ENDURANCE
COMBAT LOITER

4 ENGINES **FLAPS 50 PERCENT**

MODEL: AC-130A
T56-A-9 ENGINES

SEA LEVEL
DRAG INDEX 0

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE 220 KCAS

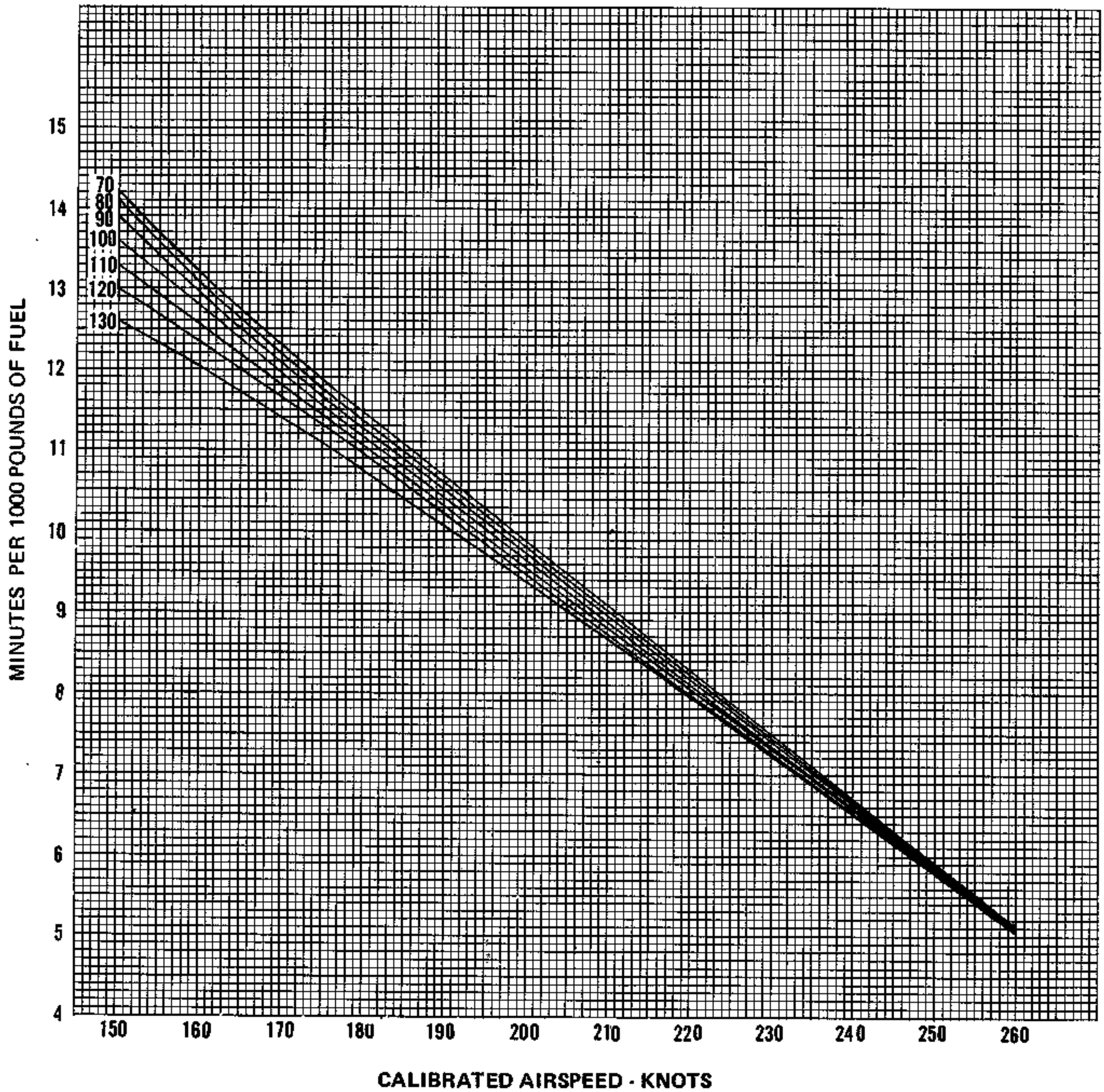


Figure A6-25.

SPECIFIC ENDURANCE
COMBAT LOITER

4 ENGINES FLAPS 50 PERCENT

MODEL: AC-130A
T56-A-9 ENGINES

ALTITUDE 5000 FT.
DRAG INDEX 0

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE 220 KCAS

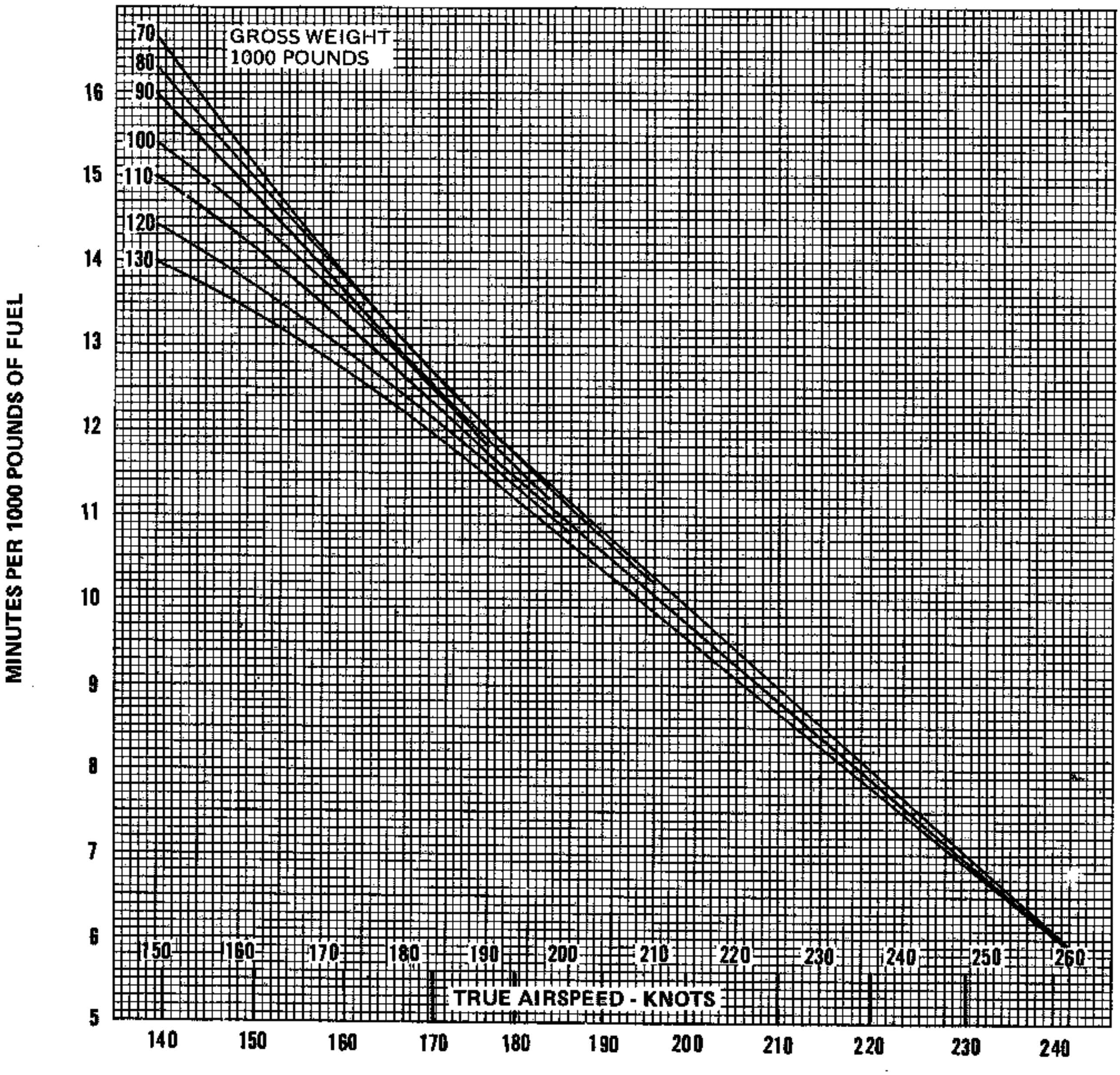


Figure A6-26.

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE 220 KTAS

SPECIFIC ENDURANCE
COMBAT LOITER

4 ENGINES FLAPS 50 PERCENT

ALTITUDE 10000 FT.
DRAG INDEX 0

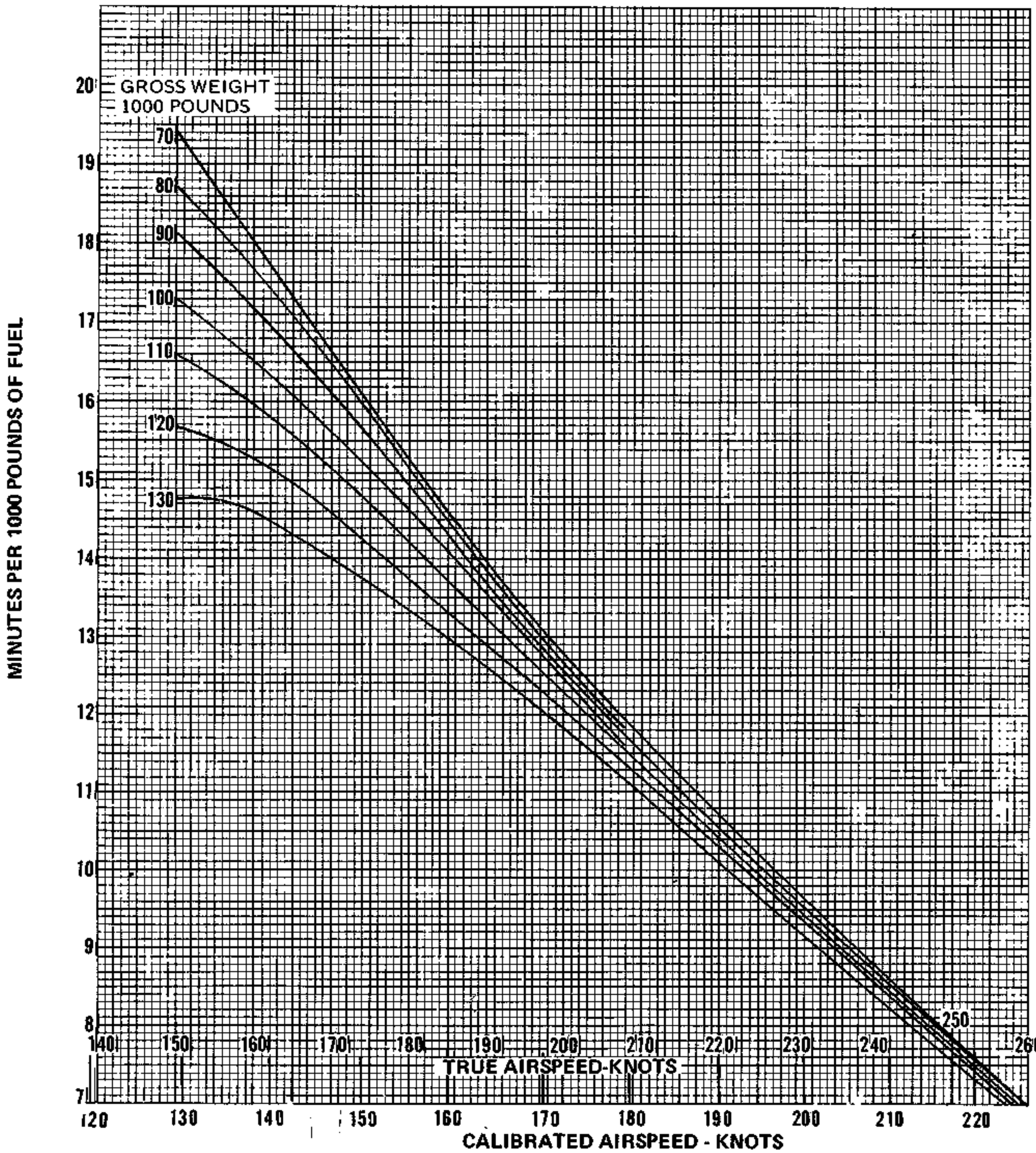


Figure A6-27.

SPECIFIC ENDURANCE
COMBAT LOITER

4 ENGINES   FLAPS 50 PERCENT

MODEL: AC-130A
T56-A-9 ENGINES

ALTITUDE 15000 FT.
DRAG INDEX 0

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE 220 KTAS

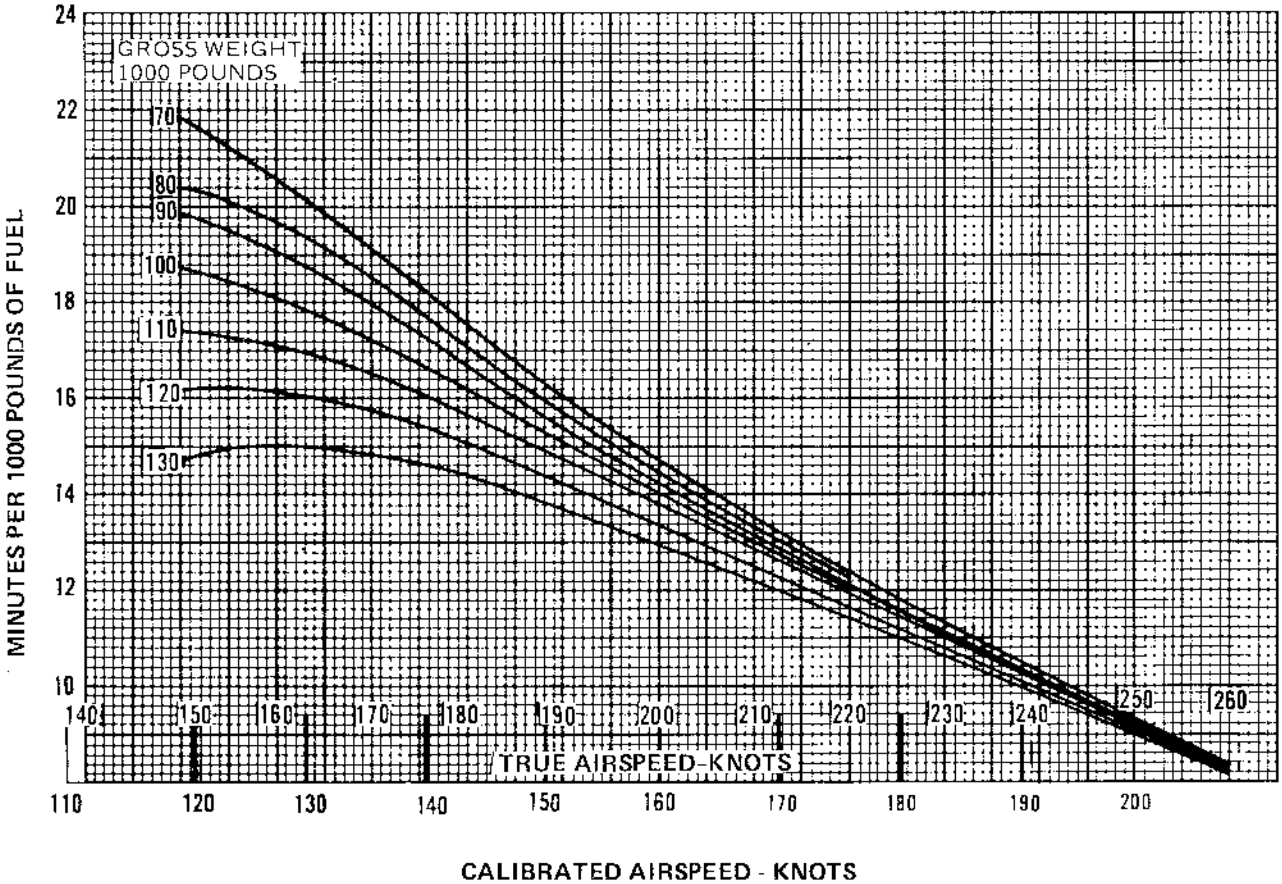


Figure A6-28.

SPECIFIC ENDURANCE
COMBAT LOITER

4 ENGINES FLAPS 50 PERCENT

MODEL: AC-130A
T56-A-9 ENGINES

ALTITUDE 20000 FT.
DRAG INDEX 0

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
ESTIMATED ABOVE 220 KCAS

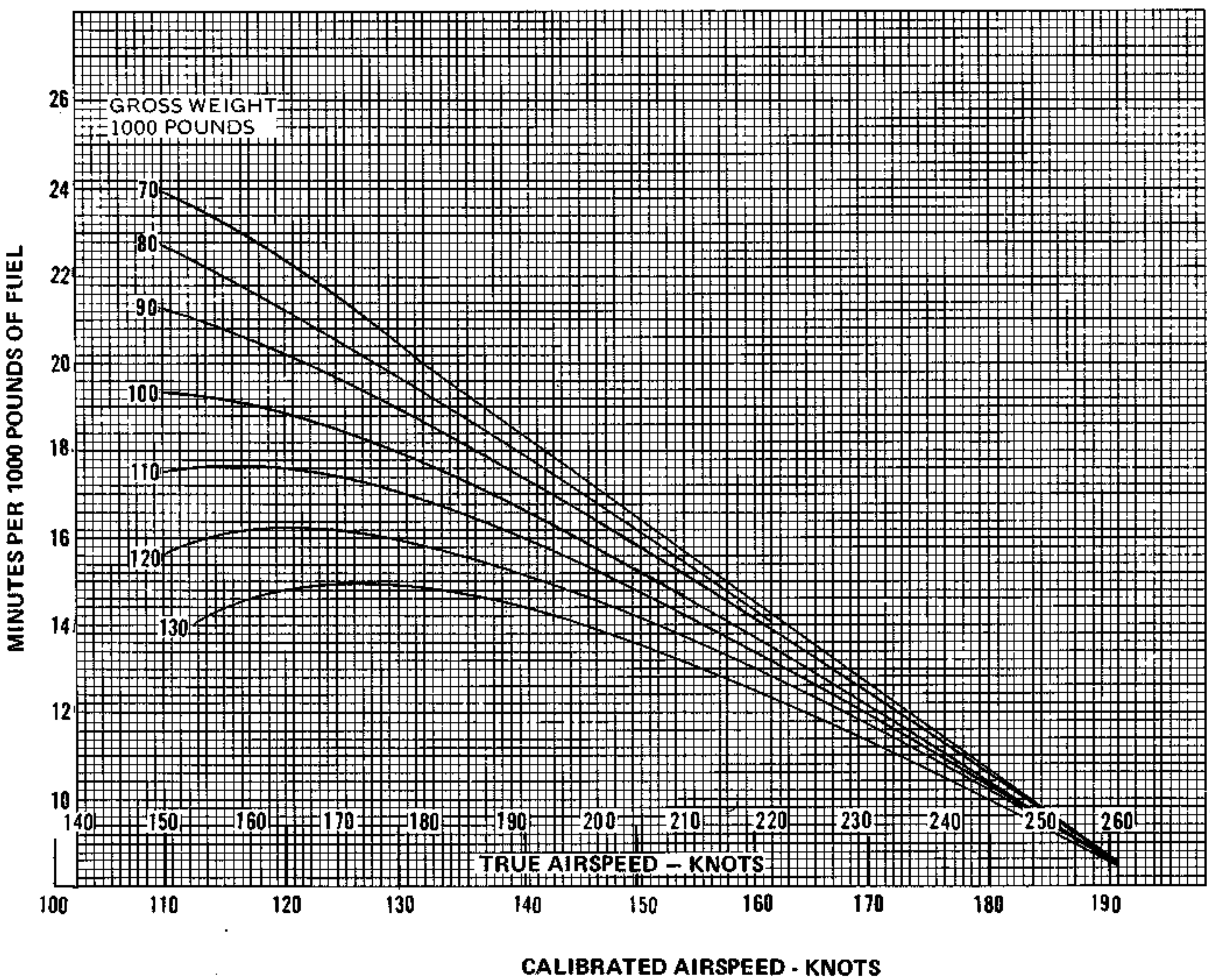


Figure A6-29.

SPECIFIC ENDURANCE
- COMBAT LOITER -
VARIANT CONFIGURATION

4 ENGINES
GEAR UP

FLAPS 50 PERCENT

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

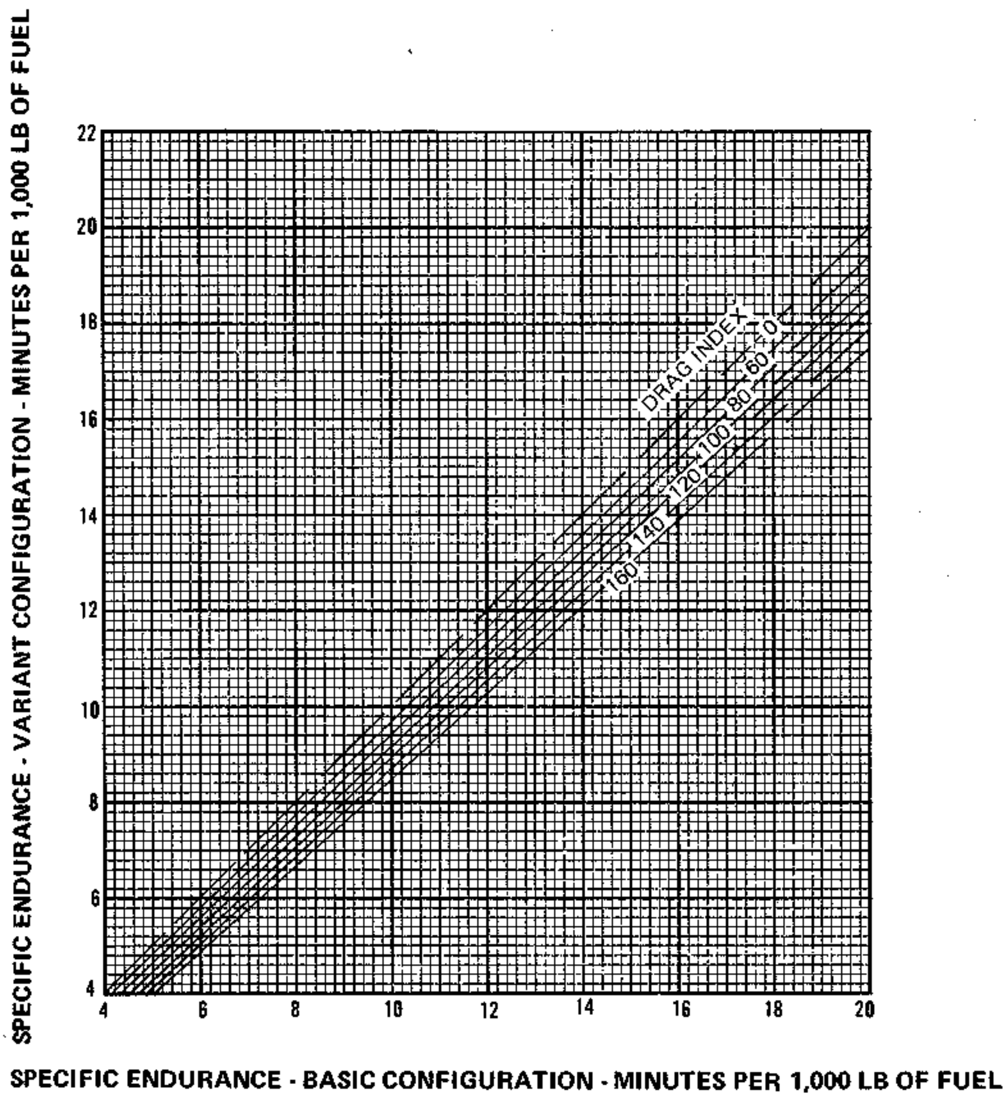


Figure A6-30.

PART 7. DESCENT PERFORMANCE

TABLE OF CONTENTS

LIST OF CHARTS

INTRODUCTION.

As in climb performance, the important factors in planning mission descent are elapsed time, distance flown, and fuel consumed.

The time, fuel and distance to descend will be approximately 5% less than indicated for the GUNSHIP ferry configurations (DI=20), 15% less for the GUNSHIP combat configuration with door closed (DI=+35), and 20% less for the GUNSHIP combat configurations with door open (DI=+85). The above estimations will apply if the speeds schedules are followed.

DESCENTS.

PENETRATION DESCENT.

A penetration descent is made in two parts. The first part is from cruise altitude to 20,000 feet at maximum lift over drag speeds as shown on figure A7-1 with throttles at FLIGHT IDLE and gear and flaps up. The second part is from 20,000 down at a constant 250 KIAS.

RAPID DESCENT.

Gear and Flaps Down.

At slow airspeeds, the highest rates of descent are obtained by retarding all throttles to flight idle, decreasing airspeed to flap placard speed (145 knots), and extending landing gear and full flaps (figure A7-2). Descend at 145 knots.

Gear and Flaps Retracted.

The highest rates of descent are obtained by retarding all throttles to flight idle with gear and flaps retracted and descending at the maximum speed, as shown in T.O. 1C-130(A)A-1, Section V. The rapid descent data shown in figure A7-3 are based on the tabulated speeds shown.

TEMPERATURE EFFECT.

For each 10°C below standard temperature, decrease rate of descent by 2 percent, and increase time and fuel by 2 percent. For temperatures above standard, reverse the direction of the correction. No corrections are required for distance.

Example.

Given:

Penetration descent.

Gross weight - 100,000 pounds.

Altitude: 25,000 feet.

Power: Four engines in FLIGHT IDLE.

Descend at speeds shown.

Find:

Horizontal distance during descent to sea level.

Elapsed time for descent to sea level.

Fuel consumed for descent to sea level.

Procedure:

All information required for a penetration descent is given in figure A7-1. Enter the chart with the end of cruise altitude of 25,000 feet, and move up to the 100,000-pound weight line and across to find the descent distance of 44 nautical miles. Reading the respective scales at the intersection of 25,000 feet pressure altitude, the time for descent to sea level is found to be 10 minutes and the fuel used is found to be 320 pounds.

PENETRATION DESCENT

TIME, DISTANCE AND FUEL

4 ENGINES FLIGHT IDLE POWER

FLAPS AND GEAR UP

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: ***PHASE IV FLIGHT TEST***

NOTE

1. Cruise ceiling based on four engines at maximum continuous power.
2. ICAO standard atmosphere.

SPEED SCHEDULE	
WEIGHT - 1,000 POUNDS	KIAS
70	122
80	130
90	138
100	144
110	151
120	157
130	163
FROM 20,000 FEET TO SL AT ALL WEIGHTS	250

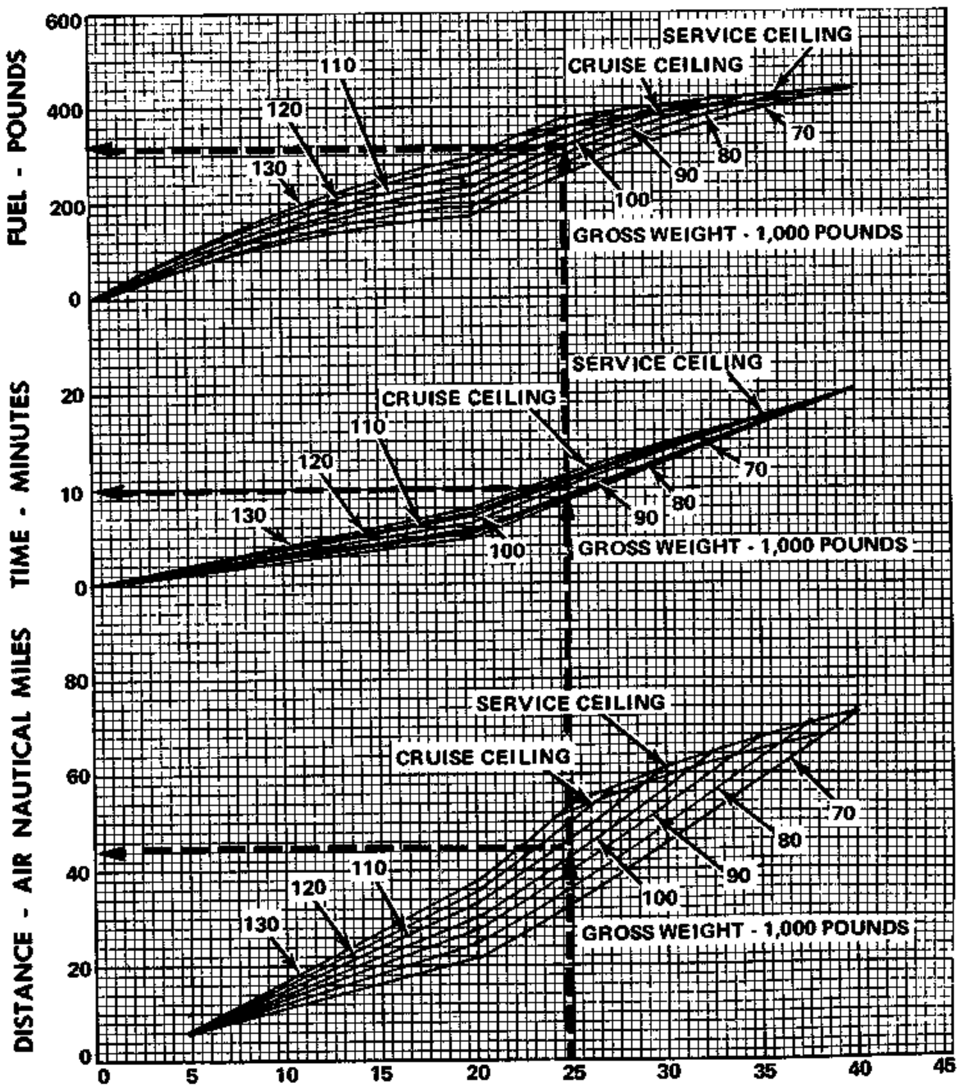


Figure A7-1.

RAPID DESCENT WITH FULL FLAPS

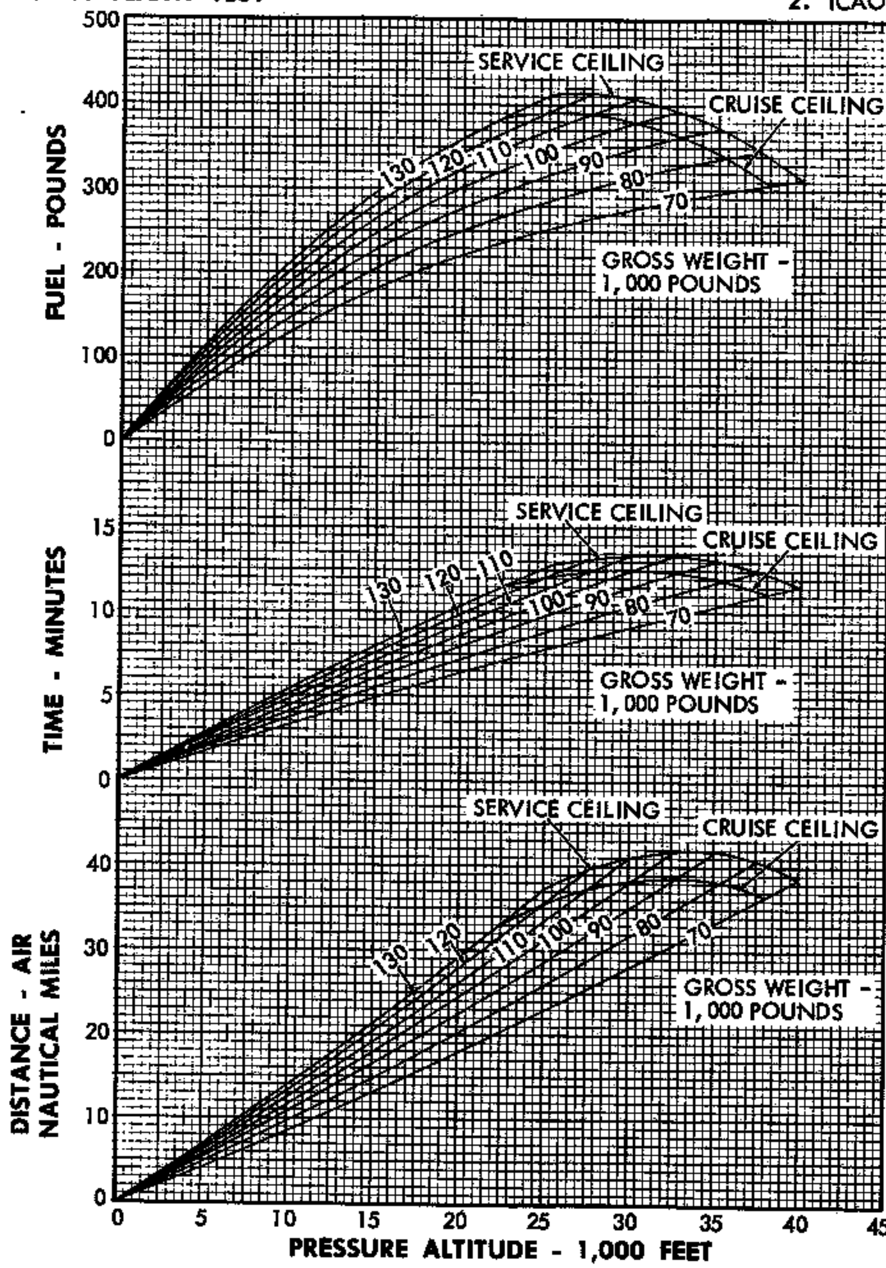
TIME DISTANCE FUEL
4 ENGINES GEAR DOWN
FLIGHT IDLE POWER 145 KIAS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Cruise ceiling based on four engines at maximum continuous power.
2. ICAO standard atmosphere.



130A-(1-1)-0-136

Figure A7-2.

RAPID DESCENT - FLAPS UP

TIME, DISTANCE AND FUEL

4 ENGINES FLIGHT IDLE POWER

GEAR UP

MODEL: AC-130A
T56-A-9 ENGINES

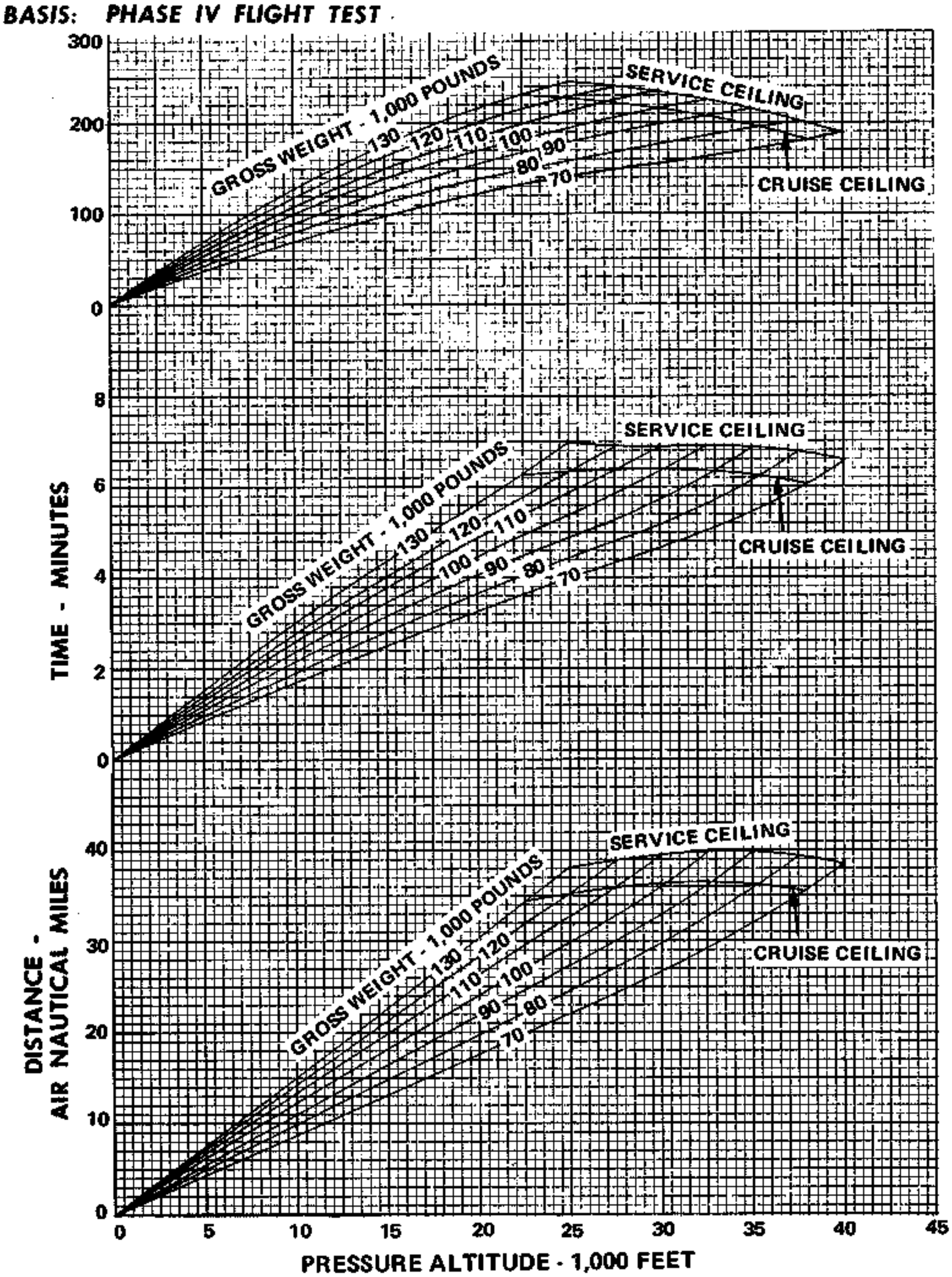
DATE: DECEMBER 1969

DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Cruise ceiling based on four engines at maximum continuous power.
2. ICAO standard atmosphere

SPEED SCHEDULE	
ALTITUDE 1,000 FT	KIAS
0	286
5	283
10	281
15	278
20	277
25	260
30	237
35	209
40	187



130A-(1-1)-0-161

Figure A7-3.

PART 8. LANDING PERFORMANCE

TABLE OF CONTENTS

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LIST OF CHARTS

INTRODUCTION.

Landing performance closely parallels take-off performance, and the variables of airplane gross weight, configuration, runway condition, and atmospheric conditions have similar effects on landing performance as on takeoff performance.

The airplane is designed for 100 percent flap landings. However, variable flap settings may be used for all landings. During landings with flap settings less than 50 percent, the following conditions prevail and caution must be exercised:

1. Because of high angle of attack at touchdown, it is possible for the aft end of the fuselage to contact the ground.

2. There will be no appreciable stall warning.

3. Stall and float characteristics due to low pitch stop are unpredictable. However, landings with zero to 50 percent flaps may be accomplished safely.

Refer to T.O. 1C-130(A)A-1, Section II, for a typical approach and landing pattern and to Section V for maneuver limits during landing approach.

APPROACH, THRESHOLD, AND TOUCHDOWN SPEEDS.

APPROACH SPEED.

Approach speed is threshold speed plus 10 KIAS for applicable flap settings.

THRESHOLD SPEED.

Threshold speed for 100 and 50 percent flap positions are shown on figures A8-1 and A8-2. These speeds are the 50 foot height speeds required to meet the landing distances shown on the landing distance charts. Because of the flying qualities consideration in the power approach configuration at slow speeds, the minimum threshold speed is limited to no lower than -99 knots IAS. The threshold speed is 1.28 times power off stall speed.

TOUCHDOWN SPEEDS.

The touchdown speeds presented in figures A8-1 and A8-2 are the initial speeds at point of contact in landing. The touchdown speeds are shown for two flap settings: 100 percent, 50 percent flaps. The speeds represent 1.2 times power-off stall speeds for each flap setting. These touchdown speeds are the criteria for calculating the ground roll distances shown on the landing distance charts and must be adhered to if consistency with these charts is expected.

AIR MINIMUM CONTROL SPEEDS.

The air minimum control speeds for one and two engines inoperative are presented in figures A8-4 through A8-6. These speeds are shown for various altitudes and temperatures from sea level to 16,000 feet and are based on the minimum speed at which full directional control of the airplane may be maintained when all operative engines are at maximum power, by using 180 pounds of rudder pedal force and a 5-degree bank away from failed engine(s). The one-engine inoperative minimum control speed is based on the assumption that the inoperative engine is outboard, that NTS is operative, and that the propeller is windmilling. The two-engine inoperative speed is based on the assumption that the inoperative engines are on the same side, that NTS is operative, and that the inboard propeller is feathered and the outboard propeller is windmilling.

Refer to T.O. 1C-130(A)A-1, Section III for further discussion of minimum control speeds.

Note

When landing with one or two engines inoperative, it is recommended that the inflight minimum control speed be compared to the recommended approach speed and the higher of the two speeds used.

Example.

Given:

Normal landing.

Gross weight: 120,000 pounds.

Find:

Approach, threshold, and touchdown speeds for 50 percent and 100 percent flaps landings.

Procedure:

To find 50 percent data enter the Landing Speed chart figure A8-2 with a gross weight of 120,000 pounds, move up to the 50 percent flaps touchdown speed line and the 50 percent flaps threshold speed line, and read a touchdown speed of 119.5 KIAS and a threshold speed of 127.5 KIAS on the airspeed scale. Approach speed will be 10 KIAS above threshold speed or 137.5 KIAS.

To find 100 percent data enter the Landing Speed chart (figure A8-1) with a gross weight of 120,000 pounds, move up to the touchdown speed line and the threshold speed line, and read a touchdown speed of 109 KIAS and a threshold speed of 118 KIAS on the airspeed scale. Approach speed will be 10 KIAS above threshold speed or 128 KIAS.

CROSSWIND LANDING.

The Crosswind chart (figure A8-7) provides a convenient method for resolving the wind into its components, and indicates the minimum recommended touchdown speed for the crosswind component. That speed must be compared to the touchdown speed determined from the Landing Speed chart and the higher speed should be used. When touchdown is made at a speed greater than that shown on the Landing Speed chart, the increase in speed must be used to determine the increased ground roll. The touchdown speed may be increased a maximum of 10 knots. The 100 percent flap placard speed (145 KIAS) must not be exceeded.

If the component falls in the recommended area of the chart, normal speeds will be used. If the winds are gusty or the wind component falls into the caution area of the chart the approach, threshold and touchdown speeds must be increased. For gusty winds increase the approach, threshold and touchdown speeds the same amount as the wind gust factor. However, do not increase these speeds more than 10 knots.

If the wind component falls in the caution area of the chart, the approach and touchdown speeds must be increased as described on figure A8-7.

Figure A8-8 presents the maximum recommended crosswind to which the C-130 airplane can be subjected on the ground and still remain under directional control. The figure presents maximum crosswind as a function of gross weight, RCR, and headwind. Maximum rudder deflection may be used, but neither brakes nor asymmetric power are applied. The smaller values of crosswind from either figure A8-7 or figure A8-8 should be used for landing.

Example.

Given:

Gross Weight: 100,000 pounds

RCR: 12

Wind: 10 knot headwind

Find:

Maximum reoommended crosswind for landing.

Procedure:

Enter figure A8-8 at 100,000 pound gross weight line, move horizontally to the RCR line of 12, move vertically to the 10 knot headwind line, then horizontally to the right to the maximum crosswind line of 21 knots. A check of figure A8-7 shows the wind vector in the recommended area of the chart. The airplane may land if the crosswind is not greater than 21 knots.

LANDING DISTANCE.

Landing distances for 100-, 50-, and zero-percent flap positions are shown on figures A8-9 through A8-14. These data are presented as functions of outside air temperature (OAT), pressure altitude, gross weight, engine configuration, runway condition reading (RCR), wind, and runway slope. The total distance from 50 feet to stop for 100 percent flaps (figure A8-9), 50 percent flaps (figure A8-11), and zero flaps (figure A8-13) is based on the touchdown speeds shown on the Landing Speed charts.

WARNING

When computing landing distance with anti-skid inoperative, increase ground roll by 1400 feet for 50% flaps and 800 feet for 100% flaps. These correction factors are not valid if wheels lock or tires skid.

Note

Should obstacles be located near the end of the runway such that the 50-foot height must be exceeded, the effect of the additional height must be considered. Since the effect is not shown on the charts, sufficient margin must be allowed based on the pilot's judgement and experience.

The landing ground roll charts for 100 percent flaps (figure A8-10), 50 percent flaps (figure A8-12), and zero flaps (figure A8-14) show the distance from touchdown to stop. The basic data on the landing distance charts are based on the following assumptions:

1. Dry asphalt or concrete runways with an RCR of 23.
2. A one-second allowance for distance traveled during transition from touchdown to a taxi attitude.
3. Full wheel brakes and reverse power application upon reaching taxi attitude.

Figure A8-10 is used for both normal and maximum effort landing ground roll.

For other conditions, corrections to the basic data may be applied in the following manner:

ENGINE CONFIGURATION - The basic data assume flight idle power in the approach phase and full reverse thrust during the ground roll phase. For other engine configurations, the increased landing distances may be estimated by use of the correction scale on the charts.

RUNWAY CONDITION READING (RCR) - The increase in landing ground roll due to a wet or icy runway surface is dependent on many factors, and each situation should be considered on the basis of past experience. Runways covered with snow have a variable braking coefficient between wet and icy. The most critical factor should be applied in computing the landing data. When the tower reports a measured RCR, the ground roll must be modified to account for the variation. 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 condition. In order to relate this categorization to an RCR or when RCR values are not available, the following relationship will be used:

RUNWAY CONDITION	ICAO REPORT	RCR
Dry	Good	23
Wet	Medium	12
Icy	Poor	05

The basic data on the charts assume a dry runway. With other conditions, the increased landing distances may be estimated by using the correction scale on the charts. The baseline on this correction scale is an RCR of 23. To correct for RCR, enter the correction scale with the uncorrected distance until the base line is reached. From this point, follow parallel to the guide lines to the RCR value. For a landing in which no brakes are applied, use an RCR of 2.

INCREASED LANDING SPEED - The basic data on the charts are based on the touchdown speeds shown on the Landing Speed chart (figures A8-10, A8-12 and 8-14). When touchdown speeds are increased for any reason, the increased ground roll may be estimated by applying the increment in KIAS to the correction scale on the charts. The threshold speed is assumed to remain the same as shown on the Landing Speed chart, and no correction for increased touchdown speed is necessary for the total distance from 50 feet, as the decrease in flare distance tends to compensate for the increase in ground roll.

WIND AND SLOPE - The basic data on the charts assume a zero wind and slope. For other conditions, the landing distances may be estimated by using the correction scales on the charts.

Example 1.

Given:

Normal landing with 100 percent flaps, reverse thrust on four engines, and maximum wheel brakes.

Gross weight: 120,000 pounds.

Field elevation: 2,000 feet.

OAT: 15°C.

Wind: 15-knot headwind measured at runway.

Reported RCR: 10

Runway slope: 2 percent downhill.

Touchdown speed increased by 9 knots due to crosswind.

Find:

Landing distance from 50 feet.

Landing ground roll.

Procedure:

To determine the landing distance from 50 feet, enter figure A8-9 with an OAT of 15°C, move across to 2,000 feet pressure altitude, down to 120,000 pounds gross weight, and read an uncorrected landing distance of 3,350 feet. To correct for RCR, move across to the RCR correction scale, follow the guideline to an RCR of 10, and read a corrected landing distance of 4,000 feet. To correct for runway slope, move across to the slope correction scale, follow the downhill guideline to a slope of 2 percent, and read a corrected distance of 4,450 feet. To correct for wind, move across to the wind correction scale, follow the headwind guideline to 7.5 knots, 50 percent of reported wind, and read a corrected landing distance from 50 feet of 4100 feet.

The landing ground roll is determined from figure A8-10 by entering the chart with 15°C OAT, 2,000 feet pressure altitude, 120,000 pounds gross weight, and reading an uncorrected ground roll of 2,200 feet. To correct for RCR, move across to the RCR correction scale, follow the guideline to an RCR of 10, and read a corrected ground roll of 2,750 feet.

To correct for the increased touchdown speed, move across to the speed correction scale, follow the guideline to the increased speed increment of 9 knots, and read a corrected ground roll of 3,100 feet. Correct for runway slope and wind in the same manner, and read a corrected landing ground roll of 2,750 feet.

Example 2.

Given:

Normal landing with 50 percent flaps, two engines in reverse thrust, two engines in ground idle, and maximum wheel brakes.

Gross weight: 120,000 pounds.

Field elevation: 2,000 feet.

OAT: 15°C.

No wind or runway slope.

Reported runway RCR: 10.

Find:

All landing data.

Procedure:

To find the recommended approach, threshold, and touchdown speeds, enter the Landing Speed chart (figure A8-2) with a gross weight of 120,000 pounds, and move up to the 50-percent flap touchdown speed line and the 50-percent flap threshold speed line. Read a touchdown speed of 119 KIAS and a threshold speed of 127 KIAS. Approach speed will be 10 KIAS above threshold speed or 137 KIAS.

To determine the landing distance from 50 feet, enter figure A8-11 with an OAT of 15°C, move across to 2,000 feet pressure altitude, down to 120,000 pounds gross weight, and read an uncorrected landing distance of 4,300 feet. To correct for engine configuration, move across to the correction scale, follow parallel to the guideline to the engine configuration of 2 reverse thrust and 2 ground idle, and read a corrected landing distance from 50 feet of 4,650 feet. To correct for RCR, move across to the RCR correction scale, follow the guideline to an RCR of 10 and read a corrected landing distance of 5,350 feet.

To find the landing ground roll distance, follow the above steps using figure A8-12. The uncorrected ground roll will be 2,600 feet, and the corrected ground roll will be 3,500 feet.

LANDING SPEEDS

4 ENGINES **FLIGHT IDLE**

100 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTES:

1. Approach speed is threshold speed plus 10 KIAS.
2. Speeds shown on this chart for 4, 3, and 2 engines. When landing with one or two engines inoperative, use threshold speed or V_{MCA}, whichever is higher.
3. If a go-around is anticipated, the minimum control speed, V_{MCA}, should be observed.
4. Refer to Part 1 for calibration effect.

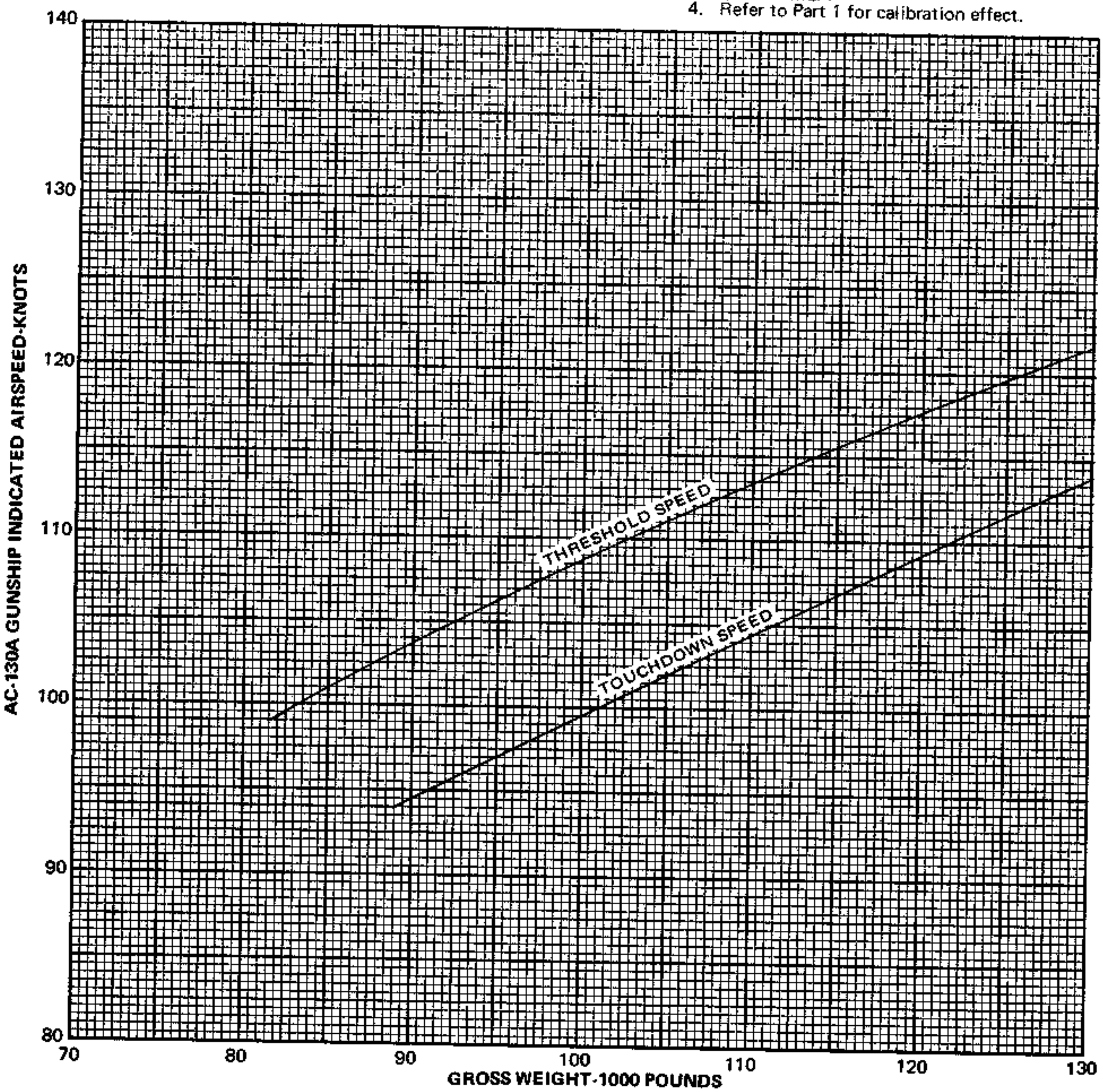

Figure A8-1

LANDING SPEEDS

4 ENGINES **FLIGHT IDLE**

50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTES:

1. Approach speed is Threshold Speed plus 10 KIAS.
2. Speeds shown on this chart are for 4, 3, and 2 engines. When landing with one or two engines inoperative, use Threshold Speed or V_{MCA}, whichever is higher.
3. If a go-around is anticipated, the minimum control speeds, V_{MCA} should be observed.
4. Refer to Part 1 for calibration effects.

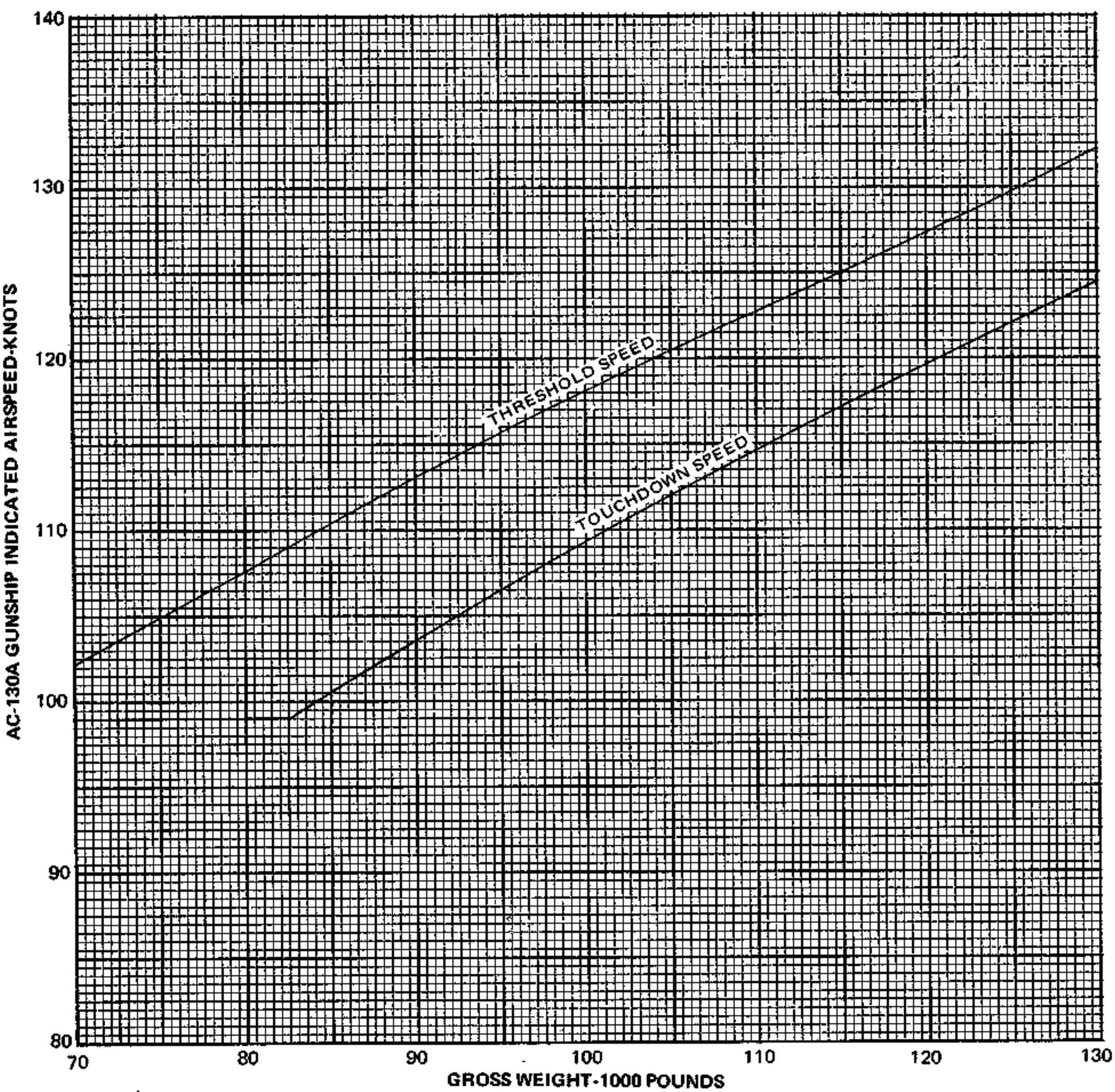

Figure A8-2

LANDING SPEEDS

4 ENGINES FLIGHT IDLE

FLAPS UP

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

NOTE

1. Approach speed is Threshold Speed plus 10 KIAS.
2. Speeds shown on this chart are for 4, 3, and 2 engines. When landing with one or two engines inoperative, use Threshold Speed or V_{MCA}, whichever is higher.
3. If a go-around is anticipated, the minimum control speeds, V_{MCA} should be observed.
4. Refer to Part 1 for calibration effects.

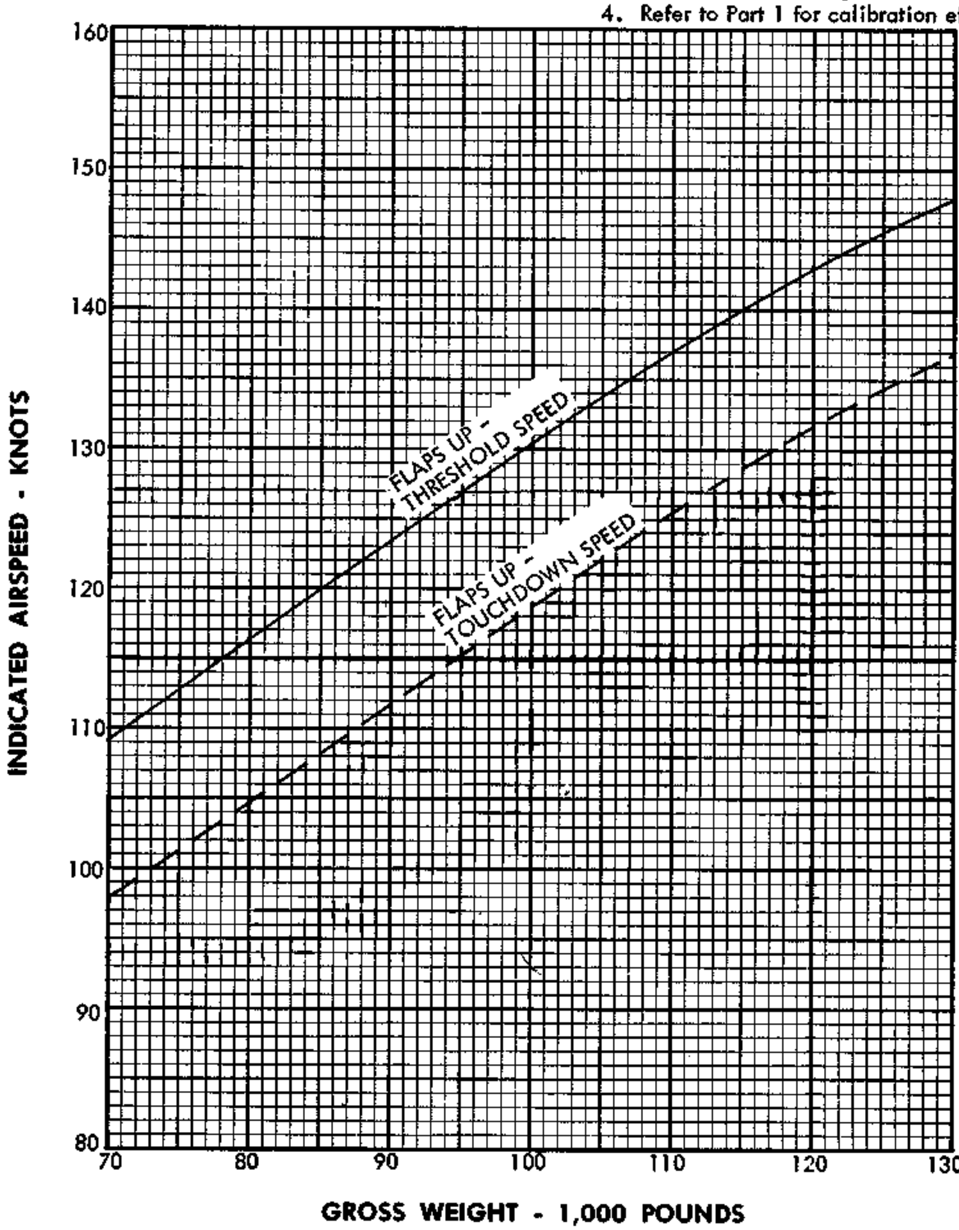

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Figure A8-3.

AIR MINIMUM CONTROL SPEED

IN GROUND EFFECT

GEAR DOWN   3 ENGINES   50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

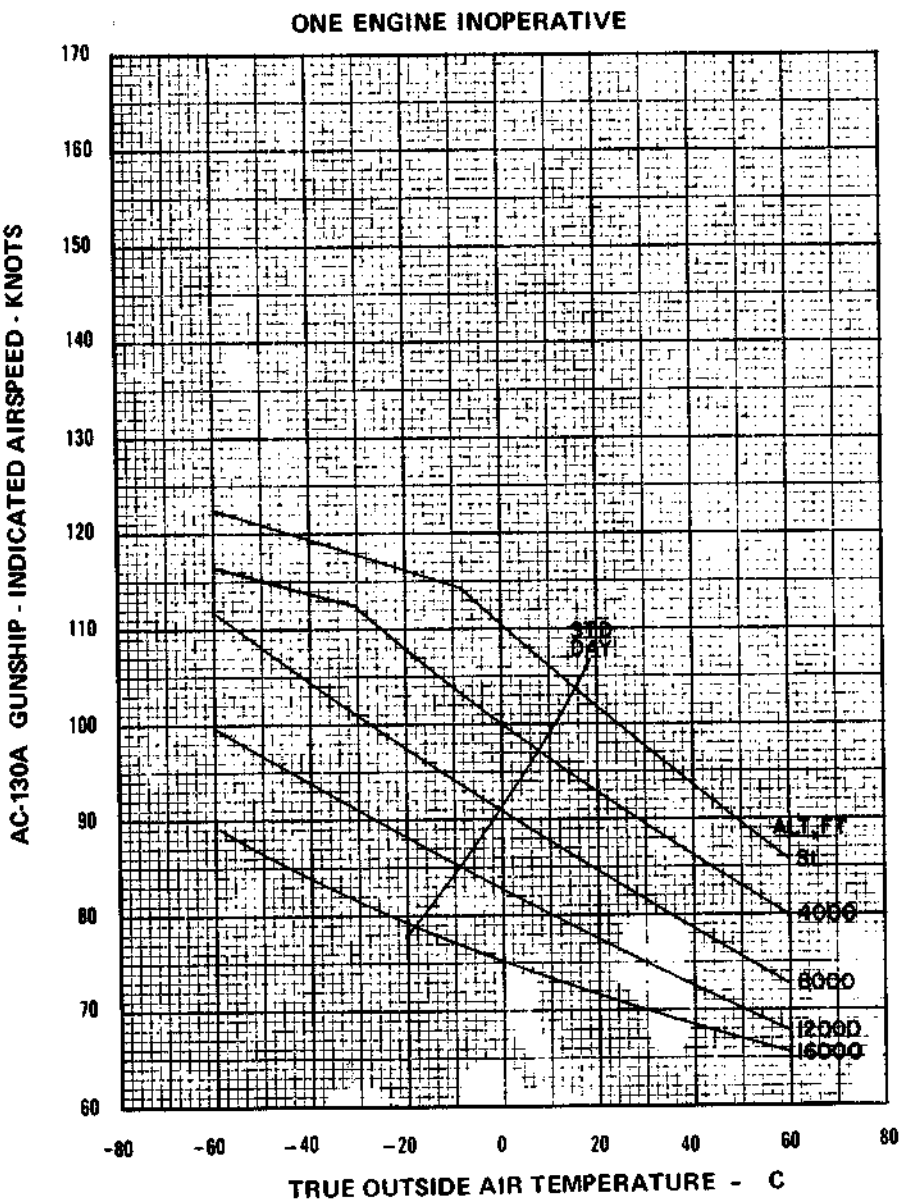


Figure 8-4.

AIR MINIMUM CONTROL SPEED

IN OR OUT OF GROUND EFFECT

GEAR DOWN 2 ENGINES 50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

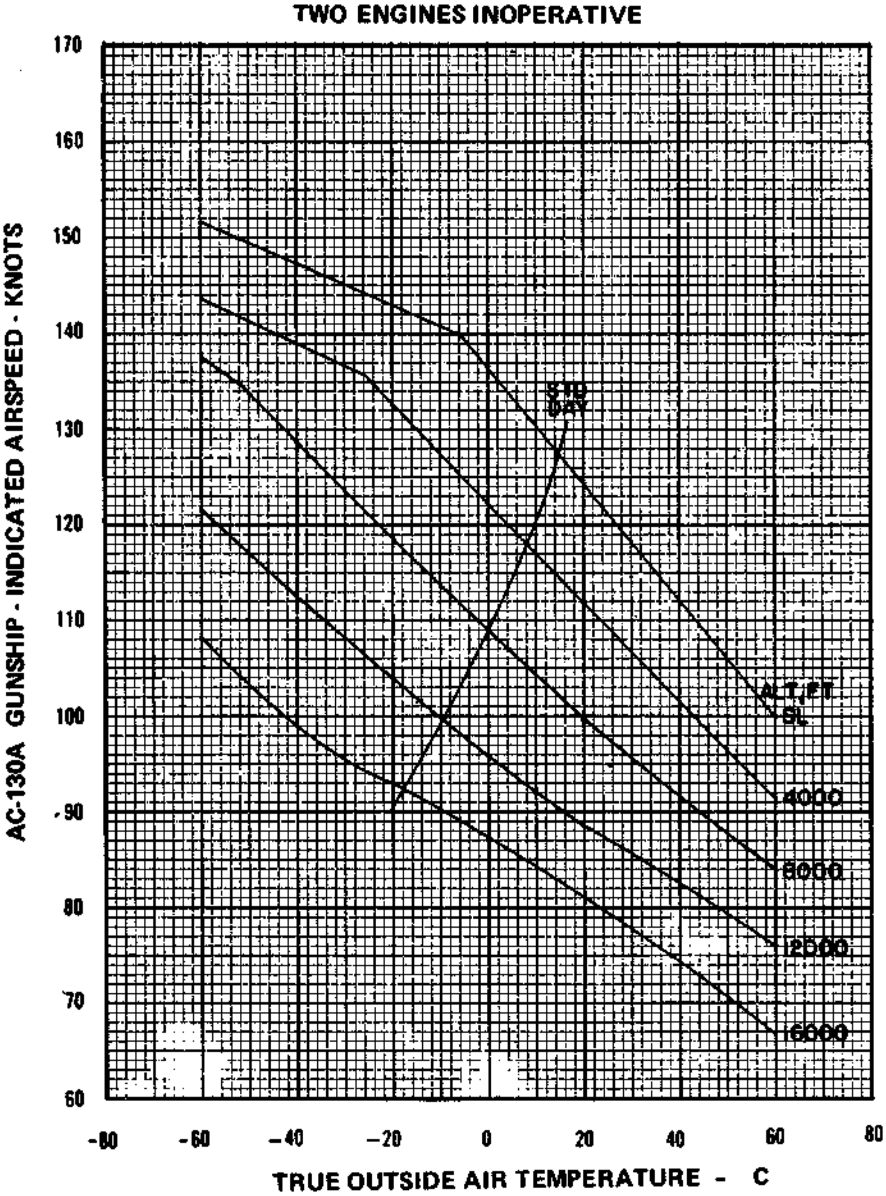


Figure A8-5

AIR MINIMUM CONTROL SPEED IN OR OUT OF GROUND EFFECT

GEAR UP OR DOWN FLAPS UP

ONE ENGINE INOPERATIVE

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

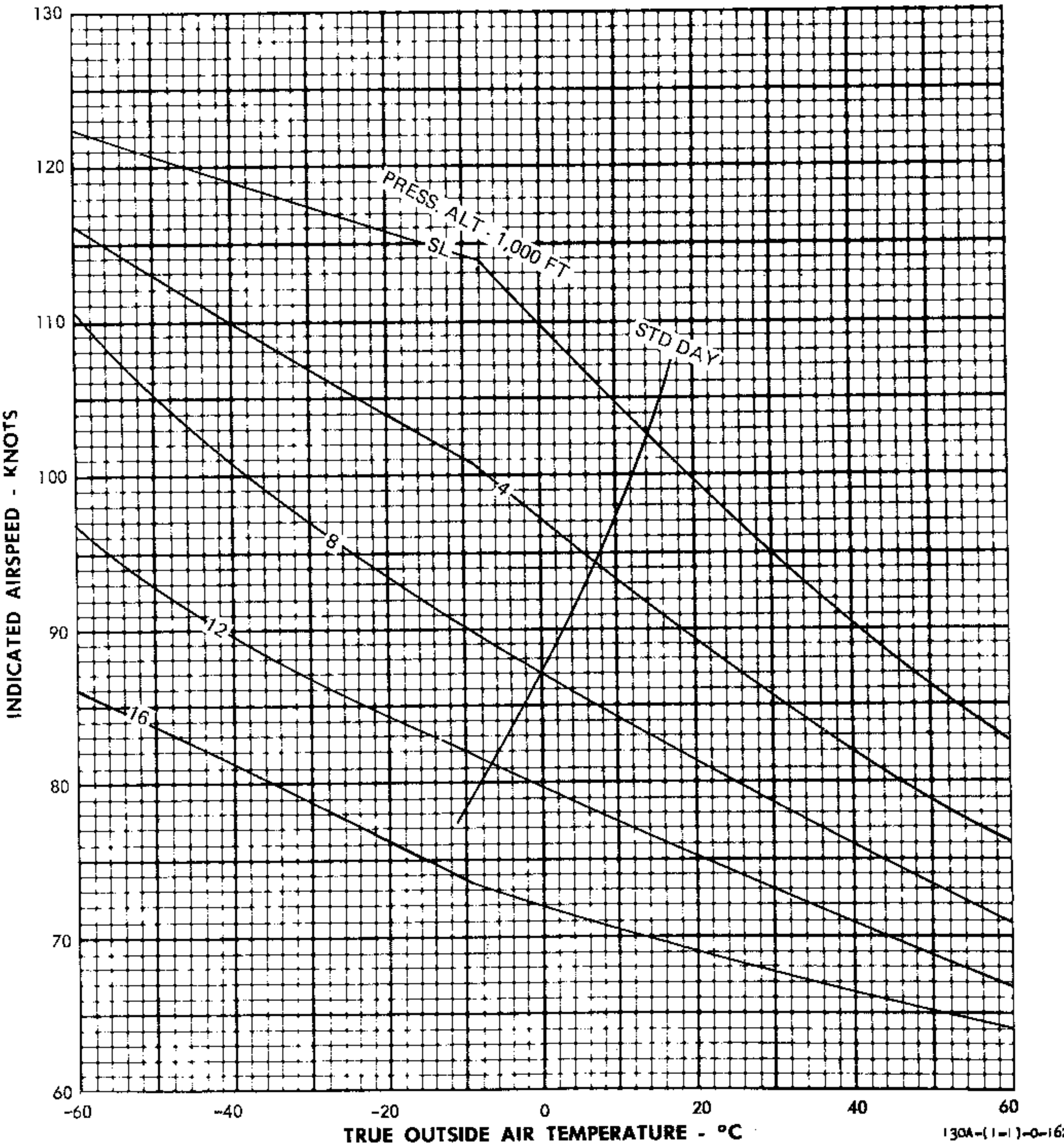


Figure A8-6.

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969

LANDING CROSSWIND CHART

DATA BASIS: PHASE IV FLIGHT TEST

EXAMPLE:

GIVEN: Landing runway 12. Wind 185° at 20 knots gusting to 30 knots. Landing weight 102,000 pounds.

FIND: Is landing recommended with landing flaps (100%).

SOLUTION:
1. From the Landing Speeds chart determine touchdown speed with landing flaps of 100.5 knots.
2. Runway wind angle is (185° - 120°) 65°.
3. Enter chart at wind angle 65° and maximum wind velocity, including gusts, of 30 knots and determine crosswind component of 27 knots.
4. Proceed vertically to touchdown speed at 100.5 knots and determine landing is in the CAUTION zone.
5. Use of 50% flaps will increase touchdown speed to 110.5 knots, still in the CAUTION zone. Flaps up will increase the touchdown speed to 122 knots which is in the RECOMMENDED zone.

REMARKS:
See text for explanation of crosswind landings.
If landing must be made in the CAUTION zone, a slight yaw may be expected between main gear contact and nose gear contact.
See Section II for crosswind taxi capability.
Increased touchdown speeds will increase the landing ground roll.

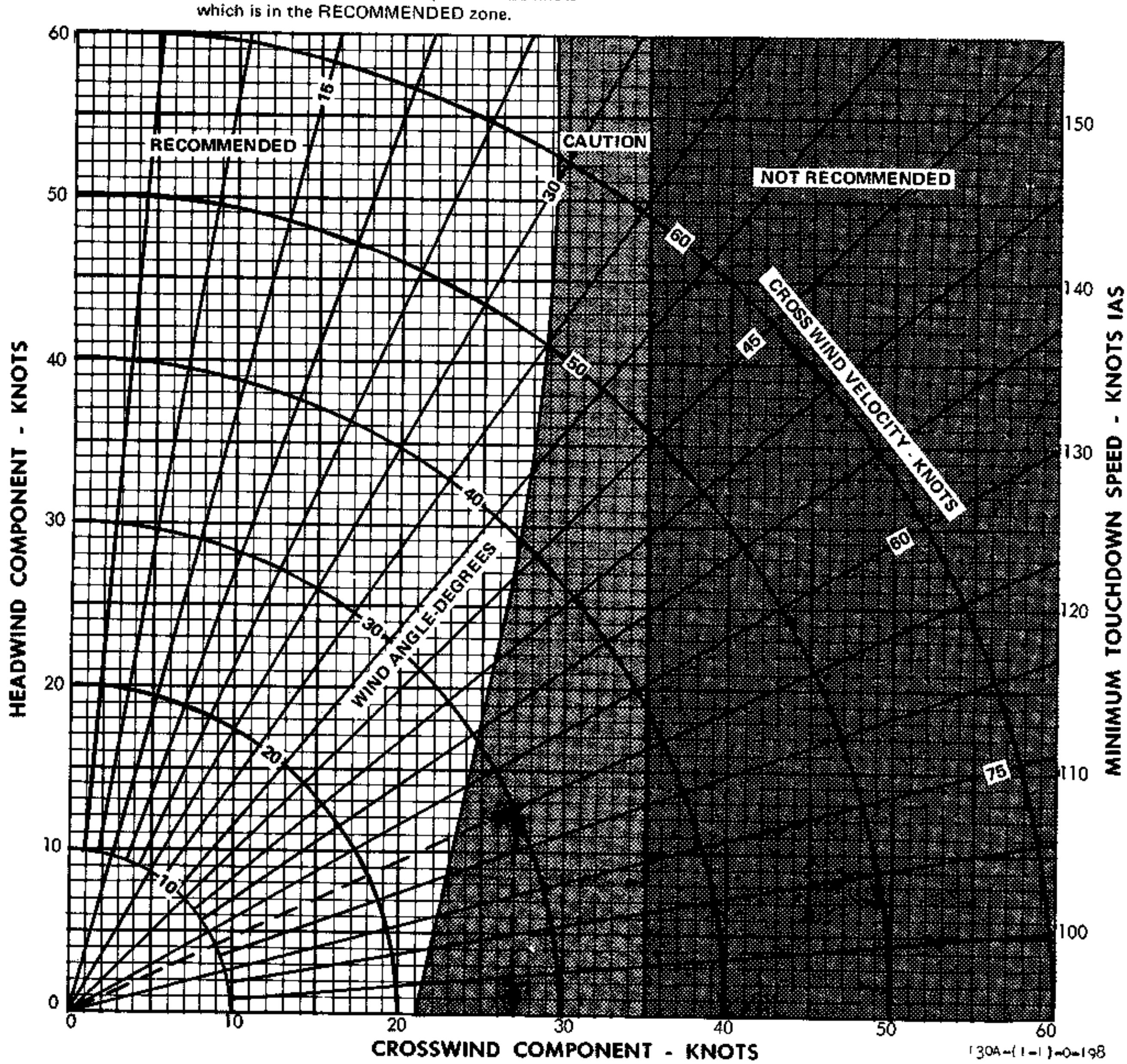


Figure A8-7.

MAXIMUM RECOMMENDED CROSSWIND FOR LANDING

MODEL: AC-130A
T56-A-9 ENGINES

DATE: MAY 1974
DATA BASIS: ESTIMATED

NOTE

1. Elevators and ailerons in neutral position.
2. Symmetrical power from engines.
3. Brakes not applied.
4. Do not exceed recommendations of figure A8-7.

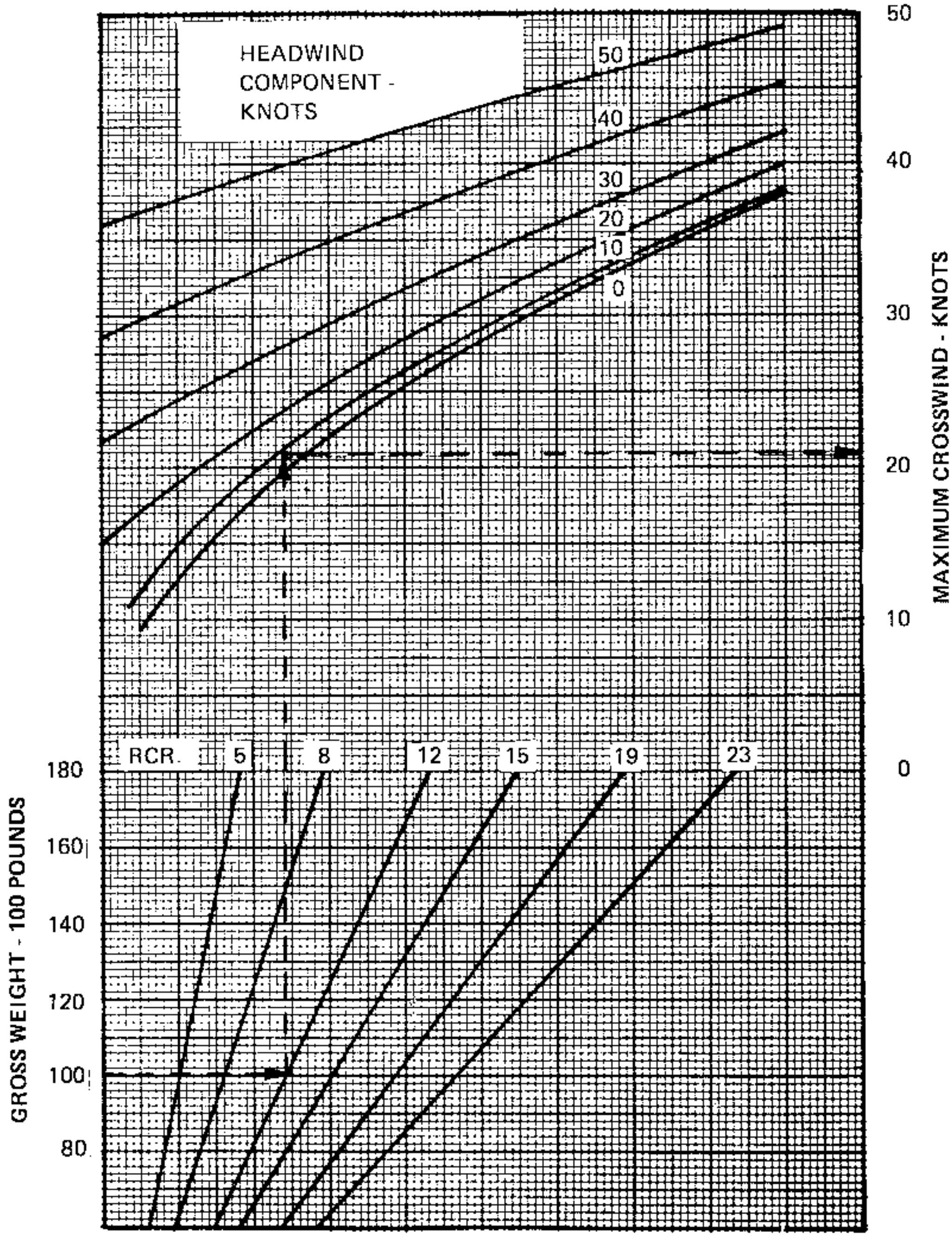
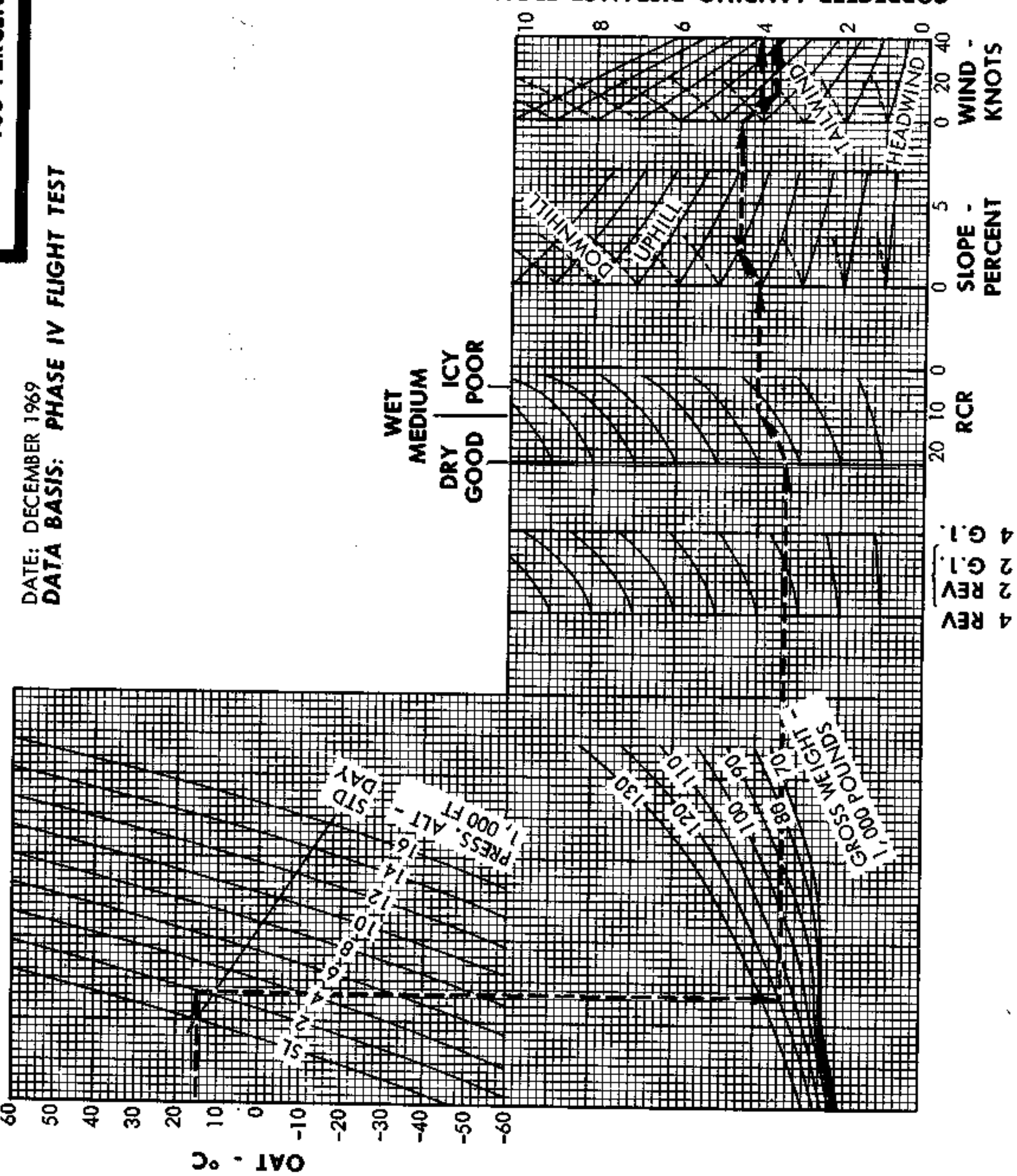


Figure A8-8.

LANDING DISTANCE FROM 50 FEET
100 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: *PHASE IV FLIGHT TEST*



130A-(1-1)-0-163

Figure A8-9.

LANDING GROUND ROLL

100 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

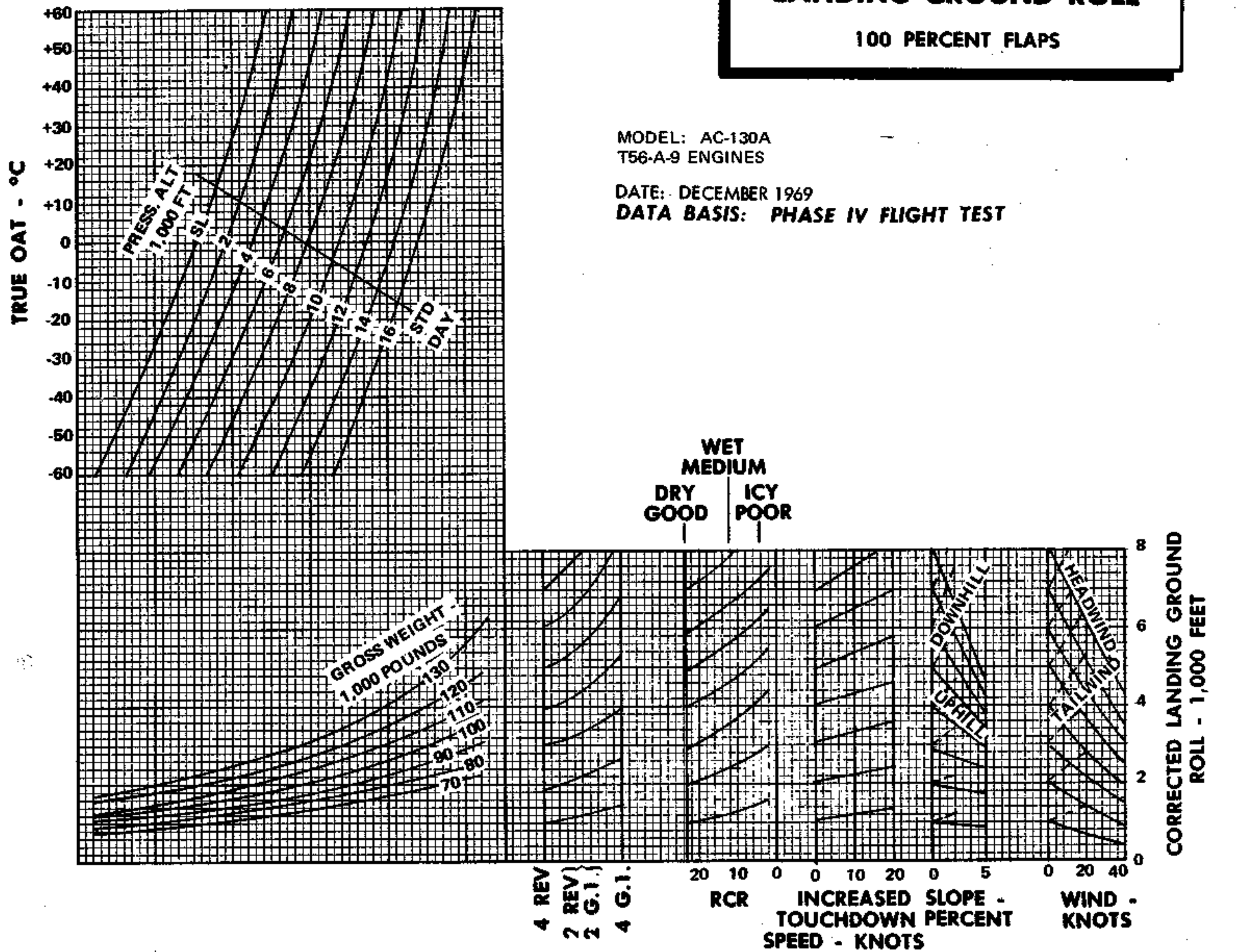


Figure A8-10.

LANDING DISTANCE FROM 50 FEET

50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: *PHASE IV FLIGHT TEST*

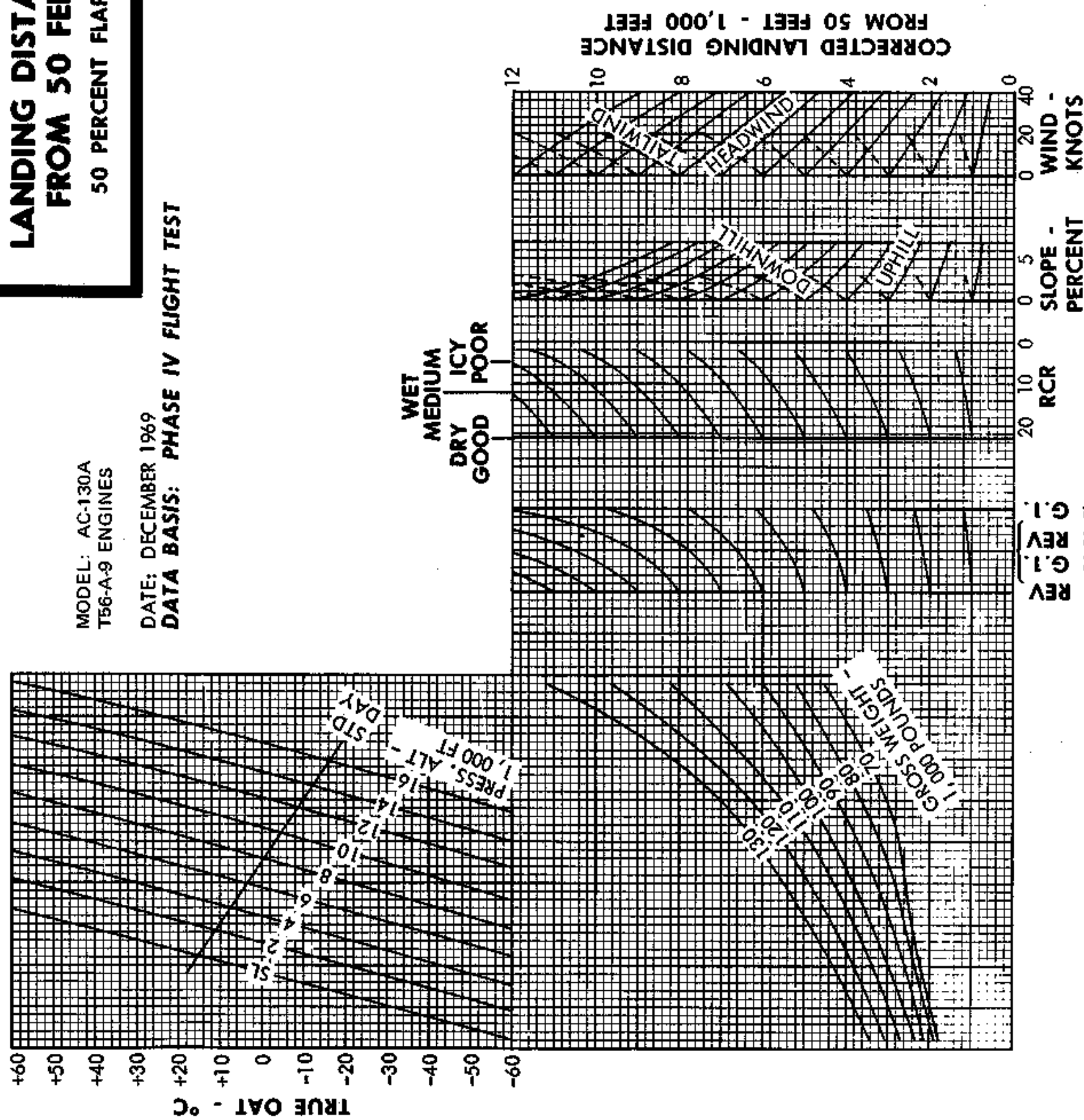


Figure A8-11.

130A-(1-1)-0-164

LANDING GROUND ROLL

50 PERCENT FLAPS

MODEL: AC-130A
T56-A-9 ENGINES

DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST

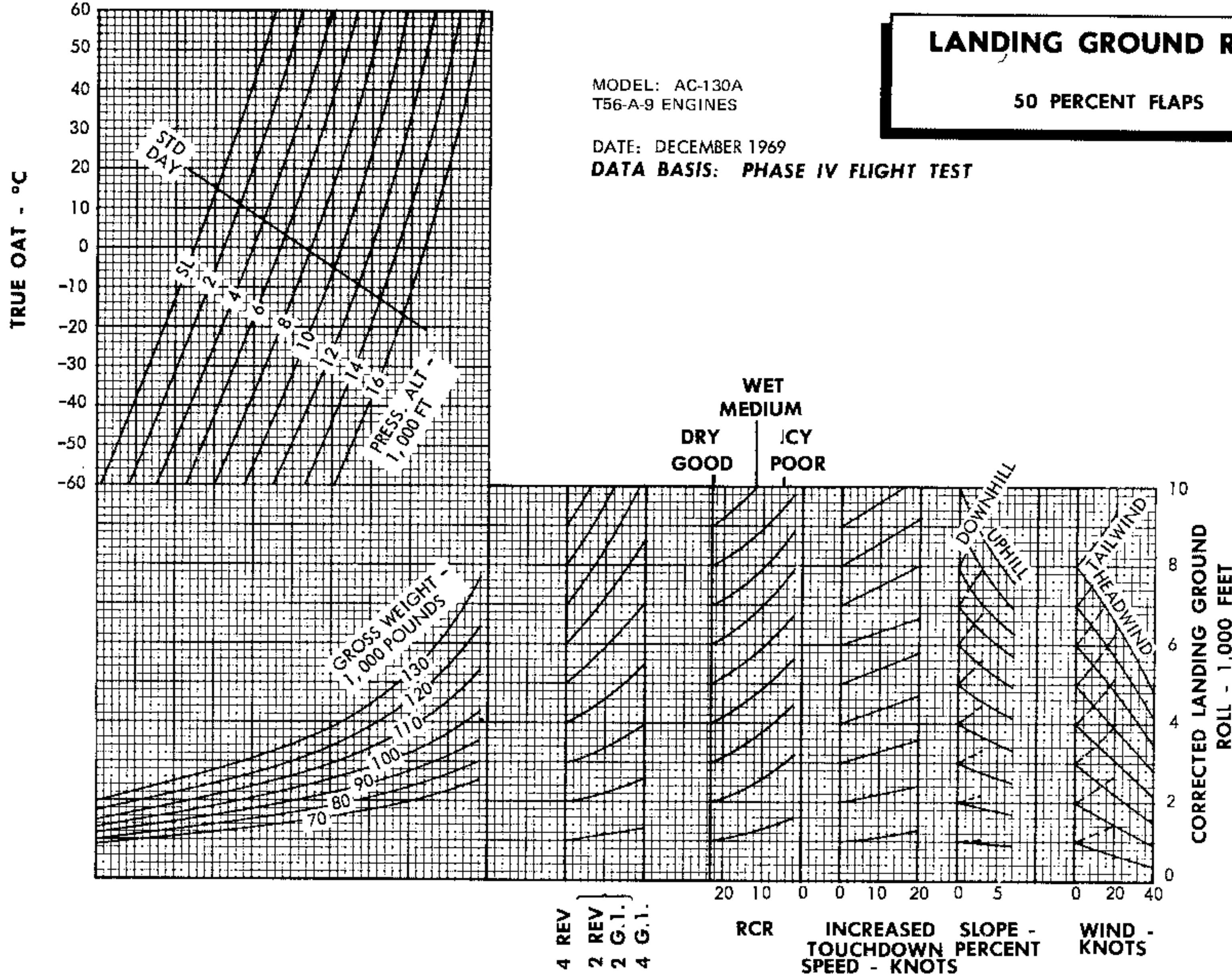


Figure A8-12.

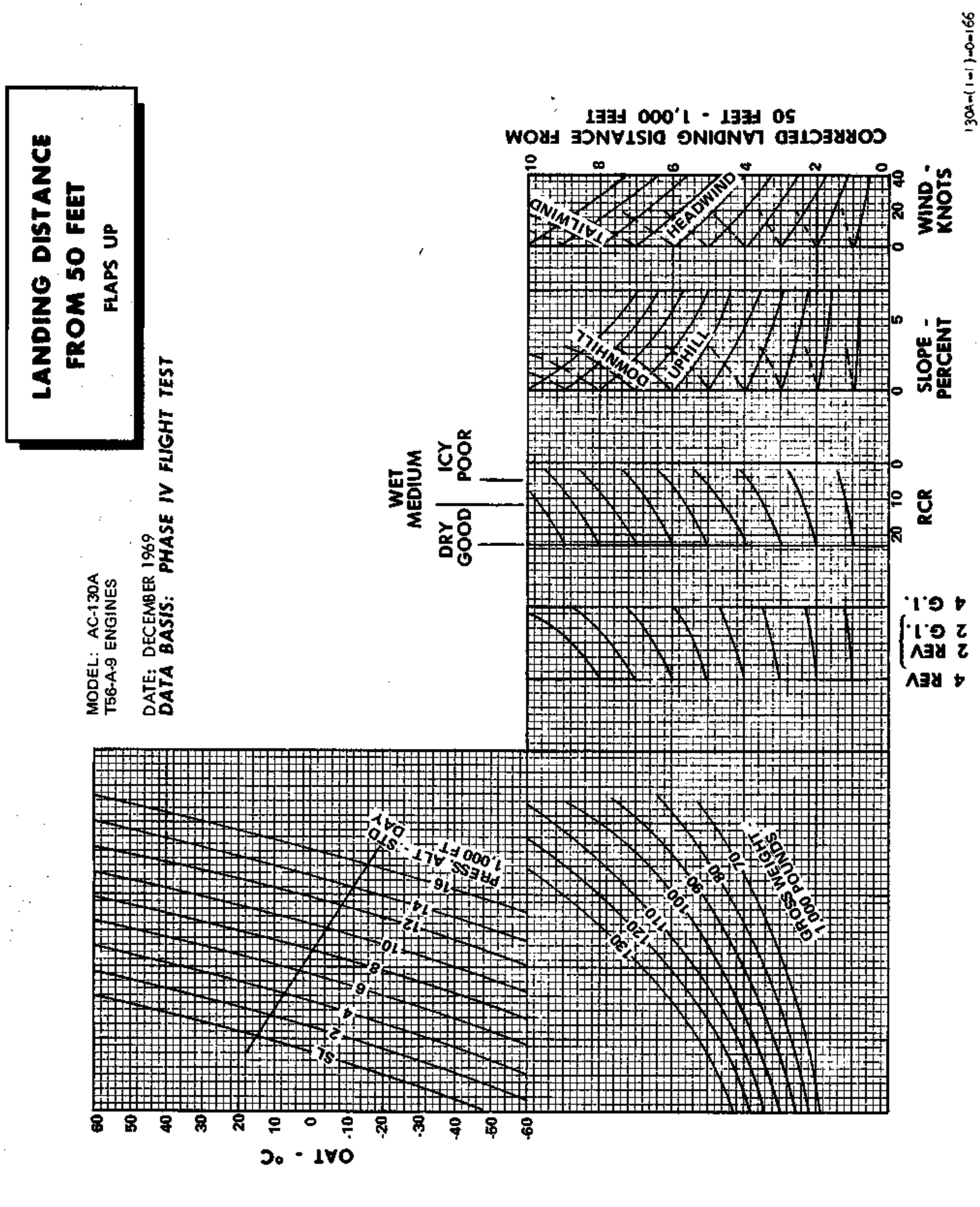

LANDING DISTANCE FROM 50 FEET
FLAPS UP
MODEL: AC-130A
T56-A-9 ENGINES
DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
OAT - °C
PRESS. ALT - 1,000 FT
STD DAY
SL
GROSS WEIGHT - 1000 POUNDS
4 REV
2 REV 2 G.I.
4 G.I.
DRY GOOD
WET MEDIUM
ICY POOR
RCR
DOWNHILL
UPHILL
SLOPE - PERCENT
TAILWIND
HEADWIND
WIND - KNOTS
CORRECTED LANDING DISTANCE FROM 50 FEET - 1,000 FEET

Figure A8-13.

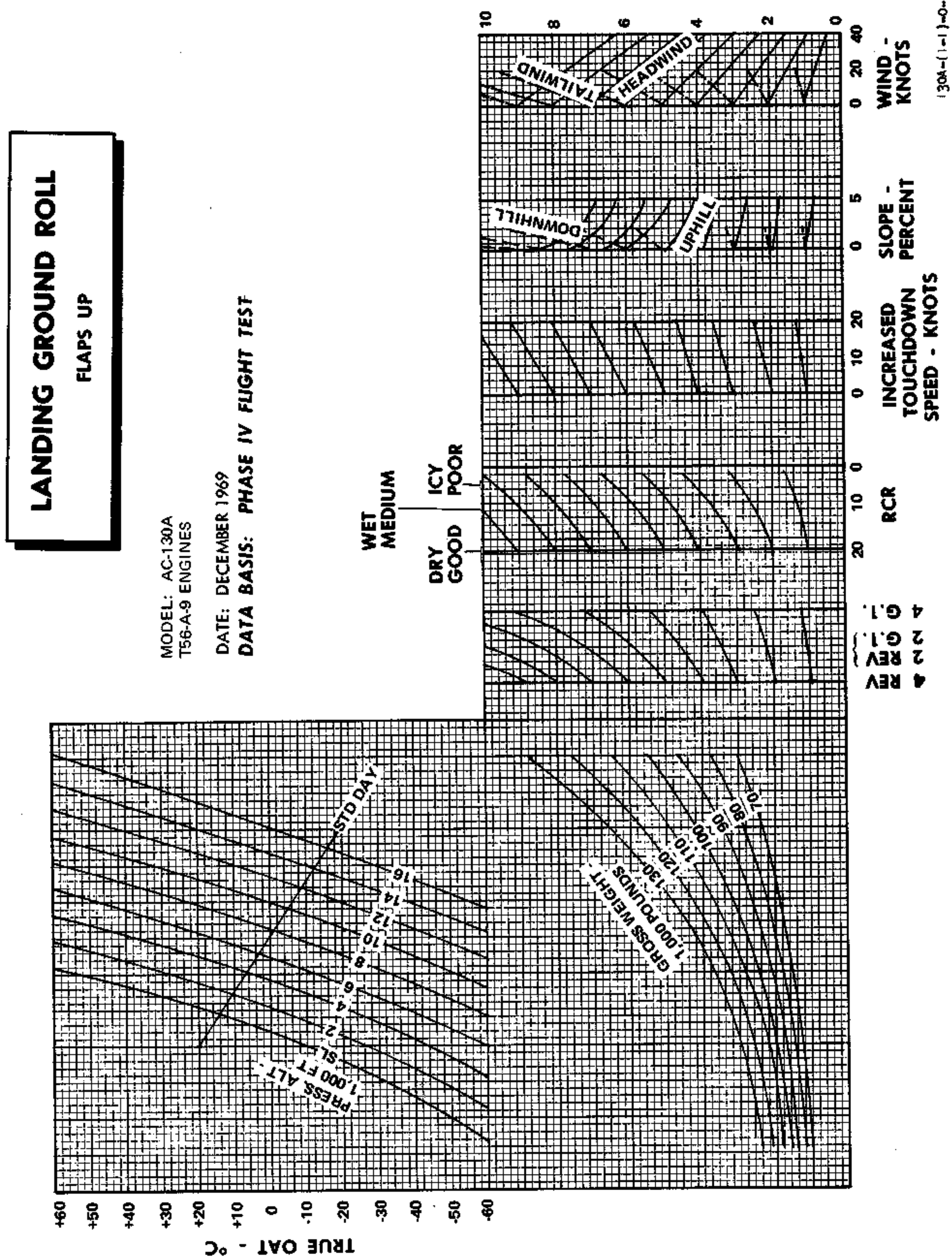

LANDING GROUND ROLL
FLAPS UP
MODEL: AC-130A
T56-A-9 ENGINES
DATE: DECEMBER 1969
DATA BASIS: PHASE IV FLIGHT TEST
TRUE OAT - °C
+60 +50 +40 +30 +20 +10 0 -10 -20 -30 -40 -50 -60
PRESS. ALT. 1,000 FT
SL 2 4 6 8 10 12 14 16
STD DAY
GROSS WEIGHT 1,000 POUNDS
130 120 110 100 90 80 70
4 REV
2 REV
2 G.I.
4 G.I.
DRY GOOD
WET MEDIUM
ICY POOR
RCR
20 10 0
INCREASED TOUCHDOWN SPEED - KNOTS
0 10 20
SLOPE - PERCENT
DOWNHILL
UPHILL
0 5
WIND - KNOTS
TAILWIND
HEADWIND
0 20 40
10 8 6 4 2 0
130A-(1-1)-0-139

Figure A8-14.

PART 9. MISSION PLANNING

TABLE OF CONTENTS

LIST OF CHARTS

INTRODUCTION.

The importance of adequate planning to the successful performance of any mission is well known. This Part of the Appendix is intended to demonstrate the proper use of the charts and the procedures to be followed in mission planning. Therefore, it should be the responsibility of the users of this Appendix to become thoroughly familiar with this Part and the examples throughout the Appendix so that mission planning may be accomplished quickly and accurately. Also familiarization with this Part and the examples will aid in coping with emergency situations.

TAKE-OFF AND LANDING DATA CARD.

A sample take-off and landing data card (figure A9-1) is provided to illustrate the use of the card. Use the sample TOLD card and the following information to determine the source of information and definitions for completing the card.

Note

Take-off and immediate landing data for the departure airfield will be computed prior to take-off. The destination landing data will be computed prior to or during the BEFORE LANDING PATTERN checklist.

GROSS WEIGHT - Gross weight of airplane in pounds at start of take-off run.

PRESSURE ALTITUDE - Obtained from briefing or tower operator.

RUNWAY LENGTH - Obtained from operations or Flight Information Publication (FLIP) charts, etc.

TEMPERATURE - Runway temperature in degrees centigrade, obtain from tower. If runway temperature is not available, use OAT plus 2 degrees centigrade if OAT is standard or above. Use actual OAT if OAT is below standard.

RUNWAY SLOPE - Obtain from Operations or Flight Information Publication (FLIP) Charts, etc.

RCR and RSC - Obtain from control tower. At forward operating locations, good judgment must be used.

WIND DIRECTION AND VELOCITY - Obtain from Weather/Operations briefing.

OBSTACLE HEIGHT AND DISTANCE - Obtain from Operations or Flight Information Publication (FLIP) Charts, etc.

CRITICAL FIELD LENGTH - Obtain from figure A3-11 or A3-27.

MINIMUM CONTROL SPEED (V_{MCA}) - Obtain from figures A3-19 and A3-20.

REFUSAL SPEED - Obtain from figure A3-12 or A3-28

MAX EFFORT TAKEOFF SPEED - Obtain from figure A3-18.

NORMAL TAKE-OFF SPEED - Obtain from figure A3-18.

NORMAL OBSTACLE CLEARANCE SPEED - Obtain from figure A3-18.

TORQUE - Obtain from figure A3-3.

GROSS WEIGHT - Gross weight of airplane in pounds at start of take-off run.

MAX EFFORT TAKE-OFF GROUND RUN - Obtain from figure A3-22.

NORMAL TAKE-OFF GROUND RUN - Obtain from figure A3-2.

MAXIMUM EFFORT OBSTACLE CLEARANCE SPEED Obtain from figure A3-18.

THRESHOLD & TOUCHDOWN SPEEDS, 50% FLAPS - Obtain from figure A8-2.

THRESHOLD & TOUCHDOWN SPEEDS, 100% FLAPS - Obtain from figure A8-1.

LANDING GROUND ROLL/DISTANCE - Compute using two engines in reverse and two in ground idle with full brakes for immediate landing or four engines in reverse and full brakes for normal destination landings, unless conditions dictate otherwise.

CHART USE IN MISSION PLANNING.

The discussion that follows is based on a typical mission with performance computed for a routine situation in which no emergencies arise. To demonstrate the use of a chart for an emergency, an assumption is made as to the emergency, and the proper use of the chart is shown. When emergencies arise, it is necessary to determine the best course of action for the existing circumstances. If the airplane performance is affected, revised performance computations may be necessary to determine the course of action. The detailed mission calculations are not shown for emergency conditions, since a clear understanding of the other information shown will enable use of the data for these conditions.

PLANNING A TYPICAL MISSION.

MISSION REQUIREMENTS.

The mission is assumed to be from the West Coast to Hawaii, a distance of 2,145 nautical miles. The take-off weight will be limited by the maximum normal structural limit of 124,200 pounds or the take-off and climb-out criteria, as applicable. The cargo will be the maximum that can be delivered the given distance as limited by available fuel or take-off weight, but it must not exceed the cargo weight limitations. Cruise will be 2,000-foot step-climb cruise at long-range cruise speeds. An 8,000-foot runway length is assumed for take-off at sea level pressure altitude. Drag Index is zero.

WEATHER, TEMPERATURE AND WIND CONDITIONS.

The following conditions are predicted for the mission:

Ceiling and visibility unlimited.

Temperatures:

At home base: 25°C, at sea level.

Enroute: Standard plus 10°C.

At destination: 25°C, at sea level.

Winds.

At home base: 20-knot headwind.

At destination: 15-knot headwind.

TAKE-OFF WEIGHT.

With the assumed atmosphere conditions, the maximum power torque is found to be 14,000 inch-pounds (figure A3-7). Figure A3-8 shows that no take-off weight limit is required to account for three-engine rate-of-climb capability, and figure A3-11 shows a critical field length of 3,400 feet for 124,200 pounds gross weight, using 50 percent of the reported headwind. The refusal speed is found to exceed take-off speed (figure A3-12). Therefore, from a performance standpoint, there is no take-off weight limit and the mission will be planned with a take-off weight of 124,200 pounds.

CLIMB.

The start climb weight is the take-off weight less 1,000 pounds. The 1,000 pounds is a fuel allowance used for taxi, warm-up, and take-off. Therefore, the begin climb weight is 124,200 pounds less 1,000 pounds, or 123,200 pounds. The time, distance, and fuel for climb to 22,000 feet are:

Time: 31.5 minutes (figure A4-1).

Distance: 90 nautical miles (figure A4-2).

Fuel: 2,550 pounds (figure A4-3).

Climb speeds: From figure A4-4.

The end climb weight, begin cruise out, is 123,200 pounds less 2,550 pounds or 120,650 pounds.

CRUISE.

It is assumed that cruise is at long-range cruise speeds with 2,000-foot step climb increments. Cruise fuel is computed at that condition from the end of climb to the point over the destination.

Begin cruise weight - 120,650 pounds (from climb calculations).

Distance to cruise - total distance less climb distance (2,145 - 90 = 2,055 nautical miles).

Since the temperature assumed for this example is midway between the standard day and the standard day +20°C condition, it is best to determine fuel used for each of those conditions and to use an average value. For standard +20° (figure A5-60) and standard (figure A5-61 conditions, the fuel requirements are:

	Standard + 20		Standard
Distance at Begin Cruise Weight	5,920		8,300
Cruise Distance	2,055		2,055
Distance at End Cruise	7,975		10,355
End Cruise Weight	92,250		94,200
Average End Cruise Weight	$\frac{92,250 + 94,200}{2}$	=	93,225

The range prediction charts for variable cruise altitude have been prepared for 2,000-foot step conditions, and the weights at which each climb step should be initiated are indicated by symbols on the curves. Cruise time is found by a similar process, from figures A5-85 and A5-86 to be 7.5 hours.

To find the speeds, power settings, and fuel flows, at any time or condition during the mission, the range summary charts, figures A5-33 thru A5-36 are used in the manner demonstrated by the examples for those charts.

LANDING.

Landing weight (average end cruise weight): 93,225 pounds.

Planned from 50 feet, 100% flaps.

Touchdown speed: 96 knots IAS (figure A8-1).

Threshold speed: 105 knots IAS (figure A8-1).

Approach speed: Threshold speed +10 or 115 knots IAS (figure A8-1).

Landing distance (50% flaps): 2,820 feet with no wind; 2,600 feet with 50 percent reported headwind (figure A8-11).

Ground roll distance (brakes plus reverse) (100 Percent flaps): 1,500 feet with no wind; 1,300 feet with wind (figure A8-10).

DESCENT.

For the cruise fuel calculations, cruise was assumed to a point over the destination. A small amount of fuel may be conserved if descent is planned so as to reach the traffic pattern altitude at the destination, conditions permitting. Penetration descent is used if it is desired to conserve the maximum amount of fuel. End cruise altitude is 28,000 feet. The penetration descent data are shown in figure A7-1.

Note

> It is not important to know the exact weight at the beginning of descent. Therefore, the end cruise weight, 93,225 pounds, may be used.

Time to descend: 12 minutes.

Distance to descend: 50 nautical miles.

Fuel for descent: 345 pounds.

Descent speed: 136 to 20,000 feet.
250 knots IAS 20,000 feet and below.

ENDURANCE.

On arriving at the destination, assume that it is necessary to hold for an hour prior to landing. Also assume that holding will be at 10,000 feet at maximum endurance. The gross weight is determined to be 93,225 pounds under the cruise discussion.

Airspeed: 122 knots CAS (figure A6-2).

Fuel flow: 765 pounds/hour/engine (figure A6-2).

Fuel required: 3,060 pounds (figure A6-2).

RESERVE FUEL.

The reserve fuel allowance is assumed to be one hour cruise at long-range cruise at the end of cruise ceiling plus 1-3/4 hours at maximum endurance at 10,000 feet. The assumption will also be made that the one hour at cruise will be calculated beginning with the calculated end cruise weight of 93,225 pounds, and that the endurance fuel is calculated beginning with the weight at the end of the one hour cruise.

Weight at beginning of one hour cruise: 93,225.

Fuel required: 1,620 x 4 = 4,480 pounds (figure A5-34).

Weight at begin endurance: 93,225 - 4,480 = 88,745 pounds.

Endurance fuel: 745 x 4 x 1-3/4 = 5,200 (figure A6-2).

Reserve fuel cruise fuel + endurance fuel (4,480 + 5,200 = 9,680 pounds).

TOLD

GROSS WEIGHT ______

PRESSURE ALTITUDE ______

RUNWAY LENGTH ______

TEMPERATURE ______ SLOPE ______

RCR ______ RSC ______

WIND DIR. ______° V ______ KTS.

OBSTACLE HGT. ____ DIST. ____ NM

TAKE-OFF FACTOR ______

CL FACTOR ______

CRITICAL FIELD LENGTH ______

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GROSS WEIGHT	TAKEOFF DATA	TORQUE

MIN CONT SPEED 1 ENG INOP	NORMAL TAKEOFF				
	REFUSAL SPEED	T.O. SPEED	GROUND RUN	OBS CLEAR SPEED	3 ENG CL SPEED
2 ENG INOP OUT OF GRD EFFECT	**MAX EFFORT TAKEOFF**				
	REFUSAL SPEED	T.O. SPEED	GROUND RUN	OBS CLEAR SPEED	3 ENG CL SPEED

LANDING DATA			GROSS WEIGHT		
FLAPS	APPROACH	THRESHOLD	TOUCHDOWN	DISTANCE	GRD ROLL
50%					
100%					
MAX EFFORT					

LOCAL REPRODUCTION OF THIS CARD IS AUTHORIZED

Figure A9-1.

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