APPENDIX I

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Original Signed By
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PART I

GENERAL INFORMATION

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LIST OF ILLUSTRATIONS

GENERAL INFORMATION.

The information in the Appendix is presented to assist operating personnel in a better understanding of the performance capabilities and limitations of the aircraft. The object of the Appendix is to provide specific performance values in graphic form, covering all reasonable conditions under which the aircraft may be operated, to enable the operating personnel to utilize the aircraft efficiently. Unless otherwise noted on the chart, all performance data contained in the Appendix is applicable to all C-54 Series aircraft.

ABBREVIATIONS, SYMBOLS, AND DEFINITIONS.

The following are abbreviations, symbols, and definitions of terms used throughout the Flight Manual.

ABBREVIATIONS.

Abbreviation	Definition
Alt	Altitude
BHP	Brake horsepower
BMEP	Brake mean effective pressure
°C	Degrees Centigrade
CAS	Calibrated airspeed
CAT	Carburetor air temperature

CG	Center of gravity
CHT	Cylinder head temperature
EAS	Equivalent airspeed
Eng	Engine
°F	Degrees Fahrenheit
FF	Fuel flow
fpm	Feet per minute
fps	Feet per second
ft	Feet
g	Gravitational force
Hg	Mercury
IAS	Indicated airspeed
ICAO	International Civil Aviation Organization
in	Inches
KIAS	Indicated airspeed in knots
lb/hr	Pounds per hour (fuel flow)
MAC	Mean aerodynamic chord
MAP	Manifold absolute pressure (inches of mercury)
Max	Maximum
METO	Maximum except takeoff (power)
Min	Minimum

OAT	Outside air temperature
psi	Pounds per square inch (pressure)
R/C	Rate of climb
RCR	Runway Condition Reading
rpm	Revolutions per minute (engine speed)
SL	Sea level
Std	Standard
T	Absolute temperature (ambient temperature ($^\circ$C) + 273)
TAS	True airspeed
Va	Acceleration check speed
Vd	Decision speed
Vmc	Minimum Control Speed
Vr	Refusal speed
Vso	Power-off stall speed
Vto	Takeoff speed
Wt	Weight
$\dfrac{1}{\sqrt{\sigma}}$	Smoe—Correction factor for air density applied to EAS
δ	Delta—Ratio of ambient air pressure to standard sea level air pressure
ρ	Rho—Air density, slugs per cubic foot
σ	Sigma—Air density ratio ρ/ρ_0

DEFINITION OF TERMS.

ABSOLUTE CEILING—Maximum altitude at which level flight can be maintained with zero feet per minute rate of climb.

ACCELERATION CHECK SPEED—The minimum acceptable speed at the acceleration check point.

ACCELERATION CHECK POINT—A predetermined point, based on time/distance at which the acceleration check speed should be attained.

AIRSPEED—The speed of the aircraft relative to the air through which it is moving (see Airspeed Terminology, this Section).

AMBIENT CONDITIONS—Condition of the air surrounding the aircraft at any given time under consideration.

BRAKE MEAN EFFECTIVE PRESSURE—That portion of the internal cylinder pressure which produces usable engine horsepower, calculated from bhp, rpm, and engine constant; for the R-2000 engine, constant = 396, $\text{bmep} = \dfrac{\text{bhp} \times 396}{\text{rpm}}$.

COMPRESSIBILITY ERROR—Error in the airspeed and OAT indicator readings caused by air being slightly compressed by the moving aircraft.

CRITICAL ALTITUDE—Altitude at which full throttle is required to maintain a given bhp at a set rpm.

CRITICAL ENGINE FAILURE SPEED—The speed at which engine failure permits acceleration to takeoff speed in the same distance that the aircraft may be decelerated to a stop.

CRITICAL FIELD LENGTH—The total length of runway required to accelerate on all engines to critical engine failure speed, experience an engine failure, and then either continue the takeoff or stop.

CROSSWIND COMPONENT—Resultant crosswind at ninety degrees to the runway as the result of wind direction and velocity.

CRUISE CEILING—Maximum altitude at which 300 feet per minute rate of climb can be maintained at METO power.

DECISION SPEED—Minimum speed from which a safe takeoff can be continued in the remaining runway length, should an engine failure occur.

DENSITY ALTITUDE—Pressure altitude corrected for temperature. Varies in direct proportion to temperature; with temperature above standard, density altitude will be higher than pressure altitude.

DEW POINT—Temperature at which condensation occurs in a cooling mass of air.

GO-NO-GO DISTANCE—Distance to the runway marker which is the first marker below the normal refusal distance. Also, the point at which the final decision to continue the takeoff or abort is made, except for cases where critical engine failure speed is greater than the go-no-go speed.

GO-NO-GO SPEED—Minimum allowable speed at the go-no-go marker.

GROUND EFFECT—The reduction in induced drag when the aircraft is near the ground. Ground effect is negligible when aircraft reaches a height equal to one half the wing span.

HEADWIND COMPONENT—Resultant headwind parallel to the runway as the result of wind direction and velocity.

LANDING DISTANCE—Total distance from a height of 50 feet over end of runway to completion of landing ground roll.

LANDING GROUND ROLL—Distance from touchdown to complete stop.

MINIMUM CONTROL SPEED—Minimum speed at which directional control can be maintained with zero yaw and an angle of bank of not more than 5 degrees to assist the rudder, in the event of failure of an outboard engine (propeller windmilling), and the remaining three engines operating at maximum power.

OPERATING WEIGHT EMPTY—Total weight of the aircraft with installed equipment and normal engine oil, excluding fuel, loose equipment, payload and crew.

POSITION ERROR—The error in airspeed indicator and altimeter readings due to the static orifices not being able to transmit a true ambient air pressure to the instruments.

PRESSURE ALTITUDE—Equivalent altitude resulting from changes in barometric pressure, uncorrected for temperature. The altitude that will be read on the altimeter (after correction for position error) with a setting of 29.92.

REFUSAL DISTANCE—Distance required to accelerate to refusal speed.

REFUSAL SPEED—Maximum speed to which the aircraft can accelerate and then stop in the remaining available runway.

RELATIVE HUMIDITY—The ratio of the amount of water vapor in a given mass of air to the maximum amount of water vapor that mass of air could hold at the same temperature.

RUNWAY CONDITIONS READING—Runway surface condition as measured on the James Brake Decelerometer.

SPECIFIC HUMIDITY—The ratio of the amount of water vapor in a given air mass to the mass of dry air, measured in pounds.

STALL SPEED—Speed at which the aircraft starts to drop because of separation of airflow over the wings due to insufficient airspeed or excessive angle of attack.

STANDARD ATMOSPHERE—An arbitrary variation of air density, pressure, and temperature with altitude used for comparing engine and aircraft performance. Standard air at sea level is represented by a barometric pressure of 29.92 in. Hg at 15° C (59° F).

STANDARD DAY—A day on which standard atmospheric conditions are assumed to exist.

TAKEOFF DISTANCE—Distance from start of takeoff ground run to point of lift-off with all engines operating.

TAKEOFF SPEED—Speed at which the aircraft is lifted off the runway. Performance charts assume a takeoff speed equal to 115

percent of power-off stall speed of 110 percent of minimum control speed, whichever is higher, for a wing flap setting of 15 degrees.

THRESHOLD SPEED—Speed at which the aircraft crosses the end of the runway during a normal landing (130 percent of power-off stall speed).

TOUCHDOWN SPEED—Speed at which the aircraft comes in contact with the runway during a normal landing (120 percent of power-off stall speed).

WEIGHT CORRECTION FACTOR—Correction factor applied to the actual aircraft gross weight to enable the operator to achieve charted range performance. Computed by comparing charted performance with actual aircraft performance under given conditions.

WING FLAP RETRACTION SPEED—The minimum recommended airspeed for starting wing flap retraction (120 percent of power-off stall speed for the zero wing flap configuration).

AIRSPEED TERMINOLOGY.

Airspeed terminology used in this Appendix is defined as follows:

Term	Abbreviation	Definition
*Indicated Airspeed	IAS	Airspeed indicator reading uncorrected
Calibrated Airspeed	CAS	Indicated airspeed corrected for position error
Equivalent Airspeed	EAS	Calibrated airspeed corrected for compressibility
True Airspeed	TAS	Equivalent airspeed corrected for air density

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

*Indicated airspeed is used in this Appendix as though the mechanical error in the instrument is zero.

All airspeed data relating to takeoff and landing procedures are given as indicated airspeed. Indicated airspeed for ground run is based on an estimated position error equal to zero. Since all cruise data is given as calibrated airspeed, the airspeed position error charts are included to obtain the corresponding indicated airspeed. The Characteristic Takeoff Speeds Chart (figure A3-12) and the Characteristic Landing Speeds Chart (figure A6-3) give indicated airspeed based on inflight calibrations. The takeoff performance charts (figures A3-2 through A3-12) give indicated airspeed based on negligible ground run position error.

DISCUSSION OF CHARTS.

The Takeoff Performance Charts in Part 3 are presented in such a manner that performance may be determined for any set of atmospheric conditions. The climb data in Part 4 is presented for ICAO Standard Day and Hot Day (Standard Day + 20° C) conditions. Range performance in Part 5 may be determined for any atmospheric temperature condition by considering the altitude specified in the charts as density altitude. The performance charts are identified according to type and conditions by colored page borders conforming to the following code:

Normal Operation	No Border
Emergency Operation	Red Corner Border
Hot Day	Yellow Corner Border

DENSITY ALTITUDE CHART.

The Density Altitude Chart (figure A1-1) is used in determining the density altitude and the value of $\frac{1}{\sqrt{\sigma}}$ for any pressure altitude and ambient temperature. The following example illustrates the use of the chart.

Example

> Given: Outside Air Temperature = 25° C
>
> Pressure Altitude = 1500 feet
>
> Find: Density Altitude and $\dfrac{1}{\sqrt{\sigma}}$

Enter the chart with an outside air temperature corrected for compressibility (see figure A1-7) of 25° C (A), and read up to pressure altitude of 1500 feet (B). Read to the left to find density altitude of 3000 feet (C), and to the right to find the value of $\dfrac{1}{\sqrt{\sigma}}$ as 1.045 (D).

ICAO STANDARD ATMOSPHERE TABLE.

The ICAO Standard Atmosphere Table (figure A1-2) shows the standard atmospheric values, as defined by ICAO, in increments of 1000 feet from sea level to 30,000 feet. The values of Density Ratio (σ), $\dfrac{1}{\sqrt{\sigma}}$ (Smoe), temperatures, speed of sound, barometric pressure in inches Hg, and pressure ratio (δ), are given for each altitude increment.

ICAO STANDARD ALTITUDE TABLE.

The ICAO Standard Altitude Table (figure A1-3) gives the value of $\dfrac{1}{\sqrt{\sigma}}$ accurately for every 100-foot increment of density altitude from 100 to 30,000 feet. The $\dfrac{1}{\sqrt{\sigma}}$ value is used to obtain true airspeed from equivalent airspeed as follows: TAS = EAS x $\dfrac{1}{\sqrt{\sigma}}$.

PRESSURE ALTITUDE TABLE.

The Pressure Altitude Table (figure A-14) provides the necessary corrections to field elevation to obtain pressure altitude from the altimeter setting. To determine pressure altitude, find the altitude correction (ΔALT). for the given altimeter setting. Add this correction algebraically to the field elevation to obtain pressure altitude.

PSYCHROMETRIC CHART.

The Psychrometric Chart (figure A1-5) graphically relates the various measures of water vapor in the atmosphere. This chart is used primarily to obtain specific humidity from the dew point and pressure altitude. The specific humidity is the measure of humidity used in determining takeoff performance. Although it is the dew point which is commonly furnished the pilot, occasionally humidity may have to be determined from wet and dry bulb temperatures, and less often as relative humidity. To meet all such situations the psychrometric chart provides a means of converting any of these variables into specific humidity. The following example illustrates the methods of using the chart.

Example.

> Given: Wet Bulb Temperature = 17° C
>
> Dry Bulb Temperature = 26° C
>
> Pressure Altitude = 5000 feet
>
> Find: Relative humidity, dew point, specific humidity, and vapor pressure.

Enter the chart from the dew point temperature line at a wet bulb temperature of 17° C (A), and follow the 5000 foot altitude guide line into the chart grid. Enter the bottom of the chart at a dry bulb temperature of 26° C (B), and read up to the intersection of the wet bulb temperature to find relative humidity of 42% (C). To find the dew point temperature, read across to the dew point temperature line at the left of the grid to find a dew point of 54.5° F (D). To find specific humidity, read across to the left and follow the guidelines to a pressure altitude of 5000 feet (E), and straight across to a specific humidity of 0.0108 (F). To find vapor pressure, read across from dew point or relative humidity to the right for a vapor pressure of 0.425 In. Hg (G).

If the dew point temperature and pressure altitude are known, specific humidity and vapor pressure can be determined by reading

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

TEMPERATURE CONVERSION CHART.

The Temperature Conversion Chart (figure A1-6) is presented in degrees centigrade versus degrees fahrenheit to facilitate the conversion of given temperatures as desired.

TEMPERATURE CORRECTION FOR COMPRESSIBILITY.

The Temperature Correction for Compressibility chart (figure A1-7) is used when determining true airspeed at high altitudes. Careful navigation requires that the indicated temperature be corrected for compressibility in order to obtain an accurate value for $\frac{1}{\sqrt{\sigma}}$.
The corrected outside air temperature (OAT) is used to enter the density altitude chart. The following example illustrates the method of using the chart.

Example

    Given: Indicated Outside Air Temperature = -10° C

             Calibrated Airspeed = 180 knots

             Pressure Altitude = 20,000 feet

    Find: Corrected outside air temperature.

Enter the chart with an airspeed of 180 knots (A), and read up to an altitude of 20,000 feet (B). Read across to find a temperature correction of 6.5° C. Subtract correction from indicated temperature—(-10° C) - (6.5° C) = -16.5° C, or, rounded off to nearest whole number, -17° C.

CALIBRATED AIRSPEED CORRECTION FOR COMPRESSIBILITY.

The Calibrated Airspeed Correction For Compressibility chart (figure A1-8) is used in determining equivalent airspeed (EAS) from the calibrated airspeed obtained from the position error correction charts. The following example illustrates the use of the chart.

Example.

    Given: Pressure Altitude = 20,000 feet

             Calibrated Airspeed = 180 knots

    Find: Equivalent airspeed.

Enter the chart at 180 knots CAS (A), and read up to pressure altitude of 20,000 (B). Read across to find correction of 1.9 knots (C). Round off to nearest whole number (2.0), and subtract from CAS to obtain EAS. 180 -2 = 178 knots EAS.

AIRSPEED POSITION ERROR CORRECTION.

The Airspeed Position Error Correction charts (figures A1-9 and A1-10) are provided to obtain calibrated airspeed from indicated airspeed by correcting for the effect of wing flaps and landing gear positions on the static source. Separate charts are provided for aircraft with and without the radome nose installed. Each of the charts have correction curves for aircraft in the clean configuration (flaps and gear up) and with the landing gear down and wing flaps set at 40 degrees. Instrument error is not included in the correction made on these charts. CAS is obtained from IAS by entering the chart at the given IAS, reading up to appropriate correction curve, and across to find the correction factor in knots. The correction factor is then added to IAS to obtain CAS.

KNOTS — MPH CONVERSION CHART.

The Knots—MPH Conversion Chart (figure A1-11) is presented in knots versus miles per hour to facilitate the conversion of given airspeeds as desired.

ALTIMETER POSITION ERROR CORRECTION.

The Altimeter Position Error Correction charts (figures A1-12 through A1-14) are provided to correct the altimeter reading for the effects of airspeed altitude and the position of the wing flaps and landing gear. Separate charts are provided for use with the aircraft in clean configuration (wing flaps and gear up), with the landing gear down and wing flaps set at 20 degrees, and with the landing gear down and the wing flaps at 40 degrees. Each chart has correction curves for aircraft with and without the radome installed. Instrument error is not included in the correction made on these charts.

To correct the altimeter reading, select the chart for the configuration desired and enter with the indicated airspeed. Read up to indicated altitude on the appropriate set of correction curves (with or without radome), and across to find the altimeter correction factor in feet. Add this correction to the altimeter reading to obtain true altitude.

FUEL DENSITY TABLE.

The Fuel Density Table presents variations in fuel density of 100/130 and 115/145 grade fuel as related to variations in temperature.

FUEL DENSITY TABLE.

FUEL TEMPERATURE		FUEL DENSITY (LB/GAL)	
°C	°F	GRADE 100/130	GRADE 115/145
-50 to -45	-58 to -49	6.34	6.27
-45 to -40	-49 to -40	6.30	6.23
-40 to -35	-40 to -31	6.27	6.19
-35 to -30	-31 to -22	6.23	6.16
-30 to -25	-22 to -13	6.20	6.12
-25 to -20	-13 to -4	6.16	6.08
-20 to -15	-4 to 5	6.12	6.04
-15 to -10	5 to 14	6.09	6.00
-10 to -5	14 to 23	6.05	5.97
-5 to 0	23 to 32	6.02	5.93
0 to 5	32 to 41	5.98	5.90
5 to 10	41 to 50	5.94	5.86
10 to 15	50 to 59	5.91	5.82
15 to 20	59 to 68	5.87	5.78
20 to 25	68 to 77	5.84	5.75
25 to 30	77 to 86	5.80	5.71
30 to 35	86 to 95	5.77	5.67
35 to 40	95 to 104	5.73	5.63
40 to 45	104 to 113	5.69	5.60
45 to 50	113 to 122	5.66	5.56

DENSITY ALTITUDE CHART
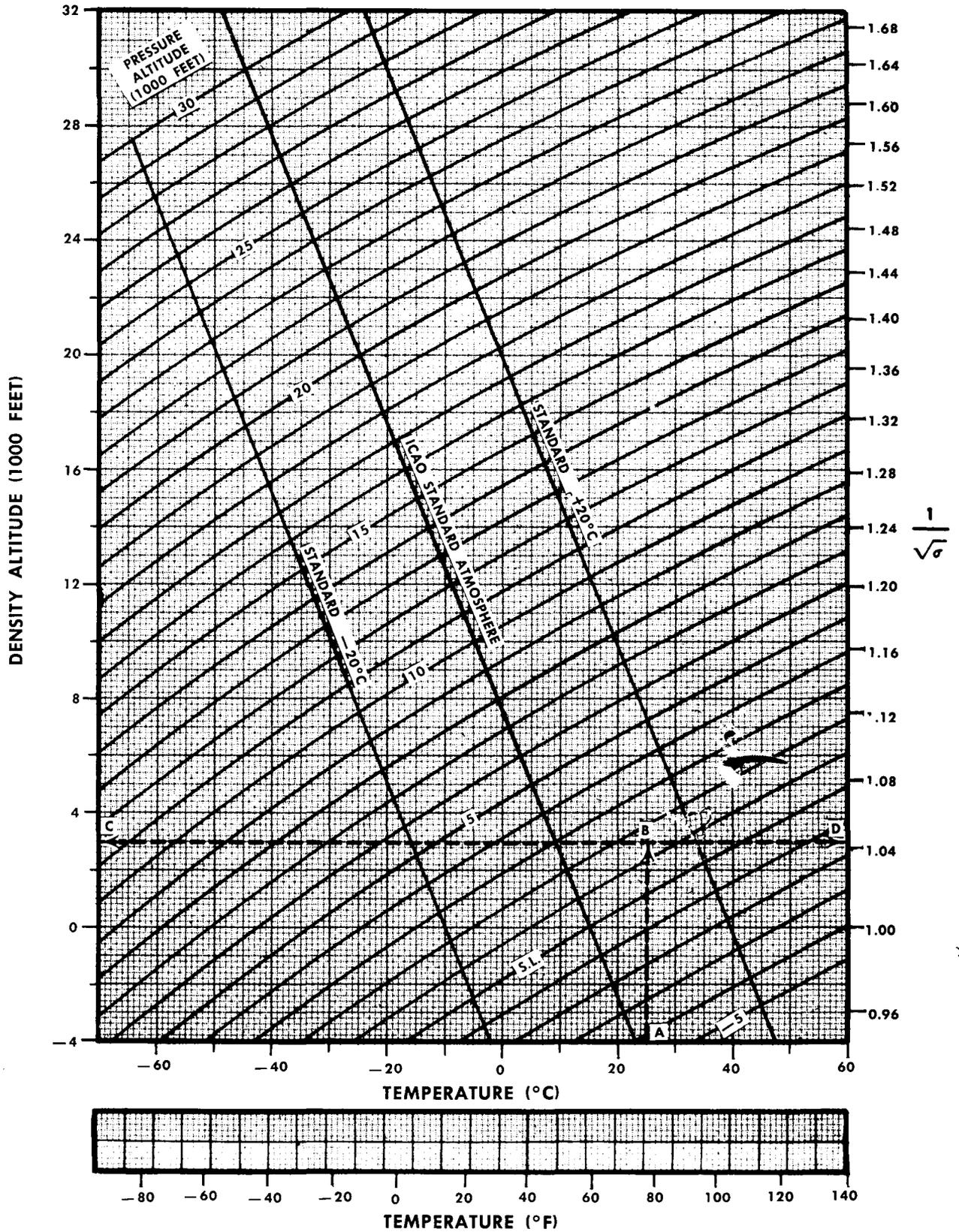
Figure A1-1

ICAO STANDARD ATMOSPHERE TABLE

STANDARD S. I. CONDITIONS:	CONVERSION FACTORS:
Temperature = 15° C (59° F)	1 In. Hg = 70.727 psf
Pressure = 29.921 In. Hg (2116.216 psf)	1 In. = 0.49116 psi
Density = .0023769 slugs/cu ft	1 Knot = 1.151 mph
Speed of sound = 1116.89 fps (661.7 knots)	1 Knot = 1.688 fps

Altitude Feet	Density Ratio σ	$\dfrac{1}{\sqrt{\sigma}}$	Temperature °C	Temperature °F	Speed of Sound (Knots)	Pressure In. Hg	Pressure Ratio δ
0	1.000	1.0000	15.000	59.000	661.7	29.921	1.0000
1000	.9711	1.0148	13.019	55.434	659.5	28.856	.9644
2000	.9428	1.0299	11.038	51.868	657.2	27.821	.9298
3000	.9151	1.0454	9.056	48.302	654.9	26.817	.8962
4000	.8881	1.0611	7.076	44.735	652.6	25.842	.8637
5000	.8617	1.0773	5.094	41.169	650.3	24.896	.8320
6000	.8359	1.0938	3.113	37.603	648.7	23.978	.8014
7000	.8106	1.1107	1.132	34.037	645.6	23.088	.7716
8000	.7860	1.1279	-0.850	30.471	643.3	22.225	.7428
9000	.7620	1.1456	-2.831	26.905	640.9	21.388	.7148
10,000	.7385	1.1637	-4.812	23.338	638.6	20.577	.6877
11,000	.7155	1.1822	-6.793	19.772	636.2	19.791	.6614
12,000	.6932	1.2011	-8.774	16.206	633.9	19.029	.6360
13,000	.6713	1.2205	-10.756	12.640	631.5	18.292	.6113
14,000	.6500	1.2403	-12.737	9.074	629.0	17.577	.5875
15,000	.6292	1.2606	-14.718	5.508	626.6	16.886	.5643
16,000	.6090	1.2815	-16.699	1.941	624.2	16.216	.5420
17,000	.5892	1.3028	-18.680	-1.625	621.8	15.569	.5203
18,000	.5699	1.3246	-20.662	-5.191	619.4	14.942	.4994
19,000	.5511	1.3470	-22.643	-8.757	617.0	14.336	.4791
20,000	.5328	1.3700	-24.624	-12.323	614.6	13.750	.4595
21,000	.5150	1.3935	-26.605	-15.889	612.1	13.184	.4406
22,000	.4976	1.4176	-28.587	-19.456	609.6	12.636	.4223
23,000	.4800	1.4424	-30.568	-23.022	607.2	12.107	.4046
24,000	.4642	1.4678	-32.549	-26.588	604.7	11.597	.3876
25,000	.4481	1.4938	-34.530	-30.154	602.2	11.103	.3711
26,000	.4325	1.5206	-36.511	-33.720	599.7	10.627	.3552
27,000	.4173	1.5480	-38.492	-37.286	597.2	10.168	.3398
28,000	.4025	1.5762	-40.474	-40.852	594.6	9.725	.3250
29,000	.3881	1.6052	-42.455	-44.419	592.1	9.297	.3107
30,000	.3741	1.6349	-44.436	-47.985	589.6	8.885	.2970

Figure A1-2

ICAO STANDARD ALTITUDE TABLE

Altitude Feet	$\dfrac{1}{\sqrt{\sigma}}$	Altitude Feet	$\dfrac{1}{\sqrt{\sigma}}$	Altitude Feet	$\dfrac{1}{\sqrt{\sigma}}$	Altitude Feet	$\dfrac{1}{\sqrt{\sigma}}$	Altitude Feet	$\dfrac{1}{\sqrt{\sigma}}$
100	1.0015	6100	1.0955	12,100	1.2030	18,100	1.3269	24,100	1.4704
200	1.0029	6200	1.0971	12,200	1.2049	18,200	1.3291	24,200	1.4729
300	1.0044	6300	1.0988	12,300	1.2069	18,300	1.3313	24,300	1.4755
400	1.0059	6400	1.1005	12,400	1.2088	18,400	1.3335	24,400	1.4781
500	1.0074	6500	1.1022	12,500	1.2107	18,500	1.3358	24,500	1.4807
600	1.0088	6600	1.1039	12,600	1.2127	18,600	1.3380	24,600	1.4833
700	1.0103	6700	1.1056	12,700	1.2146	18,700	1.3403	24,700	1.4860
800	1.0118	6800	1.1073	12,800	1.2166	18,800	1.3425	24,800	1.4886
900	1.0133	6900	1.1090	12,900	1.2185	18,900	1.3448	24,900	1.4912
1000	1.0148	7000	1.1107	13,000	1.2205	19,000	1.3470	25,000	1.4938
1100	1.0163	7100	1.1124	13,100	1.2224	19,100	1.3493	25,100	1.4965
1200	1.0178	7200	1.1141	13,200	1.2244	19,200	1.3516	25,200	1.4991
1300	1.0193	7300	1.1158	13,300	1.2264	19,300	1.3539	25,300	1.5018
1400	1.0208	7400	1.1175	13,400	1.2284	19,400	1.3561	25,400	1.5045
1500	1.0223	7500	1.1193	13,500	1.2303	19,500	1.3584	25,500	1.5071
1600	1.0238	7600	1.1210	13,600	1.2323	19,600	1.3607	25,600	1.5098
1700	1.0253	7700	1.1227	13,700	1.2343	19,700	1.3630	25,700	1.5125
1800	1.0269	7800	1.1245	13,800	1.2363	19,800	1.3653	25,800	1.5152
1900	1.0284	7900	1.1262	13,900	1.2383	19,900	1.3677	25,900	1.5179
2000	1.0299	8000	1.1279	14,000	1.2403	20,000	1.3700	26,000	1.5206
2100	1.0314	8100	1.1297	14,100	1.2423	20,100	1.3723	26,100	1.5233
2200	1.0330	8200	1.1314	14,200	1.2444	20,200	1.3746	26,200	1.5260
2300	1.0345	8300	1.1332	14,300	1.2464	20,300	1.3770	26,300	1.5287
2400	1.0360	8400	1.1350	14,400	1.2484	20,400	1.3793	26,400	1.5315
2500	1.0376	8500	1.1367	14,500	1.2504	20,500	1.3817	26,500	1.5342
2600	1.0391	8600	1.1385	14,600	1.2525	20,600	1.3840	26,600	1.5370
2700	1.0407	8700	1.1403	14,700	1.2545	20,700	1.3864	26,700	1.5397
2800	1.0422	8800	1.1420	14,800	1.2565	20,800	1.3888	26,800	1.5425
2900	1.0438	8900	1.1438	14,900	1.2586	20,900	1.3911	26,900	1.5453
3000	1.0454	9000	1.1456	15,000	1.2606	21,000	1.3935	27,000	1.5480
3100	1.0469	9100	1.1474	15,100	1.2627	21,100	1.3958	27,100	1.5508
3200	1.0485	9200	1.1492	15,200	1.2648	21,200	1.3983	27,200	1.5536
3300	1.0501	9300	1.1510	15,300	1.2668	21,300	1.4007	27,300	1.5564
3400	1.0516	9400	1.1528	15,400	1.2689	21,400	1.4031	27,400	1.5592
3500	1.0532	9500	1.1546	15,500	1.2710	21,500	1.4055	27,500	1.5620
3600	1.0548	9600	1.1564	15,600	1.2731	21,600	1.4079	27,600	1.5649
3700	1.0564	9700	1.1582	15,700	1.2752	21,700	1.4103	27,700	1.5677
3800	1.0580	9800	1.1600	15,800	1.2773	21,800	1.4128	27,800	1.5705
3900	1.0595	9900	1.1618	15,900	1.2794	21,900	1.4152	27,900	1.5734
4000	1.0611	10,000	1.1637	16,000	1.2815	22,000	1.4176	28,000	1.5762
4100	1.0627	10,100	1.1655	16,100	1.2836	22,100	1.4201	28,100	1.5791
4200	1.0643	10,200	1.1673	16,200	1.2857	22,200	1.4225	28,200	1.581
4300	1.0659	10,300	1.1692	16,300	1.2878	22,300	1.4250	28,300	1.58
4400	1.0676	10,400	1.1710	16,400	1.2899	22,400	1.4275	28,400	1.5877
4500	1.0692	10,500	1.1729	16,500	1.2921	22,500	1.4299	28,500	1.5906
4600	1.0708	10,600	1.1747	16,600	1.2942	22,600	1.4324	28,600	1.5935
4700	1.0724	10,700	1.1766	16,700	1.2963	22,700	1.4349	28,700	1.5964
4800	1.0740	10,800	1.1784	16,800	1.2985	22,800	1.4374	28,800	1.5993
4900	1.0757	10,900	1.1803	16,900	1.3006	22,900	1.4399	28,900	1.6022
5000	1.0773	11,000	1.1822	17,000	1.3028	23,000	1.4424	29,000	1.6052
5100	1.0789	11,100	1.1840	17,100	1.3049	23,100	1.4449	29,100	1.6081
5200	1.0806	11,200	1.1859	17,200	1.3071	23,200	1.4474	29,200	1.6110
5300	1.0822	11,300	1.1878	17,300	1.3093	23,300	1.4499	29,300	1.6140
5400	1.0838	11,400	1.1897	17,400	1.3115	23,400	1.4525	29,400	1.6170
5500	1.0855	11,500	1.1916	17,500	1.3136	23,500	1.4550	29,500	1.6199
5600	1.0871	11,600	1.1935	17,600	1.3158	23,600	1.4576	29,600	1.6229
5700	1.0888	11,700	1.1954	17,700	1.3180	23,700	1.4601	29,700	1.6259
5800	1.0905	11,800	1.1973	17,800	1.3202	23,800	1.4627	29,800	1.6289
5900	1.0921	11,900	1.1992	17,900	1.3224	23,900	1.4652	29,900	1.6319
6000	1.0938	12,000	1.2011	18,000	1.3246	24,000	1.4678	30,000	1.6349

Figure A1-3

PRESSURE ALTITUDE TABLE

Altimeter Setting In. Hg	Δ Alt Ft	Altimeter Setting In. Hg	Δ Alt Ft	Altimeter Setting In. Hg	Δ Alt Ft	Altimeter Setting In. Hg	Δ Alt Ft	Altimeter Setting In. Hg	Δ Alt Ft	Altimeter Setting In. Hg	Δ Alt Ft	Altimeter Setting In. Hg	Δ Alt Ft
28.00	1824	28.50	1340	29.00	863	29.50	392	30.00	- 73	30.50	-531	31.00	- 983
.01	1814	.51	1330	.01	853	.51	382	.01	- 82	.51	-540	.01	- 992
.02	1805	.52	1321	.02	844	.52	373	.02	- 91	.52	-549	.02	-1001
.03	1795	.53	1311	.03	834	.53	364	.03	-100	.53	-558	.03	-1010
.04	1785	.54	1302	.04	825	.54	354	.04	-110	.54	-567	.04	-1019
.05	1776	.55	1292	.05	815	.55	345	.05	-119	.55	-576	.05	-1028
.06	1766	.56	1282	.06	806	.56	336	.06	-128	.56	-585	.06	-1037
.07	1756	.57	1273	.07	796	.57	326	.07	-137	.57	-594	.07	-1046
.08	1746	.58	1263	.08	787	.58	318	.08	-146	.58	-604	.08	-1055
.09	1737	.59	1254	.09	777	.59	308	.09	-156	.59	-613	.09	-1064
28.10	1727	28.60	1244	29.10	768	29.60	298	30.10	-165	30.60	-622	32.00	-1073
.11	1717	.61	1234	.11	758	.61	289	.11	-174	.61	-631		
.12	1707	.62	1225	.12	749	.62	280	.12	-183	.62	-640		
.13	1698	.63	1215	.13	739	.63	270	.13	-192	.63	-649		
.14	1688	.64	1206	.14	730	.64	261	.14	-202	.64	-658		
.15	1678	.65	1196	.15	721	.65	252	.15	-211	.65	-667		
.16	1668	.66	1186	.16	711	.66	242	.16	-220	.66	-676		
.17	1659	.67	1177	.17	702	.67	233	.17	-229	.67	-685		
.18	1649	.68	1167	.18	692	.68	224	.18	-238	.68	-694		
.19	1639	.69	1158	.19	683	.69	215	.19	-248	.69	-703		
28.20	1630	28.70	1148	29.20	673	29.70	205	30.20	-257	30.70	-712		
.21	1620	.71	1139	.21	664	.71	196	.21	-266	.71	-721		
.22	1610	.72	1129	.22	655	.72	187	.22	-275	.72	-730		
.23	1601	.73	1120	.23	645	.73	177	.23	-284	.73	-740		
.24	1591	.74	1110	.24	636	.74	168	.24	-293	.74	-749		
.25	1581	.75	1100	.25	626	.75	159	.25	-303	.75	-758		
.26	1572	.76	1091	.26	617	.76	149	.26	-312	.76	-767		
.27	1562	.77	1081	.27	607	.77	140	.27	-321	.77	-776		
.28	1552	.78	1072	.28	598	.78	131	.28	-330	.78	-785		
.29	1542	.79	1062	.29	589	.79	122	.29	-339	.79	-794		
28.30	1533	28.80	1053	29.30	579	29.80	112	30.30	-348	30.80	-803		
.31	1523	.80	1043	.31	570	.81	103	.31	-358	.81	-812		
.32	1513	.82	1034	.32	560	.82	94	.32	-367	.82	-821		
.33	1504	.83	1024	.33	551	.83	85	.33	-376	.83	-830		
.34	1494	.84	1015	.34	542	.84	75	.34	-385	.84	-839		
.35	1484	.85	1005	.35	532	.85	66	.35	-394	.85	-848		
.36	1475	.86	995	.36	523	.86	57	.36	-403	.86	-857		
.37	1465	.87	986	.37	514	.87	47	.37	-412	.87	-866		
.38	1456	.88	976	.38	504	.88	38	.38	-421	.88	-875		
.39	1446	.89	967	.39	495	.89	29	.39	-431	.89	-884		
28.40	1436	28.90	957	29.40	485	29.90	20	30.40	-440	30.90	-893		
.41	1427	.91	948	.41	476	.91	10	.41	-449	.91	-902		
.42	1417	.92	938	.42	467	.92	1	.42	-458	.92	-911		
.43	1407	.93	929	.43	457	.93	-8	.43	-467	.93	-920		
.44	1398	.94	919	.44	448	.94	-17	.44	-476	.94	-929		
.45	1388	.95	910	.45	439	.95	-26	.45	-485	.95	-938		
.46	1378	.96	900	.46	429	.96	-36	.46	-494	.96	-947		
.47	1369	.97	891	.47	420	.97	-45	.47	-504	.97	-956		
.48	1359	.98	881	.48	410	.98	-54	.48	-513	.98	-965		
.49	1350	.99	872	.49	401	.99	-63	.49	-522	.99	-974		

Figure A1-4

PSYCHROMETRIC CHART
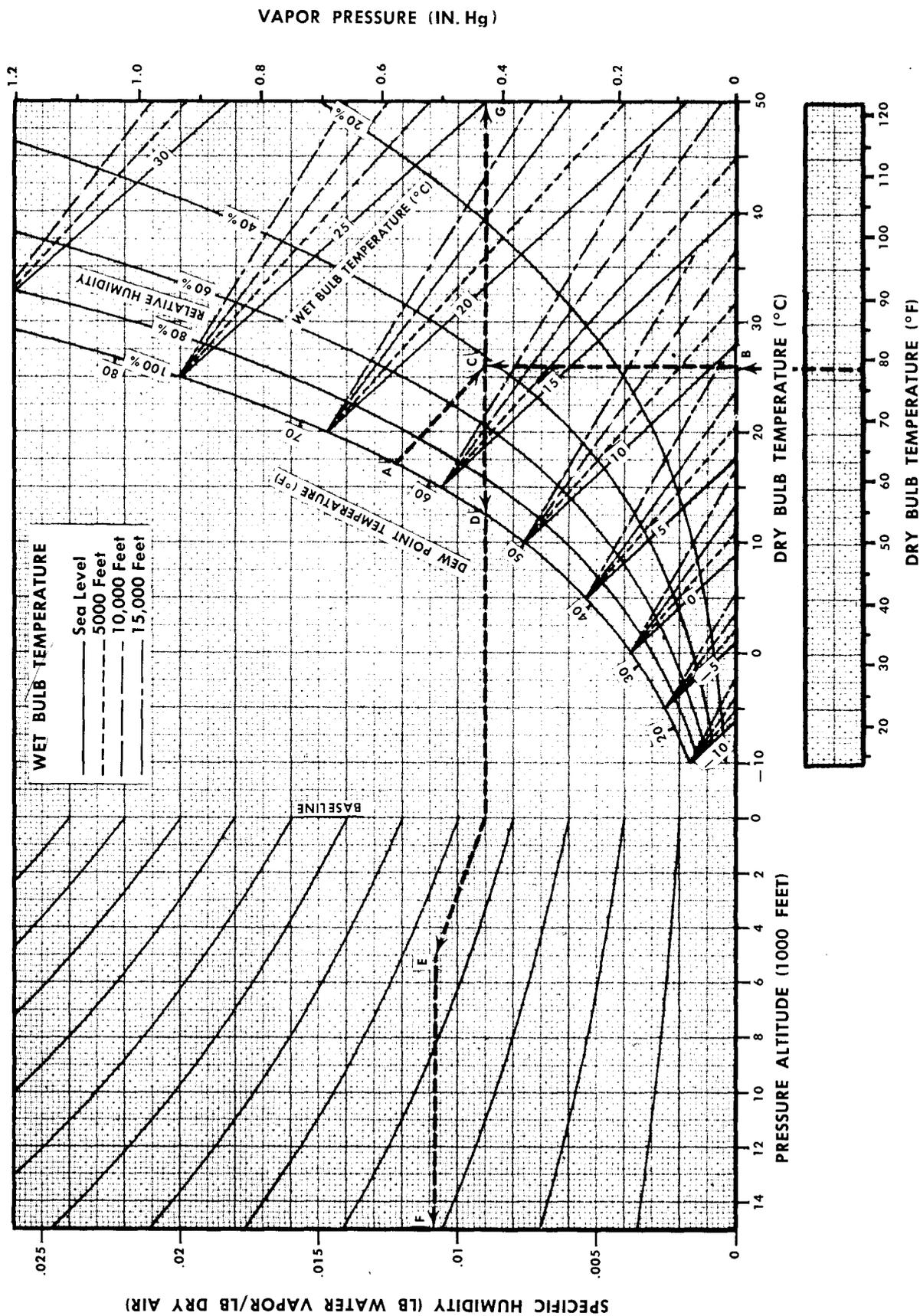
Figure A1-5

TEMPERATURE CONVERSION CHART

TEMPERATURE CONVERSION
Centigrade = 5/9 (F − 32)
Fahrenheit = 9/5 C + 32

DEGREES FAHRENHEIT

DEGREES CENTIGRADE
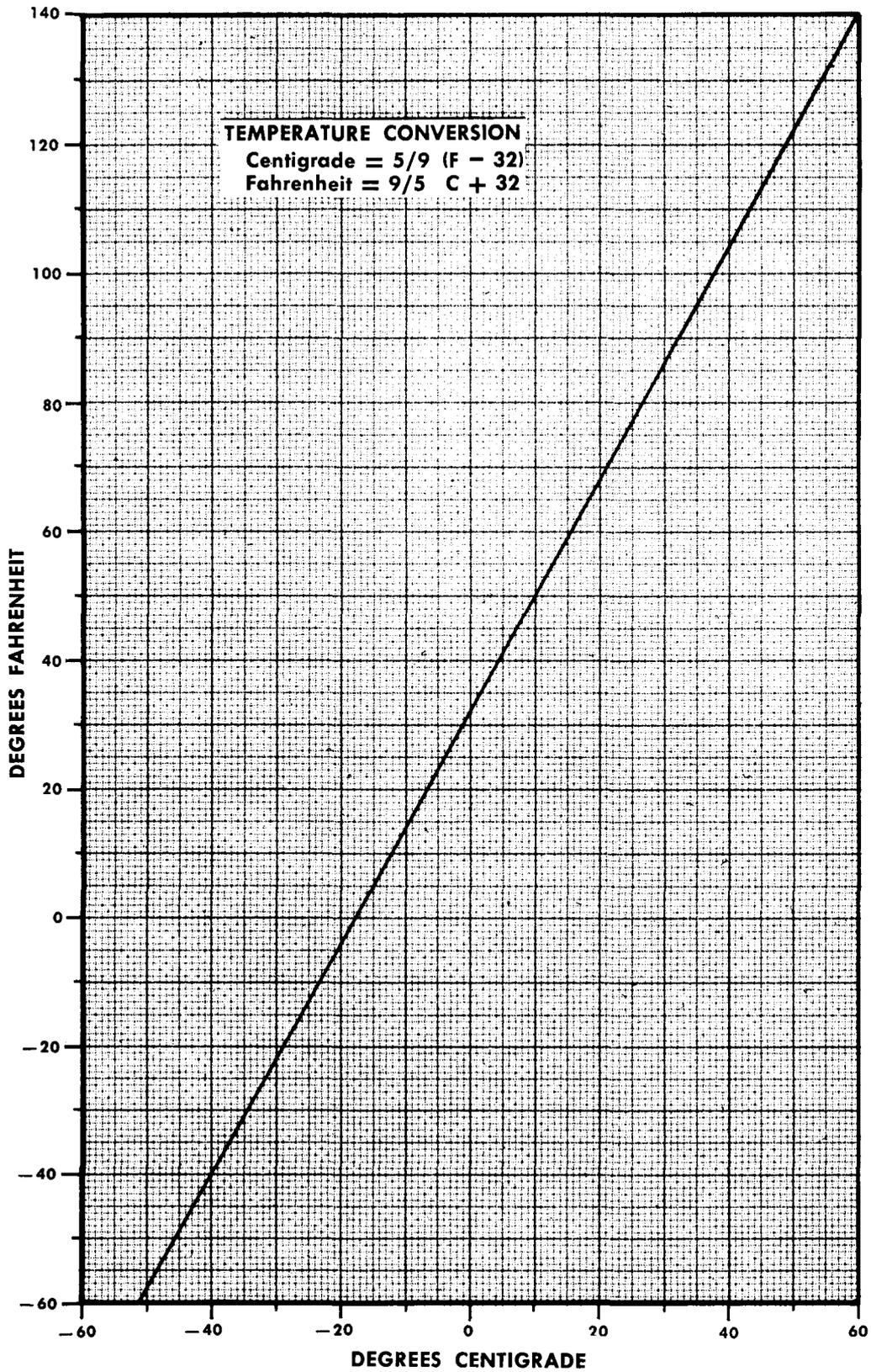
Figure A1-6

X1-302

TEMPERATURE CORRECTION FOR COMPRESSIBILITY

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

Note:
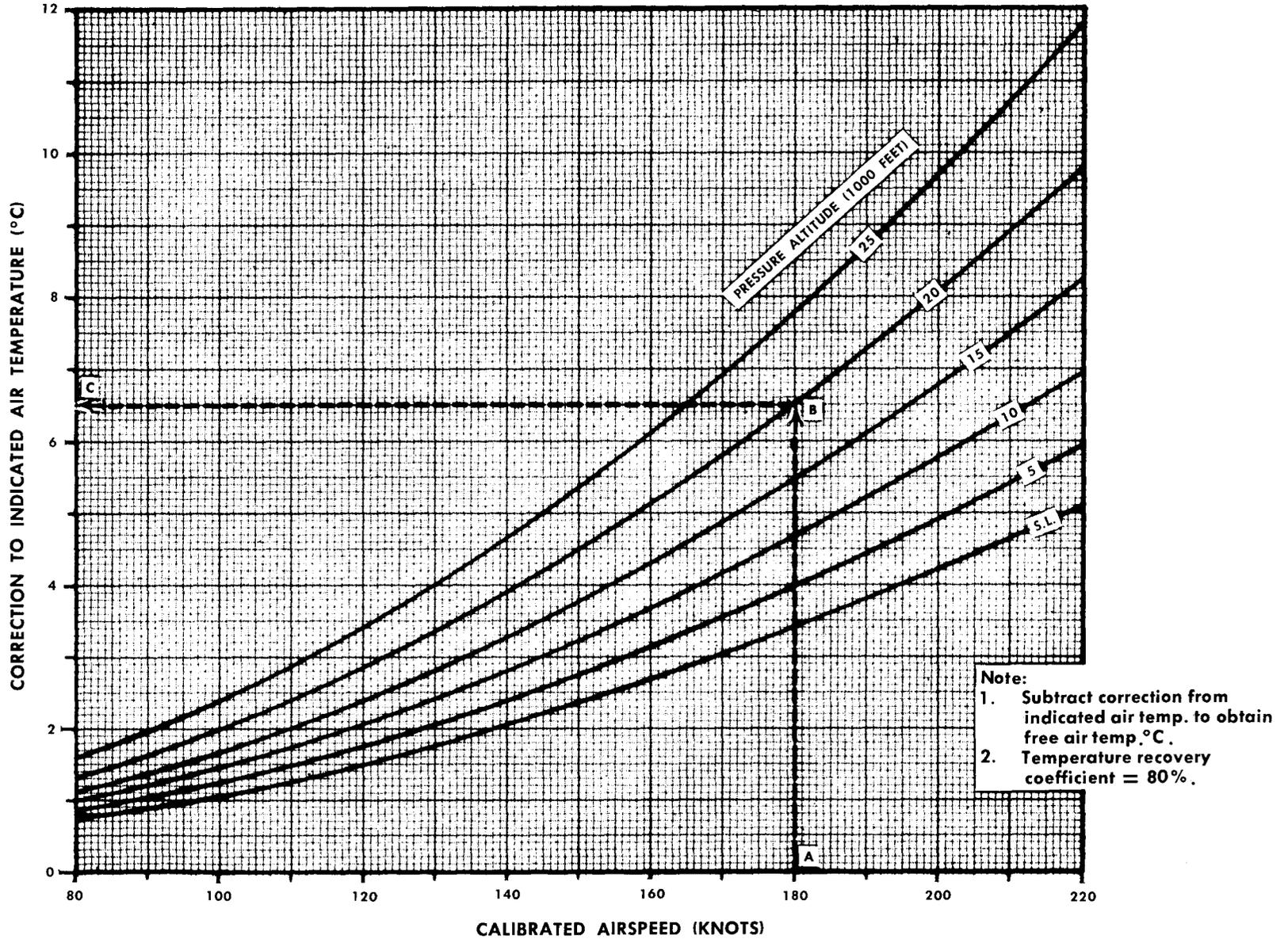1. Subtract correction from indicated air temp. to obtain free air temp.°C.
2. Temperature recovery coefficient = 80%.

CALIBRATED AIRSPEED CORRECTION FOR COMPRESSIBILITY

Note:
Subtract correction from
calibrated airspeed to
obtain equivalent airspeed.
    EAS + Corr = CAS
    CAS — Corr = EAS

CORRECTION (KNOTS)

CALIBRATED AIRSPEED (KNOTS)

PRESSURE ALTITUDE (1000 FEET)
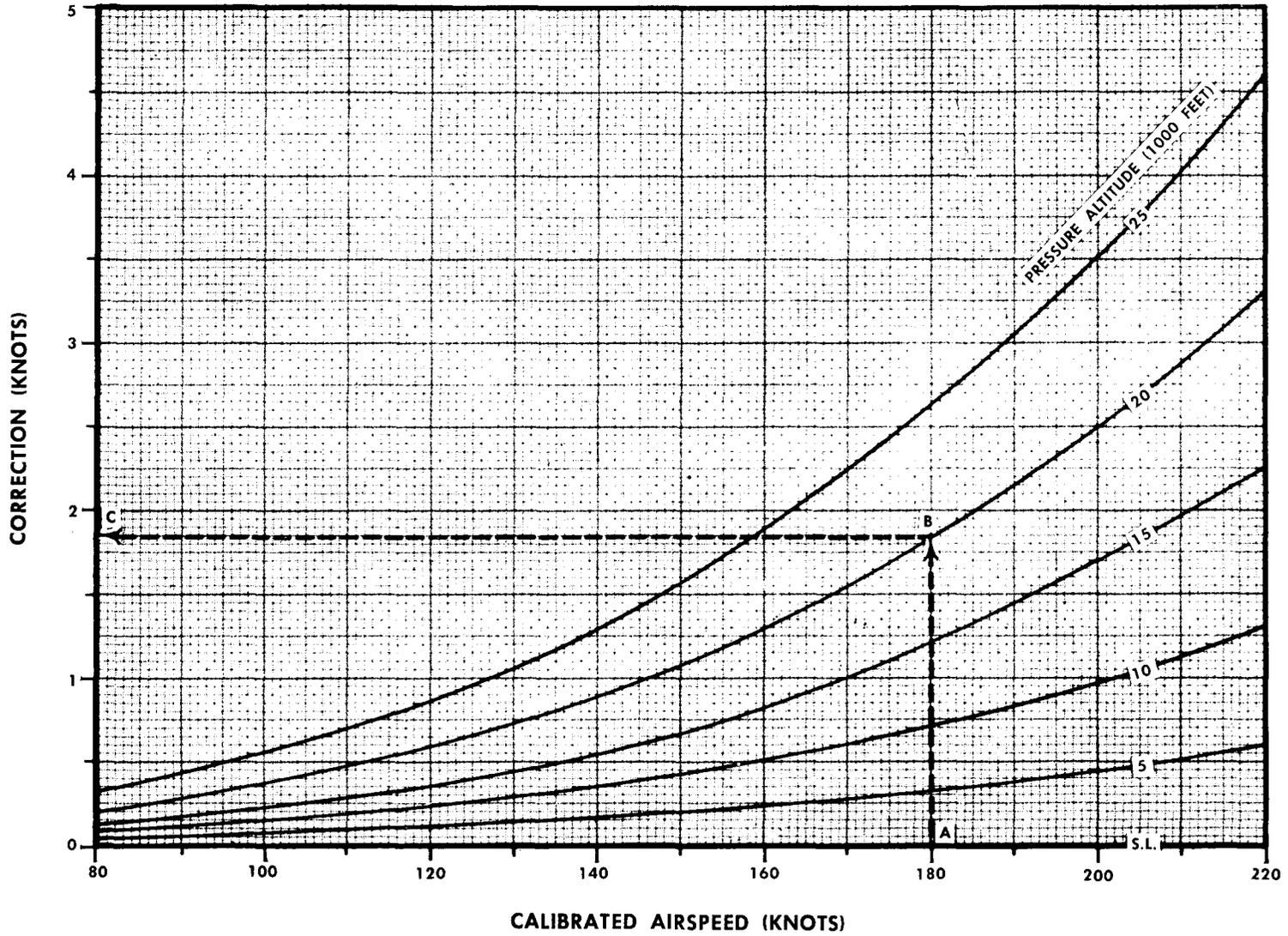
AIRSPEED POSITION ERROR CORRECTION
WITHOUT RADOME NOSE
INSTRUMENT ERROR NOT INCLUDED

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

IAS + Corr = CAS
CAS — Corr = IAS

LANDING GEAR DOWN
WING FLAPS 40 DEGREES

LANDING GEAR UP
WING FLAPS ZERO DEGREES

POSITION CORRECTION (KNOTS)

INDICATED AIRSPEED (KNOTS)
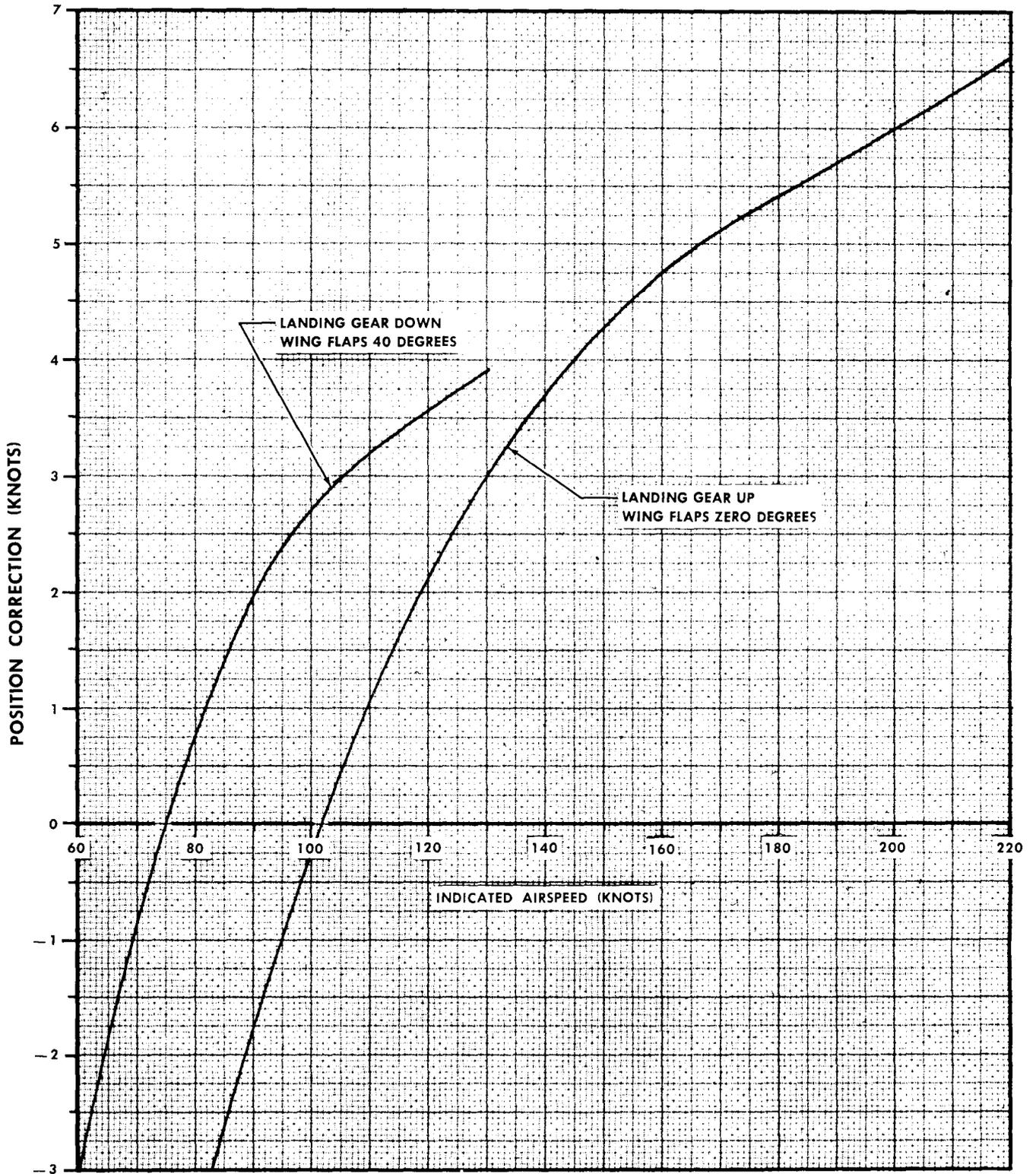
Figure A1-9

X1-305

AIRSPEED POSITION ERROR CORRECTION
WITH RADOME NOSE
INSTRUMENT ERROR NOT INCLUDED

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

IAS + Corr = CAS
CAS — Corr = IAS
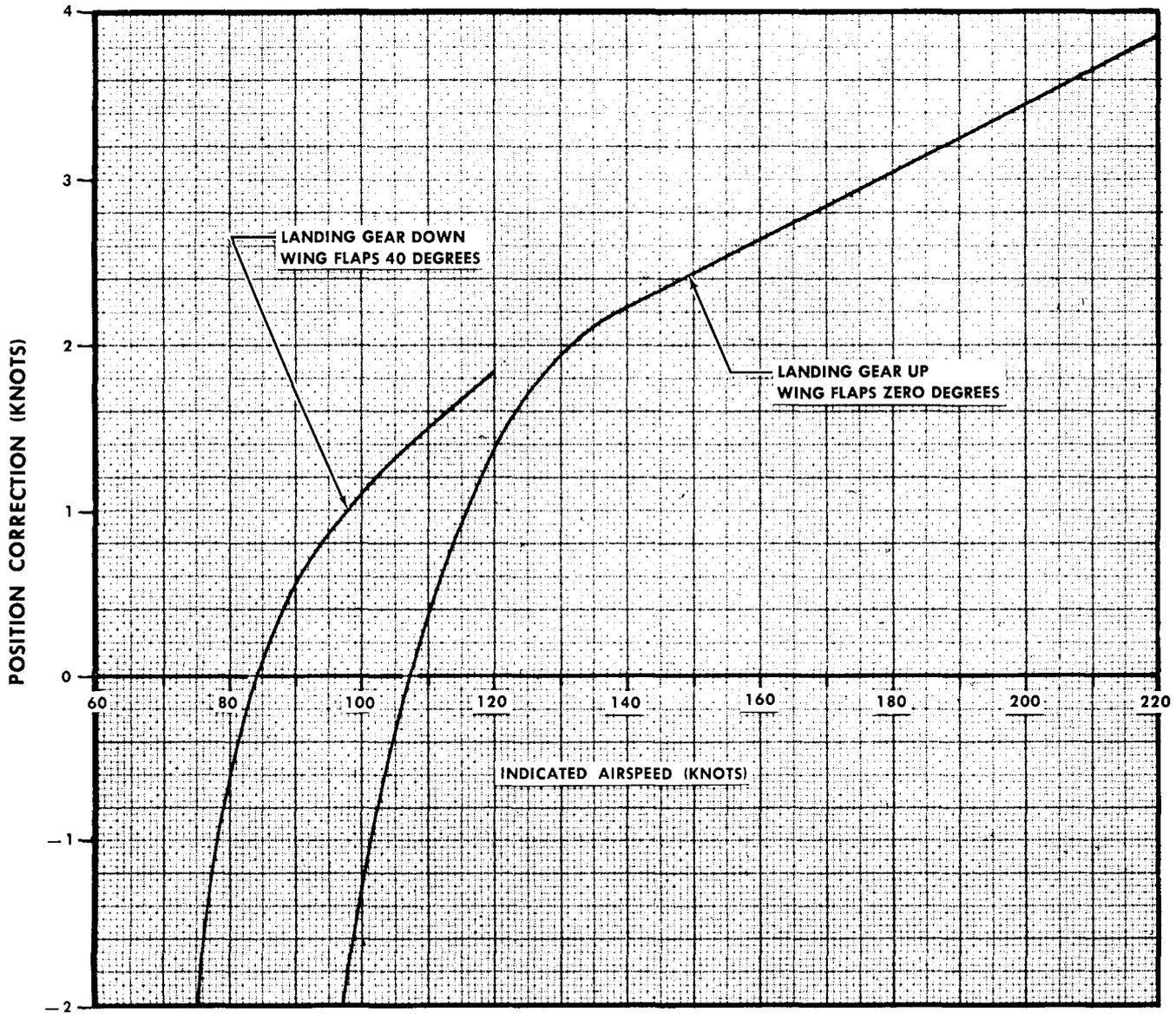
Figure A1-10

X1-306

KNOTS — MPH
CONVERSION CHART
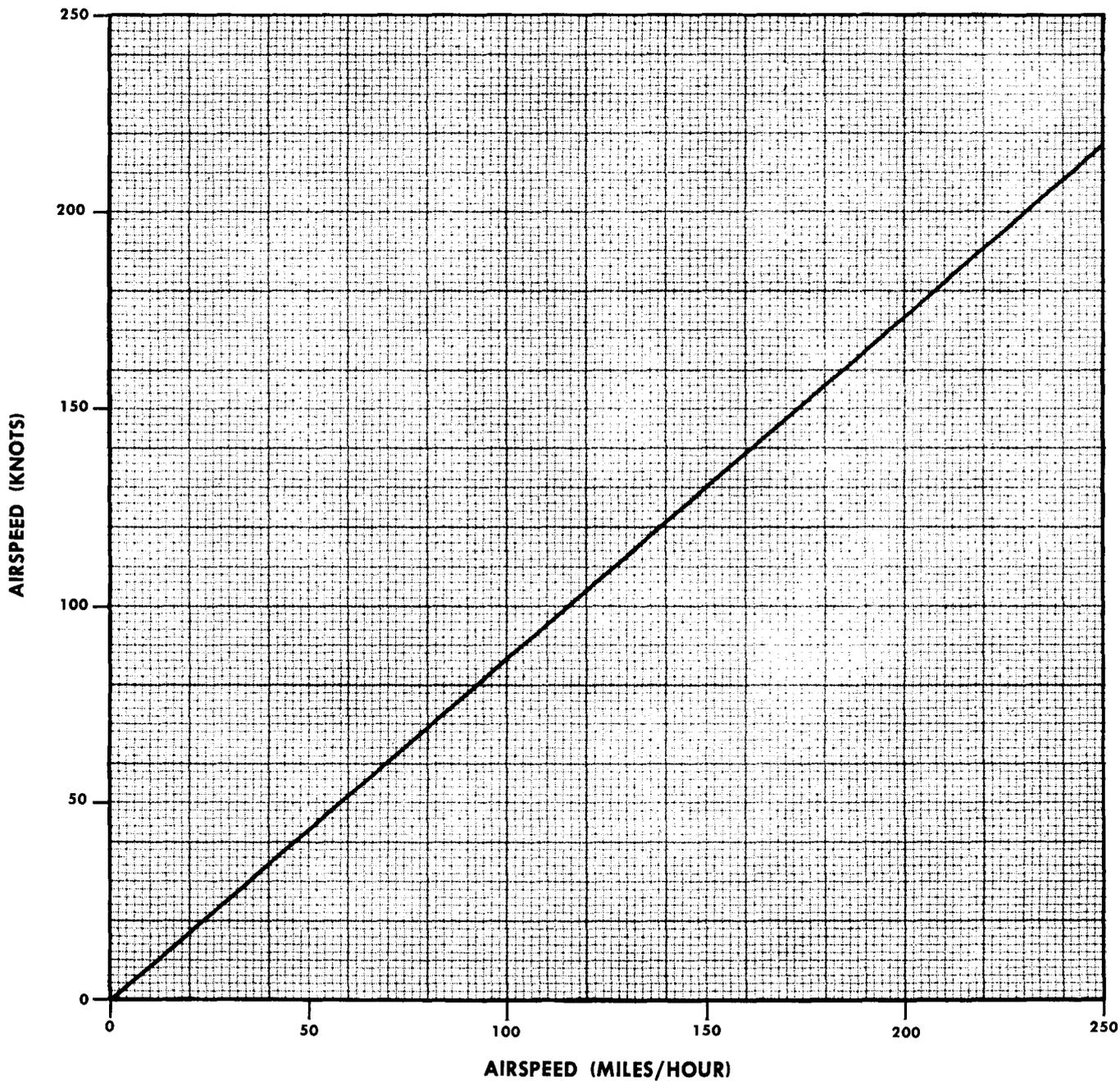
Figure A1-11

ALTIMETER POSITION ERROR CORRECTION
GEAR UP — WING FLAPS ZERO DEGREES
INSTRUMENT ERROR NOT INCLUDED

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

LEGEND:
——————— With Radome
— — — — Without Radome
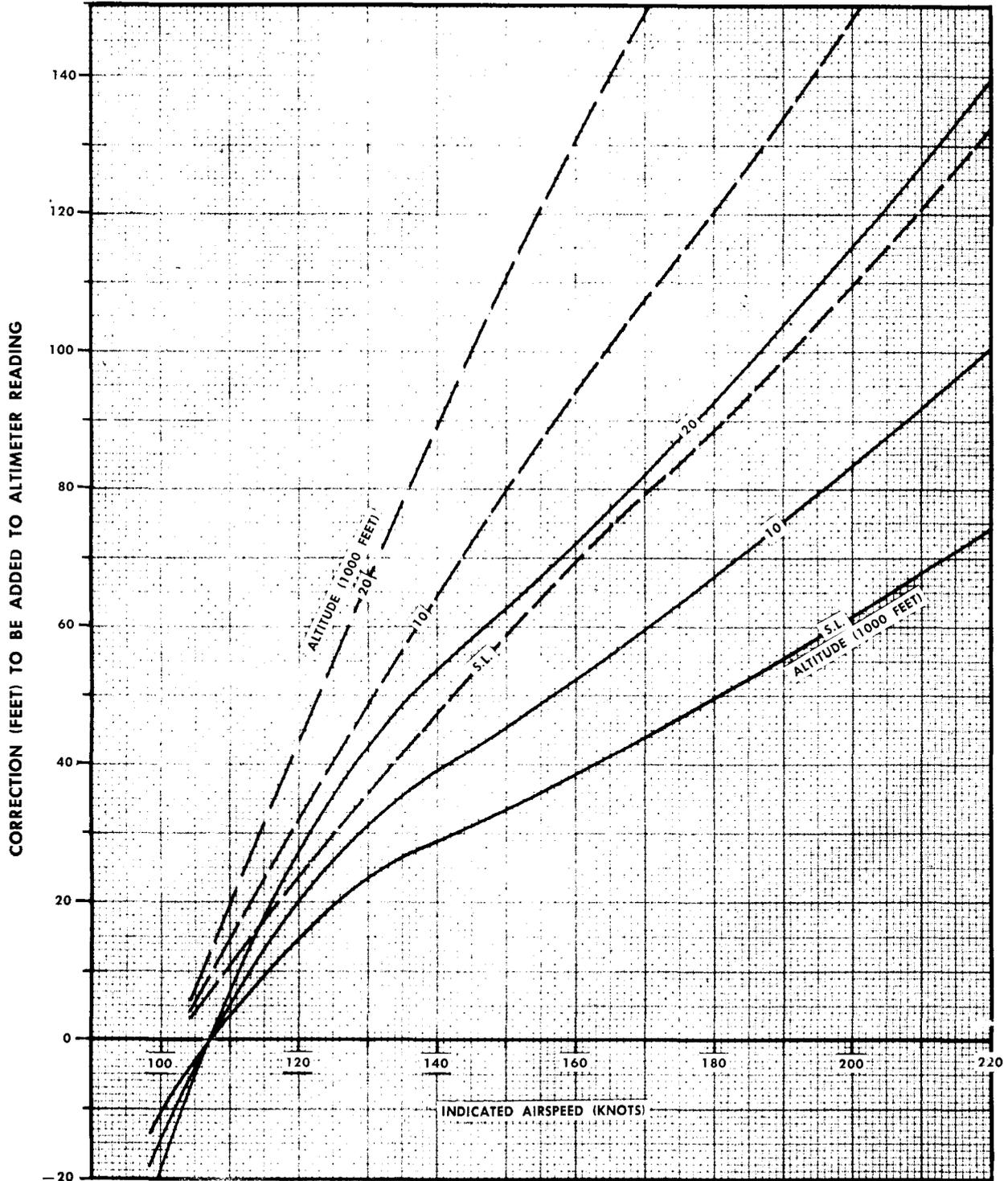
Figure A1-12

X1-40

ALTIMETER POSITION ERROR CORRECTION
GEAR DOWN — WING FLAPS 20 DEGREES
INSTRUMENT ERROR NOT INCLUDED

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

LEGEND:
———————— With Radome
— — — Without Radome
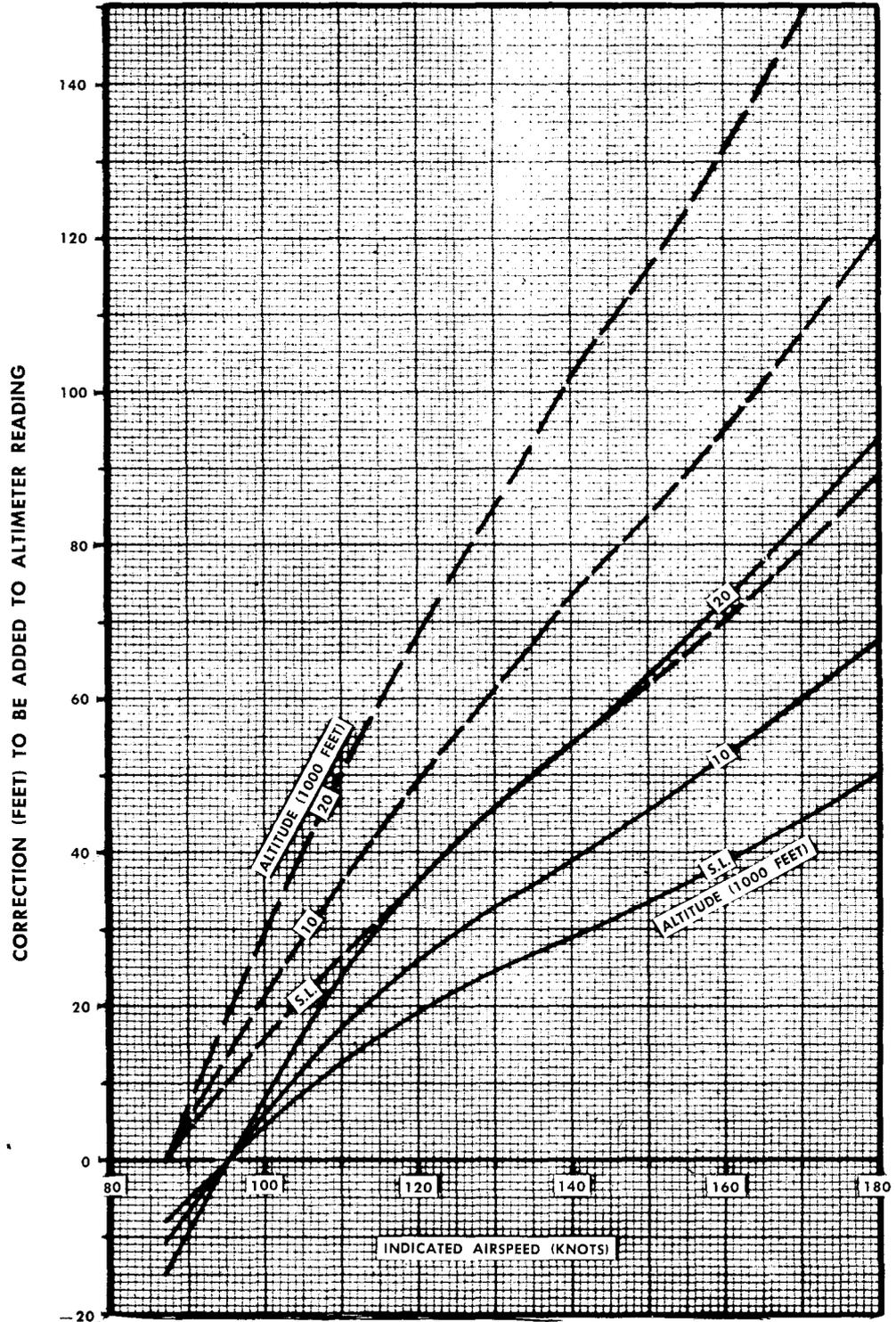
Figure A1-13

ALTIMETER POSITION ERROR CORRECTION
GEAR DOWN — WING FLAPS 40 DEGREES
INSTRUMENT ERROR NOT INCLUDED

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

LEGEND:
———— With Radome
——— —— Without Radome
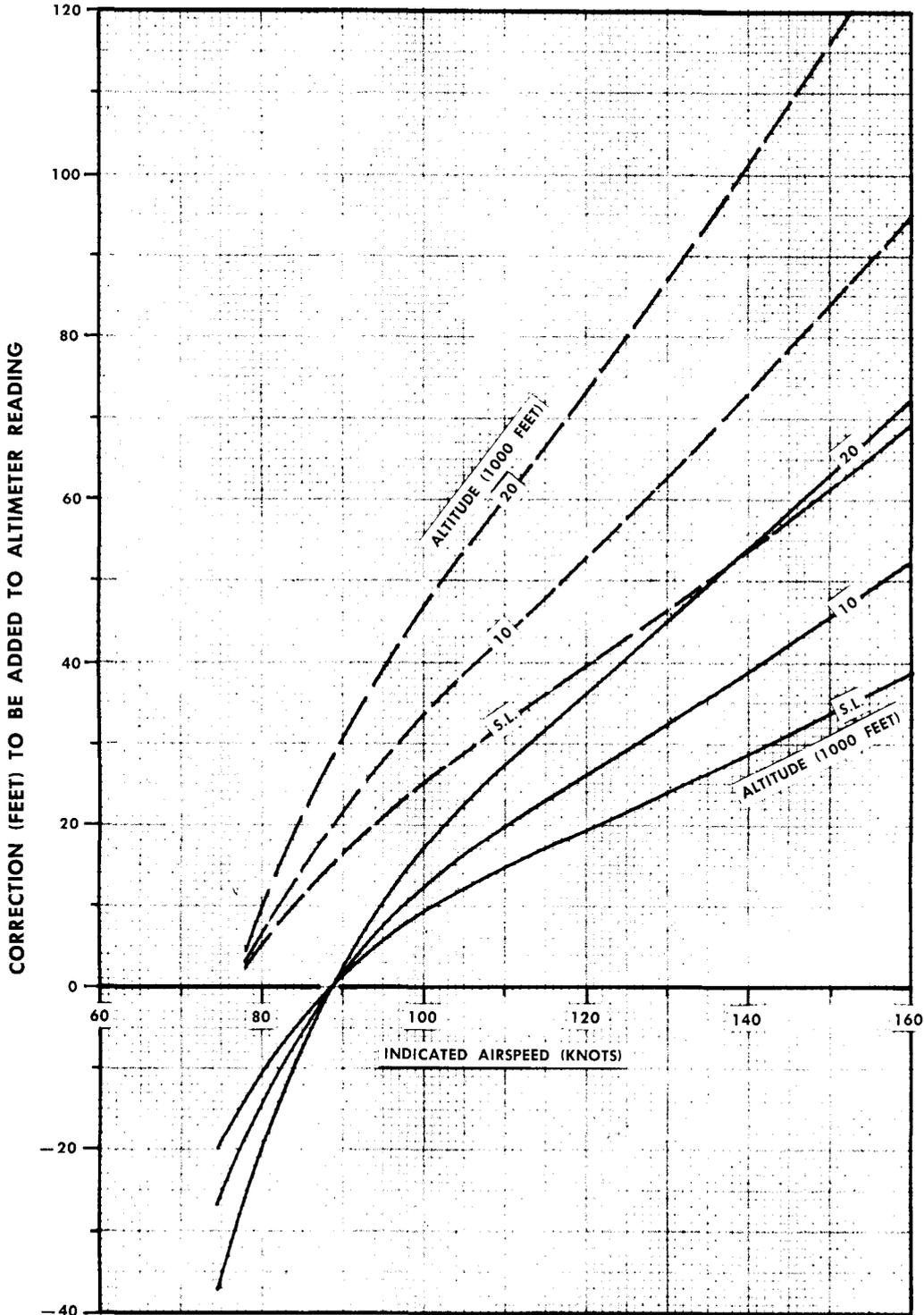
Figure A1-14

PART 2

ENGINE DATA

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

DISCUSSION OF CHARTS.

Engine data presented in this appendix is based on engines having PD-12F13 carburetors installed. The Maximum Brake Horsepower charts (figures A2-1 and A2-2) are provided to determine predicted brake horsepower for either high or low blower for varying combinations of pressure altitude and atmospheric conditions. The Power Schedule charts (figures A2-3 through A2-13) give the recommended rpm and manifold pressures for METO power, climb power, and cruise power settings based on standard atmospheric conditions. Engine characteristics are presented on the Engine Calibration Curves (figures A2-14 through A2-17) for standard day atmosphere for the "no ram" condition, for both high and low blower operation with either AUTO RICH or AUTO LEAN mixture settings. The Fuel Flow Per Engine charts (figures A2-18 and A2-19) give the desired fuel flows for a given brake horsepower in high and low blower for both AUTO RICH and AUTO LEAN mixture settings.

Manifold pressure as specified on all charts is intake manifold pressure in inches Hg absolute (based on zero pressure).

All performance charts specify engine operation with AUTO RICH or AUTO LEAN with 100/130 grade fuel, however when 115/145 grade fuel is used as an alternate grade fuel, performance and operating limits remain the same.

All flight performance is based on the carburetor air levers remaining in the COLD position. If carburetor heat is applied at a constant manifold pressure, engine power will be decreased because of the higher carburetor air temperature. In addition, the normal air induction system is partially restricted and the carburetor air is taken from a location behind the cylinders. The air, having passed over the engine section, has less ram energy remaining, so that lower manifold pressures will be obtained with a fixed throttle setting.

The power losses attributable to atmospheric conditions may be estimated. The effect of temperature on brake horsepower can be approximated by the following equations, where T_1 and T_{std} are absolute temperatures:

$$\frac{bhp_{std}}{bhpT_1} = \sqrt{\frac{T_1}{T_{std}}}$$ For part throttle constant manifold pressure operation

$$\frac{bhp_{std}}{bhpT_1} = \frac{T_1}{T_{std}}$$ For full throttle operation

Absolute temperature = ambient temperature (degrees centigrade) + 273

The following rules of thumb may be used to quickly approximate the effect of temperature on power:

1. For part throttle, constant manifold pressure operation, a 10°C temperature increase above standard results in approximately 1.7 percent power loss. Similarly, a 10°C temperature decrease below standard results in approximately 1.7 percent power gain.

2. For full throttle operation, a 10°C temperature increase above standard results in approximately 3.5 percent power loss. Similarly, a 10°C temperature decrease below standard results in approximately 3.5 percent power gain.

3. The variation in manifold pressure with temperature in order to maintain constant power is approximately 1/2-inch Hg increase for every 10°C above standard OAT. In order to maintain constant power for cold day cruise operation, the manifold pressure should be decreased approximately 1/2-inch Hg for every 10°C below standard OAT. During takeoff under cold temperature conditions, when overpowering is possible, reduce manifold pressure approximately 1 inch Hg for every 10°C below standard OAT.

$$MP_{corr} = MP_{std}\sqrt{\frac{CAT\ Absolute\ Temperature}{Std.\ Absolute\ Temperature}}$$

The effect of humidity on engine power output is as follows:

1. Effective pressure and density altitudes are increased because of the presence of vapor pressure.

2. Fuel-air ratio is increased because fuel is metered on total flow through the venturi, and the total flow includes water vapor as well as air.

3. The thermal efficiency of the combustion process is reduced because of the presence of water vapor. A correction for the effect of humidity on power output for takeoff is shown on figures A2-1 and A2-2.

4. For cruise operation, the bhp loss associated with humidity is normally cancelled out by the gain in bhp due to increased ram effect with airspeed; therefore, although the engine calibration charts are labeled zero ram, data obtained will approximate actual performance.

Note

On all charts in this Appendix, the term METO (Maximum Except Takeoff) is substituted for normal rated power and the term MAXIMUM for take-off power.

MAXIMUM BRAKE HORSEPOWER CHARTS.

The Maximum Brake Horsepower charts show the brake horsepower available for takeoff. The low blower chart (figure A2-1) covers operation in low blower at pressure altitudes between sea level and 10,000 feet at 2700 rpm. The high blower chart (figure A2-2) is for high blower operation at pressure altitudes of 10,000 to 15,000 feet with rpm limited to 2550 rpm. Data are provided for determining MAP, the predicted BHP and the corresponding 95% BHP.

The charts allow corrections to be made for altitude, carburetor air temperature, and humidity. A correction scale is included to show the amount by which the MAP limit should be reduced to prevent overboosting of the engines when the carburetor air temperature is below standard.

In allowing for the effect of humidity, one scale corrects the power downward to correct

for humidity alone, and another scale corrects the power upward to account for the allowable increase in MAP, equal to the existing water vapor pressure up to 1.5 inches Hg. This latter correction may only be made when the combination of pressure altitude and carburetor air temperature indicates that maximum allowable power for takeoff may be developed with less than full throttle setting.

Note

Some engines may not develop the additional 1.5 inches MAP due to throttles hitting the stops.

Two examples have been included to illustrate the use of the charts; one on the low blower chart with no correction for humidity and a carburetor air temperature below standard, and an example on the high blower chart showing correction for humidity.

Example 1.

Given: Pressure Altitude = 2200 Feet

CAT = -25°C

Find: Maximum allowable manifold pressure, predicted BHP and 95% BHP.

For this altitude low blower operation is required for takeoff. Enter the chart (figure A2-1) with a pressure altitude of 2200 feet (A), and read up to a CAT of -25°C (B), to find full throttle manifold pressure of 49.0 inched Hg at the intersection of altitude and CAT curve. Read across to the dew point correction baseline (C). Since dew point at this CAT is less than 0°F no correction is made. Continue across to the MAP correction baseline (D), and follow the guidelines to the maximum BHP limit line (E). Read up to find the MAP reduction of -4.25 inches Hg (F). Corrected MAP for the 1450 BHP limit = 49.0 - 4.25 = 44.75 inches Hg. Since there has been no correction in power for humidity the predicted power remains at the maximum BHP limit of 1450 BHP (G). To determine the predicted 95% BHP read down from the intersection of BHP and the 95% BHP correction curve (H) to find predicted 95%BHP. which is 1380 BHP(I)

Example 2.

Given: Pressure Altitude = 12,000 Feet

CAT = 10°C

Dew Point Temperature = 43°F

Find: Maximum allowable manifold pressure, predicted BHP and 95% BHP.

For this altitude, high blower operation will be required for takeoff. Enter the chart (figure A2-2) with a pressure altitude of 12,000 feet (A), and read up to CAT of 10°C (B) to find a manifold pressure limit of 43.25 inches Hg (by interpolation) in the part throttle range, and read across to the dew point correction baseline (C). Enter the dew point correction graph at the bottom of the chart with a dew point of 43°F (D), follow the guidelines to a pressure altitude of 12,000 feet, and read up. Correct BHP by following the guideline from the dew point correction baseline (C) to intersection of dew point temperature (F) and read across to the humidity correction baseline (G). Correct the MAP by entering the humidity correction scale with a dew point of 43°F (H), reading up to the dew point curve (I) and across for an allowable increase in MAP of 0.25 inches Hg (J). Add this correction to the MAP to obtain maximum allowable manifold pressure (43.25 + 0.25 = 43.5 inches Hg).

Obtain predicted BHP by following the guidelines from the humidity correction baseline (G) to the 0.25 inched Hg correction (K), and read across for a predicted BHP of 1027 BHP (L). To determine predicted BMEP, read down from the intersection of 95% BHP line and the 95%BHP correction curve (M) for a predicted 95% BHP of 975 BHP (N).

POWER SCHEDULES.

The Power Schedule Charts (figures A2-3 through A2-13) give the various permissible combinations of manifold pressure, rpm, and blower settings for METO power, climb

power, and constant cruise power settings from 800 to 400 BHP in 50 BHP increments. Power settings are shown for altitudes from sea level to 20,000 feet at carburetor air temperatures from -20°C to 30°C. The METO power and climb power charts are based on operation in auto rich, and powers from 800 to 400 BHP are based on auto lean operation. Resultant 95%BHP and resultant fuel flow in pounds per hour for one engine and for four engines are also indicated on the charts.

An example, using two different carburetor air temperature readings for the same altitude is included on the 700 BHP chart (figure A2-7).

Example 1.

Given: Pressure Altitude = 13,000 Feet

CAT = -10°C

Find: Manifold pressure, rpm and blower operation required to maintain 700 BHP per engine.

Enter the Power Schedule chart for 700 BHP per engine (figure A2-7) at a pressure altitude of 13,000 (A), and read straight across. Enter at a carburetor air temperature of -10°C (B) and read down to intersection of pressure altitude to obtain manifold pressure of 26.8 inches Hg (C). Follow between the guidelines, reading across to the right to find rpm of 2200 (D). Blower setting, 95%BHP and fuel flow are obtained by continuing across the chart between the guidelines.

Example 2.

Given: Pressure Altitude = 13,000 Feet

CAT = +10°C

Find: Manifold pressure, rpm and blower setting required to maintain 700 BHP per engine.

Enter the chart at pressure altitude of 13,000 feet (A) and read straight across, disregarding guidelines. Enter with a carburetor air temperature of +10°C (E) and read down to intersection of pressure altitude to obtain manifold pressure of 32.5 inches Hg (F). Read across between the guidelines to find rpm of 2050 (G). High blower operation is required for all power settings shown above the heavy line on the chart. 95%BHP and fuel flow are obtained by reading across between the guidelines.

ENGINE CALIBRATION CURVE.

The engine calibration curve charts (figures A2-14 through A2-17) are presented in facing pairs of charts, which together provide the information necessary to determine both the engine power limits and the engine power settings for a range of powers up to the allowable limits. A pair of charts is included for each of four engine conditions:

Auto-Rich	Low Blower
Auto-Rich	High Blower
Auto-Lean	Low Blower
Auto-Lean	High Blower

These charts are the basis for takeoff, climb, and cruise data shown throughout the Appendix. The charts are intended to provide a graphic presentation of the two types of engine power limitations, those imposed by the engine manufacturer to prevent detonation and other effects of overboosting, and those due to the decreasing density of air with increasing altitude. From these charts, manifold pressure and rpm settings for desired brake horsepowers within the particular limiting BMEP envelope are easily found in the event the required power and altitude conditions are not covered in Part 4, CLIMB or Part 5, RANGE in the Appendix.

The first chart of each pair (sheet 1) shows the variation of bhp with manifold pressure

for several rpm settings when maintaining a fixed altitude. The second chart (sheet 2) shows the variation of bhp and manifold pressure with altitude for several settings when maintaining full throttle. On both charts, the upper end of each rpm line is terminated at the bhp limit for that rpm. Sheet 2 shows the pressure altitude at which this bhp limit is obtained with full throttle; this altitude is known as the critical altitude for that particular rpm, blower ratio, mixture setting, and atmospheric condition.

On sheet 2, the full throttle line extending from the critical altitude towards higher altitudes, together with the imaginary part throttle line extending from the critical altitude down to sea level (at constant bhp) forms the limiting power envelope for that rpm. To determine the rpm and manifold pressure required to develop a given bhp at a given altitude, it is necessary to determine the rpm whose limiting power envelope passes through that bhp-altitude point; this will be the minimum rpm required to develop the required power. In the event the bhp-altitude point falls on the full throttle segment of the limiting power envelope, the manifold pressure may be read directly from the graph. However, if it falls on the imaginary part-throttle segment of the limiting power envelope, or if it is desirable to use an rpm higher than the minimum, the manifold pressure cannot be read directly from the graph. Instead, guidelines must be constructed showing the variation of bhp with altitude for constant rpm and manifold pressure. Brake horsepower can then be read by proceeding from the bhp-altitude point parallel to the constructed lines to the bhp scale or to the base line.

Sheet 1 should then be entered at the bhp noted previously and the manifold pressure for the desired rpm can be read from the scale at the bottom of the graph. Furthermore, the manifold pressure for the same bhp at any higher rpm can also be read.

The values of manifold pressure shown on both charts are based on standard atmospheric conditions. For temperatures above standard, the maximum and METO power manifold pressure limits remain unchanged. However, for climb powers and cruise powers the manifold pressure may be increased 1/2 inch Hg for each 10°C that the CAT is above standard.

For temperatures below standard, the maximum power manifold pressure limit should be reduced 1 inch Hg for each 10°C that the CAT is below standard. For climb powers and cruise powers, the manifold pressure should be reduced 1/2 inch Hg for each 10°C below standard.

The following example illustrates the method of using the engine calibration curves.

Example.

    Given: Pressure Altitude = 12,000 feet

              Required BHP = 550

    Find: Power settings required to maintain 550 BHP in high blower.

Enter the pressure altitude scale on sheet 2 of the high blower, engine calibration curve (figure A2-17) at 12,000 feet pressure altitude (A), and read up to a BHP of 550 (B). This intersection represents approximate rpm and manifold pressure settings, however, since the rpm falls within the restricted operation area, select the next higher rpm and the manifold pressure closest to point (B), which in this case is 30 inches Hg and 1700 rpm (C). Using this manifold pressure, enter the 10,000 foot calibration curve on sheet 1 at 30 inches Hg (D) and read up to 1700 rpm (E) and across to establish a reference point on the BHP scale (F).

On sheet 2, draw a reference line (CF) representing a line of constant rpm and manifold pressure. Draw a line parallel to CF through point (B), establishing a reference point on the BHP scale at (G). On sheet 1, read across to 1700 rpm (H) and down to find corrected manifold pressure of 29.6 (I). This calibration is based on standard atmospheric

conditions. For nonstandard day temperatures, increase or decrease manifold pressure as previously outlined.

FUEL FLOW PER ENGINE.

The Fuel Flow Per Engine charts (figures A2-18 and A2-19) are used to determine fuel consumption for various brake horsepower settings for both high and low blower operation, and for either auto lean or auto rich mixture settings. Fuel flow may be determined in either pounds per hour or gallons per hour. The following example illustrates the method of using the chart.

Example.

Given: Supercharger Operation = Low blower

Mixture Setting = Auto lean

Brake Horsepower = 650 BHP

Rpm = 2000

Find: Fuel flow in pounds per hour per engine.

Enter the chart for low blower operation (figure A2-18) with a brake horsepower of 650 BHP (A) and read up to the auto lean curve for 2000 rpm (B). Read across to find fuel flow of 287 lb/hr/eng. (C).

MAXIMUM BRAKE HORSEPOWER — LOW BLOWER
AUTO RICH — 2700 RPM

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130
or 115/145

NOTE:
1. PART THROTTLE MAP VARIES FROM 50.0 INCHES Hg AT SEA LEVEL TO 49.5 INCHES Hg AT CRITICAL ALTITUDE. (SEE NOTE R)
2. PART THROTTLE MAP MAY BE INCREASED UP TO 1.5 INCHES Hg DUE TO HUMIDITY.

ALLOWABLE INCREASE IN MAP DUE TO HUMIDITY (PART THROTTLE OPERATION ONLY)

MAP (IN. Hg)

2

1

0

0   20   40   60   80   100

DEW POINT (°F)

MAP 50.0 INCHES Hg AT SEA LEVEL

MAP REDUCTION (IN Hg)

0   -2   -4   -6   -8   -10

Figure A2-1

BASE LINE

BASE LINE

49.5
48
46
-60
44
-50
-40
42
-30
-20
40
CAT= -10°C   0
10
38
30   20
50   40
36
42
40
38
36
34

0   -1   -2
(IN HG)

FULL THROTTLE MAP (INCHES HG)

BASELINE BASELINE

1400

1300

1200

1100

1000

900

800

S.L.   1   2   3   4   5   6   7   8   9   10   10

PRESSURE ALTITUDE (1000 FEET)

5

S.L.

0   20   40   60   80   100

DEW POINT (°F)

750   850   950   1050   1150   1250   1350   1450

95% BHP
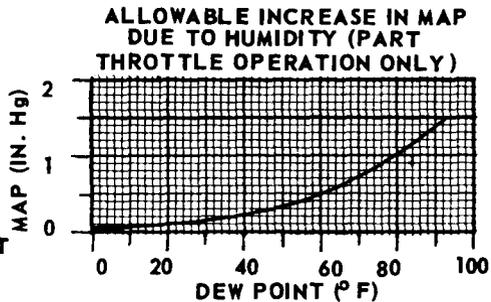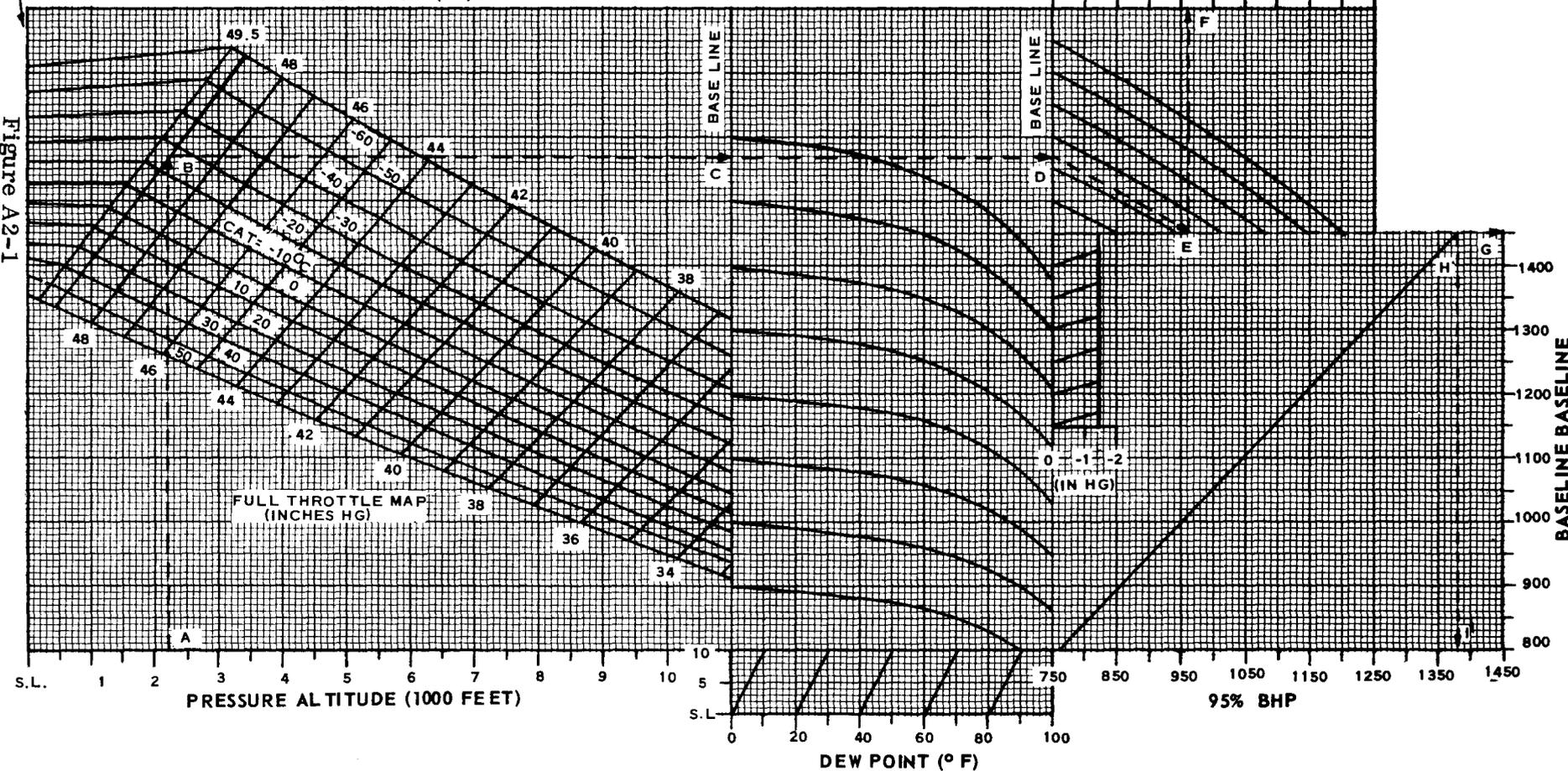
MAXIMUM BRAKE HORSEPOWER — HIGH BLOWER

AUTO RICH — 2550 RPM

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130
or 115/145

MAP 43.5 INCHES Hg AT 10,000 FEET

MAP REDUCTION (IN Hg)
0   -2   -4   -6   8

BASE LINE

BASE LINE

-60
-50
-40
-30
-20
-10
CAT = 0 °C
10 B
20
30
40
43
42
FULL THROTTLE MAP (INCHES HG)
A

PRESSURE ALTITUDE
(1000 FT.)
10   11   12   13   14   15

DEW POINT (° F)
0   20   40   60   80

(IN HG)
0   1   800   900   1000   1100

95% BHP

BRAKE HORSEPOWER
1100
1050
1000
950
900
850

ALLOWABLE INCREASE IN MAP
DUE TO HUMIDITY (PART
THROTTLE OPERATION ONLY)

MAP (IN. Hg)
5
0
0   20   40   60   80

J   I
H
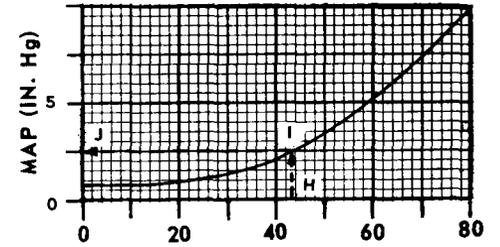
NOTE:
1. PART THROTTLE MAP VARIES
   FROM 43.5 INCHES Hg AT 10,000
   FEET TO 43.0 INCHES Hg AT
   CRITICAL ALTITUDE. (SEE NOTE
   2)

2. PART THROTTLE MAP MAY BE
   INCREASED UP TO 1.5 INCHES
   Hg DUE TO HUMIDITY.
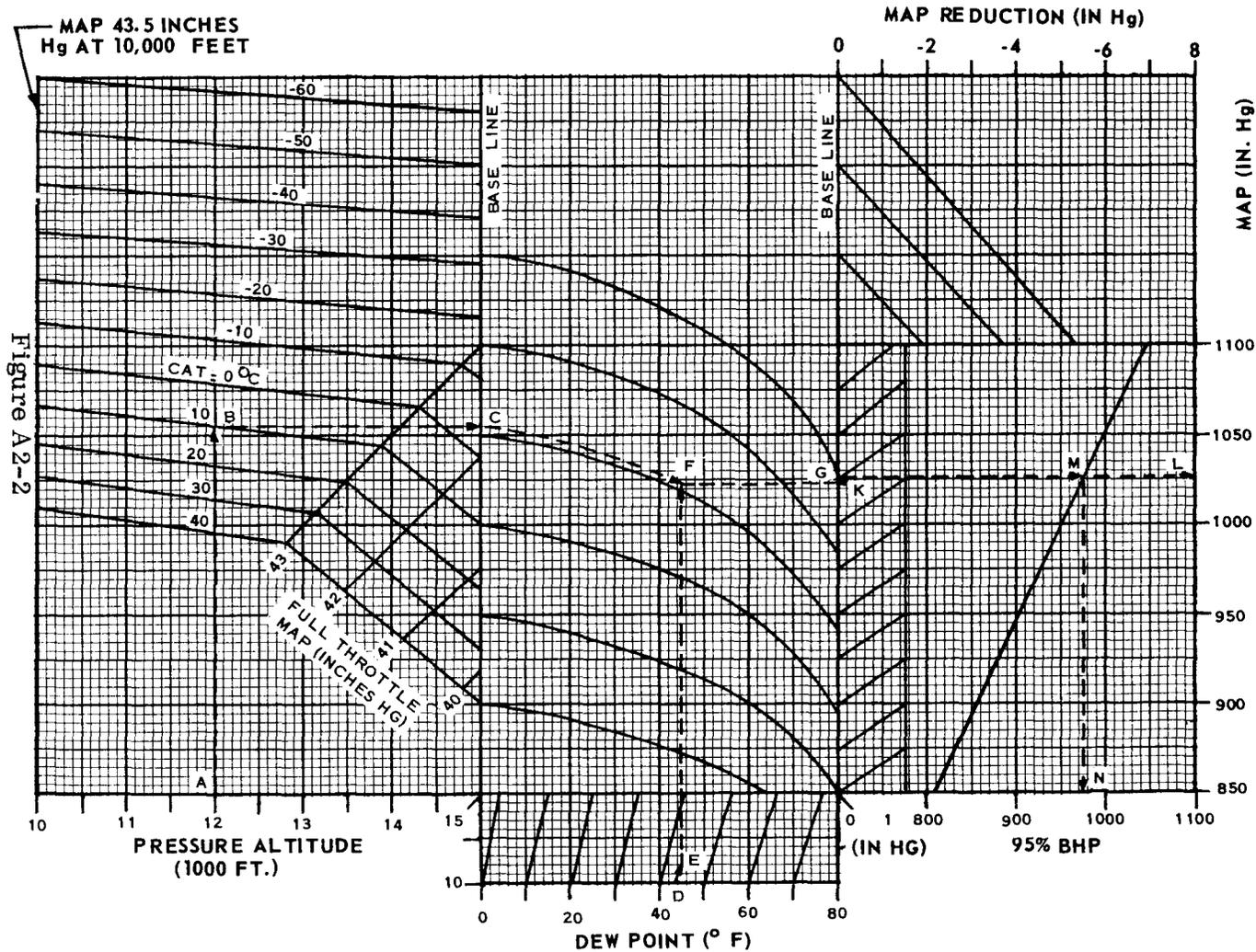
METO POWER SCHEDULE

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

1200 BRAKE HORSEPOWER PER ENGINE (LOW BLOWER)
1100 BRAKE HORSEPOWER PER ENGINE (HIGH BLOWER)
AUTO RICH

ENGINES: R-2000
FUEL GRADE: 100/130

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	BLOWER	BMEP (PSI)	FUEL FLOW LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°				PER ENG	4 ENG
20,000											
19,000											
18,000											
17,000	F.T.										
16,000	42.7	F.T.									
15,000	42.7	43.2	F.T.								
14,000	42.7	43.2	43.7	F.T.							
13,000	42.7	43.2	43.7	44.2	F.T.		2550	HIGH	171	900	3600
12,000	42.8	43.2	43.7	44.2	44.7						
11,000	42.8	43.2	43.7	44.2	44.7						
10,000	F.T.	43.2	43.8	44.2	44.7						
9,000	F.T.	F.T.	43.8	44.3	44.7						
8,000	38.8	F.T.	F.T.	44.3	44.8						
7,000	39.0	39.5	F.T.	F.T.	44.8						
6,000	39.2	39.7	40.2	F.T.	F.T.						
5,000	39.3	39.8	40.3	40.8	F.T	F.T.	2550	LOW	178	814	3256
4,000	39.5	40.0	40.5	41.0	41.5	F.T.	2550	LOW	185	857	3428
3,000	39.7	40.2	40.7	41.2	41.7	42.0					
2,000	39.9	40.4	40.9	41.4	41.9	42.0	2550	LOW	186	862	3448
1,000	40.1	40.6	41.1	41.6	42.0	42.0					
SEA LEVEL	40.2	40.7	41.2	41.7	42.0	42.0					

Notes: 1. Do NOT operate in High Blower above +15°C CAT.

2. Do NOT operate in Low Blower with carburetor heat above +38°C CAT.

MODEL: C-54	CLIMB POWER SCHEDULE	
DATE: 6-15-63	950 BRAKE HORSEPOWER PER ENGINE	ENGINES: R-2000
DATA BASIS: FLIGHT TEST	AUTO RICH	FUEL GRADE: 100/130

| PRESSURE ALTITUDE (FEET) | MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C) | | | | | | RPM | BLOWER | BMEP (PSI) | FUEL FLOW LB/HR | |
	−20°	−10°	0°	+10°	+20°	+30°				PER ENG	4 ENG
20,000											
19,000											
18,000											
17,000	F.T.										
16,000	37.3	F.T.									
15,000	37.4	37.9	F.T.								
14,000	37.4	37.9	38.4	F.T.							
13,000	37.5	38.0	38.5	39.0	F.T.		2300	HIGH	164	UNKNOWN	UNKNOWN
12,000	37.6	38.1	38.6	39.1	39.6						
11,000	32.4	38.2	38.7	39.2	39.7						
10,000	32.5	33.0	38.9	39.4	39.9						
9,000	32.6	33.1	33.6	39.5	40.0						
8,000	32.7	33.2	33.7	34.2	40.1						
7,000	32.8	33.3	33.8	34.3	34.8						
6,000	33.0	33.5	34.0	34.5	35.0	35.5					
5,000	33.1	33.6	34.1	34.6	35.1	35.6					
4,000	33.3	33.8	34.3	34.8	35.3	35.8					
3,000	33.4	33.9	34.4	34.9	35.4	35.9	2300	LOW	164	614	2456
2,000	33.6	34.1	34.6	35.1	35.6	36.1					
1,000	33.8	34.3	34.8	35.3	35.8	36.3					
SEA LEVEL	34.0	34.5	35.0	35.5	36.0	36.5					

Notes: 1. Do NOT operate in High Blower above +15°C CAT.
2. Do NOT operate in Low Blower with carburetor heat above +38°C CAT.

	POWER SCHEDULE		
MODEL: C-54	800 BRAKE HORSEPOWER PER ENGINE		ENGINES: R-2000
DATE: 6-15-63	AUTO LEAN		FUEL GRADE: 100/130
DATA BASIS: FLIGHT TEST			

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	BLOWER	BMEP (PSI)	FUEL FLOW LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°				PER ENG	4 ENG
20,000											
19,000											
18,000											
17,000											
16,000											
15,000											
14,000	F.T.						2230	LOW	142	382	1528
13,000	28.4	F.T.									
12,000	28.6	29.1	F.T.	F.T.							
11,000	30.0	29.3	29.8	30.0	F.T.						
10,000	30.1	30.6	29.9	30.4	30.6	F.T.					
9,000	30.2	30.7	31.2	30.5	31.0	31.3					
8,000	30.3	30.8	31.3	31.8	31.2	31.7	2200	LOW	144	380	1520
7,000	30.4	30.9	31.4	31.9	32.4	31.9					
6,000	30.6	31.1	31.6	32.1	32.6	33.1					
5,000	30.7	31.2	31.7	32.2	32.7	33.2					
4,000	30.9	31.4	31.9	32.4	32.9	33.4					
3,000	31.0	31.5	32.0	32.5	33.0	33.5	2112	LOW	150	372	1488
2,000	31.3	31.8	32.3	32.8	33.3	33.8					
1,000	31.5	32.0	32.5	33.0	33.5	34.0					
SEA LEVEL	31.6	32.1	32.6	33.1	33.6	34.1					

Note: Do NOT operate in High Blower above 750 BHP with AUTO LEAN MIXTURE.

	POWER SCHEDULE	
MODEL: C-54	750 BRAKE HORSEPOWER PER ENGINE	ENGINES: R-2000
DATE: 6-15-63	AUTO LEAN	FUEL GRADE: 100/130
DATA BASIS: FLIGHT TEST		

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	BLOWER	BMEP (PSI)	FUEL FLOW LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°				PER ENG	4 ENG
20,000	F.T.										
19,000	31.0	F.T.									
18,000	31.1	31.6	F.T.								
17,000	31.1	31.6	32.1	F.T.							
16,000	31.2	31.7	32.2	32.7	F.T.						
15,000	31.2	31.7	32.2	32.7	33.2		2150	HIGH	138	371	1484
14,000	27.2	31.7	32.2	32.7	33.2						
13,000	27.3	27.8	32.3	32.8	33.3						
12,000	28.7	27.9	28.4	32.8	33.3						
11,000	28.8	29.2	28.5	29.0	33.4						
10,000	29.9	29.3	29.8	29.1	29.6						
9,000	30.1	30.6	29.9	30.5	29.7	30.2	2200	LOW	135	346	1384
8,000	30.2	30.7	31.2	30.6	31.1	30.3					
7,000	30.4	30.9	31.4	31.9	31.2	31.7	2100	LOW	141	340	1360
6,000	30.5	31.0	31.5	32.0	32.5	33.0					
5,000	30.6	31.1	31.6	32.1	32.6	33.1					
4,000	30.8	31.3	31.8	32.3	32.8	33.3					
3,000	30.9	31.4	31.9	32.4	32.9	33.4	2000	LOW	149	334	1336
2,000	31.2	31.7	32.2	32.7	33.2	33.7					
1,000	31.4	31.9	32.4	32.9	33.4	33.9					
SEA LEVEL	31.6	32.1	32.6	33.1	33.6	34.1					

Note: Do NOT operate in High Blower above +15°C CAT.

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

POWER SCHEDULE
700 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

ENGINES: R-2000
FUEL GRADE: 100/130

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	BLOWER	BMEP (PSI)	FUEL FLOW LB/HR	
	−20°	B −10°	0°	E +10°	+20°	+30°				PER ENG	4 ENG
20,000	29.7	F.T.					2150	HIGH	129	339	1356
19,000	30.2	30.3	F.T.								
18,000	30.3	30.8	30.9	F.T.							
17,000	30.7	30.9	31.4	31.5	F.T.						
16,000	30.8	31.3	31.4	31.9	32.1						
15.000	26.2	31.3	31.8	32.0	32.5		2100	HIGH	132	336	1344
14,000	26.2	26.7	31.9	32.4	32.6						
A 13,000	27.5	C 26.8	27.3	F 32.5	33.0		G 2050	HIGH	135	332	1330
12,000	27.6	28.1	27.4	27.9	33.1						
11,000	29.0	28.2	28.7	28.0	28.5	29.0	2200	LOW	126	319	1276
10,000	29.1	29.6	28.8	29.3	28.6	29.1	D				
9,000	30.4	29.7	30.2	29.4	29.9	30.4	2100	LOW	132	314	1256
8,000	30.6	31.1	30.3	30.8	30.0	30.5					
7,000	30.8	31.3	31.8	30.9	31.4	31.9	2000	LOW	139	309	1236
6,000	31.0	31.5	32.0	32.5	31.6	32.1					
5,000	31.1	31.6	32.1	32.6	33.1	33.6	1900	LOW	146	304	1216
4,000	31.3	31.8	32.3	32.8	33.3	33.8					
3,000	31.4	31.9	32.4	32.9	33.4	33.9					
2,000	31.6	32.1	32.6	33.1	33.6	34.1					
1,000	31.7	32.2	32.7	33.2	33.7	34.2					
SEA LEVEL	31.9	32.4	32.9	33.4	33.9	34.4					

Note: Do NOT operate in High Blower above +15°C CAT.

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

POWER SCHEDULE
650 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

ENGINES: R-2000
FUEL GRADE: 100/130

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	BLOWER	BMEP (PSI)	FUEL FLOW LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°				PER ENG	4 ENG
20,000	28.5	28.8	F.T.	F.T.							
19,000	28.6	29.1	29.3	29.8	F.T.		2150	HIGH	120	312	1248
18,000	29.3	29.2	29.6	30.0	30.4						
17,000	29.4	29.9	29.7	30.1	30.6		2100	HIGH	123	310	1240
16,000	25.0	30.0	30.5	30.9	30.7						
15,000	25.1	25.6	30.5	31.0	31.5						
14,000	26.0	25.8	26.3	31.1	31.6		2000	HIGH	129	303	1212
13,000	26.2	26.7	26.4	26.9	31.7						
12,000	27.2	26.9	27.4	27.1	27.6	28.1	2200	LOW	117	297	1188
11,000	28.5	27.9	27.6	28.1	27.7	28.2					
10,000	28.7	29.2	28.6	29.1	28.8	29.3	2100	LOW	123	292	1168
9,000	30.1	29.4	29.9	29.4	29.9	29.5					
8,000	30.3	30.8	30.1	30.6	30.1	30.6	2000	LOW	129	287	1148
7,000	30.4	30.9	31.4	30.8	31.3	30.8					
6,000	30.6	31.1	31.6	32.1	31.5	32.0	1900	LOW	135	282	1129
5,000	30.8	31.3	31.8	32.3	32.8	32.2					
4,000	31.0	31.5	32.0	32.5	33.0	33.5					
3,000	31.2	31.7	32.2	32.7	33.2	33.7					
2,000	31.4	31.9	32.4	32.9	33.4	33.9	1800	LOW	143	278	1113
1,000	31.6	32.1	32.6	33.1	33.6	34.1					
SEA LEVEL	31.8	32.3	32.8	33.3	33.8	34.3					

Note: Do NOT operate in High Blower above +15°C CAT.

POWER SCHEDULE
600 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINES: R-2000
FUEL GRADE: 100/130

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	BLOWER	BMEP (PSI)	FUEL FLOW LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°				PER ENG	4 ENG
20,000	27.3	27.2	27.7	27.9	F.T.		2150	HIGH	111	288	1152
19,000	27.4	27.9	27.7	28.2	28.4						
18,000	28.3	27.9	28.4	28.3	28.7		2100	HIGH	113	285	1141
17,000	28.4	28.9	28.6	29.1	29.6						
16,000	24.3	29.0	29.5	29.1	29.6		2000	HIGH	119	280	1120
15,000	24.4	24.9	29.6	30.1	29.7						
14,000	25.3	25.0	25.5	30.2	30.7						
13,000	25.4	25.9	25.7	26.2	30.8		1900	HIGH	125	274	1096
12,000	26.5	26.1	26.6	26.4	26.9						
11,000	26.6	27.1	26.7	27.2	27.1	27.6	2100	LOW	113	272	1088
10,000	28.0	27.3	27.8	28.3	27.9	27.8					
9,000	28.2	28.7	28.0	28.5	29.0	28.6	2000	LOW	119	268	1073
8,000	29.7	28.8	29.3	28.7	29.2	29.7	1900	LOW	125	264	1056
7,000	29.9	30.4	29.5	30.1	30.6	29.9					
6,000	32.0	30.6	31.1	30.3	30.8	31.3	1800	LOW	132	260	1040
5,000	32.1	32.6	31.3	31.8	31.0	31.5					
4,000	32.2	32.7	33.2	32.0	32.5	31.7					
3,000	32.3	32.8	33.3	33.8	32.7	33.2	1700	LOW	140	256	1024
2,000	32.4	32.9	33.4	33.9	34.4	33.4					
1,000	32.5	33.0	33.5	34.0	34.5	35.0	1600	LOW	149	252	1008
SEA LEVEL	32.6	33.1	33.6	34.1	34.6	35.1					

Note: Do NOT operate in High Blower above +15°C CAT.

MODEL: C154
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

POWER SCHEDULE
550 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

ENGINES: R-2000
FUEL GRADE: 100/130

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	BLOWER	BMPEP (SI)	FUEL FLOW LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°				PER ENG	4 ENG
20,000	26.1	25.9	26.4	26.2	26.7						
19,000	26.2	26.7	26.5	27.0	26.8		2100	HIGH	104	264	1056
18,000	26.3	26.8	27.3	27.0	27.5						
17,000	27.3	26.9	27.4	27.9	27.6		2000	HIGH	109	259	1034
16,000	23.4	27.9	28.4	28.0	28.5						
15,000	23.5	24.0	28.6	29.1	28.6		1900	HIGH	115	254	1015
14,000	24.5	24.2	24.7	29.2	29.7						
13,000	25.5	25.1	24.8	25.3	29.8		1800	HIGH	121	249	994
12,000	25.7	26.2	25.7	25.4	25.9						
11,000	25.9	26.4	26.9	26.4	26.9	26.6	2000	LOW	109	250	1000
10,000	27.3	26.6	27.1	27.6	27.1	27.6	1900	LOW	115	245	980
9,000	27.5	28.0	28.5	27.8	28.3	27.8					
8,000	29.1	28.2	28.7	29.2	28.4	28.9	1800	LOW	121	241	964
7,000	29.3	29.8	28.9	29.4	29.9	29.1					
6,000	29.5	30.0	30.5	29.6	30.1	30.6					
5,000	29.7	30.2	30.7	31.2	30.3	30.8	1700	LOW	128	238	952
4,000	29.9	30.4	30.9	31.4	31.9	31.0					
3,000	30.1	30.6	31.1	31.6	32.1	32.6					
2,000	30.3	30.8	31.3	31.8	32.3	32.8					
1,000	30.5	31.0	31.5	32.0	32.5	33.0	1600	LOW	136	234	936
SEA LEVEL	30.7	31.2	31.7	32.2	32.7	33.2					

Note: Do NOT operate in High Blower above +15°C CAT.

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

POWER SCHEDULE
500 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

ENGINES: R-2000
FUEL GRADE: 100/130

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	BLOWER	BMEP (PSI)	FUEL FLOW LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°				PER ENG	4 ENG
20,000											
19,000	F.T.										
18,000	21.6	F.T.									
17,000	21.7	22.2	F.T.								
16,000	22.5	22.2	22.7	F.T.							
15,000	22.6	23.1	22.9	23.4	F.T.						
14,000	23.6	24.1	23.8	23.5	24.0	F.T.	2000	LOW	99	233	930
13,000	23.8	24.3	24.8	24.4	24.9	24.7					
12,000	25.0	25.5	24.9	25.4	25.1	25.6	1900	LOW	104	228	911
11,000	25.2	25.7	26.2	25.6	26.1	25.8					
10,000	26.7	25.9	26.4	26.9	26.3	26.8	1800	LOW	110	224	894
9,000	26.9	27.4	26.5	27.0	26.5	27.0					
8,000	27.1	27.6	28.1	27.2	27.7	28.2	1700	LOW	116	220	879
7,000	27.2	27.7	28.2	28.7	27.9	28.4					
6,000	27.4	27.9	28.4	28.9	29.4	28.6					
5,000	27.6	28.1	28.6	29.1	29.6	30.1					
4,000	27.8	28.3	28.8	29.3	29.8	30.3					
3,000	28.0	28.5	29.0	29.5	30.0	30.5	1600	LOW	124	216	864
2,000	28.3	28.8	29.3	29.8	30.3	30.8					
1,000	28.5	29.0	29.5	30.0	30.5	31.0					
SEA LEVEL	28.7	29.2	29.7	30.2	30.7	31.2					

POWER SCHEDULE
450 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINES: R-2000
FUEL GRADE: 100/130

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	BLOWER	BMEP (PSI)	FUEL FLOW LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°				PER ENG	4 ENG
20,000											
19,000											
18,000											
17,000											
16,000											
15,000							1700	LOW	105	202	806
14,000											
13,000											
12,000											
11,000											
10,000	24.6	25.1	25.6	26.1	25.5	26.0					
9,000	24.8	25.3	25.8	26.3	26.8	26.2					
8,000	25.0	25.5	26.0	26.5	27.0	27.5					
7,000	25.2	25.7	26.2	26.7	27.2	27.7					
6,000	25.4	25.9	26.4	26.9	27.4	27.9					
5,000	25.6	26.1	26.6	27.1	27.6	28.1					
4,000	25.8	26.3	26.8	27.3	27.8	28.3	1600	LOW	111	198	792
3,000	26.0	26.5	27.0	27.5	28.0	28.5					
2,000	26.3	26.8	27.3	27.8	28.3	28.8					
1,000	26.6	27.1	27.6	28.1	28.6	29.1					
SEA LEVEL	26.8	27.3	27.8	28.3	28.8	29.3					

	POWER SCHEDULE	
MODEL: C-54	400 BRAKE HORSEPOWER PER ENGINE	
DATE: 6-15-63		ENGINES: R-2000
DATA BASIS: FLIGHT TEST	AUTO LEAN	FUEL GRADE: 100/130

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	BLOWER	BMEP (PSI)	FUEL FLOW LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°				PER ENG	4 ENG
20,000											
19,000											
18,000											
17,000											
16,000											
15,000											
14,000											
13,000											
12,000											
11,000											
10,000	22.5	23.0	23.5	24.0	24.5	25.0					
9,000	22.7	23.2	23.7	24.2	24.7	25.2					
8,000	22.9	23.4	23.9	24.4	24.9	25.4					
7,000	23.1	23.6	24.1	24.6	25.1	25.6					
6,000	23.3	23.8	24.3	24.8	25.3	25.8					
5,000	23.5	24.0	24.5	25.0	25.5	26.0	1600	LOW	99	180	720
4,000	23.8	24.3	24.8	25.3	25.8	26.3					
3,000	24.0	24.5	25.0	25.5	26.0	26.5					
2,000	24.2	24.7	25.2	25.7	26.2	26.7					
1,000	24.4	24.9	25.4	25.9	26.4	26.9					
SEA LEVEL	24.7	25.2	25.7	26.2	26.7	27.2					

ENGINE CALIBRATION CURVE
LOW BLOWER—AUTO RICH
ZERO RAM—STANDARD DAY—SEA LEVEL CALIBRATION

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

Restricted Operation
(2310-2510 RPM)

RPM
2700
2550
2400
2300
2200
2100
2000

LIMITED BY
MAXIMUM BMEP

BRAKE HORSEPOWER

MANIFOLD PRESSURE (IN. Hg)
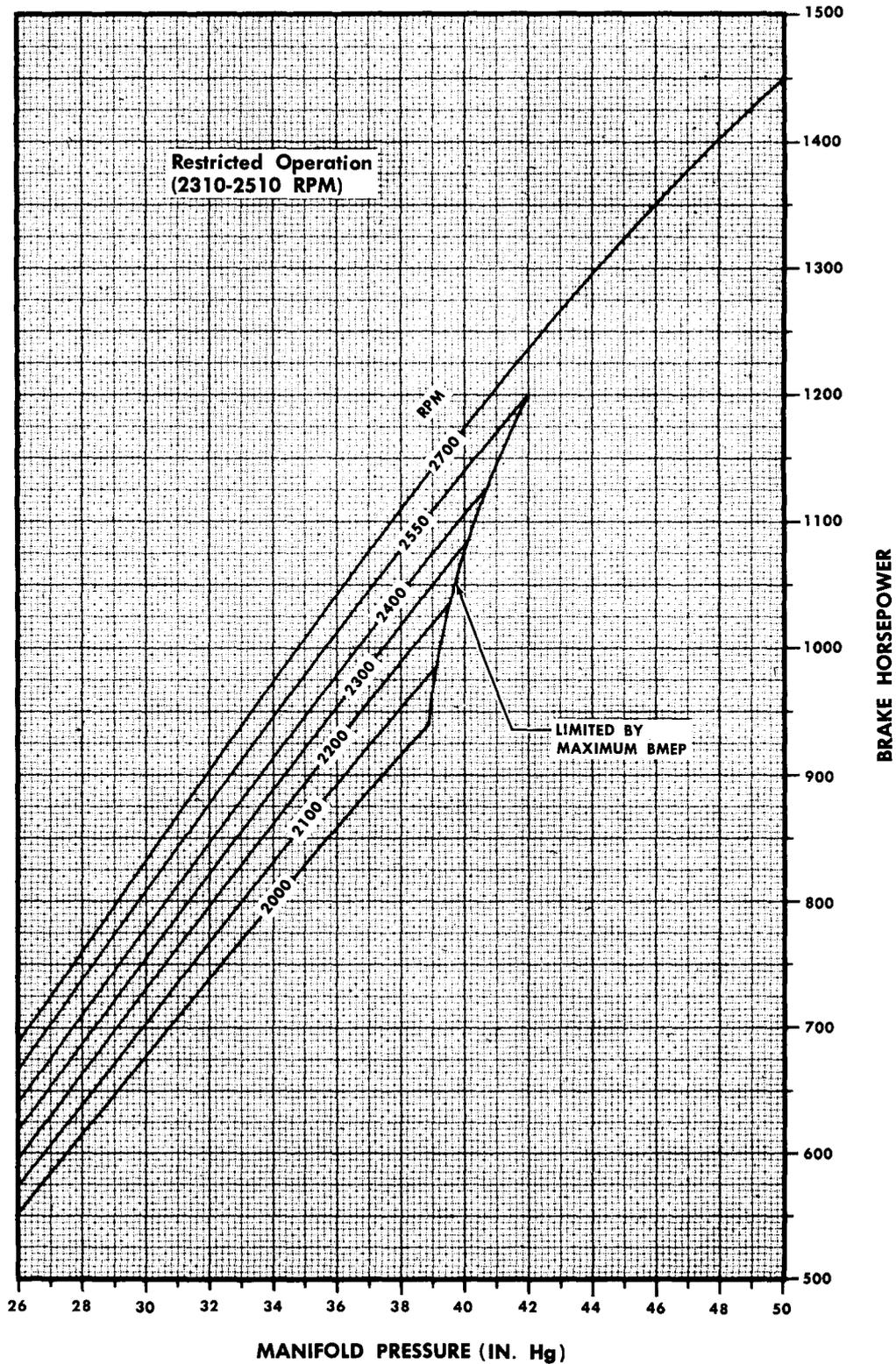
Figure A2-14 (Sheet 1 of 2)

X1-105

ENGINE CALIBRATION CURVE
LOW BLOWER — AUTO RICH
ZERO RAM — STANDARD DAY

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130
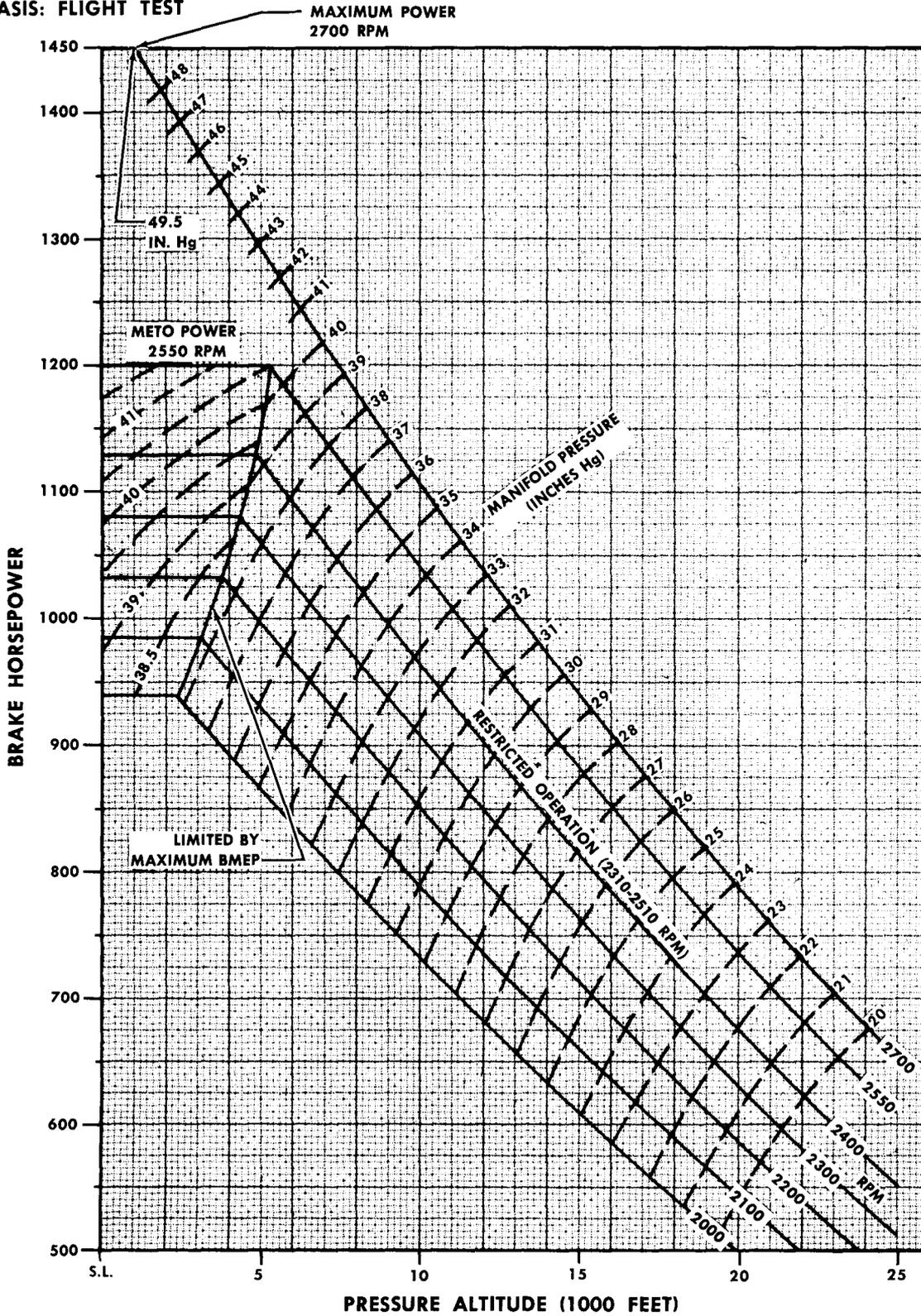
Figure A2-14 (Sheet 2 of 2)

X1-82

A2-22

ENGINE CALIBRATION CURVE
HIGH BLOWER—AUTO RICH
ZERO RAM—STANDARD DAY—10,000 FEET CALIBRATION

MODEL: C-54
DATE: 6-15-63·
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

Restricted Operation
(2310-2510 RPM)

RPM
2550
2400
2300
2200
2100
2000

LIMITED BY
MAXIMUM BMEP

BRAKE HORSEPOWER

MANIFOLD PRESSURE (IN. Hg)

Figure A2-15 (Sheet 1 of 2)

X1-325

A2-23

ENGINE CALIBRATION CURVE
HIGH BLOWER—AUTO RICH
ZERO RAM—STANDARD DAY

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

PRESSURE ALTITUDE (1000 FEET)
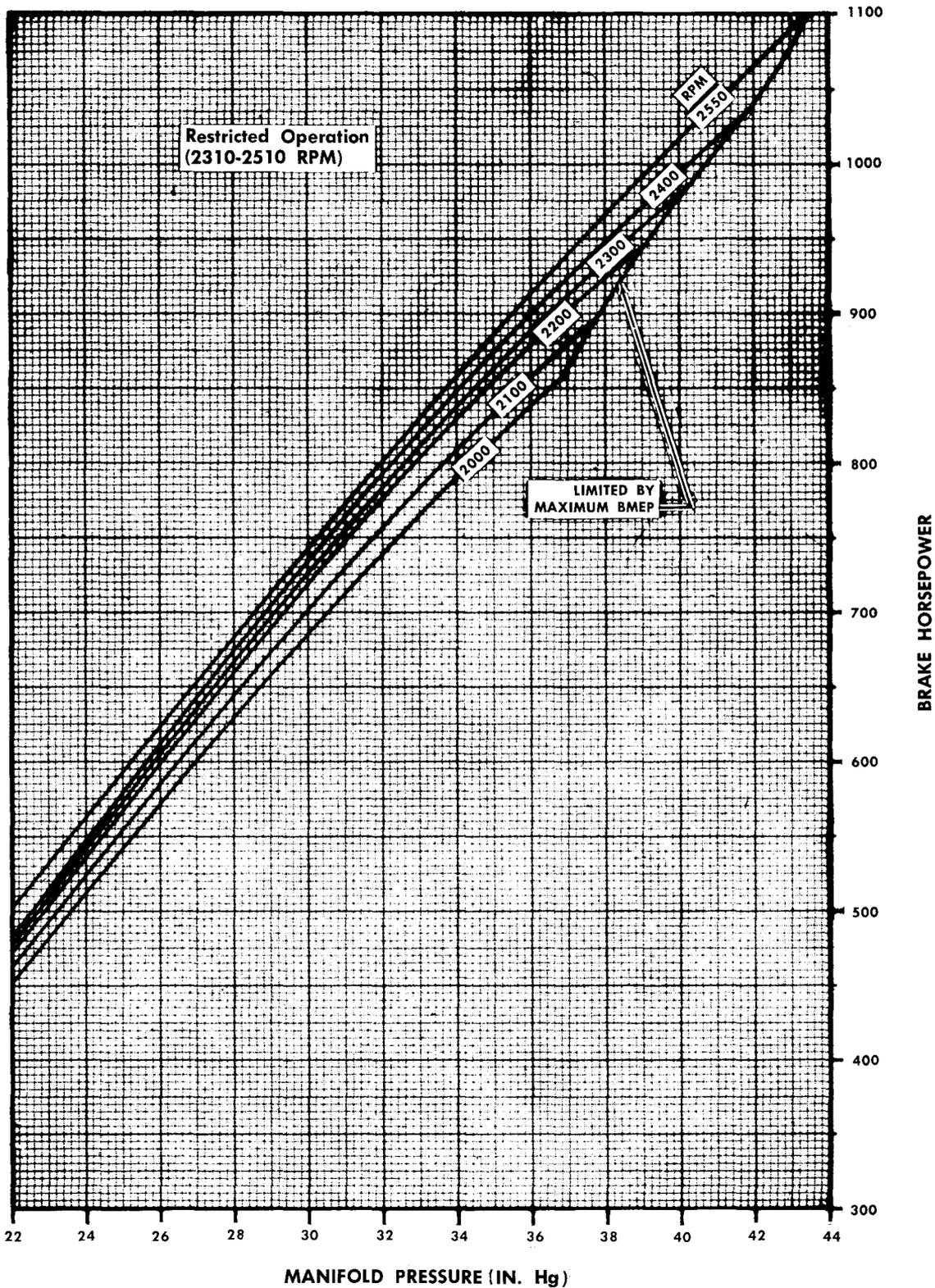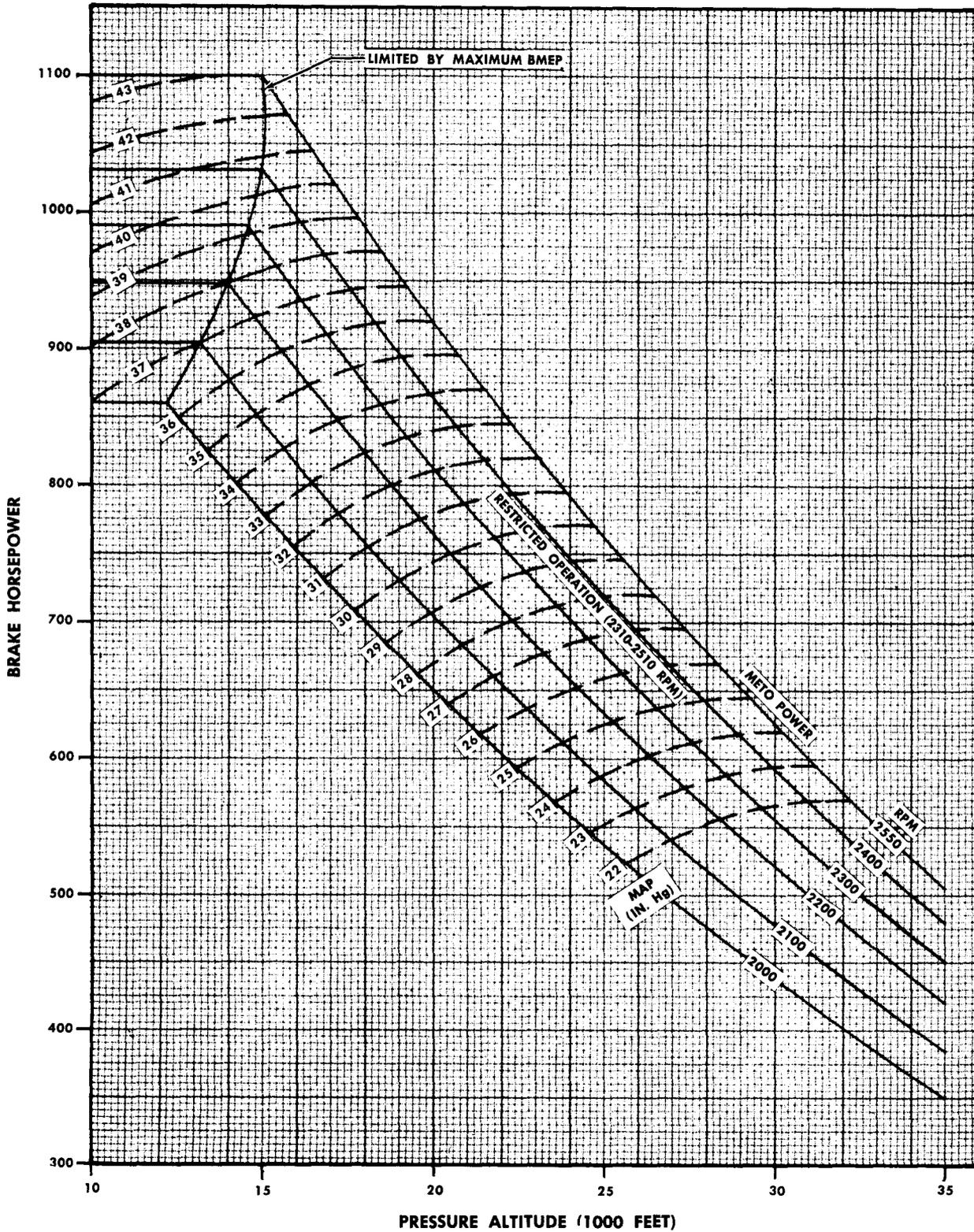
Figure A2-15 (Sheet 2 of 2)

X1-84

ENGINE CALIBRATION CURVE
LOW BLOWER—AUTO LEAN
ZERO RAM—STANDARD DAY
SEA LEVEL CALIBRATION

MODEL: C-54
DATE: 6-15-63
DATA BASIS: ESTIMATED

ENGINE(S): R-2000
FUEL GRADE: 100/130

Restricted Operation
(1601-1699 RPM)

MANIFOLD PRESSURE (IN. Hg)
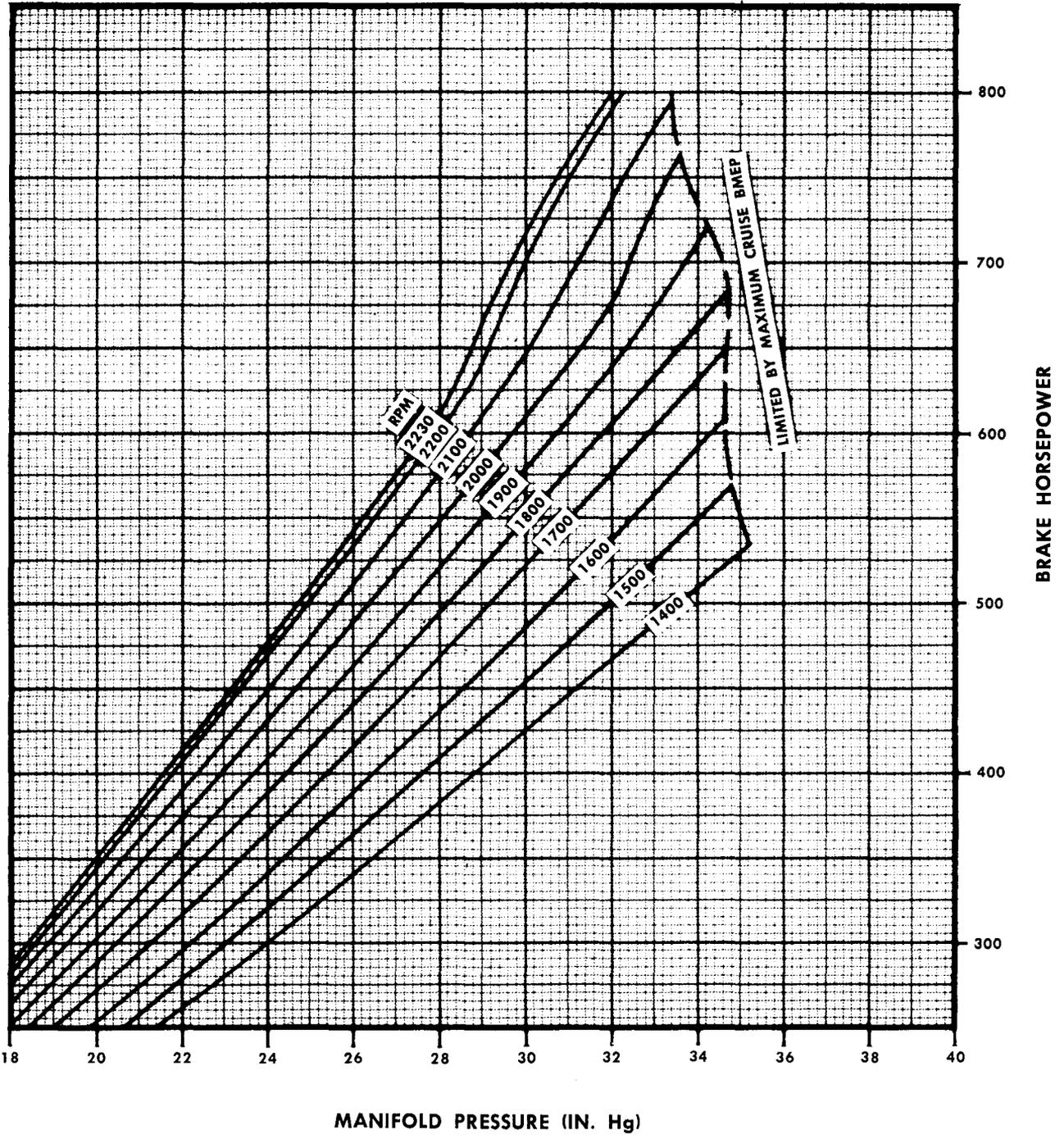
Figure A2-16 (Sheet 1 of 2)

X1-85

A2-25

ENGINE CALIBRATION CURVE
LOW BLOWER—AUTO LEAN
ZERO RAM—STANDARD DAY

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130
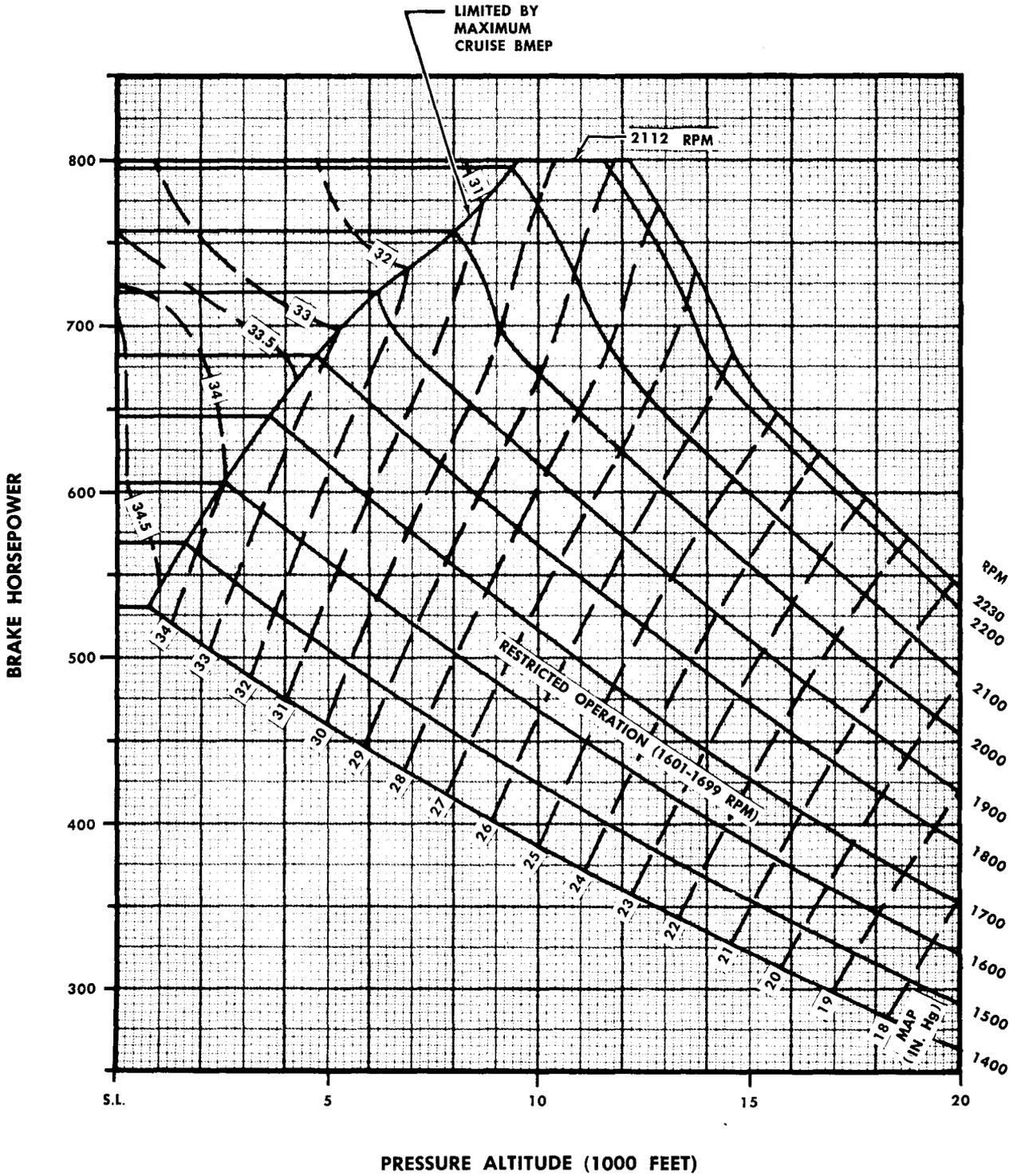
Figure A2-16 (Sheet 2 of 2)

X1-149

ENGINE CALIBRATION CURVE
HIGH BLOWER—AUTO LEAN
ZERO RAM—STANDARD DAY
10,000 FEET CALIBRATION

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

Restricted Operation
(1601-1699 RPM)

LIMITED BY MAXIMUM CRUISE BMEP

RPM
2150
2100
2000
1900
1800
1700
1600
1500
1400

BRAKE HORSEPOWER

MANIFOLD PRESSURE (IN. Hg)

Figure A2-17 (Sheet 1 of 2)

X1-86

ENGINE CALIBRATION CURVE
HIGH BLOWER—AUTO LEAN
ZERO RAM—STANDARD DAY

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

PRESSURE ALTITUDE (1000 FEET)
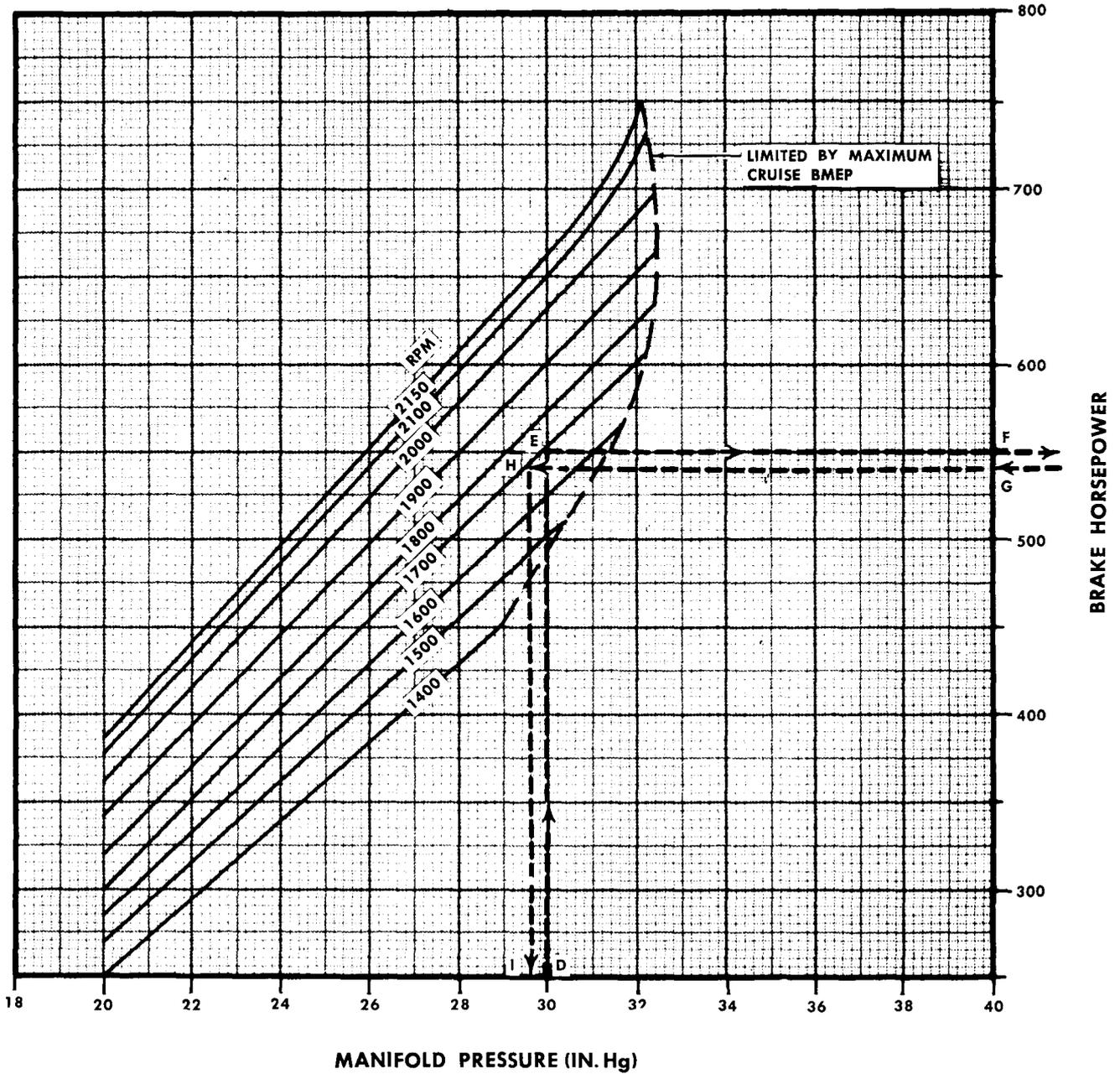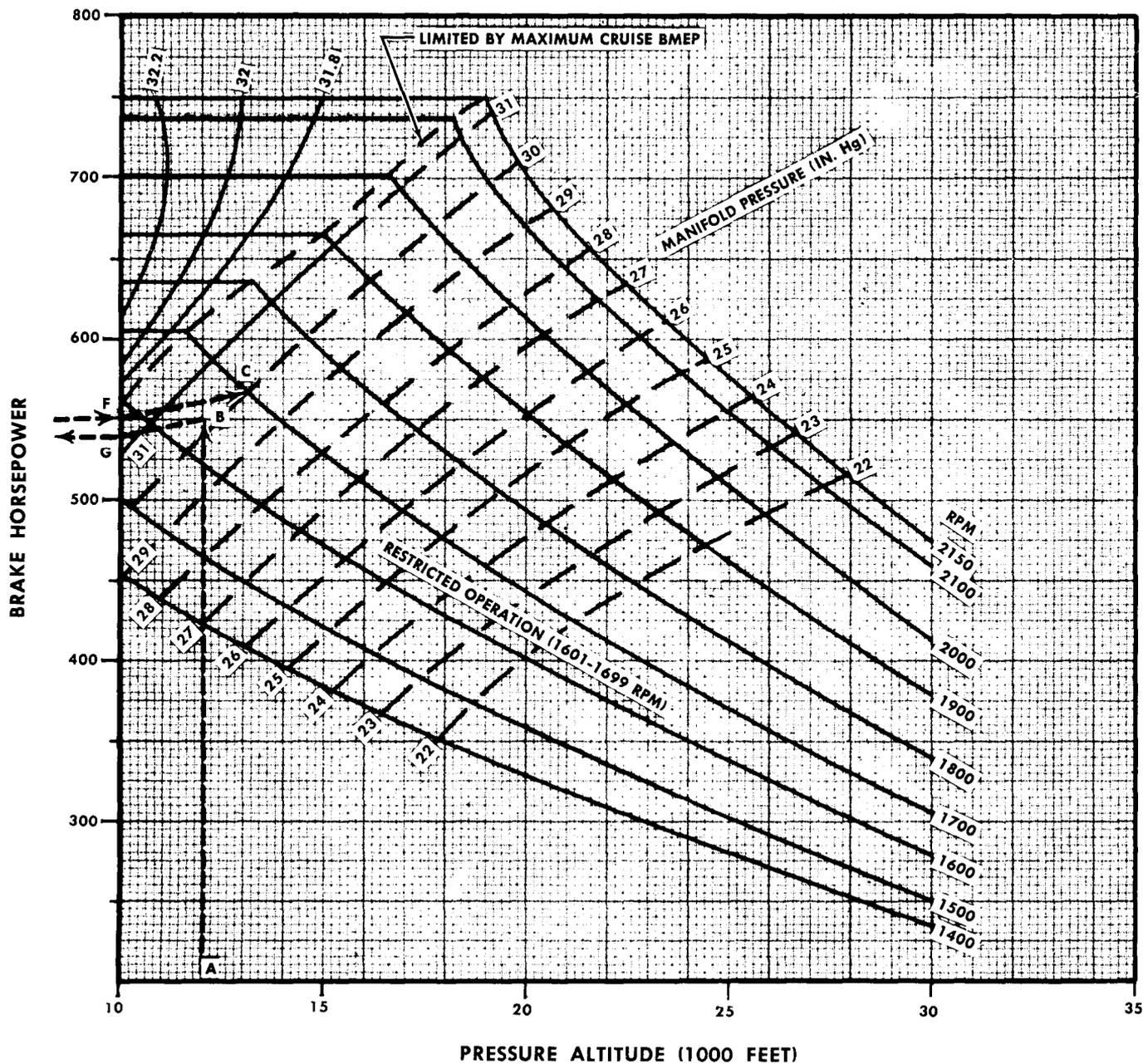
Figure A2-17 (Sheet 2 of 2)

X1-87

FUEL FLOW PER ENGINE
LOW BLOWER

MODEL: C-54
DATE: 6-15-63
DATA BASIS: ESTIMATED

ENGINE(S): R-2000
FUEL GRADE: 100/130

BRAKE HORSEPOWER PER ENGINE
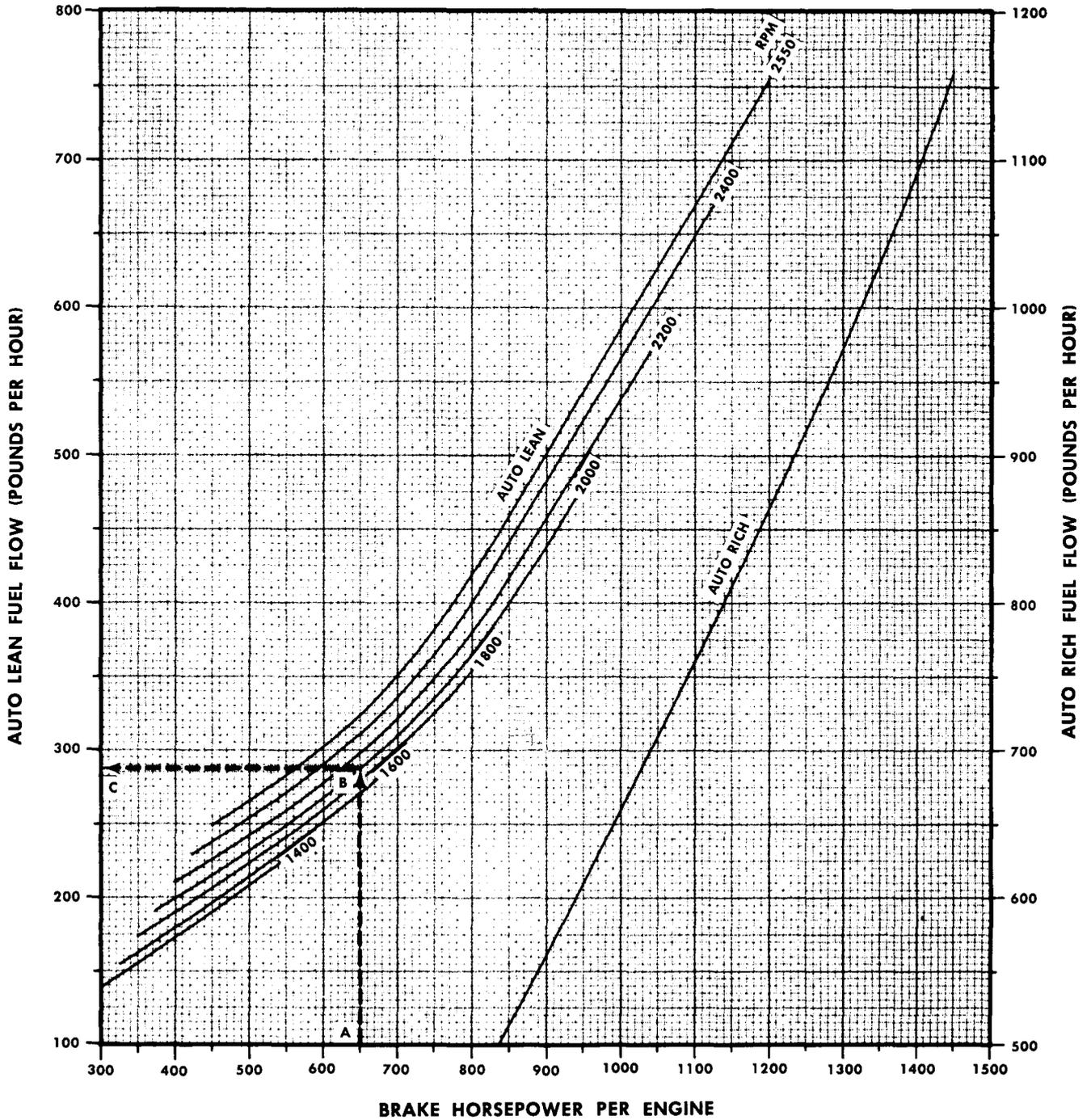
FUEL FLOW PER ENGINE
HIGH BLOWER

MODEL: C-54
DATE: 6-15-63
DATA BASIS: ESTIMATED

ENGINE(S): R-2000
FUEL GRADE: 100/130

BRAKE HORSEPOWER PER ENGINE

AUTO LEAN FUEL FLOW (POUNDS PER HOUR)

AUTO RICH FUEL FLOW (POUNDS PER HOUR)

Figure A2-19

X1-342

A2-30
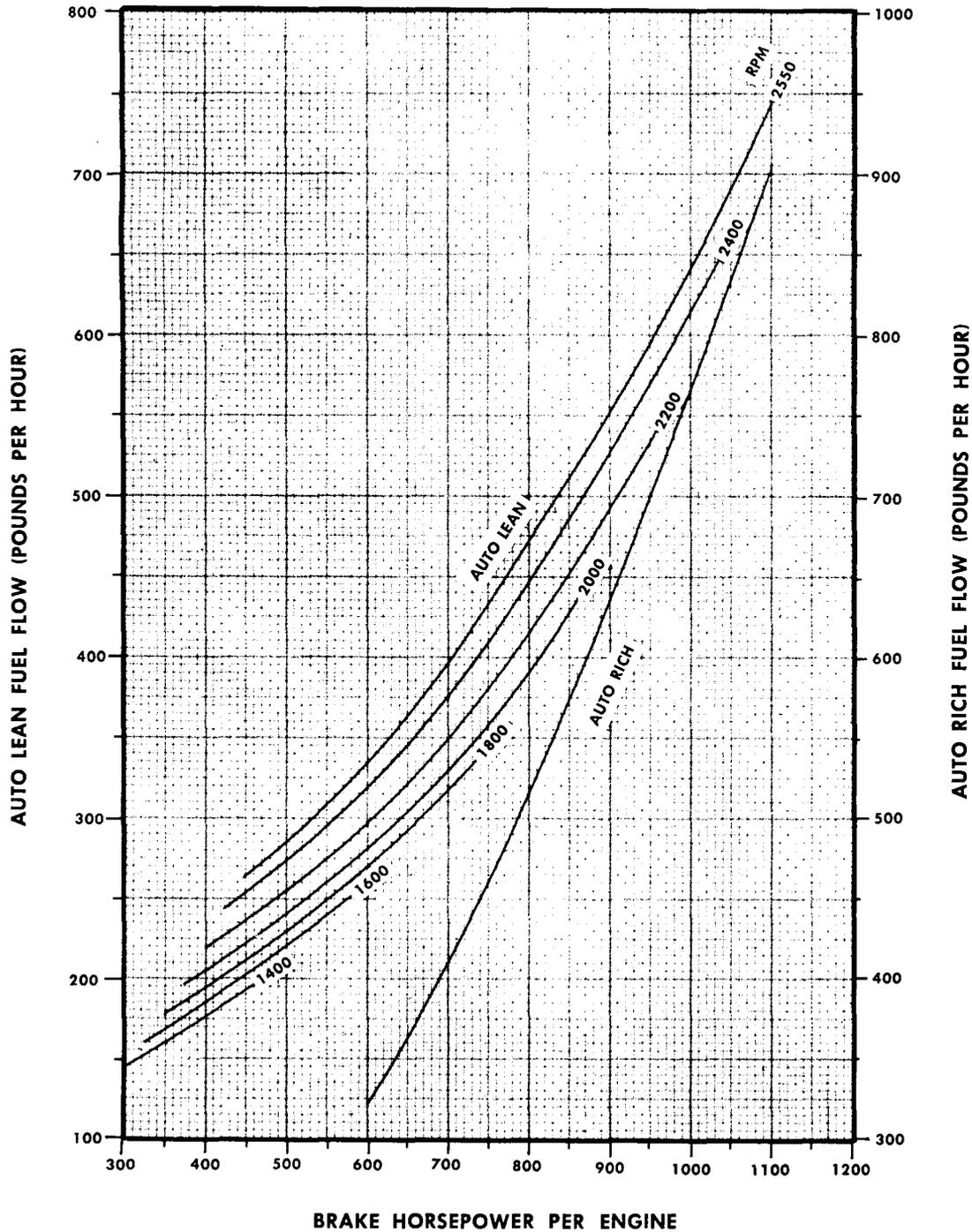
PART 3

TAKEOFF

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

TAKEOFF.

Takeoff and climbout performance data are presented for various gross weight, altitudes, powers, winds, and runway conditions. Each of the takeoff and climbout performance charts are discussed in detail using the terms covered in Definition Of Terms. The use of each type of chart is illustrated with a sample problem.

APPLICATION OF WINDS TO TAKEOFF AND LANDING DATA.

Winds usually are measured at some fixed point on the airfield, and, within instrumentation limits, are valid for the time and the geographical 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, winds of greater or lesser magnitude and/or different direction may be experienced. In addition, wind shear can result in varying wind as altitude is gained or lost on climbout or landing approach patterns.

The wind correction data provided on the charts of the Appendix, indicate only how winds of a given magnitude will affect the performance of the aircraft. Due to the variables in wind conditions, reported winds should not be used unless experience with the field in question has shown that reported winds will reflect the actual wind conditions. Where this information is lacking, to allow a safety margin for fluctuation in wind velocity, it is recommended that 50 percent of the reported headwind and 150 percent of the reported tailwinds be used with the wind correction grids on the charts in this appendix.

DEFINITION OF TERMS.

1. Critical Field Length—The total length of runway required to accelerate on all engines to the critical engine failure speed, experience an engine failure, then continue to takeoff or to stop.

2. Critical Engine Failure Speed—The speed at which engine failure permits acceleration to takeoff in the same distance that the aircraft may be decelerated to a stop.

3. Refusal Speed and Distance—The refusal speed is the maximum speed to which the aircraft can accelerate and then stop in the available runway length. The refusal distance is the distance required to accelerate to the refusal speed under normal conditions.

4. Decision Speed—Minimum speed from which a safe takeoff can be continued in the remaining runway length, should an engine failure occur.

5. Acceleration Check (Go No-Go) Speed and Distance (or Time)—The speed and corresponding distance (or time) selected as the checkpoint to determine whether the aircraft is accelerating properly. Normally the acceleration check (go no-go) distance is the nearest 1000-foot runway marker below the refusal distance; however, in some cases, the refusal distance may be so close to the runway marker that it is impractical to use this marker for the check distance. It is also the point at which the final decision to continue or abort the takeoff is made, except for cases in which the critical engine failure speed is greater than the acceleration check speed. The acceleration check (go no-go) speed is the minimum speed allowable at the acceleration check marker.

6. Takeoff Speed and Distance—Takeoff speed is the speed at which the aircraft is lifted off the runway. The takeoff performance charts assume a takeoff speed equal to 115 percent of the zero-thrust stalling airspeed for a 15-degree wing flap setting or 110 percent of the minimum control airspeed, whichever is higher.

7. Wing Flap Retraction Airspeed—The minimum recommended airspeed for starting wing flap retraction, 120 percent of the zero-thrust stalling airspeed with zero-degree wing flap deflection.

8. Minimum Control Airspeed—This airspeed is determined from flight tests. In this test, with maximum power on all four engines, the critical (No. 1) engine is abruptly cut and the propeller is allowed to windmill. Under these conditions, the minimum control airspeed is the minimum airspeed at which directional control can be maintained with zero yaw and an angle of bank of not more than 5 degrees to assist the rudder.

9. Ground Effect—Ground effect, in general, refers to a reduction in the overall drag of the 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 will have, for all practical purposes, disappeared when the wing is one half the wing span above the ground. The reduction in drag is also greatest at low velocities and becomes a lesser reduction as velocity increases. All of the takeoff performance charts in this appendix which pertain to ground run consider the reduction in drag due to ground effect.

RELATIONSHIP OF TAKEOFF TERMS.

The Takeoff Terms—Definition and Relationship Chart (figure A3-1) illustrates the relationship of the terms used on the takeoff charts. Curve No. 1 represents the normal four-engine acceleration path. It shows the distance that has been traversed at any engine failure speed. It is similar to a line on the Speed During Takeoff Ground Run chart (figure A3-9) and is used in conjunction with the refusal speed (C) to establish the refusal distance (D), the acceleration check distance (E) and the acceleration check speed (F). Four-Engine takeoff speed (I) and distance (J) are included to show relationship to the other points discussed here.

Curve No. 2 represents the sum of the distances required to accelerate on four engines to engine failure speed, and then stop.

Curve No. 3 represents the sum of the distances required to accelerate on four engines

TAKEOFF TERMS

DEFINITION AND RELATIONSHIP
SAMPLE PROBLEM

A. Critical field length
B. Critical engine failure speed
C. Refusal speed
D. Refusal distance
E. Acceleration check distance
F. Acceleration check speed
G. Minimum engine failure speed for continued takeoff
H. Runway length
I. Takeoff speed
J. Four-engine takeoff distance
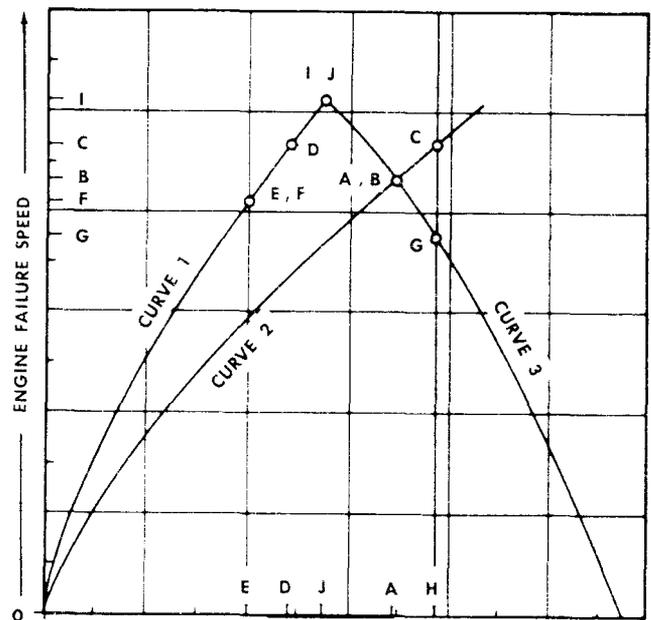
CURVE 1
Four-engine acceleration distance

CURVE 2
Total distance to accelerate then stop

CURVE 3
Total distance to accelerate to engine failure speed then continue takeoff on three engines

X1-326

Figure A3-1

to engine failure speed, and then to continue to accelerate on three engines to takeoff speed. By definition, the intersection of curves 2 and 3 depicts the critical field length (A) and the critical engine failure speed (B). The intersection of the vertical line representing runway length (H) and Curve 2, depicts refusal speed (C). The intersection of

the same vertical line and Curve 3 establishes the minimum engine failure speed (G) from which the takeoff may be continued with the remaining three engines. If the gross weight is heavy enough that the critical field length is greater than the runway length, speed (C) and (G) will occur in the reverse order. In this case, if an engine fails between speeds (C) and (G), the aircraft can neither stop within nor takeoff from the remaining runway. Therefore, takeoff gross weight should be limited by critical field length.

MAXIMUM TAKEOFF GROSS WEIGHT.

Safe operation of the aircraft requires that takeoffs not be attempted at gross weights for which acceleration, rate-of-climb, or obstacle clearance capability are marginal. There are four primary factors which must be considered when determining a safe limit for the takeoff gross weight.

1. The ability of the structure to withstand taxiing loads and inflight maneuvering loads are shown as design takeoff gross weights in the Characteristic Takeoff Speeds chart (figure A3-12).

2. The ability to take off within the available runway is shown on the Critical Field Length chart (figure A3-7).

3. The ability to have adequate rate of climb when airborne is shown on the takeoff Gross Weight Limited By Three-Engine Climb Performance chart (figure A3-2).

4. The ability to clear obstacles within the takeoff corridor is shown on the Takeoff Path—Three-Engine chart (figure A3-11).

For a given set of takeoff conditions, each of these four considerations will permit a different gross weight. Any one of the four weights may be the lowest, depending on the conditions. For this reason, all four factors must be considered for each takeoff, even though in many cases one or more of the factors may be eliminated after cursory examination. The lowest weight determined by the factors will be the maximum takeoff gross weight.

TAKEOFF WITHOUT ALLOWANCE FOR ENGINE FAILURE.

Charts are provided to show the takeoff per-

formance of the aircraft without allowance for engine failure. The charts are intended as a guide to show the ultimate performance of the aircraft. Ordinarily, takeoff performance should be determined by allowing for the possibility of an engine failure.

The takeoff of the aircraft is made with a wing flap deflection of 15 degrees and four engines operating at maximum power. Performance for this configuration is illustrated in the takeoff Ground Run chart (figure A3-4). The effect of runway slope on ground run is shown on the Runway Slope Correction chart (figure A3-5). The charts assume that acceleration is made on a hard surface runway to the indicated takeoff speed, as shown on the ground run chart. The effect of runway surface condition on the ground run is shown separately on figure A3-6.

TAKEOFF WITH ALLOWANCE FOR ENGINE FAILURE.

Critical Field Length Method.

Normal takeoff planning procedure allows for the possibility of an engine failure and utilizes a critical engine failure speed, which is a single reliable abort criterion. If an engine fails before the critical engine failure speed is reached, the aircraft should be stopped because aircraft cannot be accelerated on three engines to the takeoff speed within the critical field length. If an engine fails after the critical engine failure speed is reached, the takeoff must be continued because the aircraft cannot be stopped within the critical field length.

If the available runway length is greater than the critical field length, the critical engine failure speed is retained without change and the excess runway provides an added safety margin. Performance shown assumes maximum power and a hard surface runway.

Acceleration Check (Go No-Go) Method.

When the available runway is substantially longer than the critical field length, the pilot may elect to utilize the acceleration check (go no-go) method instead of the critical field length method. With this method, the pilot will be able to abort the takeoff and stop within the excess runway instead of being required to continue the takeoff after an engine failure before maximum refusal speed.

The takeoff should be aborted if an engine fails before the maximum refusal speed is reached or if the acceleration check distance (or time) is reached before the acceleration check speed is attained. If the engine fails after reaching the maximum refusal speed, the takeoff should be continued.

The acceleration check distance (or time) and the acceleration check speed are determined as follows:

1. Determine the four-engine ground run and indicated takeoff speed, correcting for the expected wind velocity.

2. Determine the refusal speed from figure A3-8.

3. Enter the Speed During Ground Run chart (figure A3-9) with the ground run and the takeoff speed from step 1, after subtracting the headwind from (or adding the tailwind to) the takeoff speed. From this point, follow down a line to the refusal speed (less the headwind) and read the refusal distance.

4. The acceleration check distance is the nearest 1000-foot runway marker below the refusal distance. Read the airspeed at the acceleration check distance from figure A3-9. Add the headwind to this reading to obtain the acceleration check indicated airspeed.

5. On unmarked runways or under conditions of poor visibility, aircraft acceleration may be checked by relating speed to time. The acceleration check time may be read at the acceleration check distance determined in step 4. Since the velocity is shown as indicated airspeed instead of true airspeed or ground speed, the time lines shown must be corrected for altitude and temperature by dividing the chart value by the Smoe factor, $\frac{1}{\sqrt{\sigma}}$.

The following summary indicates what action should be taken when using the acceleration check method:

1. Abort takeoff if:

    a. Acceleration check speed is not attained before the acceleration check distance (or time) is reached.

    b. Engine failure occurs before maximum refusal speed is attained.

2. Continue takeoff if:

    a. Acceleration check speed is attained at the acceleration check distance (or time).

    b. Engine failure occurs after the aircraft has attained the maximum refusal speed.

ACCELERATION CHECK SPEED TOLERANCE.

When the available runway is substantially longer than the critical field length, and the proposed takeoff gross weight is less than the maximum takeoff gross weight, there will be a speed tolerance allowable for the acceleration check speed. The minimum value of acceleration check speed, from which a takeoff can be successfully completed in the event of an engine failure, may be determined as follows:

1. Determine maximum takeoff gross weight for takeoff conditions (see Takeoff Without Allowance For Engine Failure, this Section).

2. Determine ground run and takeoff speed for maximum takeoff gross weight from the Takeoff Ground Run chart (figure A3-4).

3. Enter the Speed During Takeoff Ground Run chart (figure A3-9) with this ground run and takeoff speed (less headwind).

4. Follow down solid guideline to predetermined acceleration check distance and read speed.

5. Add headwind to this speed to obtain the minimum allowable acceleration check speed.

The object of this procedure is to insure obstacle clearance and adequate rate of climb as well as ability to takeoff should engine failure occur after the maximum refusal speed has been obtained.

DISCUSSION OF CHARTS.

TAKEOFF GROSS WEIGHT LIMITED BY THREE-ENGINE CLIMB PERFORMANCE.

The Takeoff Gross Weight Limited By Three-Engine Climb Performance chart (figure A3-2) is based on the climbing ability of the aircraft immediately after takeoff, before landing gear retraction, or propeller feathering. For given conditions of brake horsepower, density altitude, outside air temperature, and desired rate of climb from zero to 300 feet per minute, with one engine inoperative and neglecting ground effect, the maximum weight may be determined.

In determining the ability of the aircraft to leave the runway with a particular gross weight, the slope of the runway or terrain beyond the takeoff point must be considered. Lines of flight path slope versus gross weight make it possible to determine the weight at which the flight path slope will exceed the runway or terrain slope by any desired margin.

A correction for wind speed is provided to account for the variation in flight path slope with wind speed. The following example illustrates the method of using the chart.

Example.

Given: Available Brake Horsepower = 1,320 BHP

Density Altitude = 4,000 Feet

Outside Air Temperature = 34° C

Desired Rate of Climb = 100 FPM

Desired Flight Path Slope = 0.015

Reported Headwind = 20 Knots

Find: Maximum gross weights for 100 fpm rate of climb and to maintain a flight path slope of 0.015.

Enter the chart (figure A3-2) at a brake horsepower of 1320 BHP (A), read up to a density altitude of 4000 feet (B), and read across to the baseline (C). Correct for outside air temperature by following the guideline to 34°C (D), and read across to the desired rate of climb of 100 FPM (E). Read down to find a gross weight of 69,400 pounds (F).

Determine the gross weight required to maintain the desired flight path slope by reading across from (E) to the required slope of 0.015 (G) and down to the baseline (H). Correct for headwind, using one half of the reported headwind by following the guideline to 10 knots (I), and reading down to find a corrected gross weight of 67,200 pounds (J).

TAKEOFF GROSS WEIGHT LIMITED BY TWO-ENGINE CLIMB PERFORMANCE.

The Takeoff Gross Weight Limited By Two-Engine Climb Performance chart (figure A3-3) is provided for use in the event that a three-engine takeoff is necessary. The data and method of using the chart is same as for the three-engine chart.

TAKEOFF GROUND RUN.

The Takeoff Ground Run chart (figure A3-4) shows the ground run and takeoff airspeed for four-engine operation based on available brake horsepower, density altitude and gross

weight, with corrections for wind velocity. Ground run distances shown on this chart are based on zero runway slope and dry hard surface runway. The following example illustrates the method of using the chart.

Example.

Given: Available Brake Horsepower = 1380 BHP

Density Altitude = Sea Level

Gross Weight = 68,000 Pounds

Reported Headwind = 30 Knots

Find: Takeoff ground run.

Enter the chart (figure A3-4) with available brake horsepower of 1380 BHP (A), read up to density altitude of sea level (B), and across to the gross weight of 68,000 pounds (C). Note that for these conditions the takeoff IAS is approximately 99 knots. Read down to find the zero wind ground run of 2750 feet (D). Correct for wind, using one half of the reported headwind by following the guideline to 15 knots (E), and reading down to find the corrected ground run of 2100 feet (F).

RUNWAY SLOPE CORRECTION.

The Runway Slope Correction chart (figure A3-5) is provided to correct the ground run obtained from the Takeoff Ground Run chart for existing runway slopes. Corrections are made for both uphill and downhill slope (0.02 to -0.02). Runway gradient is determined by dividing the runway rise (feet) by the runway length. The following example illustrates the method of using the chart.

Example.

Given: Distance Without Runway Slope = 4750 feet

Runway Slope = 0.01

Find: Takeoff ground run corrected for slope.

Enter the chart (figure A3-5) with the uncorrected ground run distance of 4750 feet (A), read up to a runway slope of 0.01 (B) and across to find corrected ground run of 5130 feet (C).

EFFECT OF RUNWAY SURFACE CONDITION ON GROUND RUN.

The Effect of Runway Surface Condition On Ground Run chart (figure A3-6) is provided to correct takeoff ground run distances for varying runway conditions. The values of rolling coefficient of friction will vary depending on the amount of moisture on the runway. For example, a damp runway will have a coefficient of friction very close to that of a dry runway, however, enough water to wet the surface but still not a measurable amount, will fall approximately between that of a dry runway and dry turf. Snow will vary considerably depending on depth and texture. A light powder snow will be approximately the same as for wet turf, whereas hard packed snow will be the same as for dry runway. The rolling coefficient of friction should not be confused with braking friction which is measured with a decelerometer and reported as an RCR number since the two conditions are dependent on different forces. In the absence of accurate measurement of the rolling friction an approximation must be made for conditions other than those noted on the chart. The following example illustrates the method of using the chart.

Example.

Given: Ground Run, Hard Surface Runway = 7250 Feet

Rolling Coefficient of Friction = 0.04

Find: Corrected ground run.

Enter the chart (figure A3-6) with the ground run for dry hard surface runway obtained from the Takeoff Ground Run chart of 7250 feet (A), read up to the coefficient of friction of 0.04 (B), and across to obtain corrected ground run of 8500 feet (C).

CRITICAL FIELD LENGTH.

The Critical Field Length chart (figure A3-7) is used to determine the length of runway required to accelerate to critical engine failure speed and to either continue the takeoff or stop within the available runway in the event of an engine failure for various combinations of brake horsepower, density altitude and gross weights.

The chart is based on takeoff with wing flaps set at 15 degrees, and assumes engine failure occuring on the most critical engine (No. 1 engine) at critical engine failure speed. For a continued takeoff it is assumed that the aircraft leaves the runway at the takeoff speed shown on the Takeoff Ground Run chart. Drag after engine failure includes that resulting from the windmilling propeller and the deflected rudder and ailerons. For an aborted takeoff it is assumed that after engine failure, 3 seconds are allowed for reaction time; then power is reduced to zero and brakes applied, and the aircraft is decelerated with wheel braking only. The following example illustrates the method of using the chart.

Example.

Given: Available Brake Horsepower = 1360 BHP

          Density Altitude = 2000 Feet

          Gross Weight - 75,000 Pounds

          Headwind = 25 Knots

Find: Critical field length.

Enter the chart (figure A3-7) with the available brake horsepower of 1360 BHP (A), read up to density altitude of 2000 feet (B) and across to a gross weight of 75,000 pounds (C). Read down to find the zero wind critical field length of 4800 feet (D). For this problem, assume that the wind measurements and the field in question are known to be reliable, and that 100 percent of reported headwinds can be used. Correct for headwind by

following the headwind guideline to 25 knots (E), and read down to find corrected critical field length of 3500 feet (F).

REFUSAL SPEED.

The Refusal Speed chart (figure A3-8) is provided to show the maximum speed to which the aircraft can accelerate and then stop in the available runway length for various conditions of power, density altitude, gross weight and wind velocity. This chart assumes the same conditions as noted for the Critical Field Length chart.

Two limits are shown on the refusal speed chart: takeoff speed and brake performance limit. Refusal speed is not shown in excess of the takeoff speed. The brake performance limit, labelled Maximum Recommended Refusal Speed, is the speed at which, for a given gross weight, the aircraft possesses the maximum kinetic energy from which a stop has been tested.

In addition, as a third limitation, the refusal speed should never be less than the critical engine failure speed. Generally this would occur only if the available runway length is less than the critical field length. The refusal speed cannot be used as an abort criterion unless it is equal to or greater than the critical engine failure speed, because only under these conditions is it certain that if an engine fails at the refusal speed the aircraft can accelerate to the takeoff speed before reaching the end of the runway.

Critical engine failure speed is obtained from the refusal speed chart by substituting critical field length for available runway length and working the chart in the same manner as for obtaining refusal speed. The following example illustrates the method of using the chart.

Note

Always correct the Critical Engine Failure Speed for RCR when the Critical Field length is corrected for RCR.

Example.

Given: Density Altitude = 4000 Feet

          Runway Length Available = 5500 Feet

Brake Horsepower Available = 1320 BHP

Reported Headwind = 20 Knots

Gross Weight = 67,000 Pounds

Find: Refusal speed or critical engine failure speed.

Enter the chart (figure A3-8) at a density altitude of 4000 feet (A), read up to the runway length of 5500 feet (B) and across to the baseline (C). Follow the guideline to 1320 BHP (D) and read across to the baseline (E). Correct for headwind, using one half the reported headwind by following the guide line to 10 knots (F). Re-enter the chart with a gross weight of 67,000 pounds (G) and read up. From point (F) read across to the intersection of the gross weight line and corrected runway length to find refusal speed of 97 knots IAS (H). To find critical engine failure speed, substitute critical field length for available runway length and work the problem in the same manner.

SPEED DURING TAKEOFF GROUND RUN.

The Speed During Takeoff Ground Run chart (figure A3-9) is based on the character of acceleration during the takeoff ground run. The chart is used to determine if the aircraft acceleration is normal and can be expected to reach the refusal speed at the proper distance from start of the takeoff run. All refusal speeds and field lengths are valid only if acceleration is normal. The use of the chart is explained in Acceleration Check (GO NO-GO) Method for takeoff with allowance for engine failure and by the following example.

Example.

Given: Four-Engine Takeoff Ground Run Distance (corrected for wind and slope) = 2400 Feet

         Takeoff Airspeed = 98 Knots IAS

Refusal Speed = 95 Knots IAS

Headwind = 30 Knots

$$\frac{1}{\sqrt{\sigma}} = 1.033$$

Find: Refusal distance, acceleration check time, acceleration check distance, and acceleration check speed.

Correct the indicated airspeeds obtained from the Takeoff Ground Run chart and the Refusal Speed chart for wind using one half the reported headwind. Takeoff airspeed = (98−15) = 83 knots IAS. Refusal speed = (95 −15) = 80 Knots IAS.

Enter the chart (figure A3-9) with the four-engine ground run distance of 2400 feet (A), and read to the right and with the corrected takeoff speed of 83 knots, and read up. At the intersection of the distance and speed lines (C) construct a guideline following the acceleration curve (solid lines). Enter the chart with the corrected refusal speed of 80 knots (D), and read up to the guideline (E). Read to the left to find refusal distance of 2170 feet (F). Find acceleration check time by following the time line from point (E) to the time scale for a time of 31 seconds (G). Correct the time for density altitude by dividing by $\frac{1}{\sqrt{\sigma}}$, in this case 1.033. Time = (31 ÷ 1.033) = 30 seconds. Acceleration check distance is the nearest 1000 foot marker below refusal distance, in this case 2000 feet. Find the acceleration check speed by entering the chart at the check distance (H), reading across to the acceleration guideline (I), and down for a check speed of 78 knots (J) uncorrected for wind. Correct for wind by adding one half the reported headwind, or 15 knots. Acceleration check speed = (78 ÷ 15) = 93 knots IAS.

TAKEOFF PATH — FOUR-ENGINE.

A Takeoff Path Four-Engine chart (figure A3-10) is included for a four-engine takeoff

climb with a wing flap deflection of 15 degrees. This curve is presented to enable study of terrain or obstacle clearance problems peculiar to various airfields.

The flight path chart gives relationship between height attained above the runway surface and horizontal distance travelled from the start of the takeoff run. Each curve is for a specified four-engine takeoff ground run. This curve can be used for the various combinations of gross weight, altitude, and atmospheric conditions that result in the given takeoff distance. It is for this reason that gross weight and altitude do not appear explicitly.

For a known obstacle height and location (distance from start of takeoff run), the flight path chart can be used to read the corresponding takeoff ground run. This distance can then be used to enter the takeoff distance chart to obtain the permissible takeoff gross weight for this particular obstacle.

The takeoff path chart was prepared using a constant climbing airspeed of 15 percent above the zero thrust, landing gear up, power-off stalling airspeed. Landing gear retraction is initiated at takeoff and requires approximately 7 seconds to be completed. The drag of the fully extended landing gear is assumed to exist until the landing gear is completely retracted. The flight path charts terminate at a height of 300 feet. In no case is the 5-minute maximum power limit exceeded. Ground effect has not been included.

The following example illustrates the method of using the chart.

Example.

Given: Reported Headwind = 20 Knots

        Distance From Start of Takeoff Run
        = 6000 Feet

        Takeoff Ground Run = 4000 Feet

Find: Height over obstacle at 6000 feet.

Enter the chart (figure A3-10) with one half of the reported headwind, or 10 knots (A), and read across to 6000 feet (B). Read up to the takeoff ground run, uncorrected for wind or slope, of 4000 feet (C), and across to find height above the surface of 146 feet (D).

TAKEOFF PATH — THREE-ENGINE.

The Takeoff Path Three-Engine chart (figure A3-11) is shown in the same form as the Takeoff Path Four-Engine chart, and is based on a specified takeoff distance with engine failure. The use of this chart differs from the four-engine chart only in that this chart is used in conjunction with the Critical Field Length chart.

Three-engine takeoff flight path conditions are based on the following assumptions: at the critical engine failure speed, an outboard engine is assumed to fail, and acceleration is continued on the ground on three engines (with the propeller windmilling on the inoperative engine) until takeoff speed is reached (15 percent above the power-off stalling airspeed for zero thrust and landing gear up). The climb is performed at this constant speed. Landing gear retraction is initiated at takeoff and requires approximately 7 seconds to be completed. Propeller feathering is initiated at a 50-foot height or at the end of landing gear retraction, and requires 7 seconds. The drag of the fully extended landing gear is assumed to exist until the landing gear is completely retracted. The drag of the windmilling propeller is assumed to exist from the point of engine failure until completion of the feathering operation.

The method of using the three-engine chart is identical to that used for the four-engine chart with the exception that critical field length is used instead of four-engine takeoff ground run.

CHARACTERISTIC TAKEOFF SPEEDS.

Indicated power-off stalling airspeed and takeoff speeds for a wing flap deflection of 15

degrees, and indicated airspeeds recommended for wing flap retraction, can be read from the Characteristic Takeoff Speeds chart (figure A3-12) for the range of possible takeoff weights. These indicated airspeeds are for inflight use only. These airspeeds are based on the inflight position error of the airspeed system associated with the radome nose installation. The position error for the ground run is estimated to be negligible. Refer to Airspeed And Altimeter Calibration, Part 1 of the Appendix.

For a discussion of the takeoff speed, minimum control airspeed, and wing flap retraction airspeed, refer to Definition Of Terms, this part.

In using this chart, enter with the given gross weight, read up to the desired condition, and across to find the airspeed for that condition. The example on the chart shows that for a gross weight of 65,000 pounds (A), the wing flap retraction airspeed (B), would be 117 knots IAS (C).

TAKEOFF AND LANDING CROSSWIND.

The Takeoff And Landing Crosswind chart (figure A3-13) indicates the maximum crosswind components at which directional control can be maintained with the rudder after nosewheel lift off, or before nosewheel touchdown. With crosswind components greater than those recommended on the chart, the aircraft will turn into the wind, tending to veer off the runway. The maximum authorized wind velocity for takeoff or landing is 50 knots or a maximum crosswind component of 26 knots.

On takeoff, a crab should be initiated, after the aircraft leaves the ground, regardless of the amount of crosswind, since primary consideration must be given to maintaining a flight path rather than aircraft heading. The following example illustrates the method of using the chart.

Example.

Given: Wind Velocity = 28 knots (gusts to 35 knots)

Wind Direction = 190 Degrees

Runway Heading = 160 Degrees

Find: Headwind and crosswind components.

Determine the wind angle relative to the runway by finding the difference between runway heading and wind direction. In the example, the wind angle = (190 – 160) = 30 degrees. For headwind component enter the chart at the steady wind velocity of 28 knots (A), and follow the wind velocity curve to the wind angle of 30 degrees (B) and read across to find the headwind component of 24 knots (C). To find the crosswind component, enter the charts at maximum gust velocity of 35 knots (D), and follow the wind velocity curve to the wind angle of 30 degrees (E) and read down to find the crosswind components of 18 knots (F).

TAKEOFF GROSS WEIGHT LIMITED BY THREE-ENGINE CLIMB PERFORMANCE

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

BRAKE HORSEPOWER   OAT (°C)   GROSS WEIGHT (1000 POUNDS)

HEADWIND (KNOTS)

GROSS WEIGHT (1000 POUNDS)

Note:

1. Flight path slope = $\dfrac{\text{height gained *}}{\text{horizontal distance traveled *}}$

   *Measured from point of takeoff.

2. Positive slope (+) = uphill.
3. Based on three engines operating at maximum power, takeoff speed, inoperative propeller windmilling, landing gear down, cowl flaps TRAIL, and wing flaps at 15 degrees.

LEGEND:

———— Wind Correction for
+.02 Flight Path Slope

— — — — Wind Correction for
0 Flight Path Slope
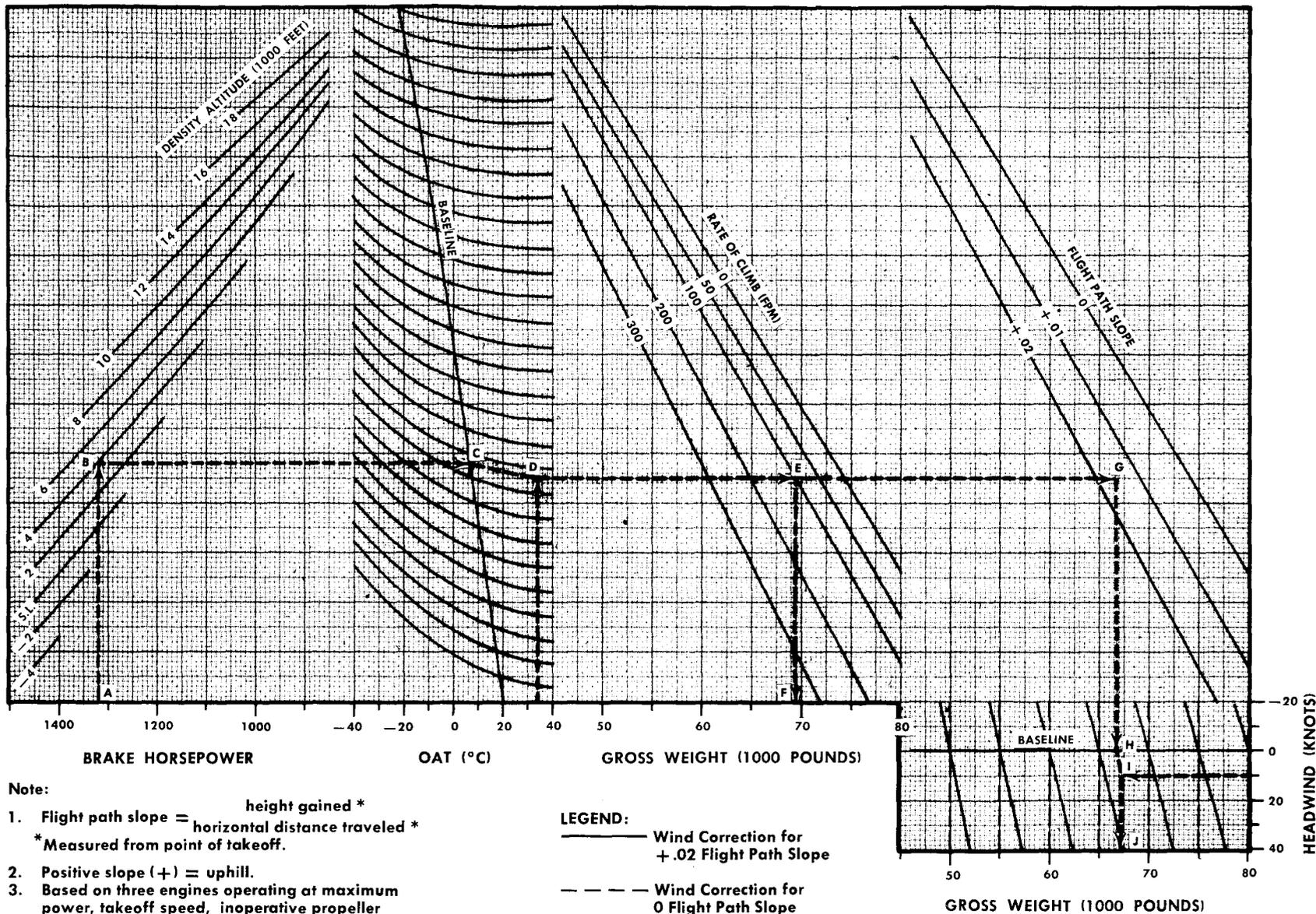
X1-329

MODEL: C-54
DATE: 9-9-64
DATA BASIS: FLIGHT TEST

TAKEOFF GROSS WEIGHT LIMITED BY THREE-ENGINE
CLIMB PERFORMANCE
(CLEAN CONFIGURATION)

ENGINE(S): R-2000
FUEL GRADE: 100/130
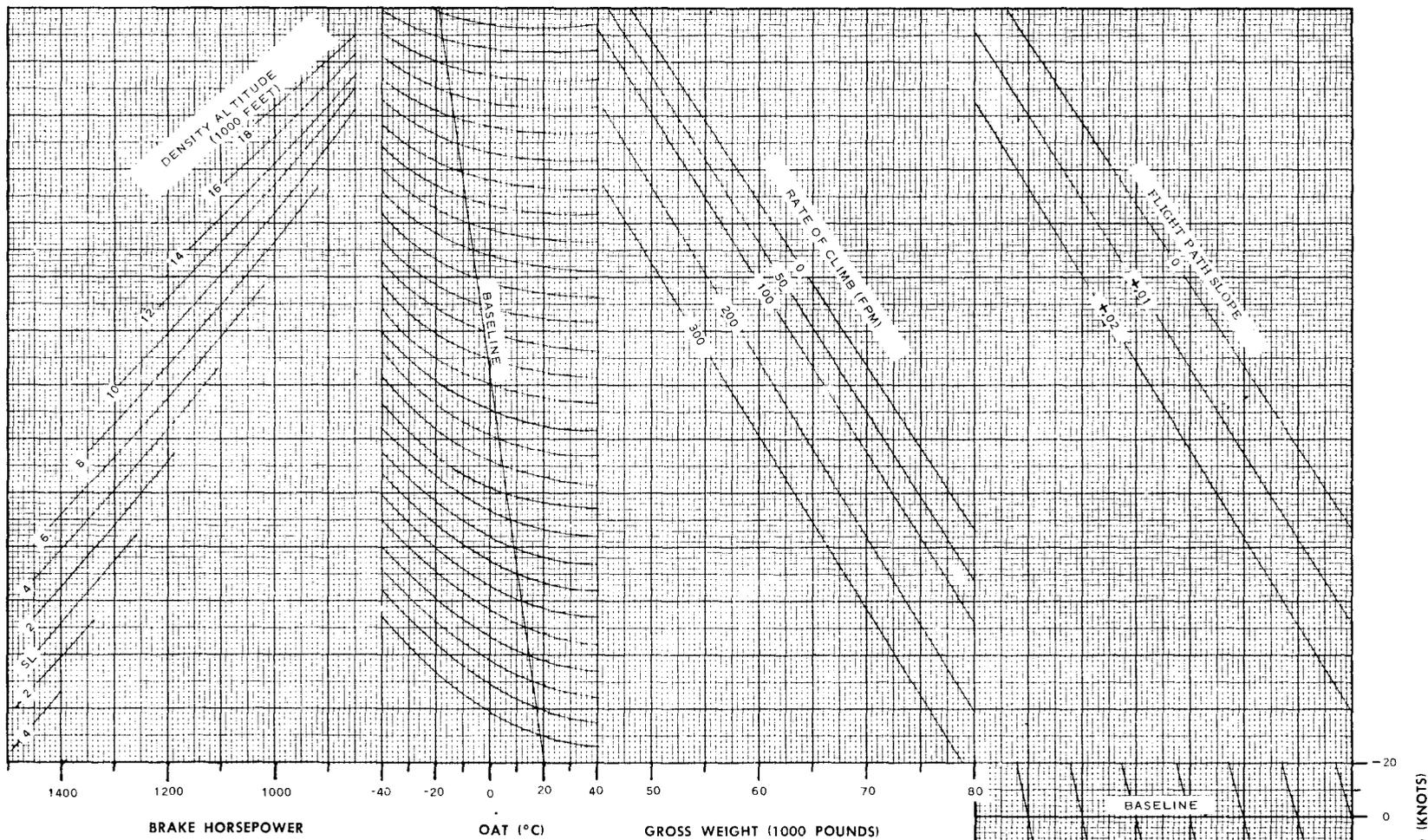
DENSITY ALTITUDE (1000 FEET)

RATE OF CLIMB (FPM)

FLIGHT PATH SLOPE

BASELINE

BRAKE HORSEPOWER

OAT (°C)

GROSS WEIGHT (1000 POUNDS)

BASELINE

GROSS WEIGHT (1000 POUNDS)

HEADWIND (KNOTS)

NOTE:
1. Flight path slope = $\dfrac{\text{height gained*}}{\text{horizontal distance traveled*}}$

   *Measured from point of takeoff
2. Positive slope ( ) – uphill.
3. Based on three engines operating at maximum
   power, takeoff speed, inoperative propeller
   feathered, landing gear down, cowl flaps TRAIL,
   and wing flaps at 15 degrees.

LEGEND:
———— Wind Correction for
      + .02 Flight Path Slope

— — — Wind Correction for
      0 Flight Path Slope

TAKEOFF GROSS WEIGHT
LIMITED BY TWO-ENGINE CLIMB PERFORMANCE

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

Figure A3-3

BRAKE HORSEPOWER

OAT (°C)

GROSS WEIGHT (1000 POUNDS)

HEADWIND (KNOTS)

BASELINE

GROSS WEIGHT (1000 POUNDS)
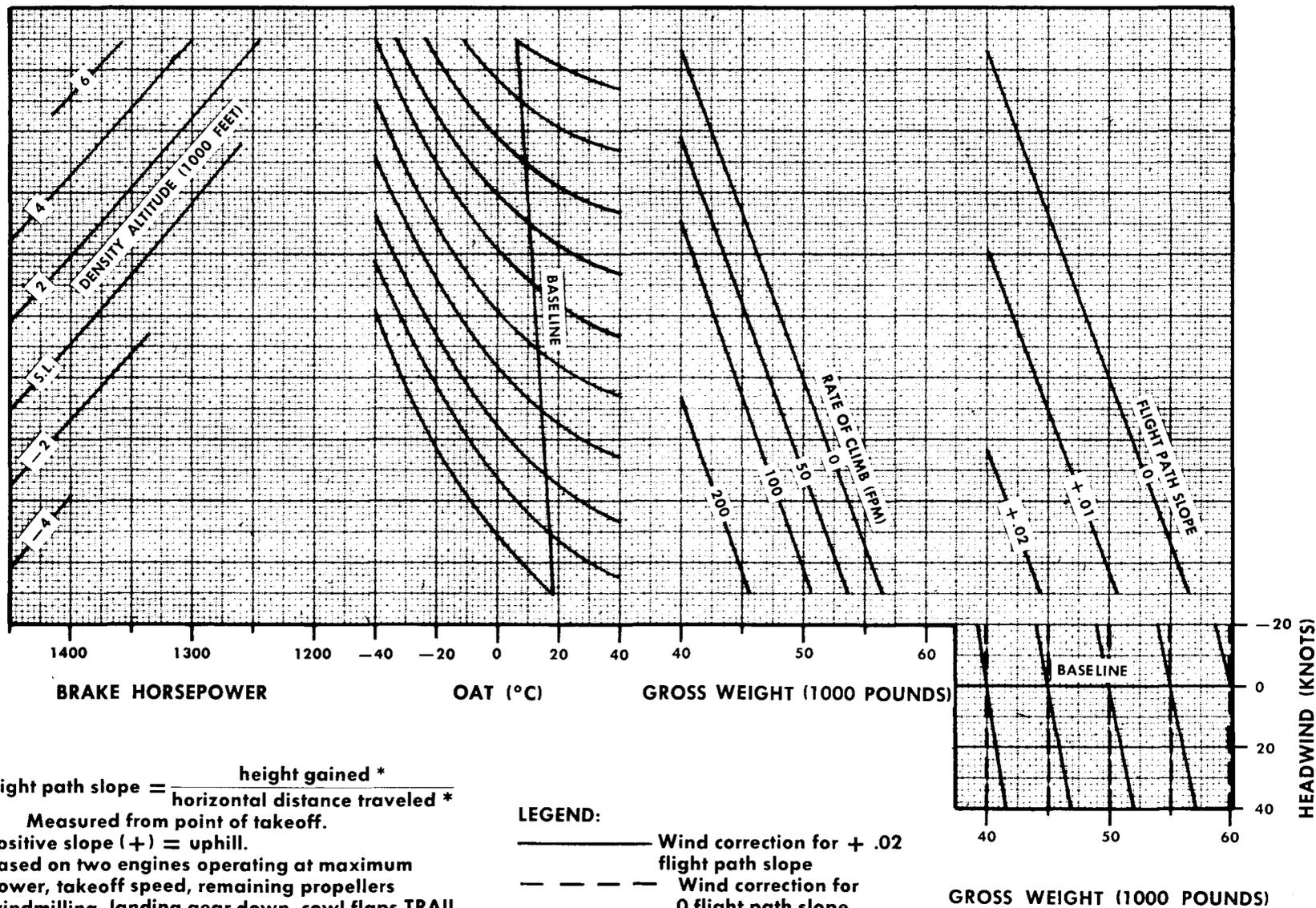
Note:

1. Flight path slope $= \dfrac{\text{height gained *}}{\text{horizontal distance traveled *}}$
   * Measured from point of takeoff.
2. Positive slope (+) = uphill.
3. Based on two engines operating at maximum power, takeoff speed, remaining propellers windmilling, landing gear down, cowl flaps TRAIL, and wing flaps at 15 degrees.

LEGEND:

—————— Wind correction for + .02 flight path slope

— — — — Wind correction for 0 flight path slope

TAKEOFF GROUND RUN
FOUR-ENGINE

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

Note:
1. Based on takeoff at 115 percent of power-off stall speed, cowl flaps in TRAIL position, wing flaps set at 15 degrees, and hard runway surface.

ENGINE(S): R-2000
FUEL GRADE: 100/130

Figure A3-4

X1-331

BRAKE HORSEPOWER (100 BHP)

GROUND RUN (1000 FEET)
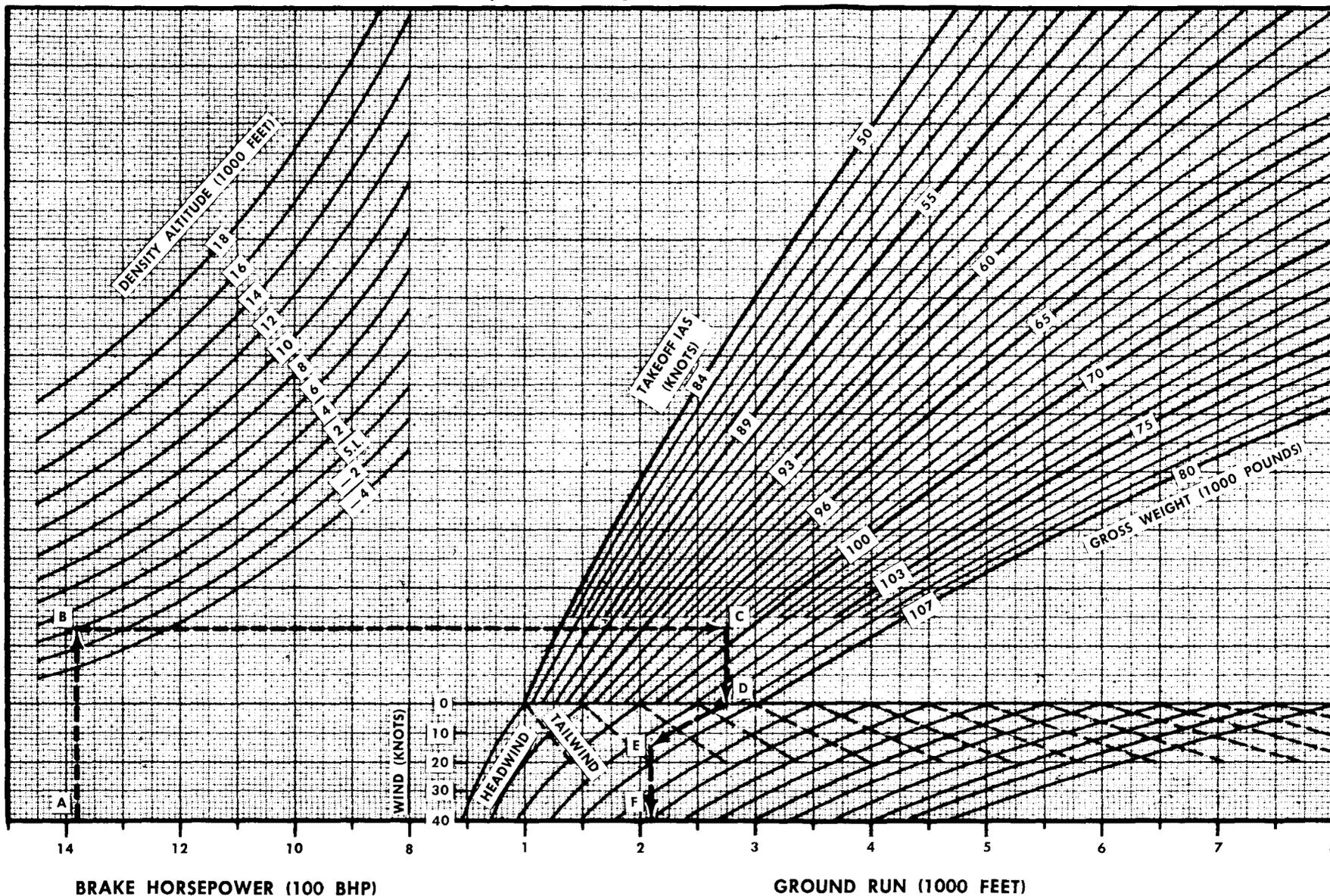
RUNWAY SLOPE CORRECTION

MODEL: C-54
DATE: 6-15-63
DATA BASIS: ESTIMATED

ENGINE(S): R-2000
FUEL GRADE: 100/130

Note:
1. Applicable to : Four engine ground run. Critical field length.
2. Runway slope = $\dfrac{\text{runway rise (feet)}}{\text{runway length (feet)}}$

Figure A3-5

X1-332
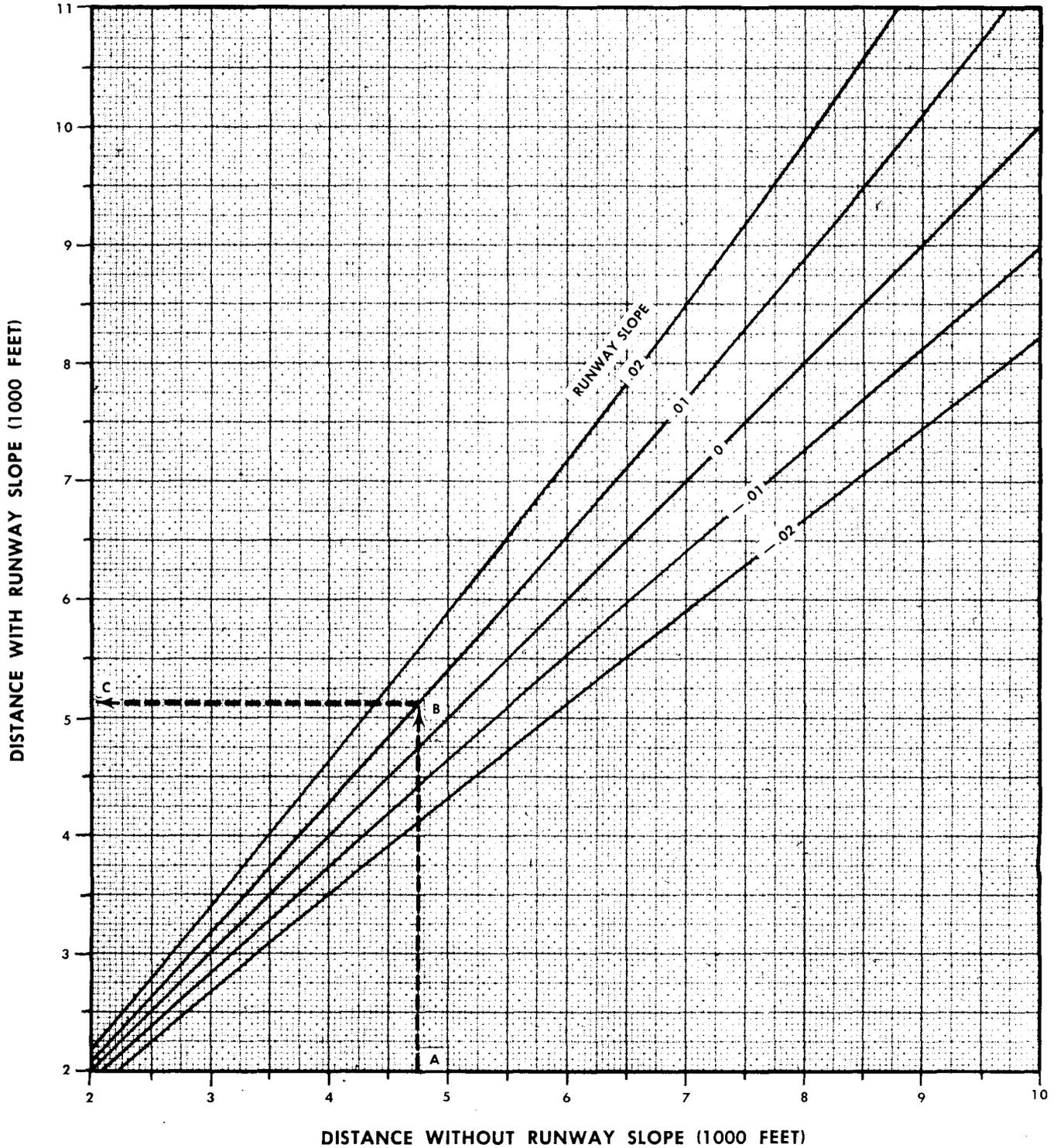
EFFECT OF RUNWAY SURFACE CONDITION
ON TAKEOFF GROUND RUN

MODEL: C-54
DATE: 6-15-63
DATA BASIS: ESTIMATED

ENGINE(S): R-2000
FUEL GRADE: 100/130

RUNWAY SURFACE CONDITION	APPROXIMATE COEFFICIENT OF ROLLING FRICTON
HARD DRY	.015
DRY SOD TURF	.05
WET SOD TURF	.09

CORRECTED GROUND RUN (1000 FEET)

ROLLING COEFFICIENT OF FRICTION

.09 .07 .05 .03 .015
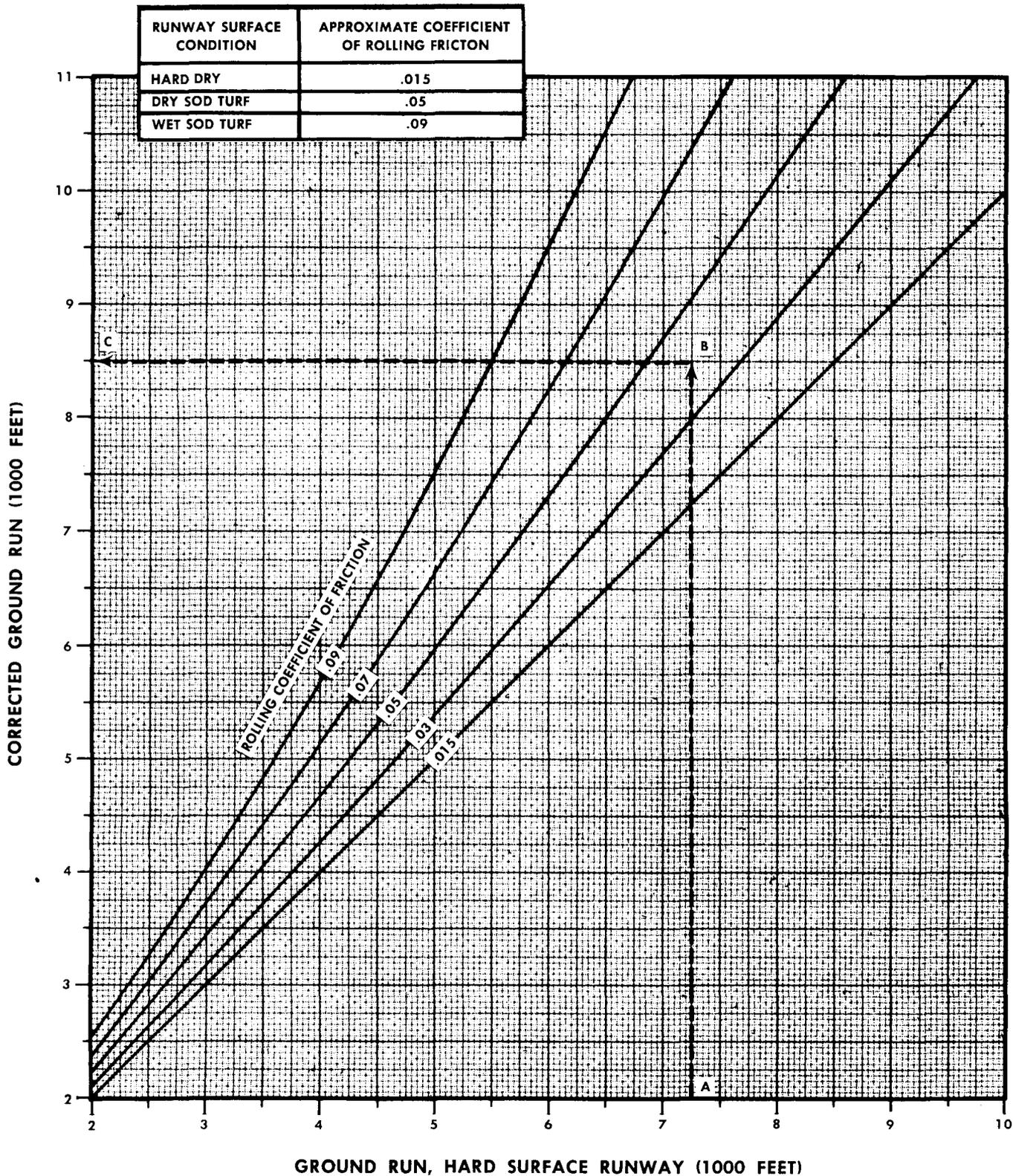
GROUND RUN, HARD SURFACE RUNWAY (1000 FEET)

Figure A3-6

CRITICAL FIELD LENGTH

MODEL: C-54
DATE: 12-17-65
DATA BASIS: ESTIMATED

ENGINE(S): R-2000
FUEL GRADE: 100/130

BRAKE HORSEPOWER (100 BHP)
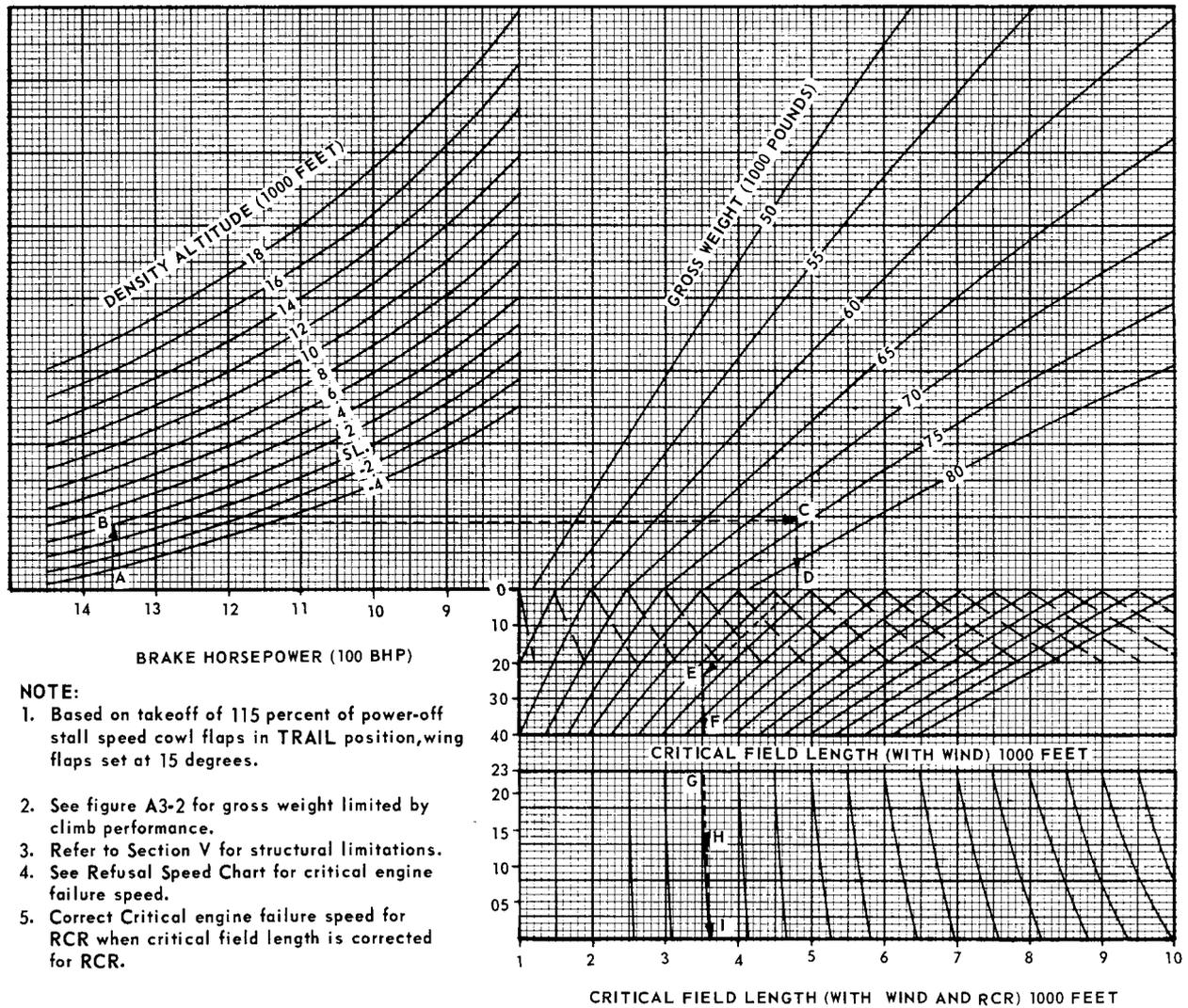
NOTE:
1. Based on takeoff of 115 percent of power-off stall speed cowl flaps in TRAIL position, wing flaps set at 15 degrees.

2. See figure A3-2 for gross weight limited by climb performance.
3. Refer to Section V for structural limitations.
4. See Refusal Speed Chart for critical engine failure speed.
5. Correct Critical engine failure speed for RCR when critical field length is corrected for RCR.

CRITICAL FIELD LENGTH (WITH WIND) 1000 FEET

CRITICAL FIELD LENGTH (WITH WIND AND RCR) 1000 FEET

Figure A3-7

X1-334

REFUSAL SPEED

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

Note:
1. Based on takeoff at 115 percent of power-off stall speed, cowl flaps in TRAIL position, wing flaps set at 15 degrees, and hard surface runway.
2. The effect of runway slope on refusal speed is negligible.
3. The maximum recommended refusal speeds (⊥⊥⊥⊥⊥⊥⊥⊥) correspond to the maximum energy at which C-54 brakes have been tested.

LEGEND:
——————— HEADWIND
— — — — TAILWIND

DENSITY ALTITUDE (1000 FEET)

BRAKE HORSEPOWER
(100 BHP)

WIND (KNOTS)   GROSS WEIGHT (1000 POUNDS)
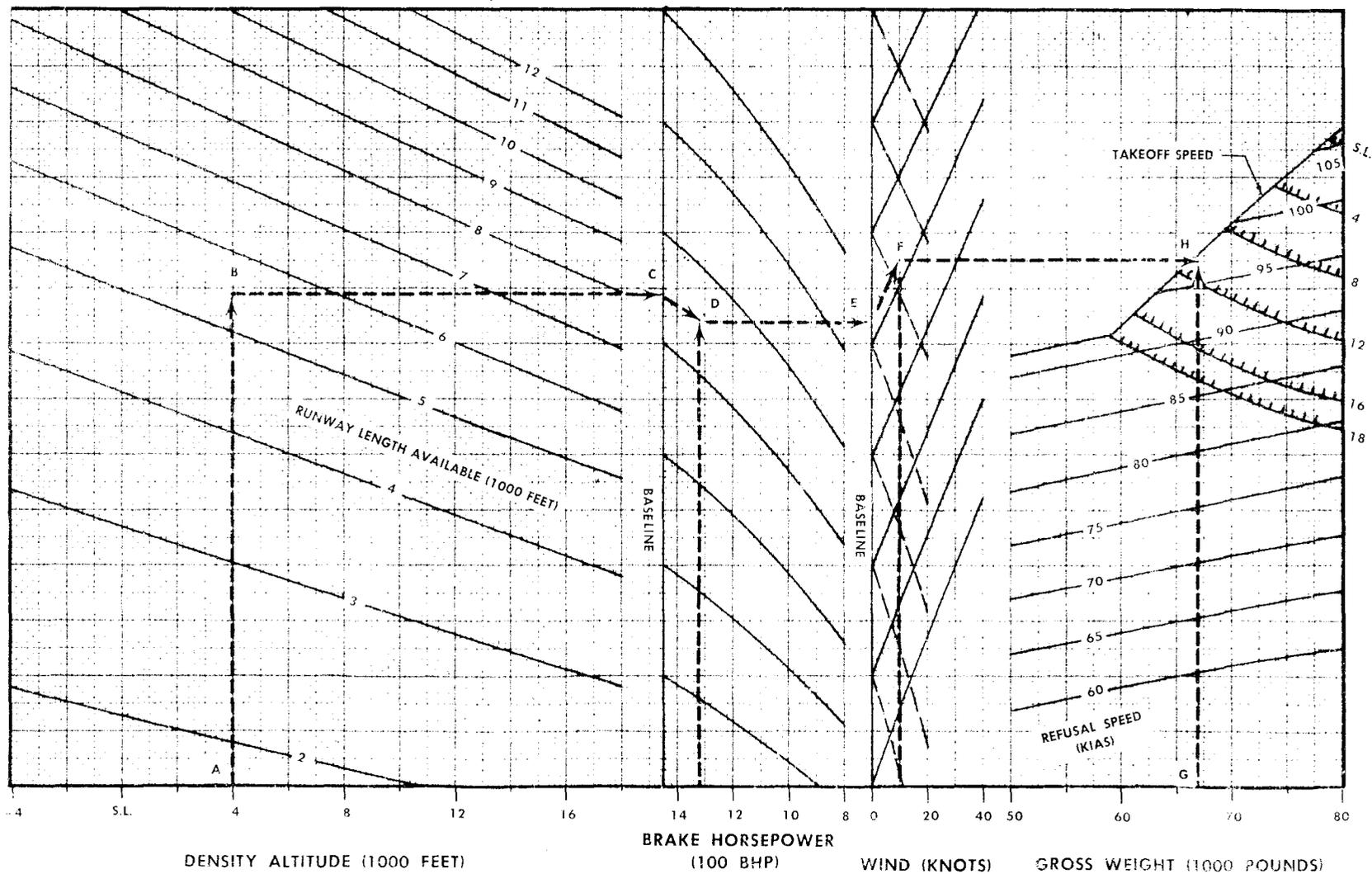
T.O. 1C-54D-1

Appendix I

Figure A3-8 (Sheet 1 of 2)

MAXIMUM RECOMMENDED REFUSAL SPEED
AT DENSITY ALTITUDE (1000 FEET)

Changed 1 November 1965

A3-18

TAKEOFF PERFORMANCE - REFUSAL SPEED

BRAKES ONLY

MODEL: C-54
DATE: 12-17-65
DATA BASIS: ESTIMATED

ENGINE(S): R-2000
FUEL GRADE: 100/130

EFFECT OF RUNWAY CONDITION

FCR NUMBER
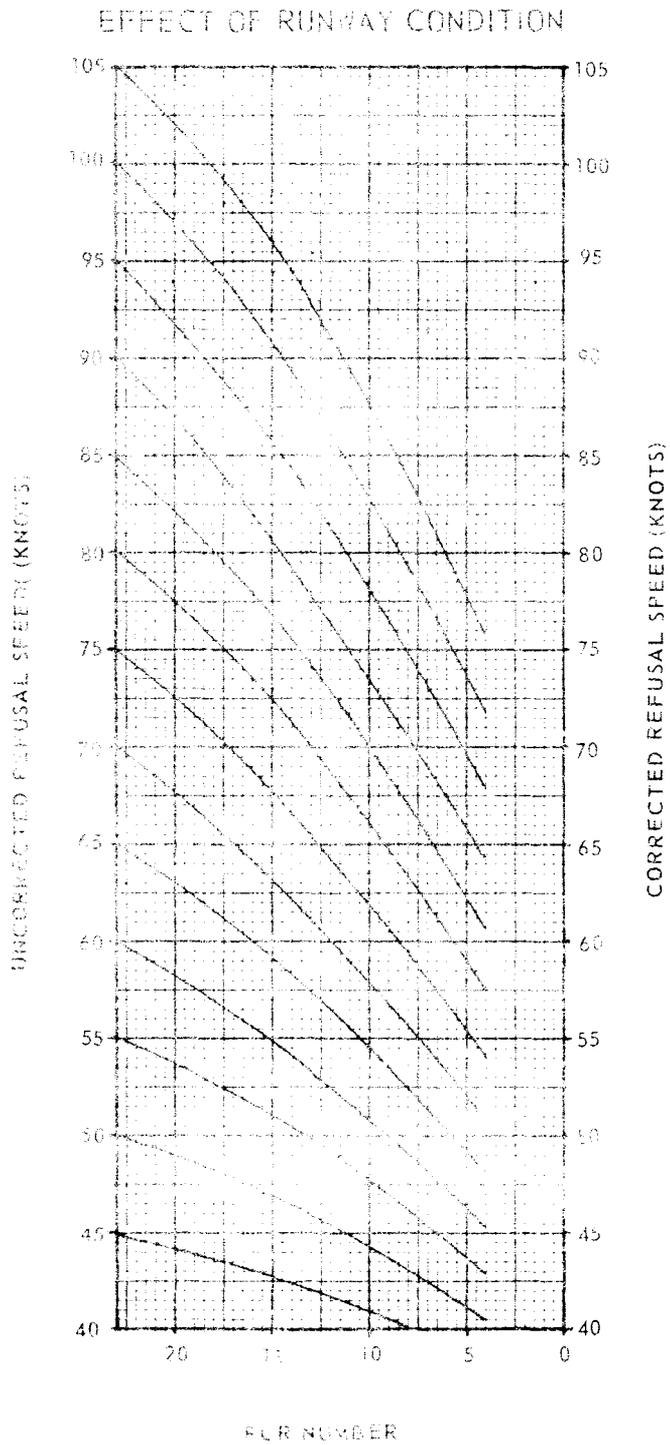
TAKEOFF PATH — THREE-ENGINE
ICAO STANDARD DAY

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

Note:
1. Based on wing flaps set at 15 degrees, hard surface runway, and no runway slope.
2. Gear retraction initiated at takeoff (6.7 sec. retraction time)
3. Propeller feathering time 7.0 seconds starting at a 50 foot height or at gear retraction (whichever occurs later).
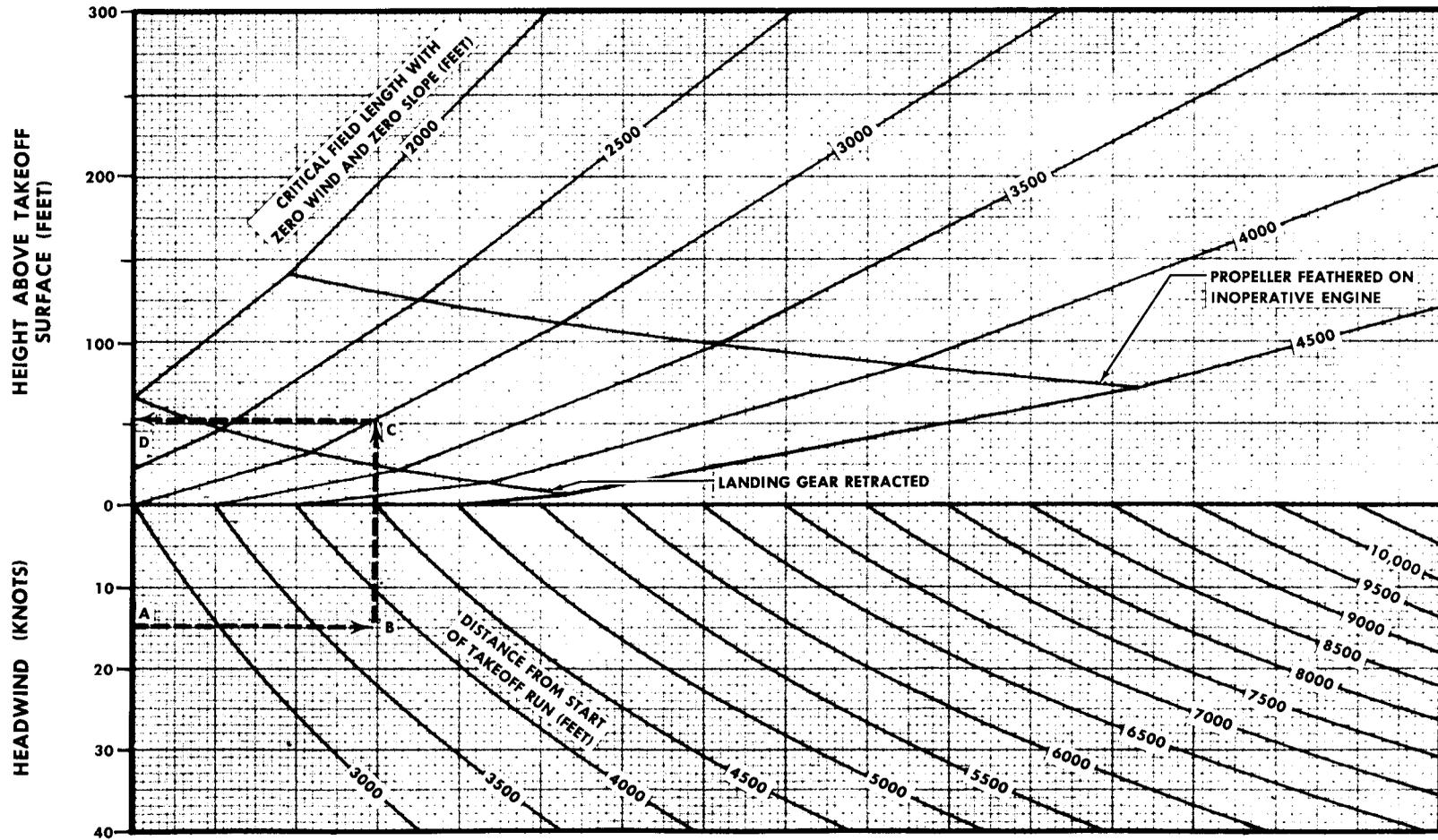
CHARACTERISTIC TAKEOFF SPEEDS

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

Note:
1. For inflight use only.
2. 73,000 pound normal take off gross weight limit.
3. Zero degree bank.
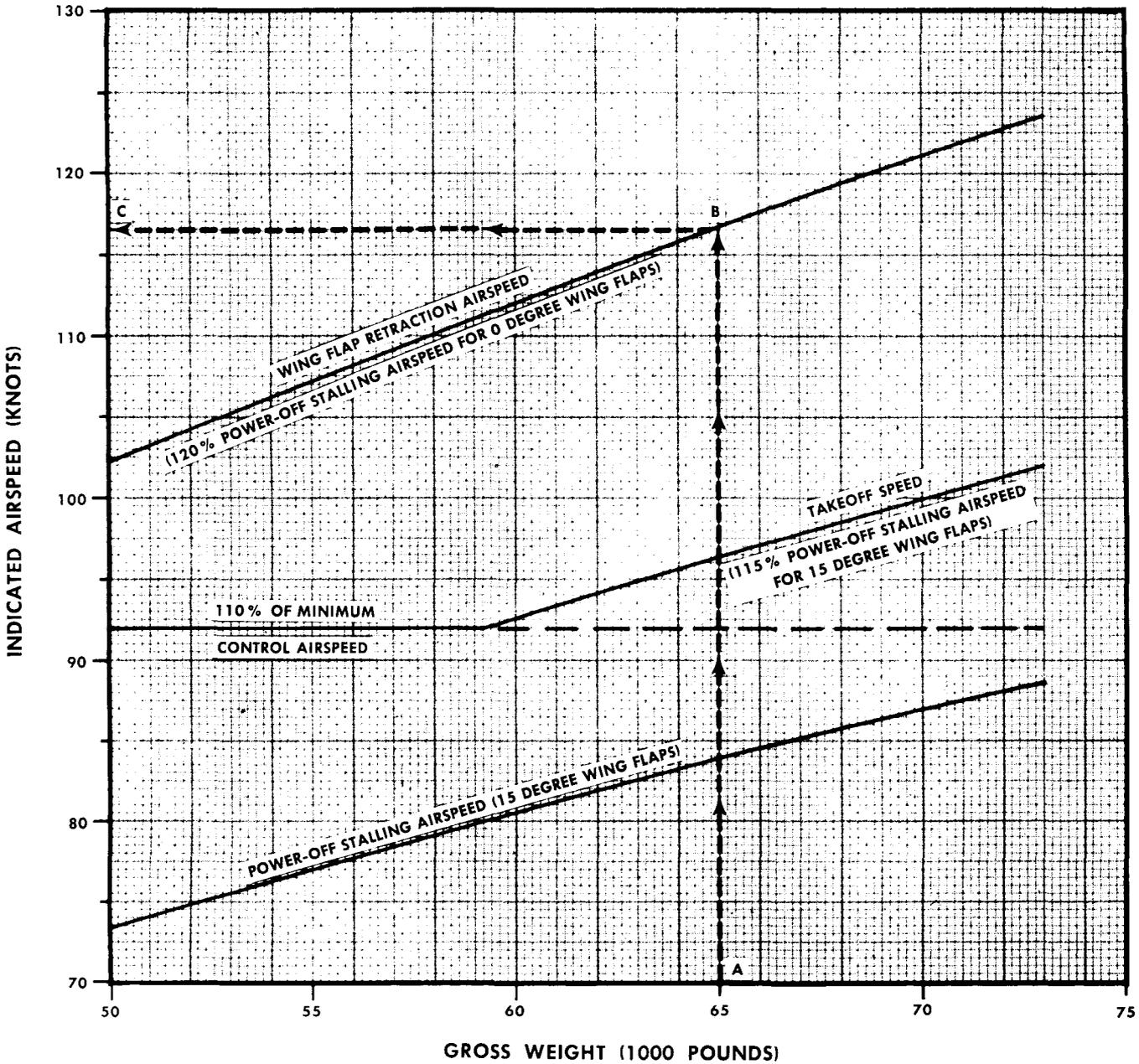
Figure A3-12

X1-307

TAKEOFF AND LANDING CROSSWIND

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

Note:
Enter chart with maximum
gust velocity to determine
crosswind component.

LEGEND:
█ Not authorized
▓ Caution
█ Authorized

HEADWIND COMPONENT (KNOTS)

CROSSWIND COMPONENT (KNOTS)
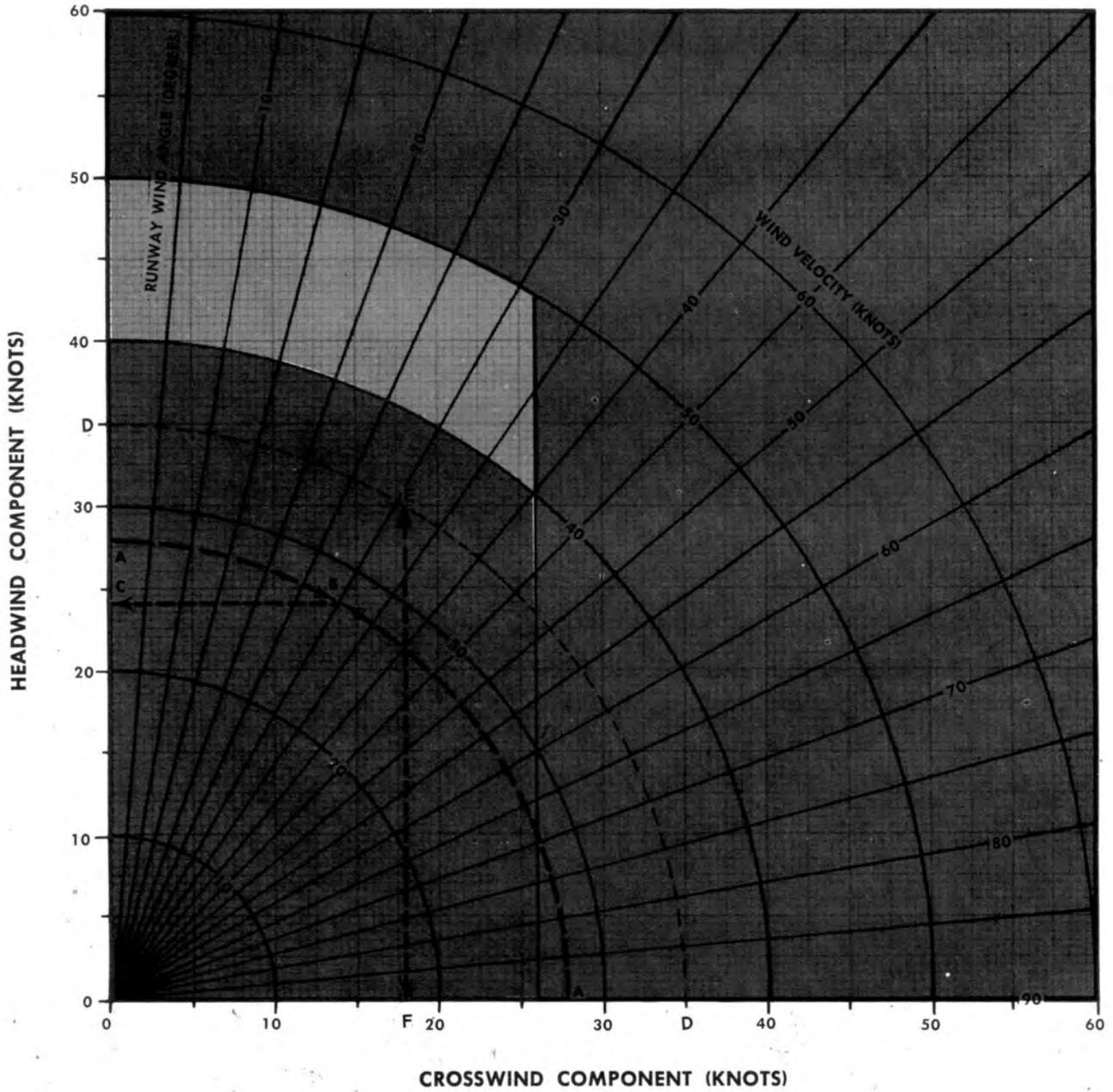
Figure A3-13

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PART 4

CLIMB

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

CLIMB.

Climb performance is presented showing time, distance and fuel to climb, rate of climb, and ceilings for various configurations, gross weights, powers and atmospheric conditions. Ground effect is not included on the climb performance charts.

DISCUSSION OF CHARTS.

TIME AND DISTANCE TO CLIMB.

The Time and Distance To Climb charts (figures A4-1 through A4-4) are used to determine time elapsed, distance traveled, and fuel consumed during a climb to various altitudes for four-engine operation at either METO power or climb power for both standard day and hot day conditions. Recommended climb speed used on the charts in 130 knots IAS. The following example illustrates the method of determining time distance and fuel consumed. For mission planning purposes the necessary values may be found by reversing the procedure.

Example.

Given: Altitude at Start of Climb = Sea Level

Gross Weight at Start of Climb = 72,150 Pounds

Desired Cruise Altitude = 15,000 Feet

Desired Power for Climb = METO Power

Temperature = Standard Day

Find: Time, distance, and fuel required for climb to cruise altitude.

Select the chart for temperature and power conditions (figure A4-1). Enter the chart at the gross weight at start of climb of 72,150 pounds (A), and follow the guidelines to 15,000 feet pressure altitude (B). Read straight across to the right to find distance traveled of 47 nautical miles (C). Follow the time line to the time scale at the left of the chart to find time to climb of 19 minutes (E). To determine fuel consumed during climb read straight down from the intersection of gross weight and altitude (B) to find gross weight at end of climb of 71,000 pounds (D). Fuel consumed equals the difference between gross weight at start (A) and end of climb (D) (72,150−71,000 = 1150 pounds.

CLIMB PERFORMANCE — ENROUTE CONFIGURATION.

The Climb Performance—Four-Engine Enroute Configuration (figures A4-5 and A4-6), and the Climb Performance—Three-Engine Enroute Configuration chart (figure A4-7) are used to determine the rate of climb in feet per minute at a given gross weight and pressure altitude, at 130 knots IAS under standard day atmospheric conditions. The four-engine charts are presented for METO and climb powers and the three-engine chart is presented for METO power. The following example illustrates the method of using the chart.

Example:

Given: Pressure Altitude = 9000 feet

         Gross Weight = 70, 000 Pounds

         Desired Power For Climb = METO Power—Four Engines

Find: Maximum rate of climb at given conditions.

Enter the METO power chart for four-engine operation at a pressure altitude of 9000 feet (A) and read across to a gross weight of 70, 000 pounds (B). Read down to find rate of climb of 720 feet per minute (C).

EMERGENCY CLIMB.

The Emergency Climb charts (figures A4-8 through A4-13) are used to determine the predicted rate of climb or descent in feet per minutes versus calibrated airspeed at density altitudes from sea level to 12, 000 feet with various power settings. Separate charts are provided for gross weights of 63, 500 and 73, 000 pounds and for operation with four, three, or two engines. Separate curves are included on each chart to show rates of climb for several configurations. The following example is included to show method of using the charts.

Example.

Given: Climb Speed = 100 Knots CAS

         Gross Weight = 63,500 Pounds

         Engines Operating = Four

         Brake Horsepower Available = 1280 BHP

         Configuration = Wing Flaps—40 degrees, Landing Gear—Down

         Density Altitude = 6000 Feet

Find: Rate of climb.

Select the chart for the gross weight and number of engines in operation (figure A4-8). Enter the chart at a calibrated airspeed of 100 knots (A), read up to the climb correction curve for wing flaps 40 degrees and gear down (B) and across to the density altitude baseline (C). Correct for density altitude by following the guidelines to a density altitude of 6000 feet (D) and across the BGP baseline (E). Follow the guidelines to 1280 BHP (F), and read across to find rate of climb of 60 feet per minutes (G).

EMERGENCY CEILING.

The Emergency Ceiling chart (figure A4-14) shows the gross weight versus pressure altitude at which the aircraft will maintain a rate of climb of 100 feet per minute on a standard day at METO power. A chase-around showing the method of using the chart is included on the chart. To find emergency ceiling enter with the gross weight, read up to the correction curve for number of engines operating and across to the altitude scale.

TIME AND DISTANCE TO CLIMB
FOUR-ENGINE — METO POWER — STANDARD DAY
WING FLAPS AND LANDING GEAR RETRACTED,
RECOMMENDED CLIMB SPEED = 130 KIAS
⊡ RATE OF CLIMB = 100 FT/MIN

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

Figure A4-1

TIME TO CLIMB (MINUTES)

GROSS WEIGHT (1000 POUNDS)

DISTANCE DURING CLIMB (NAUTICAL MILES)

PRESSURE ALTITUDE (1000 FEET)
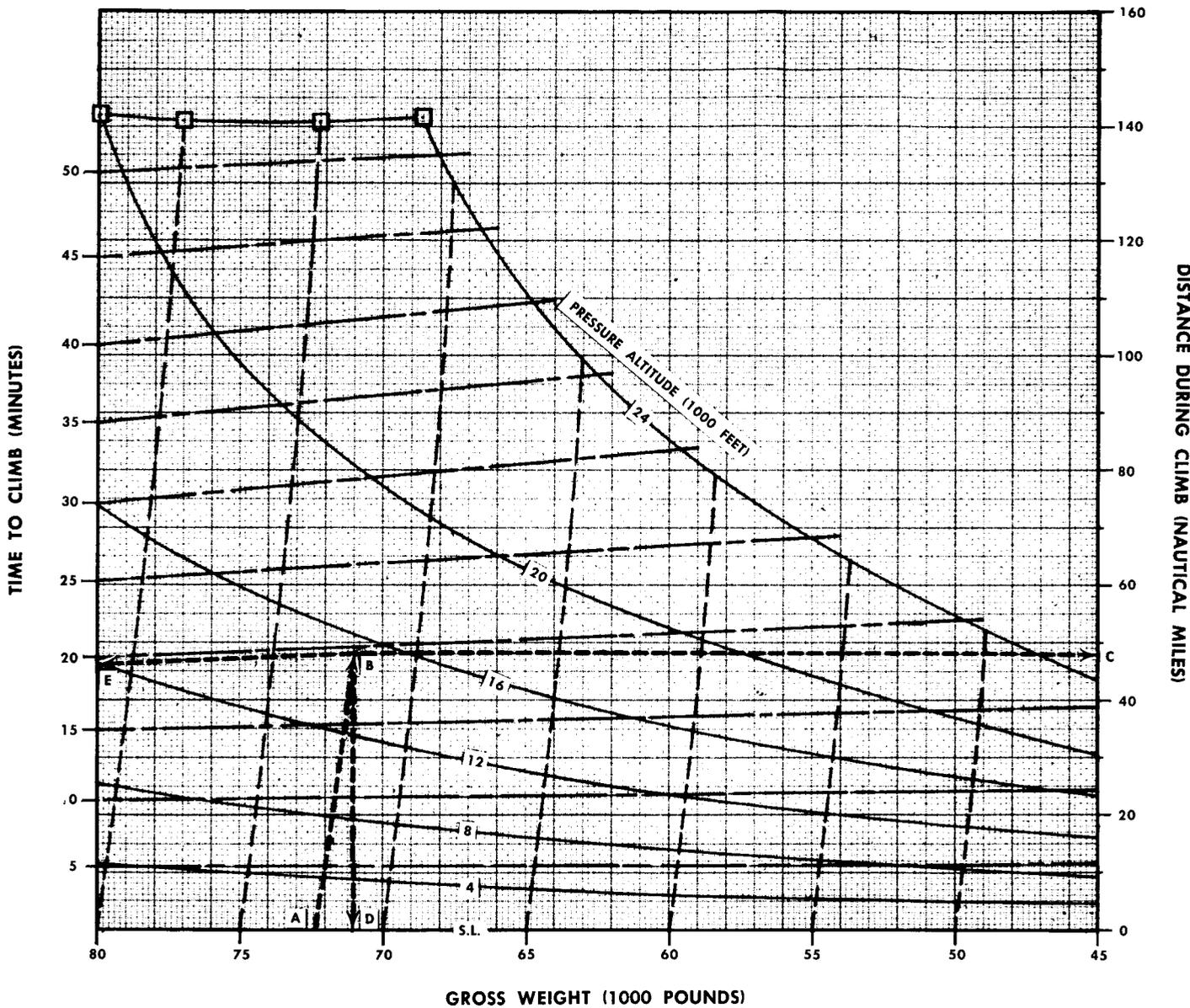
TIME AND DISTANCE TO CLIMB
FOUR-ENGINE — METO POWER — HOT DAY

MODEL: C-54
DATE: 6-15-63
DATA BASIS: ESTIMATED

WING FLAPS RETRACTED, LANDING GEAR RETRACTED
RECOMMENDED CLIMB SPEED = 130 KIAS
⊡   RATE OF CLIMB = 100 FT/MIN

ENGINE(S): R-2000
FUEL GRADE: 100/130

TIME TO CLIMB (MINUTES)

GROSS WEIGHT (1000 POUNDS)

DISTANCE DURING CLIMB (NAUTICAL MILES)

PRESSURE ALTITUDE (1000 FEET)
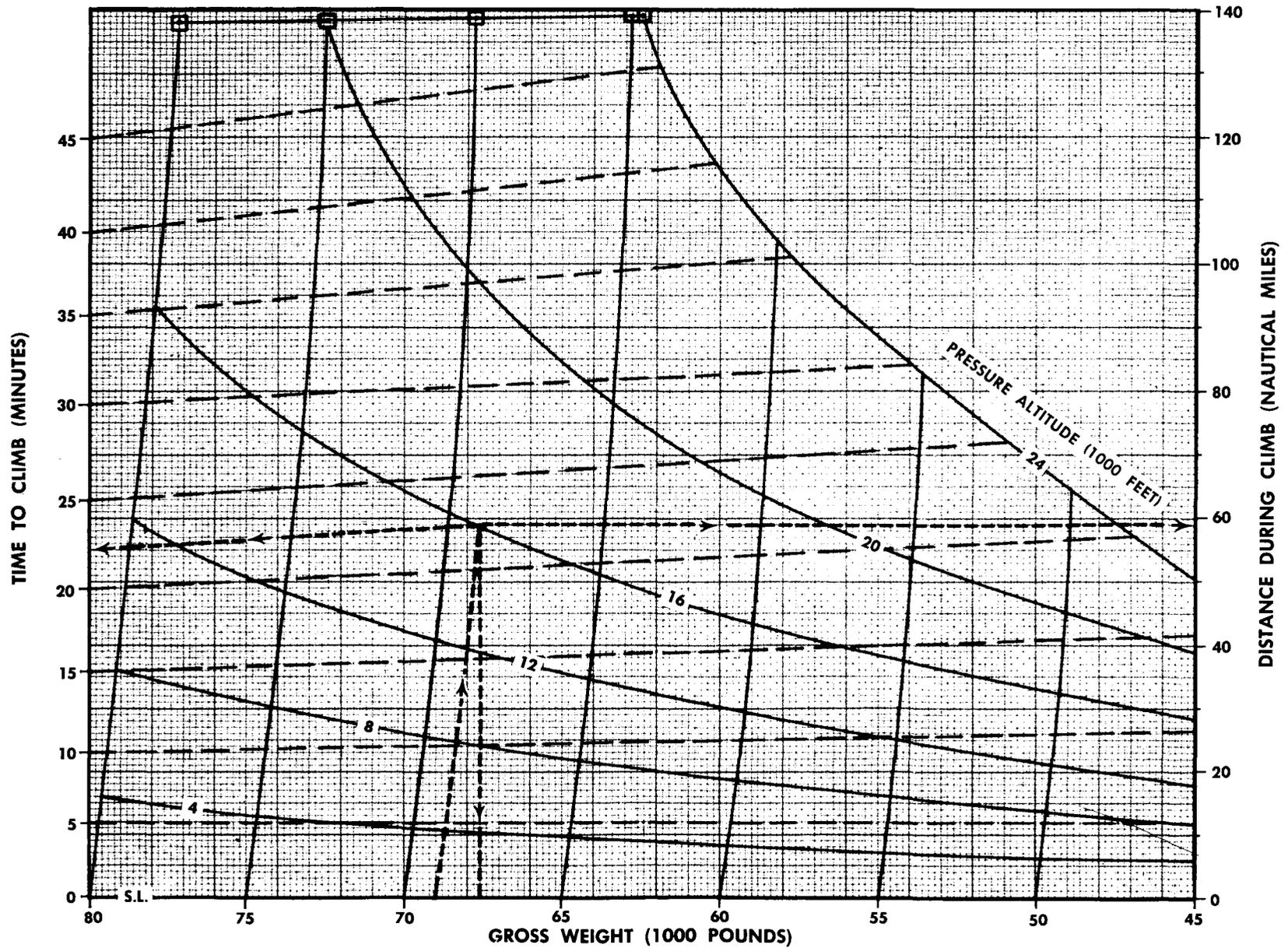
TIME AND DISTANCE TO CLIMB
FOUR-ENGINE—CLIMB POWER
STANDARD DAY

ENGINES OPERATING AT 950 BHP PER ENGINE
WING FLAPS RETRACTED—LANDING GEAR RETRACTED
RECOMMENDED CLIMB SPEED = 130 KIAS
☐ RATE OF CLIMB = 100 FT/MIN
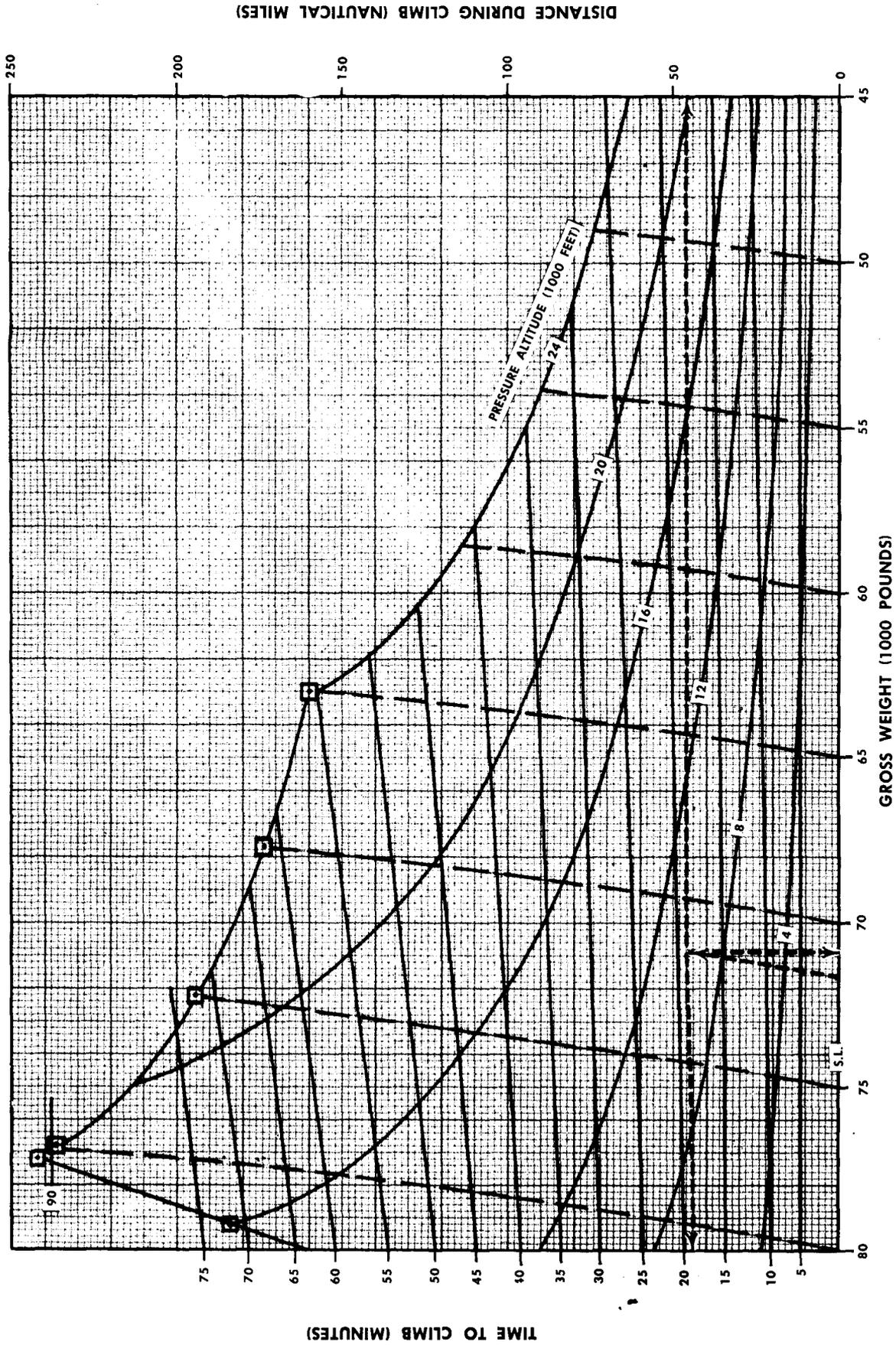
ENGINE(S): R-2000
FUEL GRADE: 100/130

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

Figure A4-3

XI-90

TIME AND DISTANCE TO CLIMB
FOUR-ENGINE — CLIMB POWER — HOT DAY
ENGINES OPERATING AT 950 BHP
WING FLAPS RETRACTED — LANDING GEAR RETRACTED
RECOMMENDED CLIMB SPEED = 130 KIAS
⊡ RATE OF CLIMB = 100 FT/MIN

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

TIME TO CLIMB (MINUTES)

DISTANCE DURING CLIMB (NAUTICAL MILES)

PRESSURE ALTITUDE (1000 FEET)

GROSS WEIGHT (1000 POUNDS)
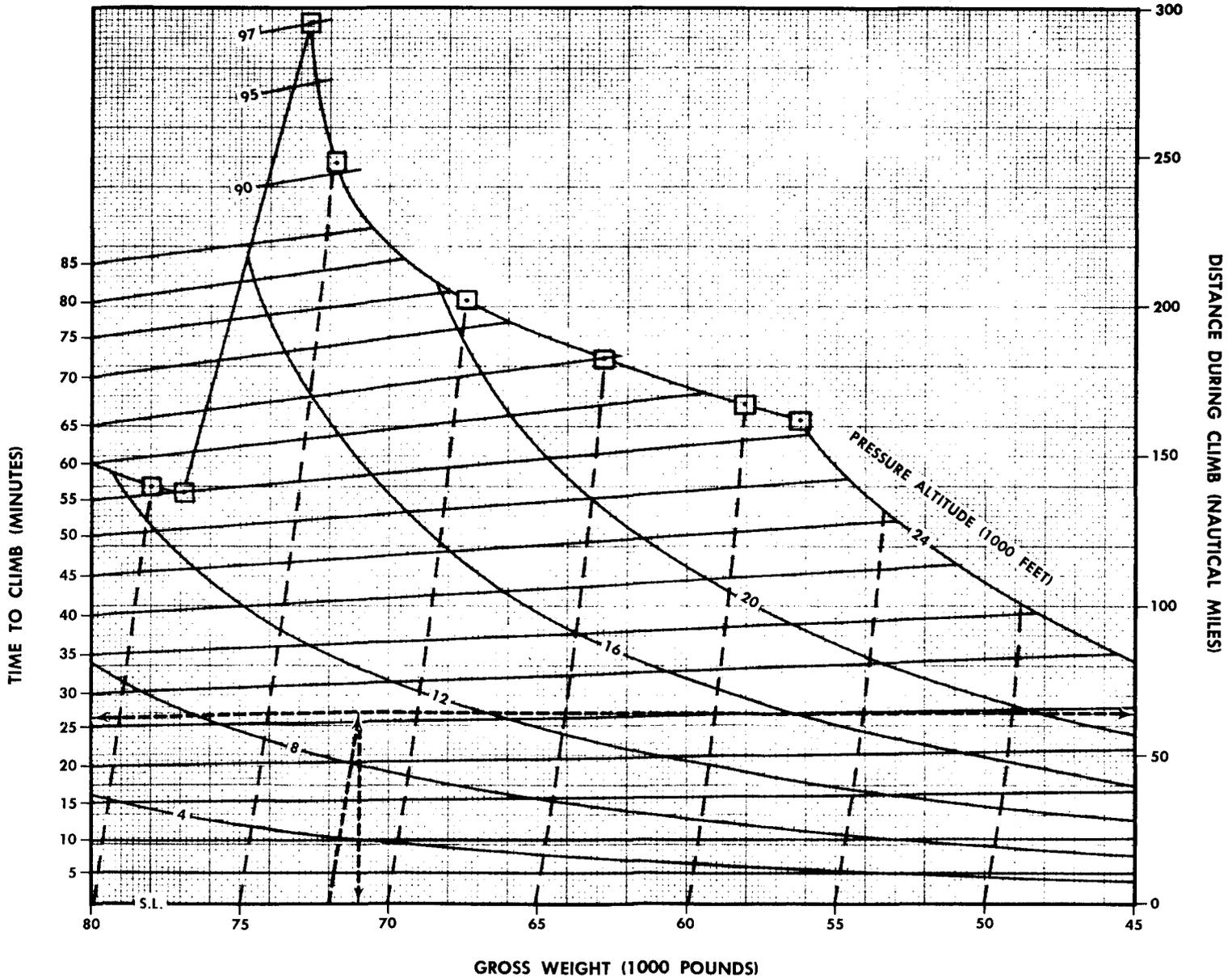
CLIMB PERFORMANCE
FOUR-ENGINE ENROUTE CONFIGURATION
METO POWER

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ICAO STANDARD DAY
COWL FLAPS IN TRAIL POSITION
WING FLAPS RETRACTED —LANDING GEAR RETRACTED
RECOMMENDED CLIMB SPEED = 130 KIAS

ENGINE(S): R-2000
FUEL GRADE: 100/130
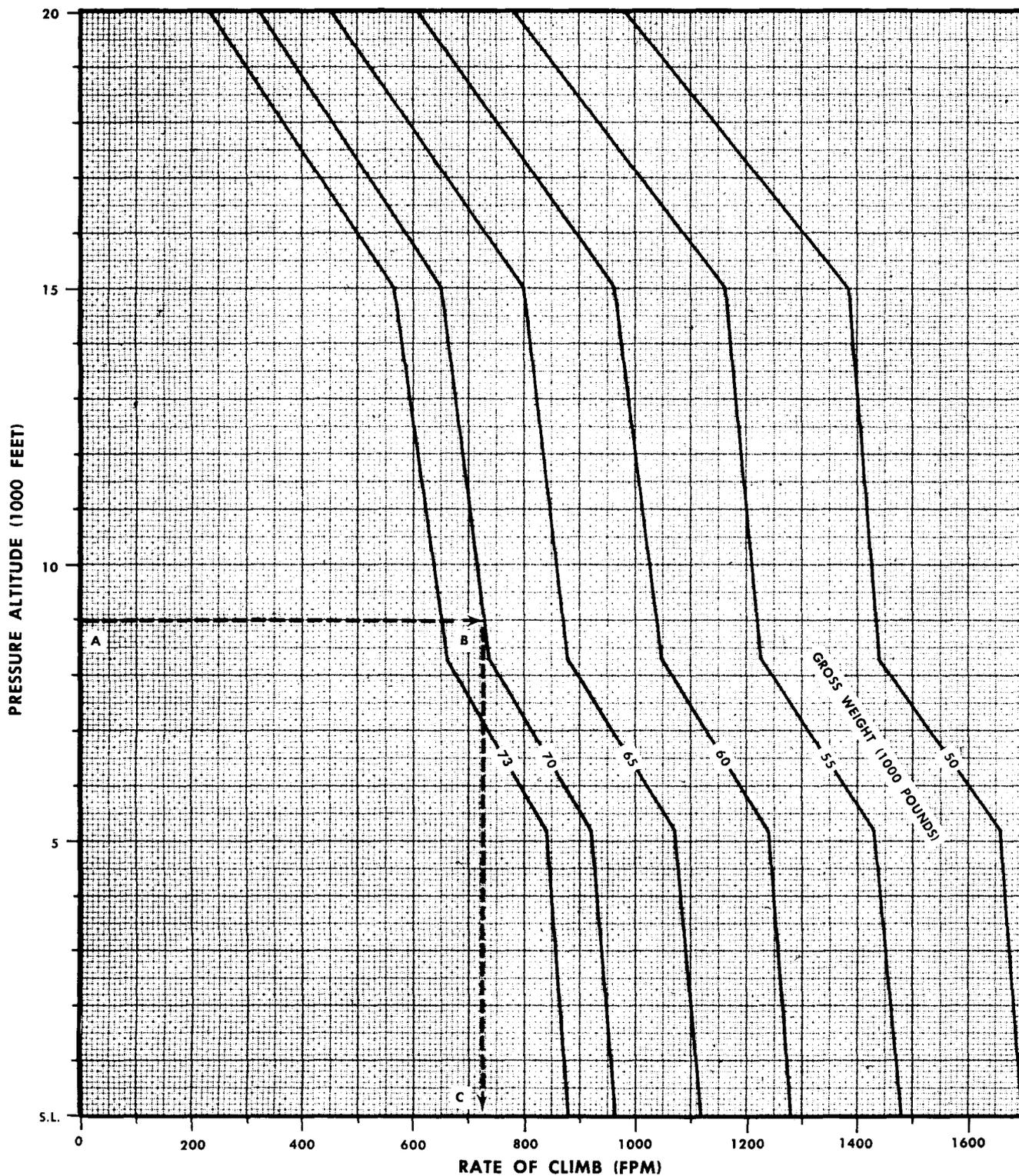
Figure A4-5

X1-49

CLIMB PERFORMANCE
FOUR-ENGINE ENROUTE CONFIGURATION
CLIMB POWER
ENGINES OPERATING AT 950 BHP PER ENGINE
COWL FLAPS IN TRAIL POSITION
WING FLAPS RETRACTED—LANDING GEAR RETRACTED
RECOMMENDED CLIMB SPEED = 130 KIAS

MODEL: C-54
DATE: 6-15-63
DATA BASIS: ESTIMATED

ENGINE(S): R-2000
FUEL GRADE: 100/130

ALTITUDE LIMIT FOR CONSTANT
950 BHP PER ENGINE AT
2300 RPM

GROSS WEIGHT (1000 POUNDS)

73 70 65 60 55 50

PRESSURE ALTITUDE (1000 FEET)

RATE OF CLIMB (FPM)

Figure A4-6

X1-337

A4-9
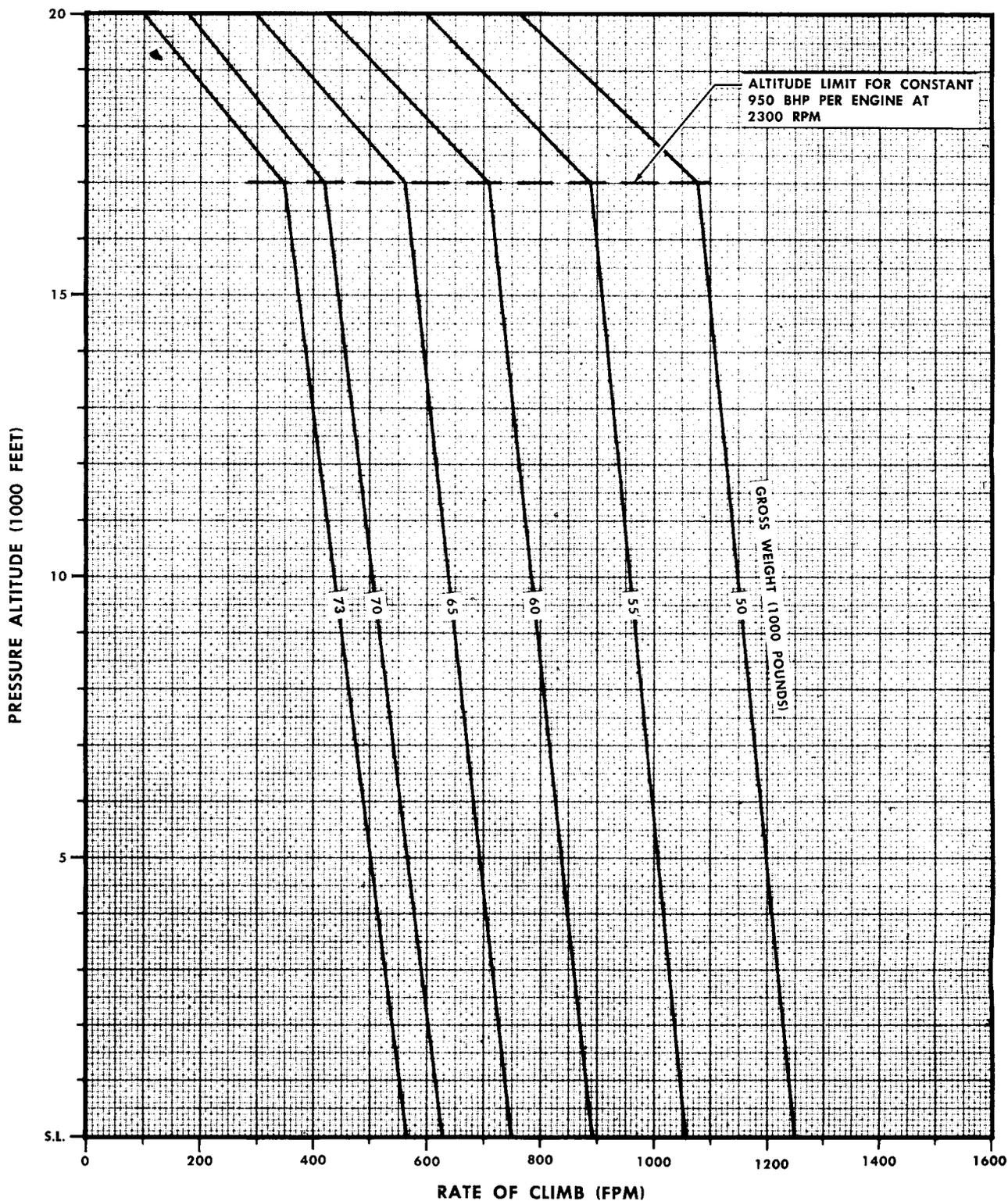
MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

CLIMB PERFORMANCE
THREE-ENGINE ENROUTE CONFIGURATION
ICAO STANDARD DAY
THREE ENGINES OPERATING AT METO POWER
COWL FLAPS TRAIL
PROPELLER FEATHERED ON INOPERATIVE ENGINE
COWL FLAPS CLOSED
WING FLAPS RETRACTED—LANDING GEAR RETRACTED
RECOMMENDED CLIMB SPEED = 130 KIAS

ENGINE(S): R-2000
FUEL GRADE: 100/130
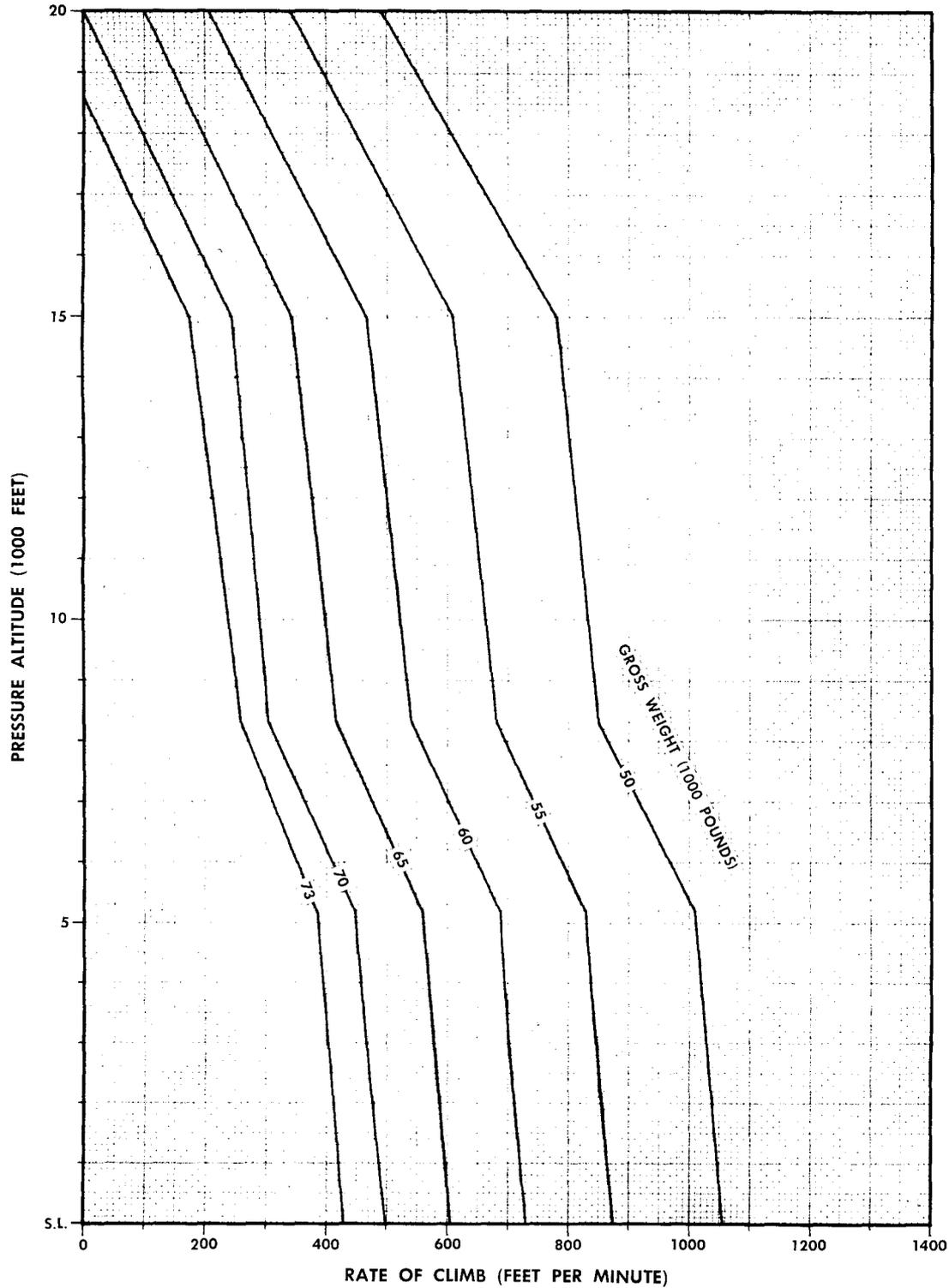
Figure A4-7

X1-96

EMERGENCY CLIMB — FOUR–ENGINE
63,500 POUNDS GROSS WEIGHT

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

Note:
1. Cowl flap position 10 degrees.
2. Ground effect not included.

CONFIGURATION

CURVE	FLAP SETTING	GEAR POSITION
a	0 DEGREES	UP
d	40 DEGREES	DOWN

ENGINE(S): R-2000
FUEL GRADE: 100/130

RATE OF CLIMB (FPM)

BHP   DENSITY ALTITUDE (1000 FEET)   CALIBRATED AIRSPEED (KNOTS)
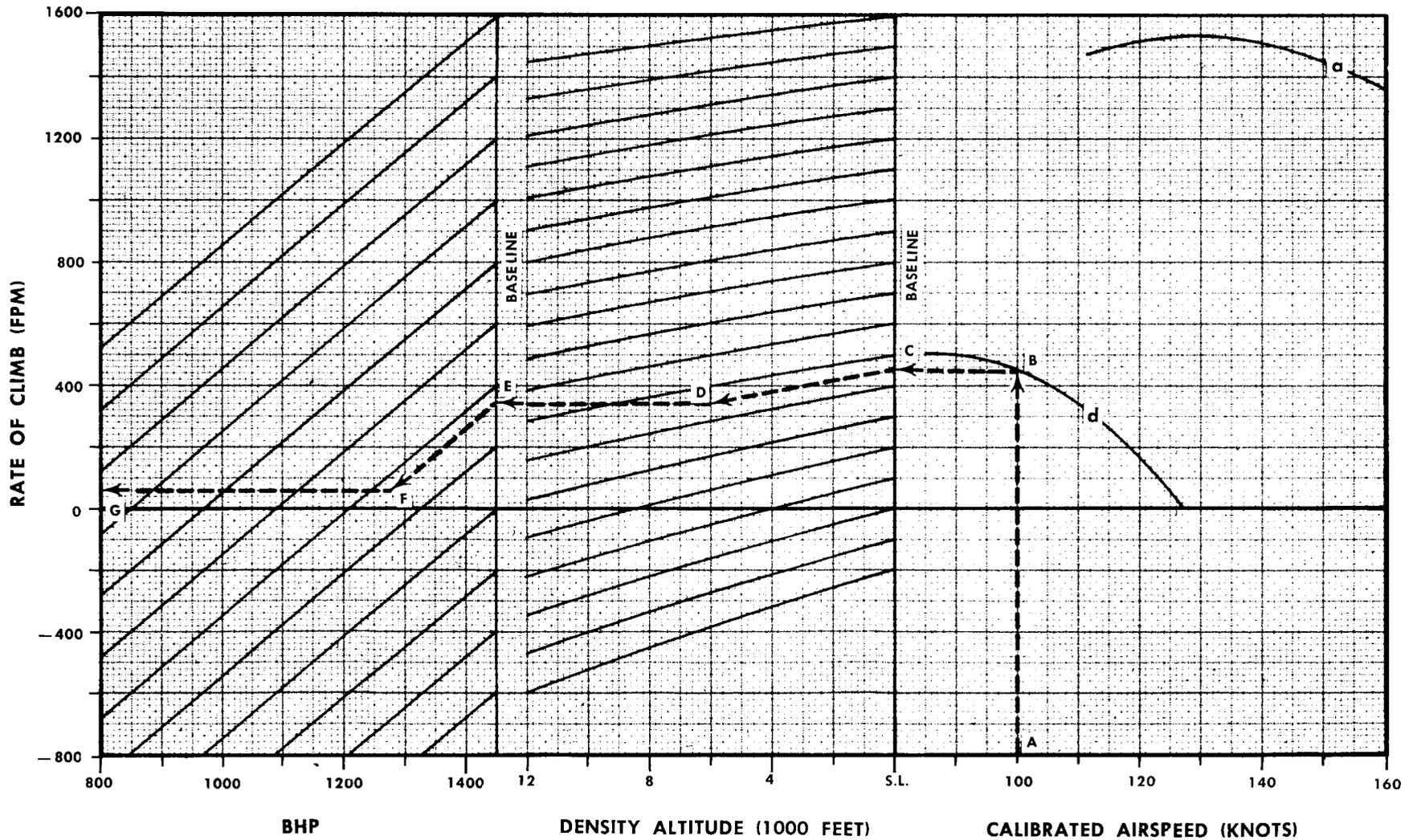
EMERGENCY CLIMB — FOUR-ENGINE
73,000 POUNDS GROSS WEIGHT

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

Note:
1. Cowl flap position 10 degrees.
2. Ground effect not included.

ENGINE(S): R-2000
FUEL GRADE: 100/130

CONFIGURATION

CURVE	FLAP SETTING	GEAR POSITION
a	0 DEGREES	UP
d	40 DEGREES	DOWN

T. O. 1C-54D-1

Figure A4-9

RATE OF CLIMB (FPM)

BHP   DENSITY ALTITUDE (1000 FEET)   CALIBRATED AIRSPEED (KNOTS)

EMERGENCY CLIMB — THREE—ENGINE
63,500 POUNDS GROSS WEIGHT

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

Note:
1. Cowl flap position 10 degrees on operating engines, TRAIL on inoperative engine.
2. Ground effect not included.

CONFIGURATION

CURVE	FLAP SETTING	GEAR POSITION
INOPERATIVE PROPELLER FEATHERED		
a	0 DEGREES	UP
b	15 DEGREES	UP
c	15 DEGREES	DOWN
d	40 DEGREES	DOWN
INOPERATIVE PROPELLER WINDMILLING		
bw	15 DEGREES	UP
cw	15 DEGREES	DOWN

RATE OF CLIMB (FPM)

BHP

DENSITY ALTITUDE (1000 FEET)

CALIBRATED AIRSPEED (KNOTS)

EMERGENCY CLIMB — THREE-ENGINE
73,000 POUNDS GROSS WEIGHT

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

CONFIGURATION

CURVE	FLAP SETTING	GEAR POSITION
INOPERATIVE PROPELLER FEATHERED		
a	0 DEGREES	UP
b	15 DEGREES	UP
c	15 DEGREES	DOWN
d	40 DEGREES	DOWN
INOPERATIVE PROPELLER WINDMILLING		
bw	15 DEGREES	UP
cw	15 DEGREES	DOWN

Note:
1. Cowl flap position 10 degrees on operating engines, TRAIL on inoperative engine.
2. Ground effect not included.

RATE OF CLIMB (FPM)

BHP   DENSITY ALTITUDE (1000 FEET)   CALIBRATED AIRSPEED (KNOTS)

EMERGENCY CLIMB — TWO-ENGINE
63,500 POUNDS GROSS WEIGHT

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

CONFIGURATION

CURVE	FLAP SETTNG	GEAR POSITION
a	0 DEGREES	UP
d	40 DEGREES	DOWN

Note:
1. Cowl flap position 10 degrees on operating engines, TRAIL on inoperative engines.
2. Propellers feathered on inoperative engines.
3. Ground effect not included.

RATE OF CLIMB (FPM)

BHP   DENSITY ALTITUDE (1000 FEET)   CALIBRATED AIRSPEED (KNOTS)
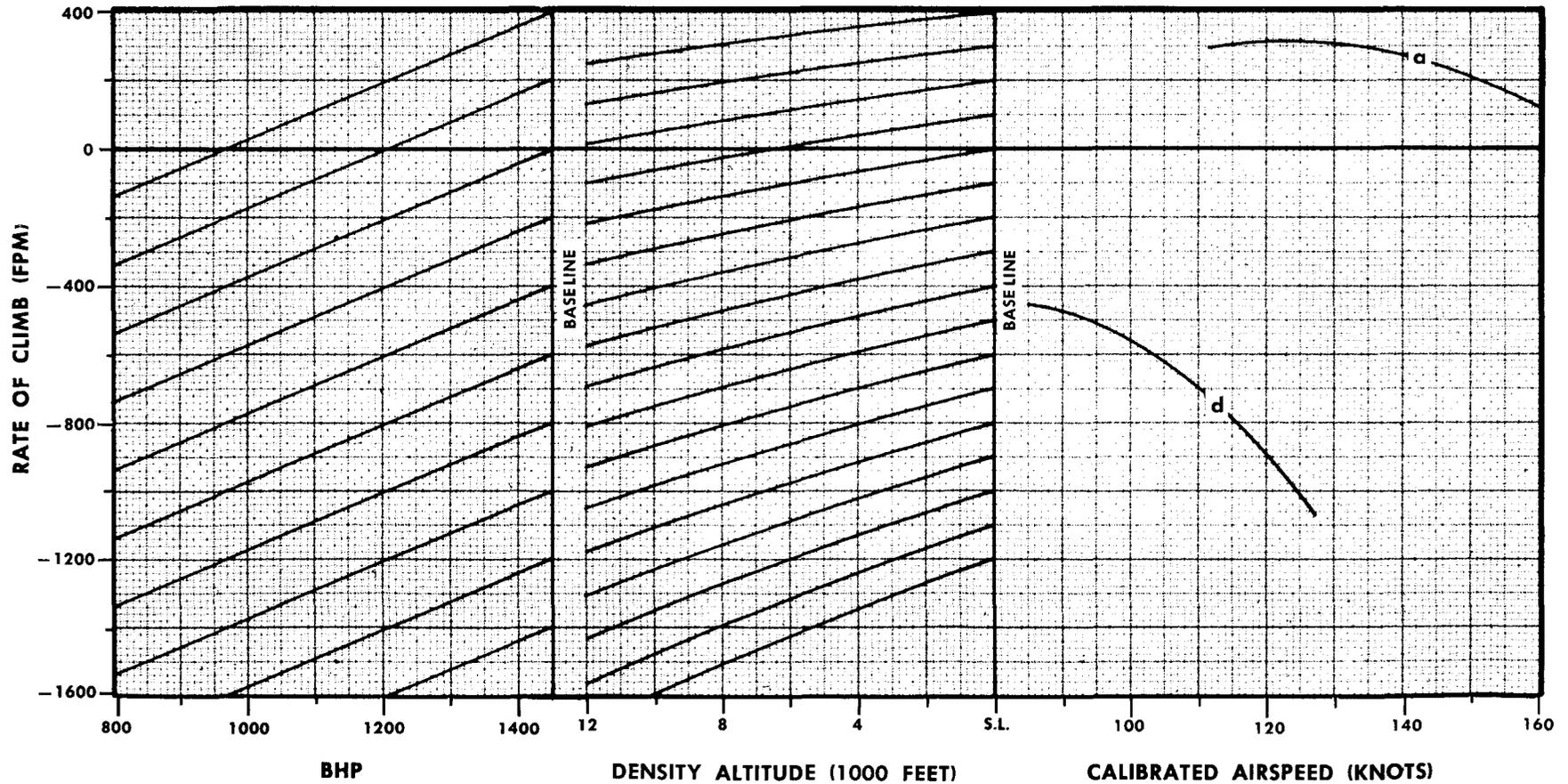
EMERGENCY CLIMB — TWO-ENGINE
73,000 POUNDS GROSS WEIGHT

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

Note:
1. Cowl flap position 10 degrees on operating engines, TRAIL' on inoperative engines.
2. Propellers feathered on inoperative engines.
3. Ground effect not included.

CONFIGURATION

CURVE	FLAP SETTING	GEAR POSITION
a	0 DEGREES	UP
d	40 DEGREES	DOWN

Figure A4-13

RATE OF CLIMB (FPM)

BHP

DENSITY ALTITUDE (1000 FEET)

CALIBRATED AIRSPEED (KNOTS)
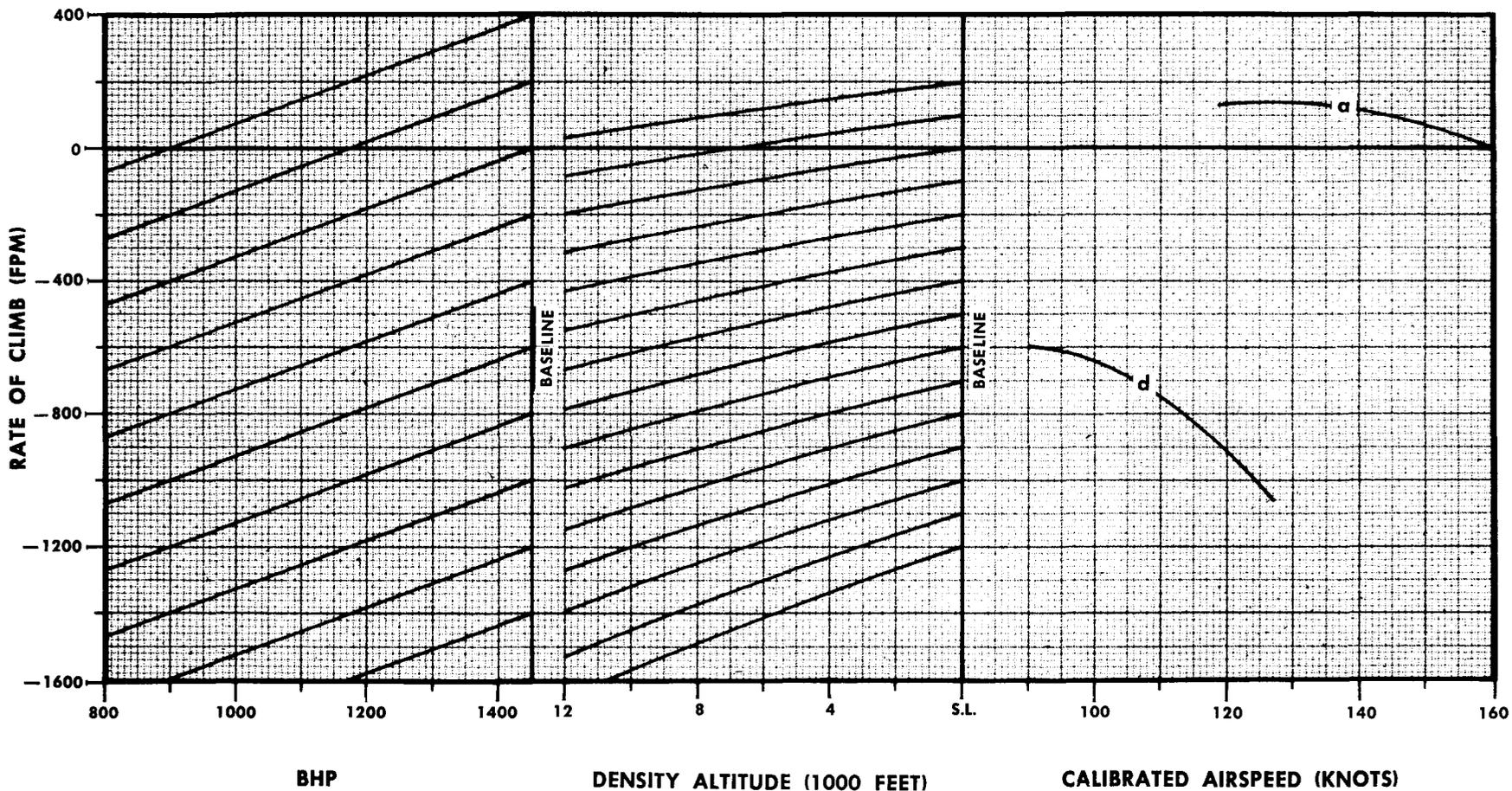
EMERGENCY CEILING
ICAO STANDARD DAY
100 FT/MIN RATE OF CLIMB AT METO POWER
CLEAN CONFIGURATION—PROPELLER FEATHERED ON INOPERATIVE ENGINE(S)
RECOMMENDED CLIMB SPEED = 130 KIAS

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130
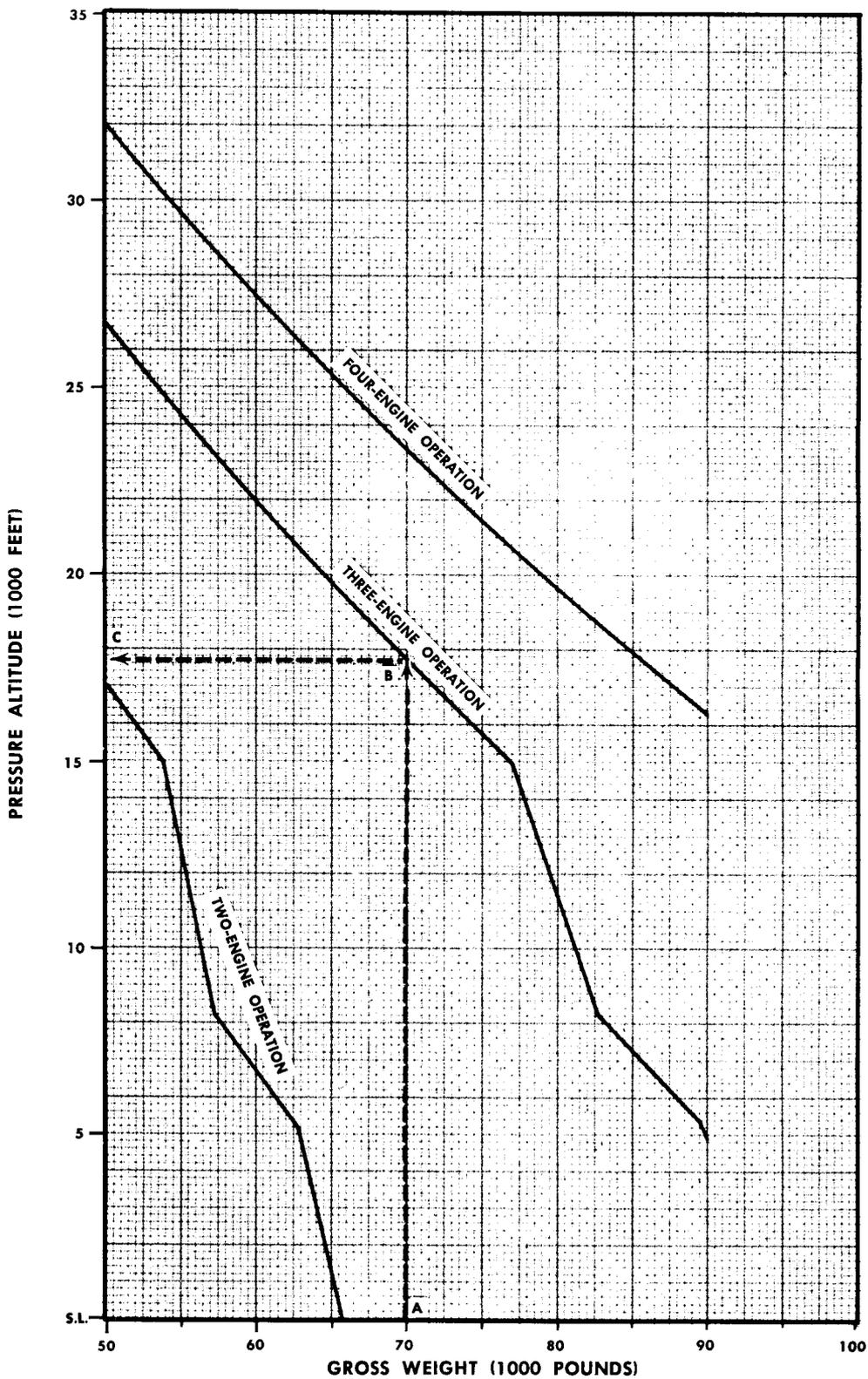
Figure A4-14

X1-98

A4-17/A4-18

PART 5

RANGE

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

RANGE.

Range performance data is provided to cover operation in four different types of cruise operation; constant power cruising, constant speed cruising, long range cruising, and maximum endurance cruising.

Constant power cruise affords the simplest technique in that adjustments in power settings are not required during the cruise portion of the mission. In addition, this type of cruise will usually result in higher airspeeds than other methods. When used over a period of several hours, this type of cruise results in poor fuel economy, with the additional drawback of the tendency toward spark plug fouling when the same power settings are maintained over long periods of time.

Constant speed cruising is advantageous when flying a strict flight schedule and gives better fuel economy than constant power cruise with a corresponding loss in speed.

Long range cruise provides the best overall fuel economy versus time and distance of the

four types of cruise. Range is slightly less than maximum range, however, selection of a higher airspeed than maximum range airspeed reduces mission time which more than compensates for the slight loss of fuel economy.

Maximum endurance cruising is used where time is the primary factor rather than distance, such as holding at the destination due to poor weather conditions. For this type of cruise a power is selected which is the lowest power at which a stable airspeed can be maintained at a given gross weight. In no case should a power be used which will result in an airspeed lower than 130 percent of the power-off stalling speed.

Range performance is determined using the required power and airspeeds as determined from charts in this Part in conjunction with the power settings and fuel flows obtained from the power schedules in Part 2 of this Appendix.

PERFORMANCE CORRECTION FACTORS.

Performance charts in this appendix are based on standard aircraft configuration. Any variation from this configuration will change the drag of the aircraft and thus will change the performance from that shown on the charts. That is, normal power requirements must be modified to compensate for these changes in configuration so that the desired airspeed can be maintained. The two main performance correction factors are the weight correction factor and the Delta F correction factor.

The weight correction factor is determined by comparing the actual performance of the aircraft with charted performance and adjusting the gross weight to arrive at a performance gross weight for computing power requirements which will equal the charted performance figures. Where past performance of an aircraft have been analyzed over a period of time, the correction factors will be supplied for use in flight planning. If the correction factor is not known, it must be calculated during cruise.

The Delta F correction factor is measured in terms of equivalent flat plate area and is applied as a correction BHP to compensate for increase or decrease in drag caused by changes in external configuration.

DISCUSSION OF CHARTS.

LEVEL FLIGHT PERFORMANCE.

The Level Flight Performance chart (figure A5-1) presents the brake horsepower required per engine for level flight performance during four, three, or two-engine operation as a function of indicated airspeed, gross weight, and density altitude. The true airspeed is also shown on the chart. Lines indicating the recommended long range airspeed, 110 percent maximum L/D airspeed, and the maximum endurance airspeed are included. The recommended long range airspeed lines are valid from sea level to approximately 12,000 feet altitude. Above 12,000 feet the airspeed should be reduced approximately 15 knots. The maximum endurance airspeed is limited by 130 percent of the power-off stall speed.

For long range cruise, the chart is used by entering with the gross weight and determining the power requirements and airspeeds for the cruise altitude. For constant power operations, the chart is entered with the desired power and altitude and the required airspeed determined for the given gross weight. For constant airspeed cruising, the speed is selected and power requirements adjusted downward as the gross weight diminishes. Maximum endurance cruise is obtained by using the maximum endurance line on the chart in the same manner as the long range cruise line, adjusting both power and airspeed as the gross weight is reduced. The following example illustrates use of the chart for long range cruise.

Example.

Given: Gross Weight = 62,000 Pounds

        Cruise Altitude = 6000 feet density
        altitude.

Find: Brake horsepower per engine, indi-
         cated airspeed, and true airspeed
         required for long range cruise with
         four engines operating.

Enter the chart on the four-engine long range
cruise line, locate the gross weight of 62,000
pounds (A), and read across to the four-en-
gine operation BHP scale. Enter the BHP
scale with a density altitude of 6000 feet (B)
and read up to the intersection of altitude
and gross weight to find required brake
horsepower of 540 BHP per engine (C). To
find indicated airspeed, read down from point
(A) to the indicated airspeed scale for a
speed of 147 knots (D). Correct IAS for alti-
tude by entering the airspeed correction
graph at 6000 feet density altitude (E) and
read across to the intersection of IAS for a
true air speed of 163 knots (F).

During cruise this process would be repeated
for each increment of cruise using the new
gross weight as determined from fuel flows
for the given power settings from charts in
Part 2 of this Appendix.

Determination Of Weight Correction Factor.

When weight correction factors based on
past performance of a given aircraft are not
available, the Level Flight Performance
chart can be used to determine a correction
factor by comparing actual performance
against charted performance.

For the preceding problem, assume that
after the aircraft has been trimmed out for
cruise, the actual indicated airspeed is only
142 knots, IAS, instead of the charted speed
of 147 knots IAS. Re-enter the chart at ac-
tual indicated airspeed and read up to the in-
tersection of line A-C to find gross weight of
65,000 pounds. The difference between this
figure and actual gross weight is the weight
correction factor (64,000 - 62,000 = 2000
pounds). Re-enter the chart at the desired
airspeed and read up to the adjusted gross
weight of 64,000 pounds and across to the
BHP correction grid to find the new BHP
setting of 560 BHP per engine.

POWER REQUIRED FOR SEARCH CONFIGURATION (EC-54).

The Power Required For Search Configura-
tion chart (figure A5-2) shows the brake
horsepower per engine (four-engine opera-
tion) required to maintain search airspeed of
120 knots IAS at a search altitude of 1000
feet pressure altitude in the search configu-
ration of wing flaps at 10 degrees. The fol-
lowing example illustrates the method of
using the chart.

Example.

Given: Outside Air Temperature = 10° C

         Gross weight = 65,000 pounds

         Configuration = Search (Gear up,
         flaps 10 degrees)

Find: Brake horsepower per engine re-
         quired to maintain search airspeed
         of 120 knots IAS at 1000 feet pres-
         sure altitude.

Enter the chart at a temperature of 10° C
(A) and read up to the pressure altitude
correction curve (B) and across to a gross
weight of 65,000 pounds (C). Read down to
find brake horsepower of 493 BHP per en-
gine (D).

LEVEL FLIGHT PERFORMANCE

MODEL: C-54
DATE: 1-11-65   ENGINE(S): R-2000
DATA BASIS: FLIGHT TEST   FUEL GRADE: 100/130
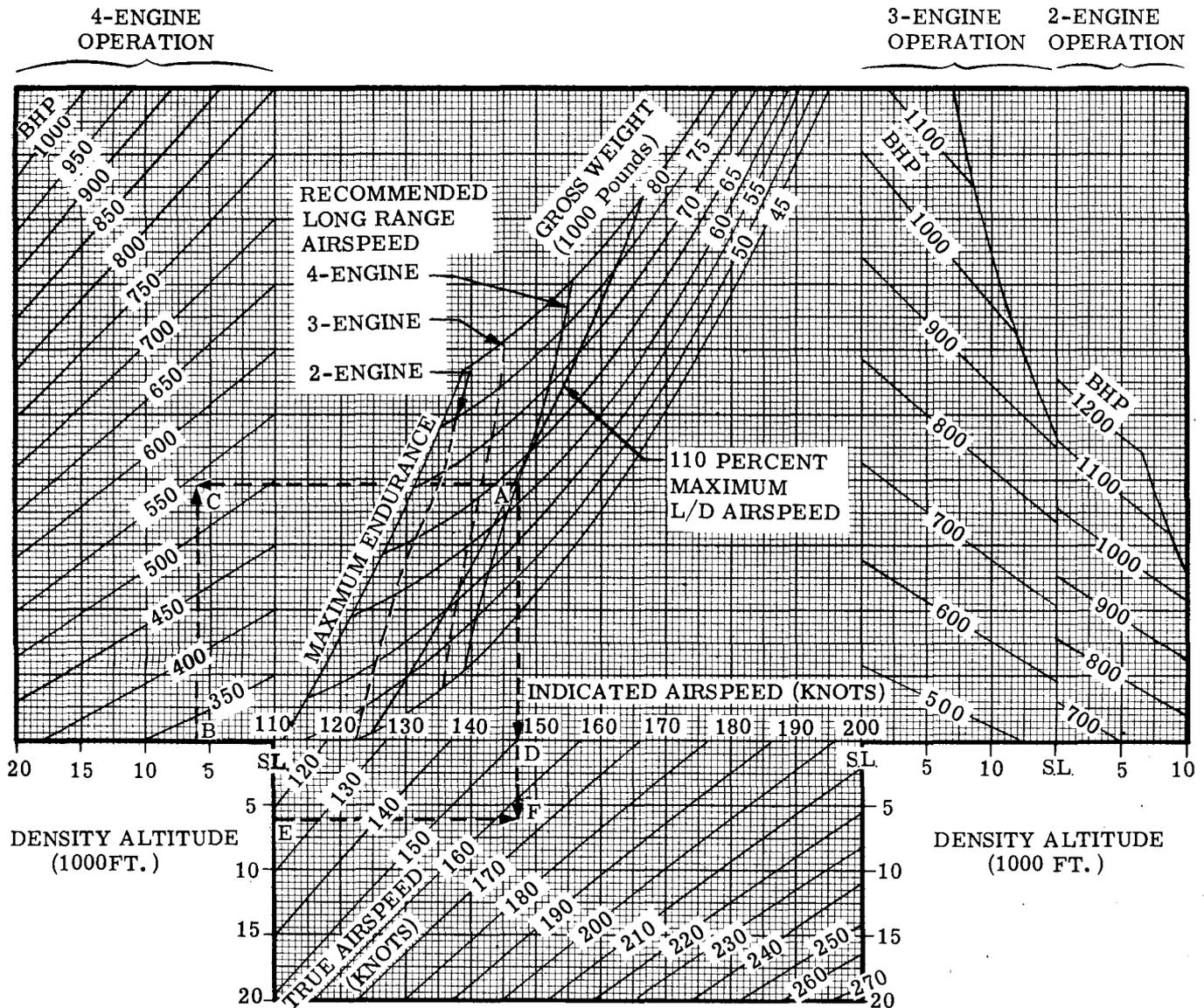
Figure A5-1

MODEL: HC-54
DATE: 6-15-63
DATA BASIS: ESTIMATED

ENGINE(S): R-2000
FUEL GRADE: 100/130
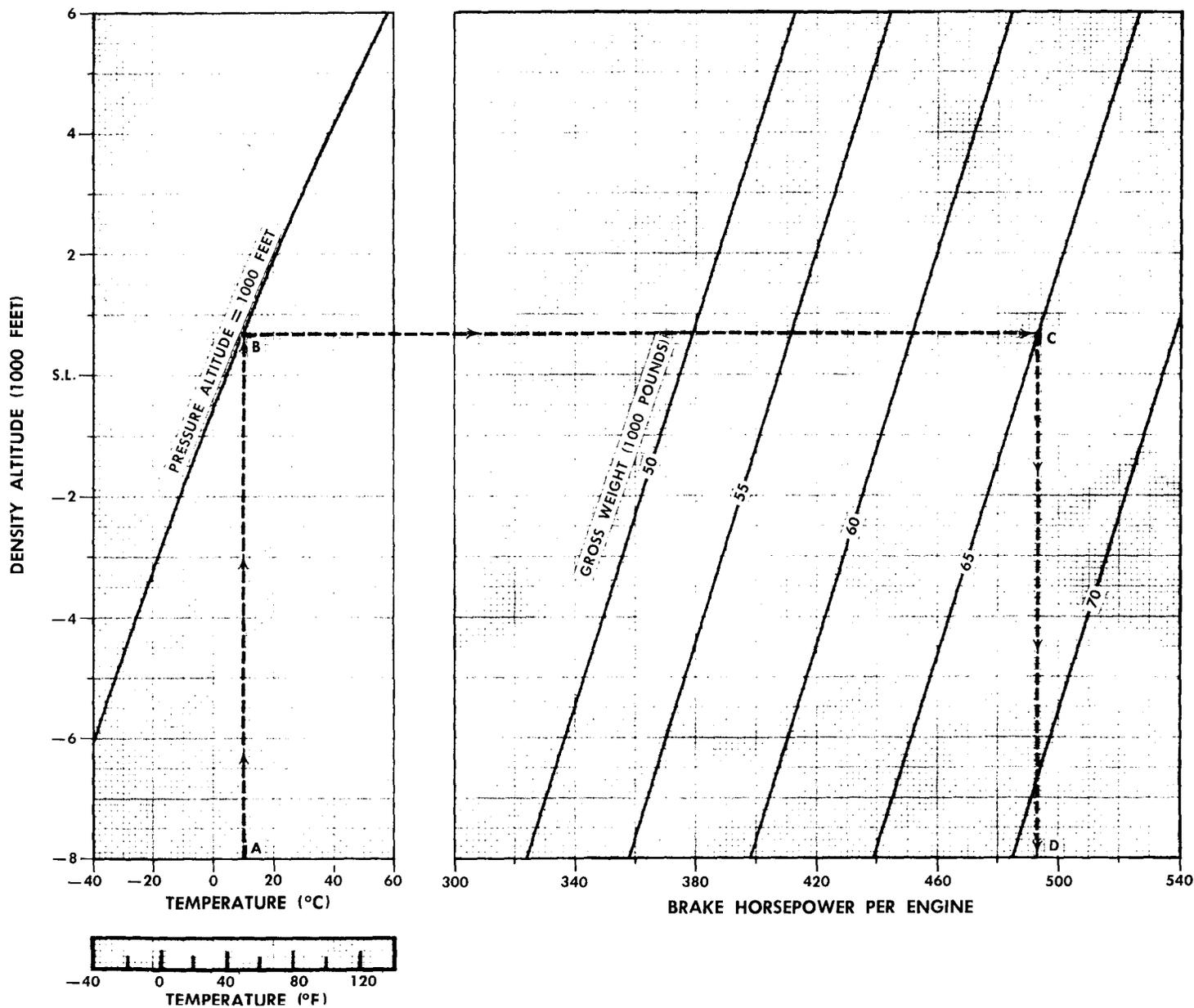
PART 6

LANDING

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

APPROACH AND LANDING.

The landing charts are included to enable the pilot to determine the length of runway necessary to land the aircraft safely under various conditions of wind, density altitude and runway surface.

The landing distances presented require using the threshold airspeeds and touchdown speeds shown on the Characteristic Landing Speeds chart (figure A6-3) and maximum braking without skidding. Headwind and crosswind components may be found by referring to the Takeoff and Landing Crosswind chart (figure A3-13) in Part 3.

DISCUSSION OF CHARTS.

LANDING DISTANCE.

The Landing Distance chart (figure A6-1) is used to determine the landing ground roll distance and the total landing distance from a

height of 50 feet. Variables of density altitude, gross weight and headwind are included. The chart is based on wing flaps full down (40 degrees). Factors to obtain ground roll distances with zero, 10, 20, and 30 degree wing flap settings are listed on the chart. Data is based on a dry hard surface runway. The following example illustrates the method of using the chart.

Example.

Given: Density Altitude = 3550 Feet

Gross Weight = 63,700 Pounds

Headwind = 30 Knots

Wing Flap Setting = 40 Degrees

Find: Ground roll distance and total landing distance from 50 foot height.

Enter the chart (figure A6-1) at a density altitude of 3550 feet (A) and read across to a gross weight of 63,700 pounds (B). Correct for headwind, using one half the reported headwind by reading down to the baseline (sea level) and following the guidelines to a headwind of 15 knots (C). Read up to find ground roll distance of 1950 feet (D) and down for total landing distance of 2535 feet (E). For 40 degree flap settings no correction is necessary. For other than 40 degree settings, correct chart distances by increasing by factors noted on the chart.

EFFECT OF RUNWAY CONDITIONS ON LANDING GROUND ROLL.

The Effect Of Runway Conditions On Landing Ground Roll chart (figure A6-2) provides a correction to the landing ground roll distances for various runway surface conditions. The length of the landing ground roll depends to a great extent on the coefficient of friction which

will vary directly with the runway surface and condition. Coefficients of friction will be given in terms of runway condition readings (RCR), as measured by the James brake decelerometer, and will vary from 23 for a dry, hard surface runway to six for ice. Where RCR numbers are not reported, the table included on the chart shows the average RCR's for various runway surface conditions. The following example illustrates the method of using the chart.

Example.

Given: Computed Landing Ground Roll = 1950 Feet

Runway Condition Reading = 8

Find: Corrected landing ground roll.

Enter the chart (figure A6-2) with the computed landing ground roll of 1950 feet (A), read across to the reported RCR of 8 (B), and down to find corrected ground roll of 4320 (C). To correct total landing distance from 50 foot height, subtract uncorrected ground roll distance from corrected distance and add this figure to the total landing distance.

CHARACTERISTIC LANDING SPEEDS.

The Characteristic Landing Speeds chart (figure A6-3) presents 120 and 130 percent of power-off stall speeds for 0, 20, and 40 degree wing flap settings as functions of gross weight. The 110 percent of minimum control airspeed is shown for planning purposes in the event a three-engine approach or go-around is necessary. To find the desired speed for a given flap setting and condition, enter the chart with the gross weight at time of landing, read up to the curve for the desired flap setting and percent of power-off stall speed and across to the indicated airspeed scale.

LANDING DISTANCE
WING FLAPS = 40 DEGREES
DRY CONCRETE

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

Note:
1. Speed at 50 foot height = 130 percent of stall speed.
2. Speed at touchdown = 120 percent of stall speed.
3. When landing with other than full down flaps (40°), increase ground roll distance by the following factors:

FLAP SETTING	DISTANCE FACTOR
0°	1.75
10°	1.40
20°	1.22
30°	1.10

MAXIMUM ENERGY AT WHICH C-54 BRAKES HAVE BEEN TESTED

DENSITY ALTITUDE (1000 FEET)

GROSS WEIGHT (1000 POUNDS)

50 55 60 65 70 73

LANDING GROUND ROLL DISTANCE (1000 FEET)

HEADWIND (KNOTS)

LANDING DISTANCE FROM 50 FOOT HEIGHT (1000 FEET)

Figure A6-1

X1-143
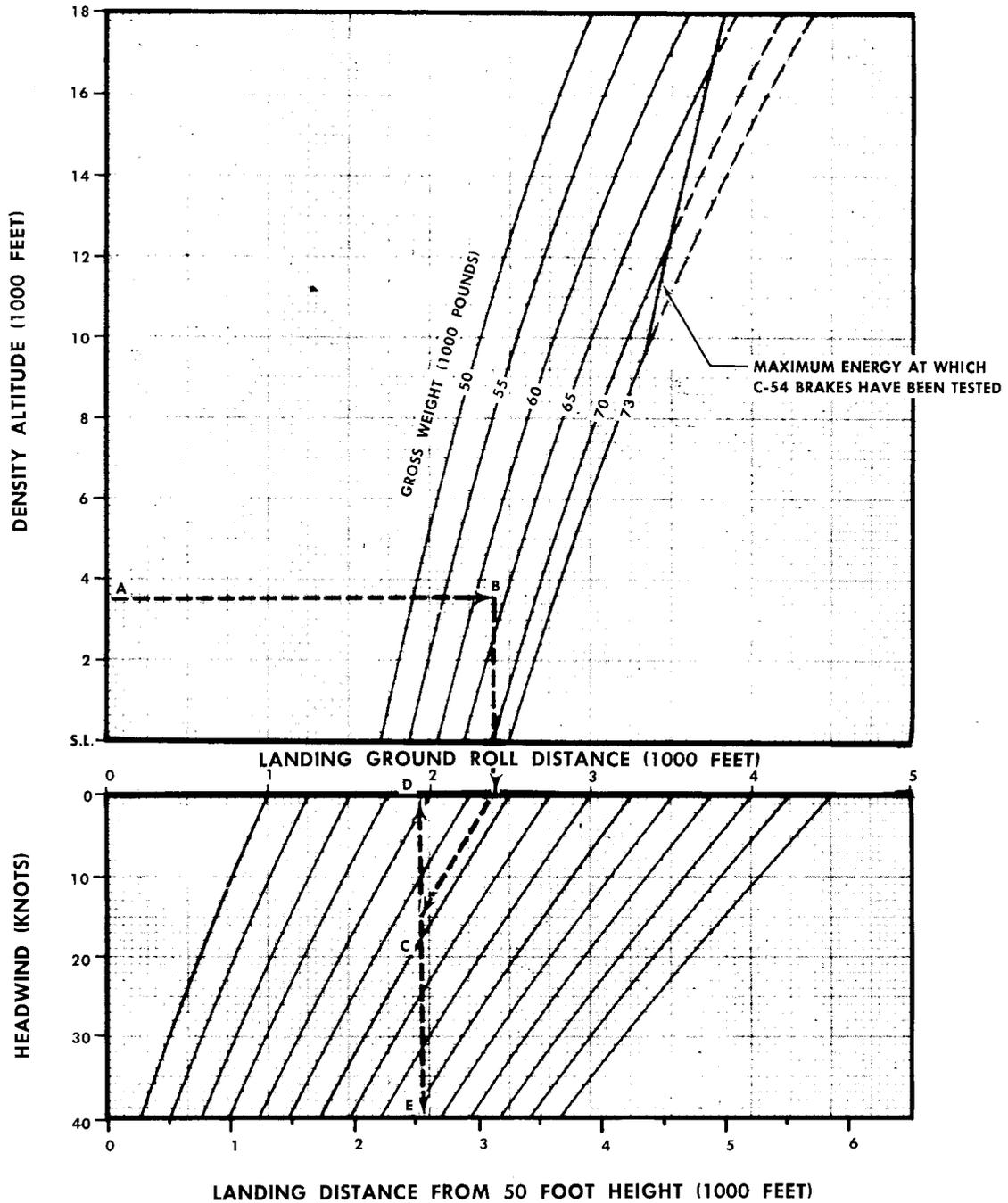
MODEL: C-54
DATE: 9-7-65
DATA BASIS: CALCULATED

**EFFECT OF RUNWAY CONDITIONS ON
LANDING GROUND ROLL**

ENGINE(S): R-2000
FUEL GRADE: 100/130

Note:
Runway condition reading used
on landing charts = 23.

RUNWAY SURFACE	RUNWAY CONDITION READING (RCR)
DRY CONCRETE OR MACADAM	
DRY TURF	
WET CONCRETE OR MACADAM	
SNOW OR WET GRASS	
ICE	

Figure A6-2

T.O. 1C-54D-1

Appendix I

A6-4
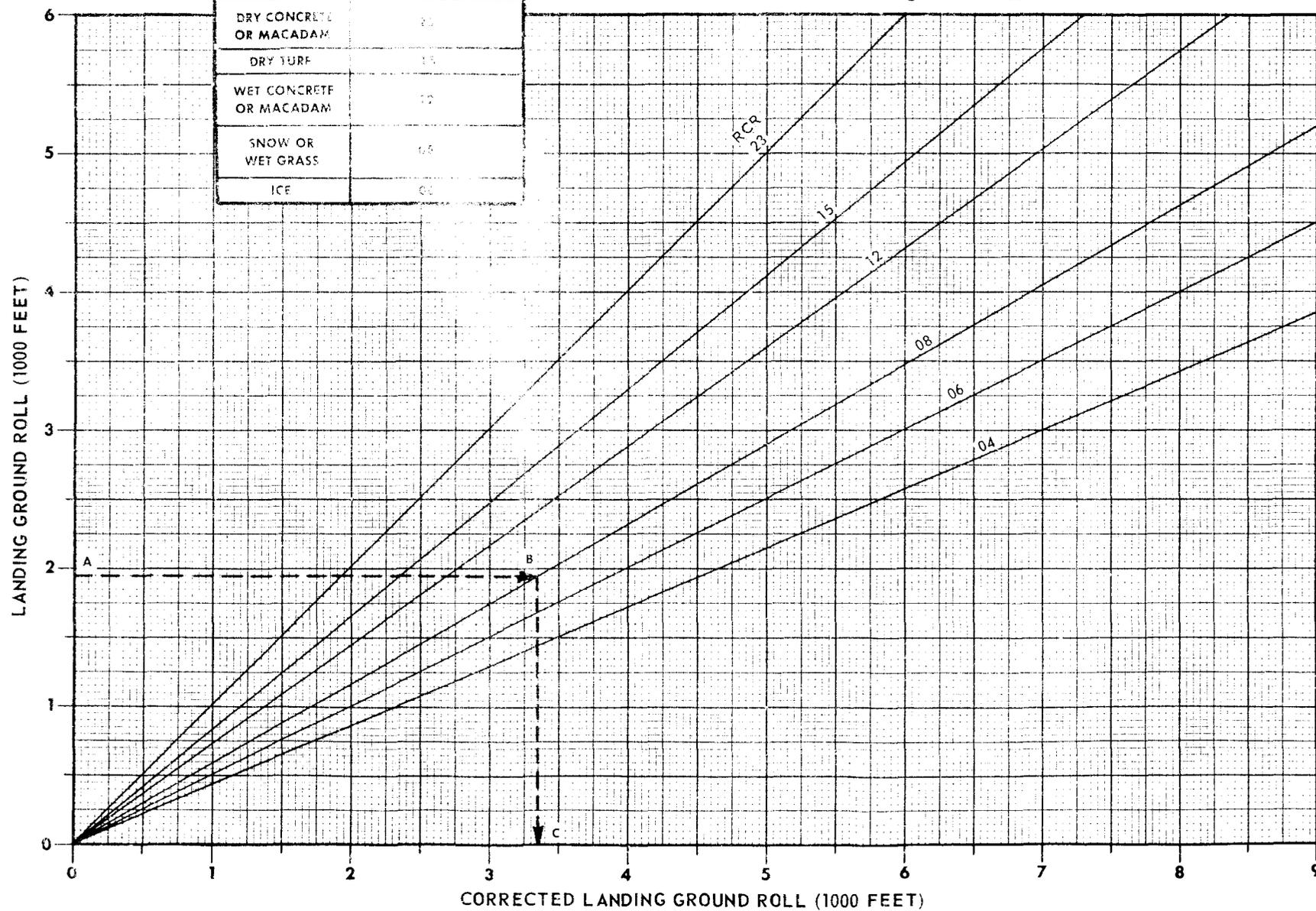
X1-328

Changed 1 November 1965

CHARACTERISTIC LANDING SPEEDS

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINE(S): R-2000
FUEL GRADE: 100/130

Note:
Do not attempt three-engine go-around at
speeds below 110 percent of minimum control
airspeed.

Figure A6-3

PART 7

MISSION PLANNING

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LIST OF ILLUSTRATIONS

MISSION PLANNING.

To obtain optimum use of the aircraft, mission planning prior to flight and constant checking of the progress of the flight against a predicted flight plan are required. The following items are pertinent to mission planning and consideration should be given to each item by the crew before each mission. Applicable data will be entered on the Takeoff and Landing Data Cards. Availability of this information, revised to reflect any changes in flight plans or conditions, at all times during the mission, will insure the safest and most economical operation of the aircraft under all operating conditions.

TAKEOFF AND LANDING DATA CARDS.

Takeoff and Landing Data Cards are included in the Pilots' And Flight Engineers Normal Abbreviated Checklist, T.O. 1C-54D-CL-1-1

(Following Section IIN for Navy C-54 Aircraft). The cards are included to provide readily available information for takeoff and landing emergencies. Before each flight, applicable data should be computed and entered on the cards. This information can then be reviewed by the pilot or read aloud as a checklist item immediately prior to takeoff or landing. Sample data cards (figures A7-2 and A7-3) are included using the data from the constant power operation sample problem.

SOURCES OF INFORMATION.

Sources of information on the Takeoff and Landing Data Cards are as follows:

▌Conditions.

Field Elevation—Operations or Flight Information Publications (FLIP) charts.

Gross Weight—Basic aircraft operating weight, plus fuel, cargo, and crew.

Runway Length—Operations or FLIP charts.

Runway Slope—Operations or FLIP charts.

Pressure Altitude—Weather briefing or tower operator.

Density Altitude—Density Altitude chart (figure A1-1).

OAT—Weather briefing.

CAT—Assume same as OAT for planning purposes.

Dew Point—Weather briefing.

Wind — Component Headwind component derived from figure A3-13, based on weather briefing.

Runway Condition Reading (RCR)—Weather briefing.

Takeoff. ▌

Predicted Manifold Pressure—Maximum Brake Horsepower charts (figure A2-1 or A2-2).

Brake Horsepower Available—Maximum Brake Horsepower charts (figure A2-1 or A2-2).

Ground Run—Takeoff Ground Run chart (figure A3-4). Runway Slope Correction chart (figure A3-5), and Effect of Runway Surface Condition on Takeoff Ground Run chart (figure A3-6).

Critical Field Length—Critical Field Length chart (figure A3-7).

Acceleration Check Marker/Time—Speed During Takeoff. Ground Run chart (figure A3-9).

Acceleration Check Speed—Speed During Takeoff Ground Run chart (figure A3-9).

Refusal Speed—Refusal Speed chart (figure A3-8).

Takeoff Speed (lift off)—Takeoff Ground Run chart (figure A3-4).

Flap Retraction Speed—Characteristic Takeoff Speeds chart (figure A3-12).

Landing Immediately After Takeoff. ▌

Threshold Speed (130 percent of power-off stall speed)—Characteristic Landing Speeds Chart (figure A6-3).

Touchdown Speed (120 percent of power-off stall speed)—Characteristic Landing Speeds chart (figure A6-3).

Total Landing Distance—Landing Distance Chart (figure A6-1) and Effect of Runway Conditions on Landing Ground Roll chart (figure A6-2).

Landing. ▌

Threshold Speed (130 percent of power-off stall speed)—Characteristic Landing Speeds chart (figure A6-3).

Touchdown Speed (120 percent of power-off stall speed) Characteristic — Landing Speeds chart (figure A6-3).

Go-Around Speed (takeoff speed)— Takeoff Ground Run chart (figure A3-4).

Total Landing Distance —Landing Distance chart (figure A6-1), and Effect of Runway Conditions on Landing Ground Roll chart (figure A6-2).

Ground Roll—Landing Distance Chart (figure A6-1), and Effect of Runway Conditions on Landing Ground Roll chart (figure A6-2).

SAMPLE PROBLEMS.

Sample problems are provided to clarify the use of the performance charts when applied to a typical mission and to emphasize the need for adequate mission planning.

LONG RANGE OPERATION PROBLEM.

The following sample problem is a typical search mission for the HC-54 aircraft. With the exception of the search portion of the mission, this problem is typical for all C-54 series aircraft.

The mission requires that the aircraft take off; climb to 10,000 feet pressure altitude; cruise to a search area 1000 miles from the base at 10,000 feet pressure altitude then descend to 1000 feet pressure altitude; search for 5 hours at 1000 feet pressure altitude in the search configuration; climb to 7000 feet pressure altitude; then return to the home base, cruising at 7000 feet pressure altitude.

All climbs will be made using climb power settings. Both cruises will be made using recommended long range airspeeds and power settings. The mission requires that the aircraft return to the base with sufficient fuel to cruise 100 miles at sea level, plus an additional 10 percent of the takeoff fuel load.

Conditions.

Takeoff Conditions.

Pressure Altitude = Sea level

OAT = 24°C

Density Altitude = 1050 feet

Specific Humidity = 0.015

Dew Point = 71°F

Headwind (20 knots reported, use 50 percent) = 10 knots

Runway Length Available = 4000 feet

Runway Slope (uphill) = 0.015

Rolling Coefficient of Friction = 0.030

Runway Condition Reading = 23

Brake Horsepower Available = 1365 BHP

Takeoff Gross Weight.

Maximum Takeoff Weight Based on Runway Slope and Three=Engine Capability at Take-off (from figure A3-2) = 71,200 pounds

Three-Engine Climb Limit for 100 Feet Per Minute Rate of Climb (from figure A3-2) = 73,500 pounds

Aircraft operating weight, empty including oil (gross weight less fuel and cargo) = 41,435 pounds

Cruise Conditions.

Headwind = None

Temperature at 10,000 Feet Pressure Altitude = -10°C

Density Altitude at 10,000 Feet Pressure Altitude = 9,400 feet

Temperature at 7000 Feet Pressure Altitude = 1°C

Density Altitude at 7000 Feet Pressure Altitude = 7000 feet

Temperature at 1000 Feet Pressure Altitude = 11°C

Weight Correction Factors:

800 BHP = +8900 pounds

750 BHP = +6975 pounds

700 BHP = +5675 pounds

650 BHP = +4600 pounds

600 BHP = +3725 pounds

550 BHP = +2825 pounds

500 BHP = +2025 pounds

Note

When weight correction factors are not provided, compute range performance on actual gross weight. During cruise compare actual performance with charted performance during first increment of cruise, to determine weight correction factor (see Part 5). Cruise data may then be adjusted to obtain charted values. Weight correction factor should be recomputed for each increment of cruise.

Takeoff and Abort Criteria.

Takeoff Ground Run (from figure A3-4) = 3200 feet

Takeoff Speed (from figure A3-4) = 101 knots IAS

Critical Field Length (from figure A3-7) = 3620 feet

Refusal Speed (from figure A3-8) = 87 knots IAS

Refusal Distance (from figure A3-9) = 2020 feet

Acceleration Check Distance (from figure A3-9) = 1000 feet

Acceleration Check Speed (from figure A3-9) = 67 knots IAS

Flap Retraction Speed (from figure A3-12) = 121 knots IAS

Fuel Consumed During Warmup = 300 pounds

Fuel Consumed During Takeoff = 100 pounds

Note

Fuel consumed during warmup and takeoff are estimated. These allowances may be specified by the using commands.

Landing Immediately After Takeoff.

Threshold Speed (from figure A6-3) = 100 knots IAS

Touchdown Speed (from figure A6-3) = 92 knots IAS

Total Landing Distance (from figure A6-1 = 2900 feet

Climb to 10,000 Feet Pressure Altitude.

Climb to cruise altitude will be made at climb power settings. The gross weight at start of climb is 70,800 pounds (71,200 - 400 = 70,800). The time and distance to climb, and the gross weight at end of climb are determined from figure A4-3 as follows:

Time To Climb = 18 minutes

Distance To Climb = 44 nautical miles

Gross Weight At End Of Climb = 70,200

Fuel consumed during climb is 600 pounds (70,800 - 70,200 = 600).

Cruise at 10,000 Feet Pressure Altitude.

Fuel requirements for cruise may be determined using increments of time (usually one hour), horsepower, or gross weight. Increments should be small enough to allow a speed tolerance of ± 2 knots from the desired airspeed during each increment. The disadvantage of using small increments for cruise planning is that interpolation of power settings for odd horsepower increments is necessary to achieve accurate manifold pressure and fuel flows from the power schedules in Part 2. Use of even horsepower increments reduces the number of interpolations necessary but results in a wider range of airspeed over the cruise increment. The end results of the two methods are sufficiently close to allow the use of increments of horsepower for cruise planning. However, for accurate cruise control, smaller increments are recommended.

From Figure A5-1 it is determined that the brake horsepower required to maintain recommended long range cruise at the cruise altitude and gross weight at end of climb will be 665 BHP. Apply the weight correction for the nearest even brake horsepower (4600 pounds at 650 BHP) to the actual gross weight to obtain a performance gross weight of 74,800 pounds (4600 + 70,200 = 74,800 pounds). Brake horsepower for the first increment of cruise will be based on this figure. The nearest even 50 BHP for this weight is 700 BHP. From figure A2-7, the power requirements for the first increment of cruise are as follows:

Rpm = 2000

Manifold Pressure = 29.6 inches Hg

Fuel Flow = 1236 lb/hr

From figure A5-1 determine weight reduction necessary to reduce power to the next even

BHP increment as 5800 pounds by re-entering the chart at 650 BHP and 9400 feet density altitude and reading across to the recommended long range airspeed line for a gross weight of 69,000 pounds and subtracting this figure from the initial gross weight (74,800 - 69,000 = 5800 pounds). Determine the average gross weight for this increment by subtracting one half the weight reduction from the initial gross weight (74,800 - 2900 = 71,900 pounds). Determine the average airspeed for the first increment of cruise by re-entering the chart at 700 BHP for cruise altitude and reading across to the average gross weight of 71,900 pounds and down to the airspeed correction grid. (Av. G.W. = 71,900 pounds, IAS = 157 knots, TAS = 183 knots). Determine the time required to consume 5800 pounds of fuel at a fuel flow of 1236 lb/hr, as 4 hours 42 minutes, and the distance traveled during this time as 859 nautical miles. Summary for the first increment of cruise is as follows (see figure A7-1):

Fuel Consumed = 5800 pounds

Gross Weight At End of Cruise #1 (Actual) = 64,400 pounds

Average Gross Weight (Corrected) = 71,900 pounds

TAS = 183 knots

Time = 4 hours 42 minutes

Distance Traveled = 859 nautical miles

Total Distance Traveled = 903 nautical miles

Since only 97 nautical miles remain to be traveled before reaching the search area, the second increment of cruise may be computed without determining an average gross weight and airspeed. Apply the weight correction factor to the actual gross weight at end of first cruise increment and determine the power requirements, airspeeds and fuel consumed as follows:

BHP = 650

Rpm = 1900

Sample Mission Planning Schedule—Typical

A	B	C	D		E		F	G	H	I	J	K
	Hp	H d	BHP		MIX	SP	ΔTIME	ΔUSED	ΔUSED	ΔF BHP	IAS	ΔDIST
CONDI-TION	OAT a	AVG H d	RPM		FUEL/HR		TOTAL	TOTAL	GROSS WT.	WT. COR.	EAS	TOTAL
	$\frac{1}{\sqrt{\sigma}}$	AVG $\frac{1}{\sqrt{\sigma}}$	MP	TP	FUEL/PD		O	O	71,200	PERF. G.W.	TASK	O
W/U & Taxi	S.L.	1050	-		AR	-	+ :20	+ 300	- 300	-	-	+ -
	+24°C	-	-		-		-	-	70,900		-	-
	-	-	-	-	300							-
T. O.	S.L.	1050	1365		AR	-	+ :05	+ 100	- 100	-	-	+ -
	+24°C	-	2700		-		:25	400	70,800		-	-
	-	-	50.5		100						-	-
Climb	S.L.	1050	950		AR		+ :18	+ 600	- 600	-	130	+ 44
	+15°C	5275	2300		2456		:43	1000	70,200		-	44
	-	-	36.0	-	600						-	
Cruise #1	10,000	9400	700		AL		+ 4:42	+5800	- 5,800	Wt. Corr. 4600	157	+ 859
	-10°C	-	2000		1236		5:25	6800	64,400	Av. G.W. 71,900	-	903
	-	-	29.6	-	5800						183	
Cruise #2	10,000	9400	650		AL	-	+ :33	+ 622	- 622	Wt. Corr. 4600	151	+ 97
	-10°C	-	1900		1129		5:58	7422	63,778		-	1000
	-	-	29.2	-	622					-	176	
Search #1	1000	800	500		AL	-	+ 1:00	+ 864	- 864	Wt. Corr. 2025	120	+ 120
	+11°C	-	1600		864		6:58	8286	62,914	Av. G.W 65,371	-	1120
	-	-	30.0	-	864						-	
Search #2	1000	800	490		AL	-	+ 1:00	+ 850	- 850	Wt. Corr. 2025	120	+ 120
	+11°C	-	1600		850		7:58	9136	62,064	Av. G.W. 64,507	-	1240
	-	-	29.6	-	850						-	
Search #3	1000	800	485		AL	-	+ 1:00	+ 843	- 843	Wt. Corr. 2025	120	+ 120
	+11°C	-	1600		843		8:58	9979	61,221	Av. G.W 63,657	-	1360
	-	-	29.4	-	843						-	
Search #4	1000	800	475		AL	-	+ 1:00	+ 828	- 828	Wt. Corr. 2025	120	+ 120
	+11°C	-	1600		828		9:58	10,807	60,393	Av. G.W. 62,814	-	1480
	-	-	29.0	-	828						-	
Search #5	1000	800	470		AL	-	+ 1:00	+ 821	- 821	Wt. Corr. 2025	120	+ 120
	+ 11°C	-	1600		821		10:58	11,628	59,572	Av. G.W 61,986	-	1600
	-	-	28.9	-	821						-	
Climb	1000	800	950		AR	-	+ :07	+ 285	- 285		130	+ 16
	+11°C	3900	2300		2456		11:05	11,913	59,287	-	-	1616
	-	-	35.0	-	285						-	
Cruise #2	7000	7000	550		AL	-	+ 5:47	+5510	- 5510	Wt. Corr. 2025	151	+ 984
	+1°C	-	1700		952		16:52	17,423	53,777	Av. G.W. 58,756	-	2600
	-	-	28.9	-	5510						171	
Reserve	S.L.	1050	450		AL	-	+ :40	+ 528	- 528	Wt. Corr. 2025	145	+ 100
	+24°C	-	1600		792		17:32	17,951	53,249	Av. G.W. 55,802			+ 100
	-	-	29.0	-	528						150	2700

Figure A7-1

Manifold Pressure = 29.2 inches Hg

Fuel Flow = 1129 lb/hr

IAS = 151 knots

TAS = 176 knots

Distance Traveled = 97 nautical miles

Time = 33 minutes

Fuel Consumed = 622 pounds

Gross Weight At End Of Cruise (Actual) = 63,978 pounds

Cruise At 1000 Feet Pressure Altitude
(Search Configuration).

Fuel consumed for descent to search altitude need not be computed since cruise fuel is figured to the search area and differences if fuel consumption at descent power and cruise power are negligible.

Fuel consumed during search may be computed as one increment if desired, using the gross weight at end of cruise, applying the weight correction factor and computing an average gross weight for the entire 5 hours of search, based on fuel flow for the horsepower required at beginning of the search pattern. From figure A5-2 it is determined that the power requirement for the start of the search pattern is approximately 500 BHP and from fuel flows given on the power schedules it can be seen that for the entire search portion of the mission, the fuel consumed will not reduce the gross weight enough to require reduction to the next even horsepower increment of 450 BHP. Search cruise at a constant power of 500 BHP would result in airspeeds in excess of the 120 knots IAS recommended for search pattern as fuel is burned off. For this reason it is recommended that fuel consumption for the search portion of the mission be computed on the basis on one hour increments, with power requirements reduced to the nearest 5 BHP.

From figure A5-2, rough calculation indicates the horsepower required for the first increment of the search pattern to be approximately 500 BHP. From figure A2-12, the fuel flow for this power setting is found to be 864 lb/hr. Determine the average gross weight for the first increment of search by subtracting one half the fuel flow from the gross weight at end of cruise and adding the correction factor for 500 BHP (63,778 - 432 + 2025 = 65,371 pounds). From this figure, determine the actual power requirements from figure A5-2 as 500 BHP (to nearest 5 BHP), and from figure A2-11, the required power settings as follows:

BHP = 500

Rpm = 1600

Manifold Pressure = 30.0 inches Hg

Fuel Flow = 864 lb/hr.

The average gross weight for second increment is computed as 64,507 pounds by subtracting the fuel flow from the average gross weight for the first increment (63,371 - 864 = 64,507 pounds). Compute power requirements of 490 BHP from figure A5-2, and determine the power settings by interpolation between figures A2-11 and A2-12 as follows:

Rpm = 1600

Manifold Pressure = 29.6 inches Hg

Fuel Flow = 850 lb/hr.

Repeat this procedure for remainder of the search portion of the mission. Summary of conditions at end of search is as follows (see figure A7-1):

Gross Weight At End Of Search = 59,572 pounds

Total Fuel used = 11,628 pounds

Total Distance Traveled = 1600 nautical miles

Climb to 7000 Feet Pressure Altitude.

Climb to 7000 feet pressure altitude at the end of the search pattern will be made at climb power settings. The gross weight at start of climb is 59,572 pounds. Time, distance and fuel to climb are determined from figure A4-3 as follows:

Time to Climb = 7 minutes

Distance to Climb = 16 nautical miles

Gross Weight at End Of Climb = 59,278 pounds

Fuel Consumed During Climb = 285 pounds

Cruise at 7000 Feet Pressure Altitude.

Cruise at 7000 feet pressure altitude will be made at long range power settings, computed to the nearest 50 BHP increment. For the gross weight at end of climb, the closest brake horsepower increment is 500 BHP. Apply the weight correction factor for 500 BHP to the gross weight at end of climb to obtain a performance weight of 61,303 pounds (59,278 + 2025 = 61,303 pounds). From figure A5-1 it is determined that 550 BHP is the nearest even power increment that will achieve recommended long range airspeeds at this weight. Power settings obtained from figure A2-10 for this power and cruise altitude are as follows:

Rpm = 1700

Manifold Pressure = 28.9 inches Hg

Fuel Flow = 952 lb/hr

Comparison of the fuel flow for this portion of cruise against the fuel flow for the outbound cruise indicates that the entire return cruise can be made at the initial power setting of 550 BHP. By estimating on the basis of time required to reach the search area, an approximate average gross weight can be

computed to establish an airspeed for the return cruise. Fuel flow for 550 BHP multiplied by one half the outbound cruise time, subtracted from the corrected gross weight at start of return cruise gives an approximate average gross weight of 58,756 pounds. For this gross weight the average airspeeds at 550 BHP are computed as 151 knots IAS and 170 knots TAS. Time required to cruise 984 nautical miles is 5 hours 47 minutes (984 nautical miles ÷ 170 knots = 5:47). Fuel required for cruise is 5510 pounds (952 x 5:47). Summary for conditions at end of cruise are as follows:

Average TAS = 170 knots

Time to Cruise = 5 hours 47 minutes

Fuel Consumed During Cruise=5510 pounds

Gross Weight At End Of Cruise (Actual) = 53,777 pounds

Reserve Fuel and Cargo.

To determine the amount of cargo that can be carried, the reserve fuel load must be computed. The reserve fuel load for this mission was specified as fuel to cruise for 100 nautical miles at sea level plus ten percent of the fuel load at takeoff. Using the gross weight at end of cruise of 53,777 pounds, apply the weight correction factor for 500 BHP of 2025 pounds to obtain a performance weight of 55,802 pounds. From figure A5-1 it is determined that 450 BHP is the nearest even power increment that will provide an airspeed approximating the long range airspeed, and that the airspeed for this power, gross weight and altitude is 145 knots IAS and 150 knots TAS. Power settings from figure A2-12 are as follows:

Rpm = 1600

Manifold pressure = 29.0 inches Hg

Fuel Flow = 792 lb/hr

Time required to cruise for 100 nautical miles is 40 minutes (100 ÷ 150 = 0:40), fuel used is 528 pounds (792 x 0:40 = 528). Summary of reserve fuel and total fuel consumption is as follows:

Fuel Consumed (100 nautical miles = 528 pounds

Required Fuel Load At Takeoff = 17,951 pounds

Reserve Fuel (10 percent of takeoff fuel) = 1795 pounds

Total Fuel Load At Takeoff = 19,746 pounds

Operating weight empty plus fuel load at takeoff is 61,181 pounds (41,435 + 19,746 = 61,181). Therefore, maximum cargo load is 10,019 pounds (71,200 - 61,181 = 10,019).

CONSTANT POWER OPERATION PROBLEM.

The following sample problem is a typical cargo mission for this type of aircraft. The mission requires that the aircraft take off; climb to 10,000 feet density altitude; cruise at 10,000 feet density altitude for 1000 miles at 750 brake horsepower per engine and descend; and land with enough reserve fuel for 3 hours cruise at 10,000 feet.

❚ Conditions.

❚ Cruise Conditions.

Atmospheric Condition = Standard day

Headwind = 20 knots

Cruise Distance = 1000 nautical miles

Cruise Altitude = 10,000 feet density altitude

Cruise Power = 750 BHP per engine

Reserve Fuel (maximum endurance airspeed) = 3 hours at 10,000 feet density altitude

Takeoff Conditions.

Pressure Altitude = Sea level

Outside Air Temperature = 24°C

Density Altitude = 1050 feet

Specific humidity = 0.015

Dew Point = 71°F

Reported Headwind = 20 knots (use 50 percent = 10 knots)

Runway Length Available = 5500 feet

Runway Slope = 0.012 uphill

Rolling Coefficient Of Friction = 0.015

Runway Condition Reading = 18

Obstacle Height Above Runway = 60 feet

Obstacle Distance From End Of Runway = 3500 feet

Empty Operating Weight, including oil (gross weight less fuel and cargo) = 41,435 pounds

Cargo Weight = 19,265 pounds

Brake Horsepower Available For Takeoff = 1365 BHP

Predicted Manifold Pressure = 50.0 inches Hg

Fuel For Warmup (300 pounds) and Takeoff (100 pounds) = 400 pounds

Climb Power = 950 BHP per engine (33 inches Hg MAP and 2300 rpm)

Landing Conditions (Destination).

Pressure Altitude = 1500 feet

Outside Air Temperature = 30°C

Density Altitude = 3600 feet

Reported Headwing = 30 knots (use 50 percent = 15 knots)

Runway Condition Reading (RCR) = 12

Reserve Fuel and Landing.

To determine the reserve fuel, first solve for the landing weight less the reserve fuel. This is equal to the operating weight empty plus the cargo, or 60,700 pounds (41,435 + 19,265 = 60,700). Estimate the fuel required to cruise for three hours at destination. Since time for holding, rather than distance is the primary factor, maximum endurance of airspeeds may be used for this portion of the mission. Using a fuel flow of 800 pounds per hours as an estimate of fuel consumption at maximum endurance airspeeds for low gross weights, the estimated fuel reserve will be 2400 pounds (800 lb/hr x 3 hours = 2400). Check this figure by computing the average gross weight for the final 3 hours of holding as 61,900 pounds (landing weight plus one half the reserve fuel). From figure A5-1 power required to cruise at maximum endurance airspeeds at this gross weight is determined as 475 BHP per engine. From figures A2-11 and A2-12, fuel flow for this power setting is 835 pounds per hour. Using this figure as the average for the 3 hours, determine gross weight at end of cruise as 63,205 pounds (835 x 3 = 2505 + 60,700 = 63,205).

Determine total landing distance from 50 foot height and landing ground roll for this weight and reported conditions at destination from figures A6-1 and A6-2. Threshold and touchdown speeds are obtained from figure A6-3 and go-around speed is obtained from figure A3-4. Data for landing at destination are as follows:

Gross Weight = 63,205 pounds

Total Landing Distance From 50 Foot Height = 3760 feet

Landing Ground Roll = 3220 feet

Threshold Speed = 93 knots IAS

Touchdown Speed = 88 knots IAS

Go-Around Speed = 95 knots IAS

Cruise at 10,000 Feet Density Altitude.

Knowing the weight at the end of cruise, the actual cruise distance is estimated to determine the weight at the beginning of cruise. Assume that the climb distance is 50 nautical miles, leaving 950 nautical miles to be flown in cruise at 10,000 feet density altitude. Estimate the cruise fuel as 7500 pounds; thus, the average cruise weight is 66,955 pounds $(63,205 + \frac{7500}{2} = 66,955)$. Enter figure A5-1 at 750 BHP and 66,955 pounds at 10,000 feet density altitude and read true airspeed as 197 knots. Enter figure A2-6 at 10,000 feet pressure altitude and read fuel flow as 1360 pounds per hours. Ground speed is true airspeed minus headwind or 177 knots (197 - 20 = 177). Estimated time elapsed in 5.37 hours (950 ÷ 177 = 5.37). The estimated fuel used during cruise is then 7303 pounds (1360 x 5.37 = 7303). The estimated gross weight at the start of cruise is then 70,508 pounds (63,205 + 7303 = 70,508). This is also the gross weight at end of climb.

From figure A4-3 it is determined, with a gross weight of 70,508 pounds, that the distance traveled in climb to 10,000 feet is 44 nautical miles, and the time required is 0.32 hours (19 minutes). It is assumed that an average of 75 percent of the headwind at 10,000 feet is encountered during the climb. This will decrease the climb distance by 5 nautical miles (0.75 x 0.32 x 20). The distance to climb is then 39 nautical miles. The distance in cruise is then 961 nautical miles (1000 - 39 = 961).

With the actual cruise distance known to be 961 nautical miles an accurate tabulation of

elapsed ime, fuel used and gross weight at start of cruise can be determined. From the estimated cruise values above it is known that ground speed is 177 knots and fuel flow is 1360 pounds per hour. The elapsed time during cruise is 5.43 hours (961 ÷ 177 = 5.43). The fuel used is 7385 pounds (5.43 x 1360 = 7385). Therefore, the gross weight at the start of cruise is 70,590 pounds (63,205 + 7385 = 70,590).

Climb to 10,000 Feet Density Altitude.

From figure A4-3 determine time, distance and fuel to climb for a gross weight at end of climb of 70,590 pounds and cruise altitude of 10,000 feet as follows:

Distance Traveled = 45 nautical miles

Time To Climb = 19 minutes

Weight At Start Of Climb = 71,200 pounds

The fuel used during climb is 610 pounds (71,200 - 70,590 = 610).

Takeoff and Ground Operation.

The takeoff gross weight is 71,600 pounds (71,200 + 400 = 71,600). Before determining takeoff performance, check to see if the proposed takeoff is permitted by the takeoff conditions.

Structural Limit For Normal Operation (See Section V) = 73,000 pounds

Maximum Takeoff Weight Based On Three-Engine Climb Performance At 50 Feet Per Minute Rate Of Climb (See figure A3-2) = 76,000 pounds

Maximum Takeoff Weight Based On Runway Slope and Three-Engine Capability At Takeoff (See figure A3-2) = 72,800 pounds

Critical Field Length (See figure A3-7) = 3700 feet

The proposed takeoff gross weight of 71,600 pounds is less than any of the limiting weights, and the critical field length is less than the available runway length, therefore, the takeoff is permitted if obstacle clearance is adequate.

Determine obstacle clearance for three-engine operation to include the possibility of engine failure after takeoff. Add the runway length to the obstacle distance from end of runway to determine distance from start of takeoff of 9000 feet. With this distance and a critical field length of 3700 feet, height above the takeoff surface is determined as 230 feet from figure A3-11. Subtract the height of the obstacle from this figure to obtain a clearance margin of 170 feet (230 - 60 = 170).

Since the flight path will clear the obstacle by an adequate margin and the other takeoff limits are not exceeded, takeoff is permitted at the proposed gross weight of 71,600 pounds. Compute the following data and enter on the Takeoff And Landing Data Cards.

Takeoff Ground Run = 2930 feet

Critical Field Length = 3700 feet

Acceleration Check Distance/Time = 2000 feet/28 seconds

Acceleration Check Speed = 89 knots IAS

Refusal Speed = 100 Knots IAS

Refusal Distance = 2820 feet

Takeoff Speed = 101 knots IAS

Wing Flap Retraction Airspeed = 122 knots IAS

Compute the following data for landing imme-
diately after takeoff, based on takeoff gross
weight, and enter the data on the card.

Threshold Speed = 100 knots IAS

Touchdown Speed = 93 knots IAS

Landing Ground Roll = 2530 feet

Landing Ground Roll Corrected for RCR =
3130 feet

Total Landing Distance = 3650 feet

T.O. 1C-54D-1

C-54 TAKEOFF DATA CARD

CONDITIONS

GROSS WEIGHT ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ 71,600 Pounds
RUNWAY LENGTH ⋯⋯⋯⋯⋯⋯⋯⋯⋯ 5500 Feet
RUNWAY SLOPE ⋯⋯⋯⋯⋯⋯⋯ Uphill 0.012 Percent
FIELD ELEVATION ⋯⋯⋯⋯⋯⋯⋯⋯⋯ 150 Feet
PRESSURE ALTITUDE ⋯⋯⋯⋯⋯⋯ Sea Level Feet
DENSITY ALTITUDE ⋯⋯⋯⋯⋯⋯⋯ 1050 Feet
CAT ⋯⋯⋯⋯ 24° C   CAT ⋯⋯⋯⋯⋯ 24° C
DEW POINT ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ 71° F
WIND COMPONENT ⋯⋯⋯⋯⋯⋯ 20 Knots Headwind
RUNWAY CONDITION READING (RCR) ⋯⋯⋯⋯ 18

TAKEOFF

PREDICTED MANIFOLD PRESSURE ⋯⋯ 50.0 In. Hg
BRAKE HORSEPOWER AVAILABLE ⋯⋯ 1365 BHP
TAKEOFF GROUND RUN ⋯⋯⋯⋯⋯⋯ 2930 Feet
CRITICAL FIELD LENGTH ⋯⋯⋯⋯⋯ 3700 Feet
ACCELERATION CHECK MARKER/
TIME ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ 2000 ft/28 sec.
ACCELERATION CHECK SPEED ⋯⋯⋯ 89 Knots
REFUSAL SPEED ⋯⋯⋯⋯⋯⋯⋯⋯ 100 Knots
TAKEOFF SPEED (LIFTOFF) ⋯⋯⋯⋯ 101 Knots
FLAP RETRACTION SPEED ⋯⋯⋯⋯ 122 Knots

LANDING IMMEDIATELY AFTER TAKEOFF

THRESHOLD SPEED (130%) ⋯⋯⋯⋯⋯ 100 Knots
TOUCHDOWN SPEED (120%) ⋯⋯⋯⋯ 93 Knots
TOTAL LANDING DISTANCE ⋯⋯⋯⋯ 3650 Feet

Figure A7-2

T. O. 1C-54D-1

C-54 LANDING DATA CARD

CONDITIONS

GROSS WEIGHT . . . . 63, 205 Pounds
RUNWAY LENGTH . . . . 6, 000 Feet
RUNWAY SLOPE . . . . None Percent
FIELD ELEVATION . . . . 200 Feet
PRESSURE ALTITUDE . . . . 1500 Feet
DENSITY ALTITUDE . . . . 3600 Feet
TEMPERATURE . . . . 30° C
WIND COMPONENT . . . . 30 Knots Headwind
RUNWAY CONDITION READING (RCR) 12

LANDING

THRESHOLD SPEED (130%) . . . . 93 Knots
TOUCHDOWN SPEED (120%) . . . . 88 Knots
GO-AROUND SPEED (TAKEOFF) . . . . 95 Knots
TOTAL LANDING DISTANCE . . . . 3760 Feet

Figure A7-3

ALPHABETICAL INDEX

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V

W

POWER SCHEDULE
600 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

ENGINES: R-2000
FUEL GRADE: 100/130

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	BLOWER	BMEP (PSI)	FUEL FLOW LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°				PER ENG	4 ENG
20,000	27.3	27.2	27.7	27.9	F.T.		2150	HIGH	111	288	1152
19,000	27.4	27.9	27.7	28.2	28.4						
18,000	28.3	27.9	28.4	28.3	28.7		2100	HIGH	113	285	1141
17,000	28.4	28.9	28.6	29.1	29.6						
16,000	24.3	29.0	29.5	29.1	29.6		2000	HIGH	119	280	1120
15,000	24.4	24.9	29.6	30.1	29.7						
14,000	25.3	25.0	25.5	30.2	30.7		1900	HIGH	125	274	1096
13,000	25.4	25.9	25.7	26.2	30.8						
12,000	26.5	26.1	26.6	26.4	26.9						
11,000	26.6	27.1	26.7	27.2	27.1	27.6	2100	LOW	113	272	1088
10,000	28.0	27.3	27.8	28.3	27.9	27.8					
9,000	28.2	28.7	28.0	28.5	29.0	28.6	2000	LOW	119	268	1073
8,000	29.7	28.8	29.3	28.7	29.2	29.7	1900	LOW	125	264	1056
7,000	29.9	30.4	29.5	30.1	30.6	29.9					
6,000	32.0	30.6	31.1	30.3	30.8	31.3	1800	LOW	132	260	1040
5,000	32.1	32.6	31.3	31.8	31.0	31.5					
4,000	32.2	32.7	33.2	32.0	32.5	31.7					
3,000	32.3	32.8	33.3	33.8	32.7	33.2	1700	LOW	140	256	1024
2,000	32.4	32.9	33.4	33.9	34.4	33.4					
1,000	32.5	33.0	33.5	34.0	34.5	35.0	1600	LOW	149	252	1008
SEA LEVEL	32.6	33.1	33.6	34.1	34.6	35.1					

Note: Do NOT operate in High Blower above +15°C CAT.

MODEL: C-54
DATE: 6-15-63
DATA BASIS: FLIGHT TEST

POWER SCHEDULE
650 BRAKE HORSEPOWER PER ENGINE
AUTO LEAN

ENGIN_
FUEL GRADE: 1U͟

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN. Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	BLOWER	BMEP (PSI)	FUEL FLOW LB/HR	
	−20°	−10°	0°	+10°	+20°	+30°				PER ENG	4 ENG
20,000	28.5	28.8	F.T.	F.T.			2150	HIGH	120	312	1248
19,000	28.6	29.1	29.3	29.8	F.T.						
18,000	29.3	29.2	29.6	30.0	30.4						
17,000	29.4	29.9	29.7	30.1	30.6		2100	HIGH	123	310	1240
16,000	25.0	30.0	30.5	30.9	30.7						
15,000	25.1	25.6	30.5	31.0	31.5						
14,000	26.0	25.8	26.3	31.1	31.6		2000	HIGH	129	303	1212
13,000	26.2	26.7	26.4	26.9	31.7						
12,000	27.2	26.9	27.4	27.1	27.6	28.1	2200	LOW	117	297	1188
11,000	28.5	27.9	27.6	28.1	27.7	28.2					
10,000	28.7	29.2	28.6	29.1	28.8	29.3	2100	LOW	123	292	1168
9,000	30.1	29.4	29.9	29.4	29.9	29.5					
8,000	30.3	30.8	30.1	30.6	30.1	30.6	2000	LOW	129	287	1148
7,000	30.4	30.9	31.4	30.8	31.3	30.8					
6,000	30.6	31.1	31.6	32.1	31.5	32.0	1900	LOW	135	282	1129
5,000	30.8	31.3	31.8	32.3	32.8	32.2					
4,000	31.0	31.5	32.0	32.5	33.0	33.5					
3,000	31.2	31.7	32.2	32.7	33.2	33.7					
2,000	31.4	31.9	32.4	32.9	33.4	33.9	1800	LOW	143	278	1113
1,000	31.6	32.1	32.6	33.1	33.6	34.1					
SEA LEVEL	31.8	32.3	32.8	33.3	33.8	34.3					

Note: Do NOT operate in High Blower above +15°C CAT.