# part 3 takeoff

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### INTRODUCTION.

The takeoff and climbout performance charts are presented for various gross weights and altitudes for standard atmospheric conditions. Headwind, runway slope, specific humidity and nonstandard temperature may be taken into account by use of correction plots. In all charts, the wind corrections given are based on 50 percent of effective headwind and, where tailwinds are included, 150 percent of the effective tailwind. This allows a safety margin for fluctuation of wind velocity. It is assumed that the wind speed is measured at a height of 50 feet above the ground. Allowance is made for wind gradient from 50 feet down to the approximate height of the airplane on the ground, where the wind velocity is slightly reduced. In charts showing temperature corrections, the equivalent density altitude obtained for any given combination of outside air temperature and pressure altitude includes the effect of air temperature on power output. However, the engine manufacturer's limiting maximum brake horsepower of 1450 is observed. Each of takeoff and climbout performance charts is discussed in detail in the paragraphs that follow, using the terms covered in the following list of definitions. On each type of chart, its use is illustrated by a sample problem with chase-around lines.

### 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. Go-No-Go Speed and Distance — The go-no-go distance is the distance to the runway marker which is the first 1000-foot marker below the normal refusal 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 go-no-go speed. (See discussion on go-no-go method.) The go-no-go speed is the minimum speed allowable at the go-no-go distance 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 speed for a 15-degree flap setting or 110 percent of the minimum control speed, whichever is higher. (See figure A3-2 for the ground run and figure A3-11 for inflight use.)

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

8. Minimum Control Speed — This speed is determined from flight tests. In this test, with takeoff 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 speed is the 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.

### 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 *(figure A3-11)*.

2. The ability to take off within the available runway is shown on the Critical Field Length chart *(figure A3-5)*.

3. The ability to have adequate rate of climb when airborne is shown on the Gross Weight Limited by Three-Engine Climb Performance chart *(figure A3-1)*.

4. The ability to clear obstacles within the takeoff corridor is shown on the Takeoff Path — Three Engine chart *(figure A3-10)*.

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 them may be eliminated after cursory examination. The lowest weight determined by these factors will be the maximum takeoff gross weight.

## TAKEOFF WITHOUT ALLOWANCE FOR ENGINE FAILURE.

Charts are provided to show the takeoff performance of the aircraft without allowance for engine failure. They 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 this section by the Four-Engine Ground Run chart *(figure A3-2)* containing the indicated takeoff speed graph, and the Takeoff Distance to a 50-Foot Height chart *(figure A3-4)*. The effect of runway slope on the ground run is shown separately *(figure A3-3)*. These charts assume that acceleration is made on a hard surfaced runway to the indicated takeoff speed plotted on the ground run chart, and that this IAS is held during the climb to a 50-foot height. Also indicated on the takeoff speed graph for convenient reference are the design takeoff weights, which are discussed in Section V.

## 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 it 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 added safety margin. Performance shown assumes maximum power and a hard surface runway.

### Go-No-Go Method.

When the available run is substantially longer than the critical field length, the pilot may elect to utilize the go-no-go method instead of the critical field length method. One feature of the go-no-go method is that under certain circumstances 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.

The go-no-go marker and the go-no-go speed provide abort criteria in cases either of engine failure or inadequate acceleration. The takeoff is aborted if an engine fails before the go-no-go marker is reached or if the go-no-go marker is reached before the go-no-go speed is attained. If the engine fails after reaching the go-no-go marker, the takeoff is continued.

The go-no-go marker and the go-no-go speed are determined in the following manner.

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

2. Determine the refusal speed *(figure A3-6)*.

3. Enter the Speed During Takeoff Ground Run chart *(figure A3-7)* 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 contour line to the refusal speed (less the headwind) and read the refusal distance.

4. The go-no-go distance is the nearest 1000-foot runway marker below the refusal distance. Read the airspeed at the go-no-go distance *(figure A3-7)*. Add the headwind to obtain the go-no-go indicated airspeed.

If the go-no-go speed is less than the critical engine failure speed, it may not be possible to accelerate the aircraft to takeoff speed if an engine should fail shortly after attaining the go-no-go speed. In such cases, the critical engine failure speed should be the abort criterion rather than the go-no-go marker.

It is possible for the aircraft performance to be better than predicted. This situation can arise from an unanticipated power increase due to overboosting of the engines on cold days, a drop in humidity, or a drop in temperature. The result can be acceleration to a higher speed than expected at the go-no-go marker, from which the aircraft might not be stopped within the remaining length of runway. Normally, the takeoff is aborted if an engine fails before the go-no-go marker is reached, or if the indicated airspeed at the go-no-go marker is less than the go-no-go speed. In addition, to avoid an attempt to stop from too high a speed, the takeoff should be continued if an engine fails after the aircraft has attained the go-no-go speed, even though the go-no-go marker has not been reached.

The following steps summarize what action should be taken when using the go-no-go method.

1. **STOP** (abort takeoff):

   a. If go-no-go speed is not attained by the time go-no-go marker is reached.

   b. If engine failure occurs before go-no-go speed is attained.

2. **GO** (continue takeoff): If engine failure occurs after reaching go-no-go speed.

**Go-No-Go Speed Tolerance.**

When the available runway is substantially longer than the critical field length and the proposed takeoff weight is less than the maximum takeoff gross weight, there will be a speed tolerance allowable for the go-no-go speed. The minimum value of go-no-go speed, from which a takeoff can successfully be completed in the event of an engine failure, may be determined as follows:

1. Determine maximum takeoff gross weight for takeoff conditions (see text on Maximum Takeoff Gross Weight).

2. Determine ground run and takeoff speed for maximum takeoff gross weight *(figure A3-2).*

3. Enter chart of Speed During Ground Run *(figure A3-7)* with this ground run and takeoff speed (less headwind).

4. Follow down contour to predetermined go-no-go marker distance and read speed.

5. Add headwind to this speed to obtain the minimum allowable go-no-go speed.

The object of this procedure is to insure obstacle clearance and adequate rate of climb as well as ability to take off should engine failure occur after the go-no-go speed has been attained.

## GROSS WEIGHT LIMITED BY THREE-ENGINE CLIMB PERFORMANCE CHART.

The effect of temperature, pressure, and humidity on climb performance and of wind on the flight path slope cannot be shown accurately for the limit lines on the critical field length chart; therefore, a separate plot is provided *(figure A3-1).* This chart is based upon the climbing ability of the aircraft immediately after takeoff, before gear retraction or propeller feathering. For given conditions, it gives the maximum weight at which the airplane can take off at a zero to 50-foot-per-minute rate of climb with one engine inoperative, neglecting ground effect. A rate of climb capability of 50 feet per minute at takeoff means that the aircraft will climb a minimum of about 10 feet above the point of takeoff in the first 1300 feet of airborne travel. This corresponds to the flight path for a critical field length of about 4500 feet. This is shown in the Three-Engine Takeoff Path Chart *(figure A3-10).*

In determining the ability of the aircraft to leave the runway with a particular gross weight, the slope of the runway 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 desirable margin, and, therefore, to what takeoff weight the aircraft may be limited by the runway slope. A correction for wind speed is provided to account for the variation in flight path slope with wind speed.

## GROUND RUN CHART.

This chart *(figure A3-2)* is discussed under Takeoff Without Allowance for Engine Failure.

## RUNWAY SLOPE CORRECTION CHART.

This chart *(figure A3-3)* is discussed under Takeoff Without Allowance for Engine Failure.

## TOTAL DISTANCE TO A 50-FOOT HEIGHT CHART.

This chart *(figure A3-4)* is discussed under Takeoff Without Allowance for Engine Failure.

## CRITICAL ENGINE FAILURE SPEED AND FIELD LENGTH CHART.

Critical engine failure speed and critical field length are defined under Definition of Terms, and their significance and use are discussed under Takeoff With Allowance for Engine Failure. The use of the chart *(figure A3-5)* is further clarified by a sample problem and chase-around line. This chart is based on the following configuration and assumptions.

1. Wing flap deflection is 15 degrees.

2. The most critical engine (No. 1) fails at the critical engine failure speed.

3. If takeoff is continued:

   a. Drag after engine failure, includes that resulting from the windmilling outboard propeller and the deflected rudder and aileron.

   b. The aircraft leaves the runway at the takeoff speed shown on the Ground Run chart *(figure A3-2).*

4. If takeoff is aborted:

   a. After engine failure, the aircraft continues to accelerate for 3 seconds on the remaining three engines at which time power is reduced to zero and brakes are applied. (It is understood that once the decision is made to abort takeoff, the throttles will be closed and the brakes applied as soon as possible.)

   b. The aircraft is decelerated with wheel braking only.

**REFUSAL SPEED CHART.**

The refusal speed is defined under Definition of Terms. On the Refusal Speed chart *(figure A3-6)*, a sample problem and chase-around lines illustrate how to read the chart.

This chart is based on the assumptions listed above for the Critical Field Length chart.

There are four kinds of limits which should be observed when using the refusal speed chart. Three of these are represented on the graph: takeoff speed, a brake performance limit, and design takeoff weights. The refusal speed is not shown in excess of the takeoff speed. The brake performance limit is labeled maximum recommended refusal speed, and for a given takeoff weight it is the speed at which the aircraft possesses the maximum kinetic energy from which a stop has been tested. The third limit, design takeoff weights, is discussed in Section V of this manual.

In addition, as a fourth limit, the refusal speed should never be less than the critical engine failure speed, which is obtained from figure A3-5. Generally, this would occur only if the available runway 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.

**SPEED DURING GROUND RUN CHART.**

This chart *(figure A3-7)* is based on the character of acceleration during the takeoff ground run with four engines operating. Each line gives a particular relationship of indicated airspeed to distance from start of takeoff. As explained in detail under Takeoff With Allowance for Engine Failure (Go-No-Go Method), this chart is entered with the ground run for the actual takeoff conditions and with an indicated airspeed which equals the takeoff speed less the effective headwind (or plus the tailwind). In this way, the appropriate contour is located.

**DISTANCE TO STOP—ABORTED TAKEOFF CHART.**

This chart *(figure A3-8)* provides the distance required to stop from any indicated airspeed up to the highest takeoff speed at altitudes from sea level to 8000 feet. The stopping curves assume windmilling propellers and takeoff wing flap deflection of 15 degrees. They are generally applicable to all takeoff gross weights. However, at high weights and speeds, varying degrees of brake fading may be experienced. See the Refusal Speed chart *(figure A3-6)* for a recommended maximum indicated airspeed from which reliable braking can be expected.

**TAKEOFF PATH—FOUR ENGINES.**

A Takeoff Path chart *(figure A3-9)* is included for 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 airports.

The flight path chart gives the relationship between height attained above the runway surface and horizontal distance travelled from the start of takeoff roll. Each curve is for a specified four-engine takeoff distance over a 50-foot height. 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 roll), the flight path chart can be used to read the corresponding takeoff distance over a 50-foot height. This distance can then be used to enter the takeoff distance chart to obtain the permissible takeoff gross weight for this particular obstacle.

The Four-Engine Takeoff Flight Path chart was prepared using a constant climbing speed of 15 percent above the zero thrust, gear up, stalling speed. Landing gear retraction is initiated at takeoff and requires 6.7 seconds to be completed. The drag of the fully extended gear is assumed to exist until the gear is completely retracted. The flight path charts terminate at a height of 300 feet. In no case is the 5-minute MAX-power limit exceeded. Ground effect has not been included.

**TAKEOFF PATH—THREE ENGINES.**

The Three-Engine Takeoff Path chart *(figure A3-10)* is shown in the same form as the Four-Engine Takeoff Path chart *(figure A3-9)*, and is based on a specified takeoff distance with engine failure. The use of this chart differs from the Four-Engine Takeoff Path 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 stalling speed for zero thrust and landing gear up). The climb is performed at this constant speed. Landing gear retraction is initiated at takeoff and requires 6.7 seconds to be completed. Propeller feathering is initiated at a 50-foot height or at the end of gear retraction, and requires 7.0 seconds. The drag of the fully extended gear is assumed to exist until the 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.

## CHARACTERISTIC TAKEOFF SPEEDS CHART.

Indicated stalling and takeoff speeds for a wing flap deflection of 15 degrees and indicated speeds recommended for wing flap retraction can be read from this chart *(figure A3-11)* for the range of possible takeoff weights. These indicated speeds are for inflight use only. They 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. See discussion of airspeed calibration in part 1.

The takeoff speed, minimum control speed, and flap retraction speed are discussed under definitions of terms in part 3.

## TAKEOFF AND LANDING CROSSWIND CHART.

The minimum touchdown or nosewheel liftoff speed, under crosswind conditions, may be determined by reference to the Takeoff and Landing Crosswind chart (figure A3-12). A heavy diagonal (recommended touchdown or nosewheel liftoff speed) line indicates the minimum speed at which directional control can be maintained with the rudder for various combinations of aircraft and crosswind velocities. If takeoff or touchdown is accomplished at a speed less than recommended, the aircraft will turn into the wind, tending to veer off the runway. After obtaining the runway heading and existing surface winds, compute the wind angle relative to the runway. Using this wind angle, enter the chart at zero headwind and zero crosswind angle (as determined by interpolation) to the appropriate wind velocity curve (point A). From point A, project a line vertically to the heavy diagonal line (point B). From point B, project a line horizontally to the speed scale, and read the minimum touchdown or nosewheel liftoff speed. If the takeoff speed as determined from figure A3-2 is less than that speed shown at point B, the speed shown at point B should be used for takeoff or touchdown. If the speed as determined from figure A3-2 is greater than that speed shown at point B, the speed as determined from figure A3-2 should be used for takeoff or touchdown. The headwind component can be determined by projecting a line horizontally from point A to the headwind component scale (point C). The crosswind component can be determined by projecting a vertical line from point A to the crosswind component scale (point D).

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 flight path rather than aircraft heading.

# TAKE-OFF GROSS WEIGHT LIMITED BY THREE-ENGINE CLIMB PERFORMANCE

THREE ENGINES OPERATING AT MAXIMUM POWER, GEAR DOWN
FLAPS = 15 DEGREES, TAKEOFF SPEED, NO GROUND EFFECT
INOPERATIVE PROPELLER WIND MILLING

MODEL: C-54 AND R5D

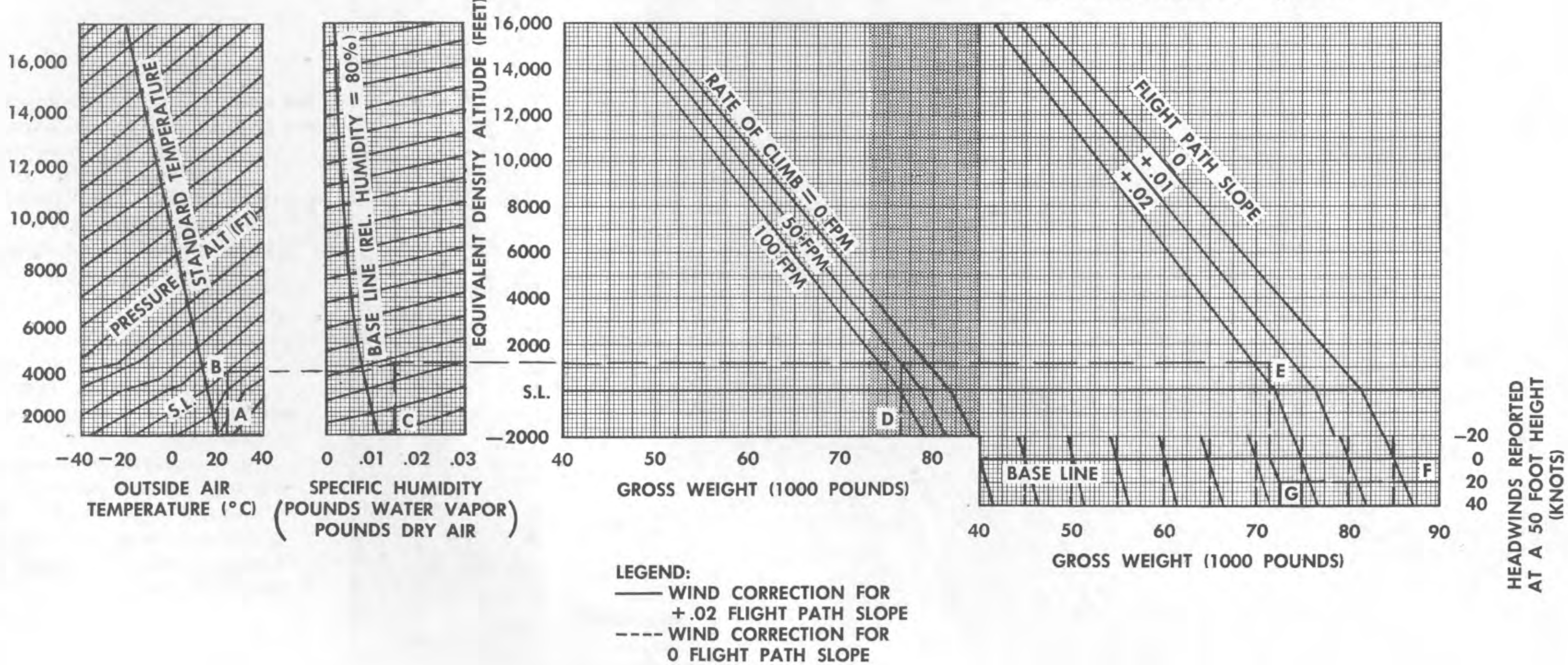
ENGINE(S): (4) R2000-4 AND -9M2

NOTES:

1. Flight path slope = height gained* / horizontal distance traveled*
2. Positive slope (+) = uphill
   *Measured from point of takeoff.
3. Use 50% of reported headwinds and 150% of reported tailwinds with the wind correction grid if wind is measured at a source other than the runway. This is a recommended procedure which may be revised at the discretion of the pilot, dependent upon the source of measurement of the wind data.

SAMPLE PROBLEM:

GIVEN: A. Outside Air Temperature = 24°C
B. Pressure Altitude = Sea level
C. Specific Humidity = .015
FIND: D. Maximum Weight for 50 FPM R/C at Take-off = 76,500 pounds
GIVEN: E. Runway Slope = .015
F. Headwind = 20 Knots
G. Take-off Flight Path Slope = Runway Slope at 72,500 pounds. Conclusion: Take-off with an engine failure is limited by runway slope to weights less than 72,500 pounds.




BASED ON: FLIGHT TEST DATA
DATA AS OF: 1-15-59

FUEL GRADE 100/130

Figure A3-1. Takeoff Gross Weight Limited by Three-Engine Climb Performance

MODEL: C-54 AND R5D
BASED ON: FLIGHT TEST DATA
DATA AS OF: 9-16-56

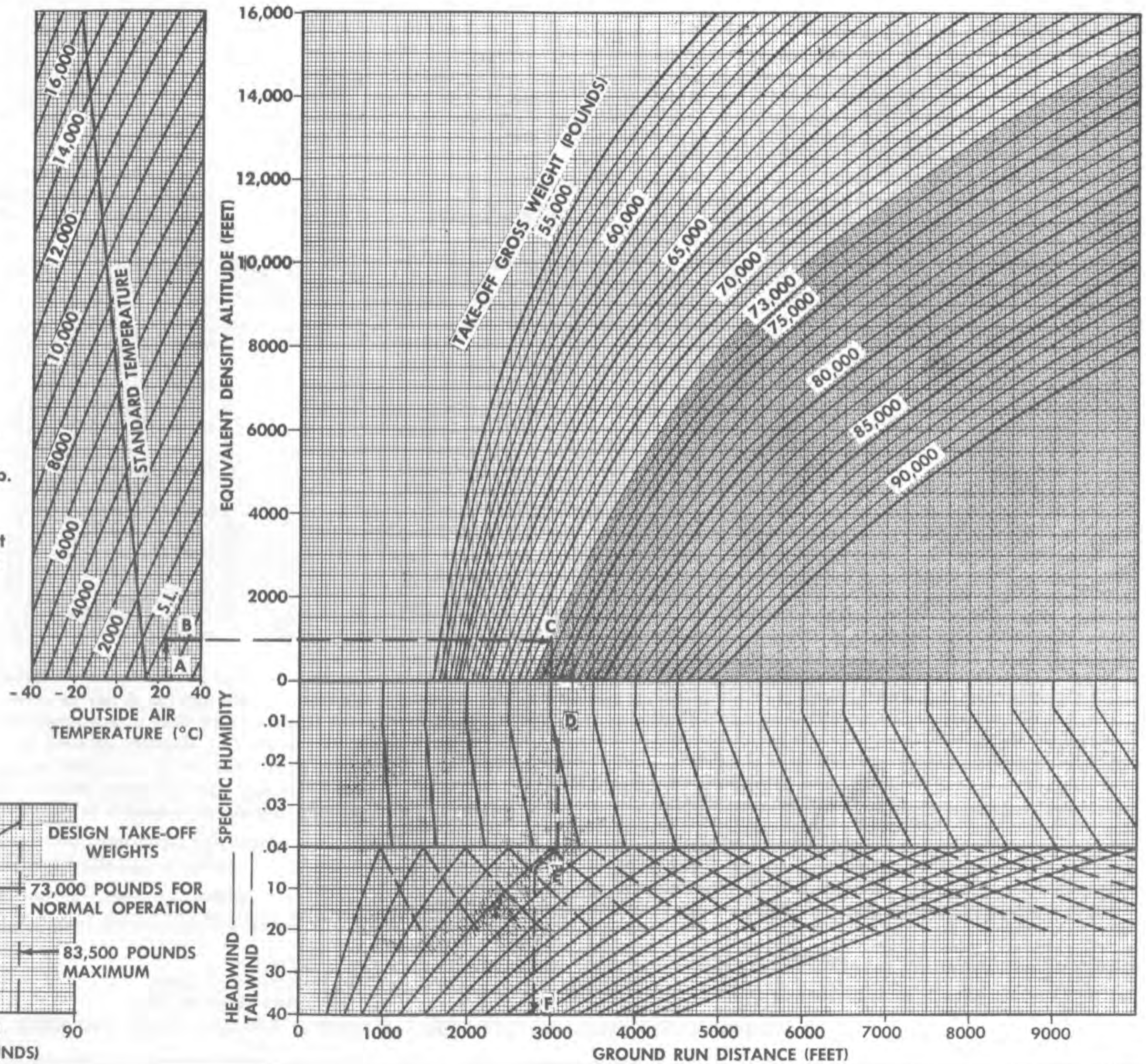
## TAKE-OFF PERFORMANCE GROUND RUN

1450 BHP AT SEA LEVEL COWL FLAPS IN OPEN TRAIL POSITION
WING FLAPS = 15° TAKEOFF SPEED = 115 PERCENT OF STALL SPEED
(ZERO THRUST) HARD SURFACE RUNWAY

ENGINE(S): (4) R2000-4 AND -9M2
FUEL GRADE: 100/130

NOTE:
Use 50% of reported headwinds and 150% of reported tailwinds with the wind correction grid if wind is measured at a source other than the runway. This is a recommended procedure which may be revised at the discretion of the pilot, dependent upon the source of measurement of the wind data.

SAMPLE PROBLEM:
A. Outside air temperature = 24°C.
B. Pressure altitude = sea level
C. Take-off gross weight = 72,410 lb.
D. Specific humidity = .015
E. Headwind = 10 knots
F. Ground run distance = 2825 feet
G. Take-off speed = 101.3 knots IAS



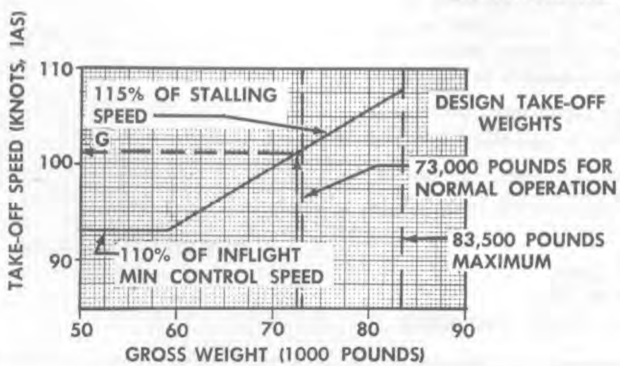




Figure A3-2. Takeoff Performance—Ground Run

## TAKEOFF GROUND RUN DISTANCE
## RUNWAY SLOPE AND SURFACE CONDITION CORRECTION

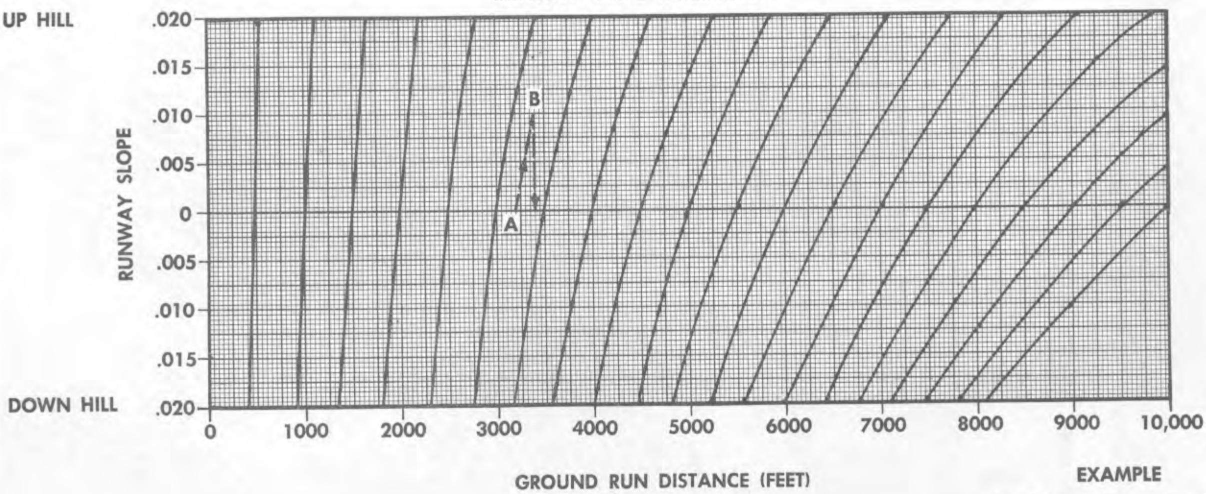
WING FLAPS = 15 DEGREES

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND -9M2

$$SLOPE = \frac{RUNWAY\ RISE\ (FEET)}{RUNWAY\ LENGTH\ (FEET)}$$

RUNWAY SLOPE CORRECTION

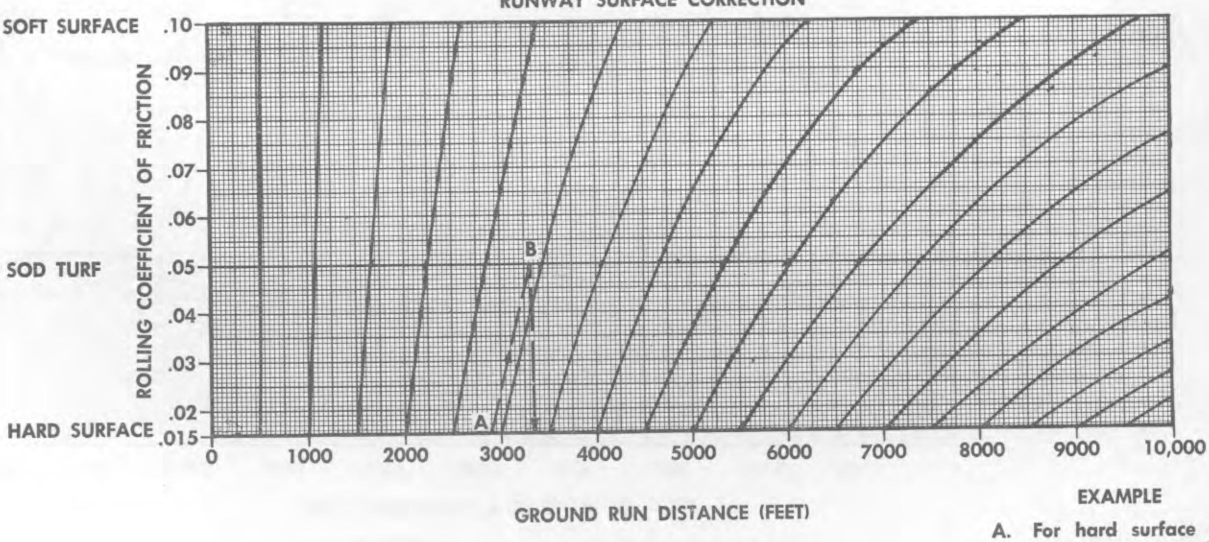



**EXAMPLE**

A. For zero runway slope: Takeoff ground run distance = 3200 feet

B. Correction for runway slope of .01 (10 feet rise per 1000 feet of runway): Takeoff ground run distance = 3400 feet

RUNWAY SURFACE CORRECTION




**EXAMPLE**

A. For hard surface runway takeoff ground run distance = 2905 feet

B. Correcting for sod turf runway takeoff ground run distance = 3310 feet

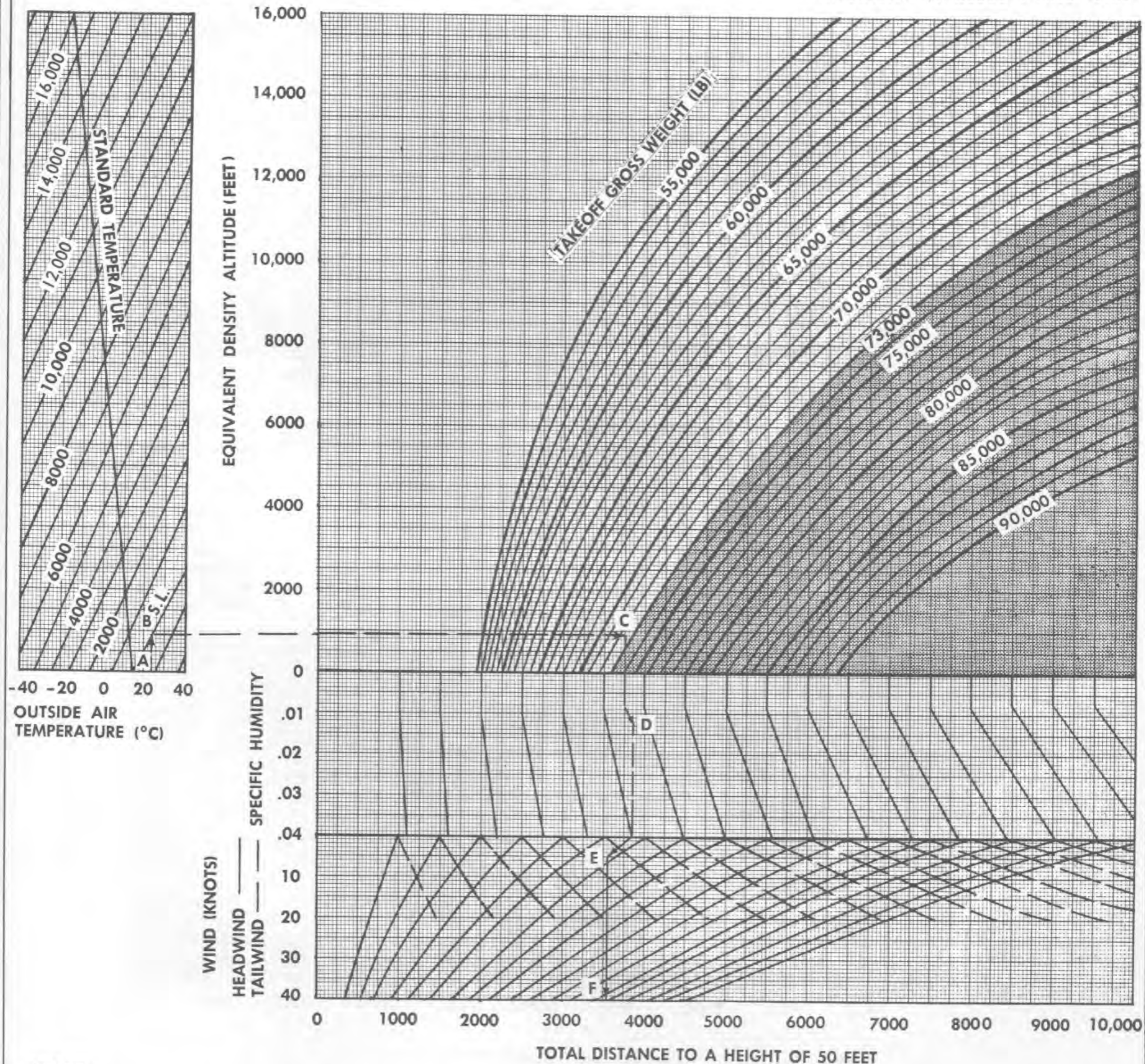
BASED ON: ESTIMATED DATA
DATA AS OF: 2-15-59

FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

*Figure A3-3. Takeoff Ground Run Distance — Runway Slope Correction — Wing Flaps 20 Degrees*

**TAKE-OFF PERFORMANCE**
**TOTAL DISTANCE TO A 50 FOOT HEIGHT**
**1450 BHP AT SEA LEVEL**
**COWL FLAPS IN OPEN TRAIL POSITION**
**WING FLAPS = 15°**
**$V_{T.O.}$ = 115% $V_S$ (ZERO THRUST)**
**HARD SURFACE RUNWAY**

**MODEL: C-54D/E AND R5D** **ENGINE(S): (4) R2000-4 AND -9M2**




**NOTE:**

**Use 50% of reported headwinds and 150% of reported tailwinds with the wind correction grid if wind is measured at a source other than the runway. This is a recommended procedure which may be revised at the discretion of the pilot, dependent upon the source of measurement of the wind data.**

BASED ON: FLIGHT TEST DATA
DATA AS OF: 9-16-56

SAMPLE PROBLEM

- A. Outside air temperature = 24°C
- B. Pressure altitude = sea level
- C. Take-off gross weight = 72,410 lb
- D. Specific humidity = .015
- E. Headwind = 10 knots
- F. Total distance to a 50 ft height = 3550 ft

FUEL GRADE: 100/130

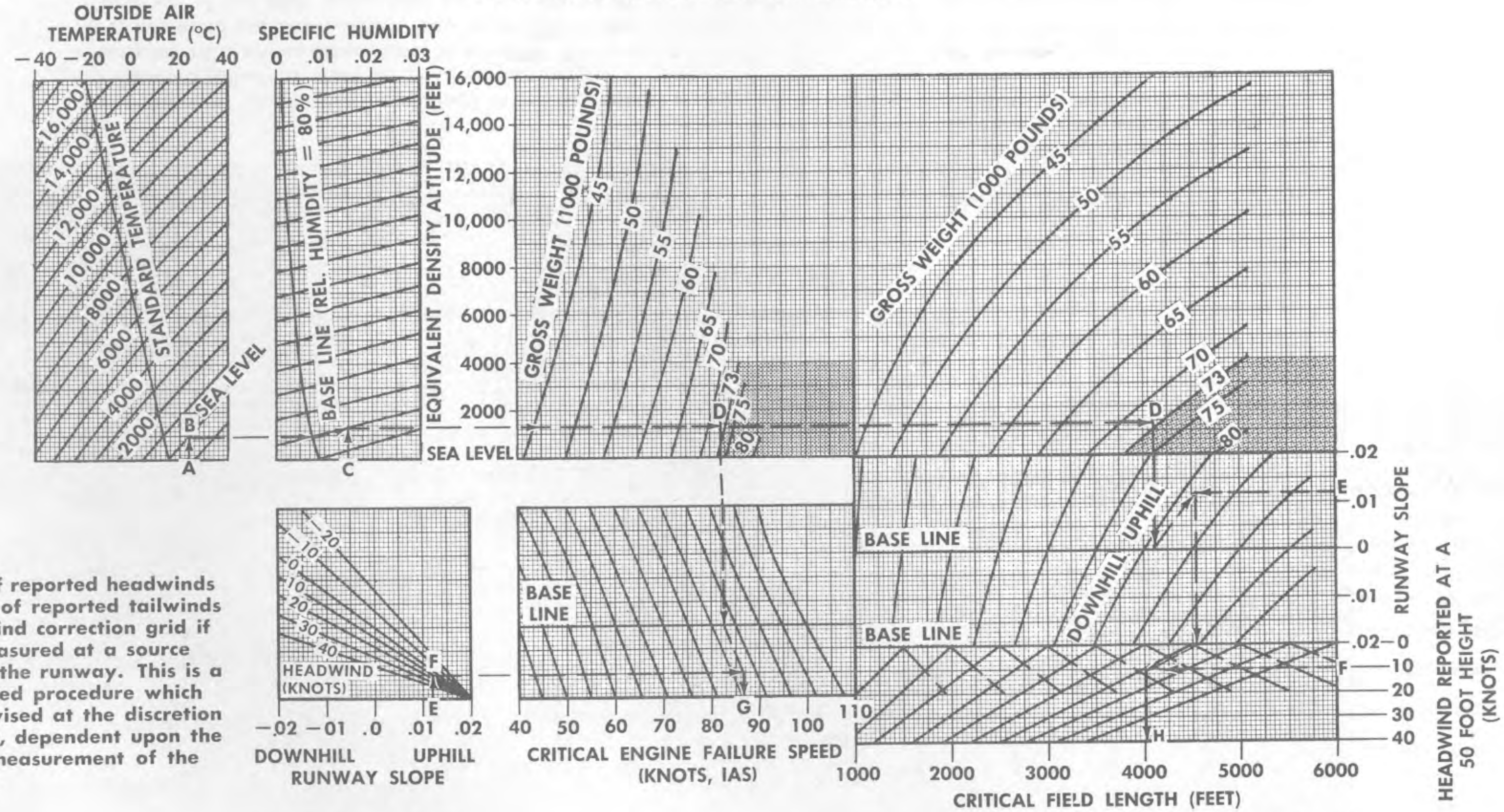
*Figure A3-4. Takeoff Performance—Total Distance to a 50-Foot Height*

MODEL: C-54 AND R5D
BASED ON: FLIGHT TEST DATA
DATA OF: 1-15-59

## TAKE-OFF PERFORMANCE
## CRITICAL ENGINE FAILURE SPEED AND FIELD LENGTH

TAKE-OFF SPEED = 115 PERCENT OF STALL SPEED (ZERO THRUST)
MAXIMUM POWER ~ COWL FLAPS IN OPEN TRAIL POSITION
WING FLAPS 15 DEGREES ~ HARD SURFACE RUNWAY
SEE FIGURE A3-1 FOR GROSS WEIGHT LIMIT
DUE TO THREE ENGINE CLIMB PERFORMANCE

ENGINE(S): (4) R2000-4
FUEL GRADE: 100/130




**NOTE:**
Use 50% of reported headwinds and 150% of reported tailwinds with the wind correction grid if wind is measured at a source other than the runway. This is a recommended procedure which may be revised at the discretion of the pilot, dependent upon the source of measurement of the wind data.

SAMPLE PROBLEM
GIVEN:
A. Outside air temperature = 24°C
B. Pressure altitude = sea level
C. Specific humidity = .015
D. Gross weight = 72,410 pounds
E. Runway slope = +.012
F. Headwind = 20 knots reported

FIND:
G. Critical engine failure speed = 86.5 knots, IAS
H. Critical field length = 4030 feet

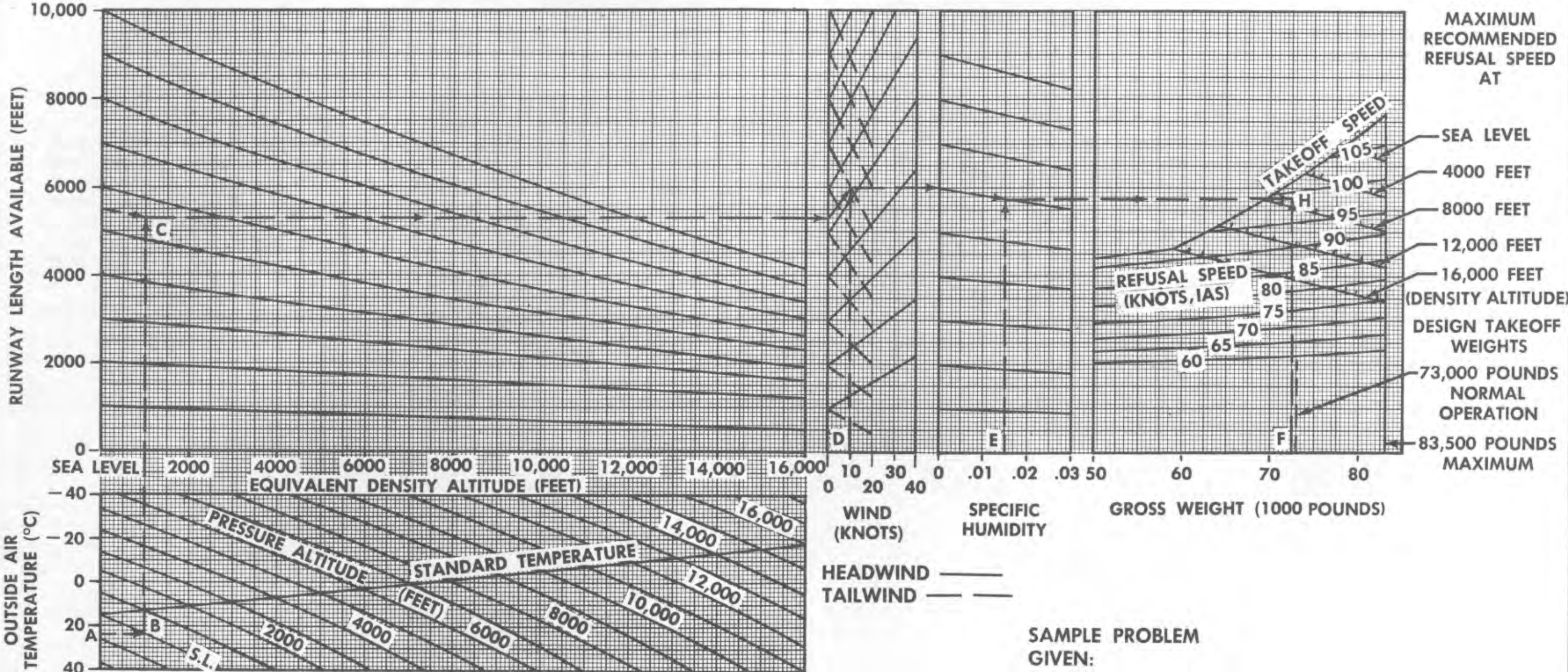
Figure A3-5. Takeoff Performance — Critical Engine Failure Speed and Field Length

## TAKEOFF PERFORMANCE
## REFUSAL SPEED

TAKEOFF SPEED = 115 PERCENT OF STALL SPEED (ZERO THRUST)
MAXIMUM POWER ~ COWL FLAPS IN OPEN TRAIL POSITION
WING FLAPS 15 DEGREES ~ HARD SURFACE RUNWAY
SEE FIGURE A3-1 FOR GROSS WEIGHT LIMIT
BY THREE ENGINE CLIMB PERFORMANCE

MODEL: C-54D AND R5D

ENGINE(S): (4) R2000-4




NOTE:
1. Use 50 **percent** of reported headwinds and 150 **percent** of reported tailwinds with the wind correction grid if wind is measured at a source other than the runway. This is a recommended procedure which may be revised at the discretion of the pilot, dependent upon the source of measurement of the wind data.
2. The effect of runway slope on refusal speed is negligible.
3. The maximum recommended refusal speed corresponds to the maximum energy at which C-54 brakes have been tested.

SAMPLE PROBLEM
GIVEN:
A. Outside air temperature = 24°C
B. Pressure altitude = sea level
C. Runway available = 5500 feet
D. Headwind = 20 knots reported
E. Specific humidity = .015
F. Gross weight = 72,410 pounds
G. Runway slope = .012 (correction zero, see note No. 2)
FIND:
H. Refusal speed = 99 knots, IAS

BASED ON: FLIGHT TEST DATA
DATA AS OF: 1-15-59

FUEL GRADE 100/130

Figure A3-6. Refusal Speed

## TAKEOFF PERFORMANCE—SPEED DURING GROUND RUN

FOUR ENGINE TAKEOFF ACCELERATION
ZERO WIND

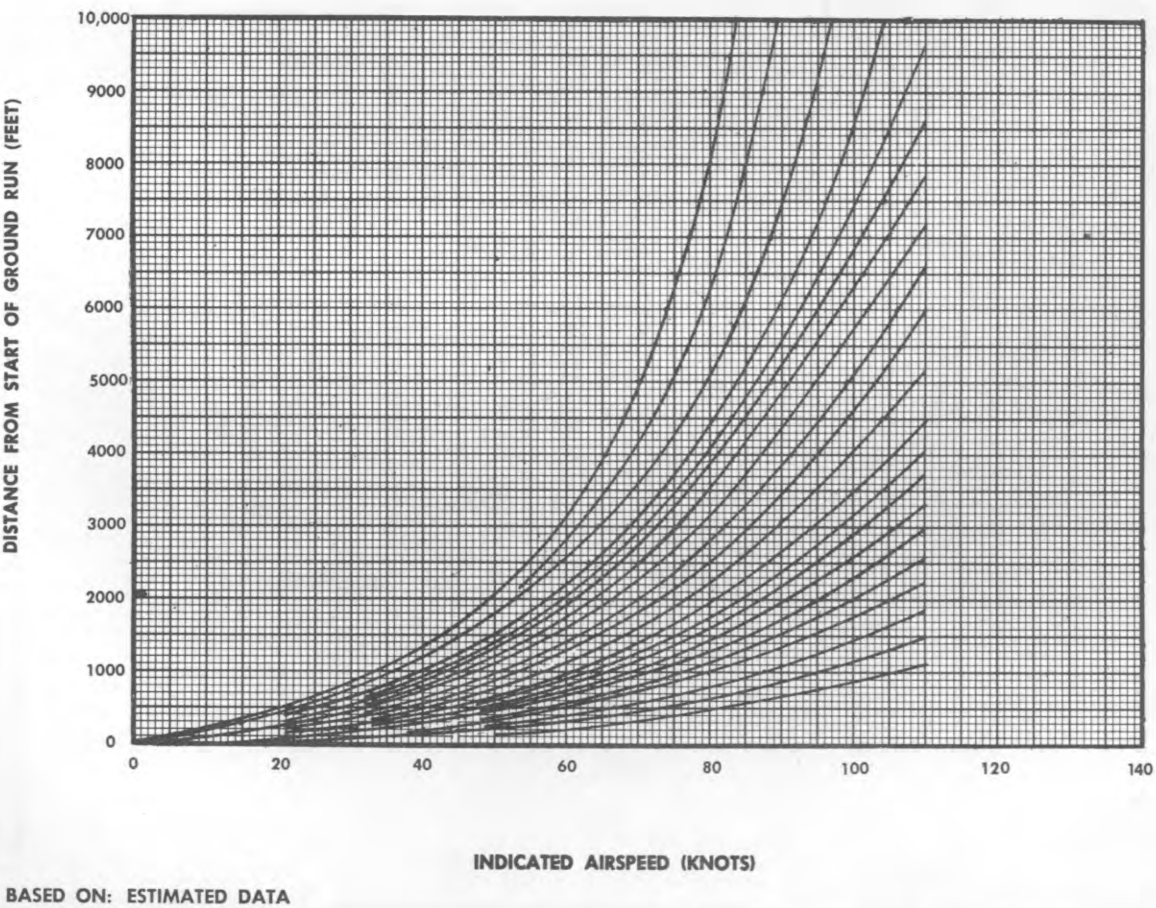
MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND-9M2

Note:
If go-no-go speed is less than the critical engine failure speed, then the decision to continue take-off or to stop must be made when the critical engine failure speed is reached rather than at the go-no-go marker.

SAMPLE PROBLEM:

A. Take-off gross weight = 72,410 pounds. Pressure altitude = sea level. Outside air temperature = 24°C. Specific humidity = .015. Effective headwind = 10 knots.
B. From page showing Take-off Performance Ground Run, determine that:
   Ground run distance = 2825 feet.
   Indicated airspeed at liftoff = 101.5 knots.
C. Subtract effective headwind from indicated airspeed at liftoff: 101.5 knots − 10 knots = 91.5 knots.
D. Enter chart at 91.5 knots and 2825 feet to determine contour line.
E. Follow down contour to desired go-no-go marker distance, 2000 feet and read zero-wind indicated airspeed: 80.5 knots.
F. Add effective headwind to 80.5 knots to obtain indicated airspeed at 2000 feet: 80.5 knots + 10 knots = 90.5 knots.




BASED ON: ESTIMATED DATA

*Figure A3-7. Speed During Ground Run*

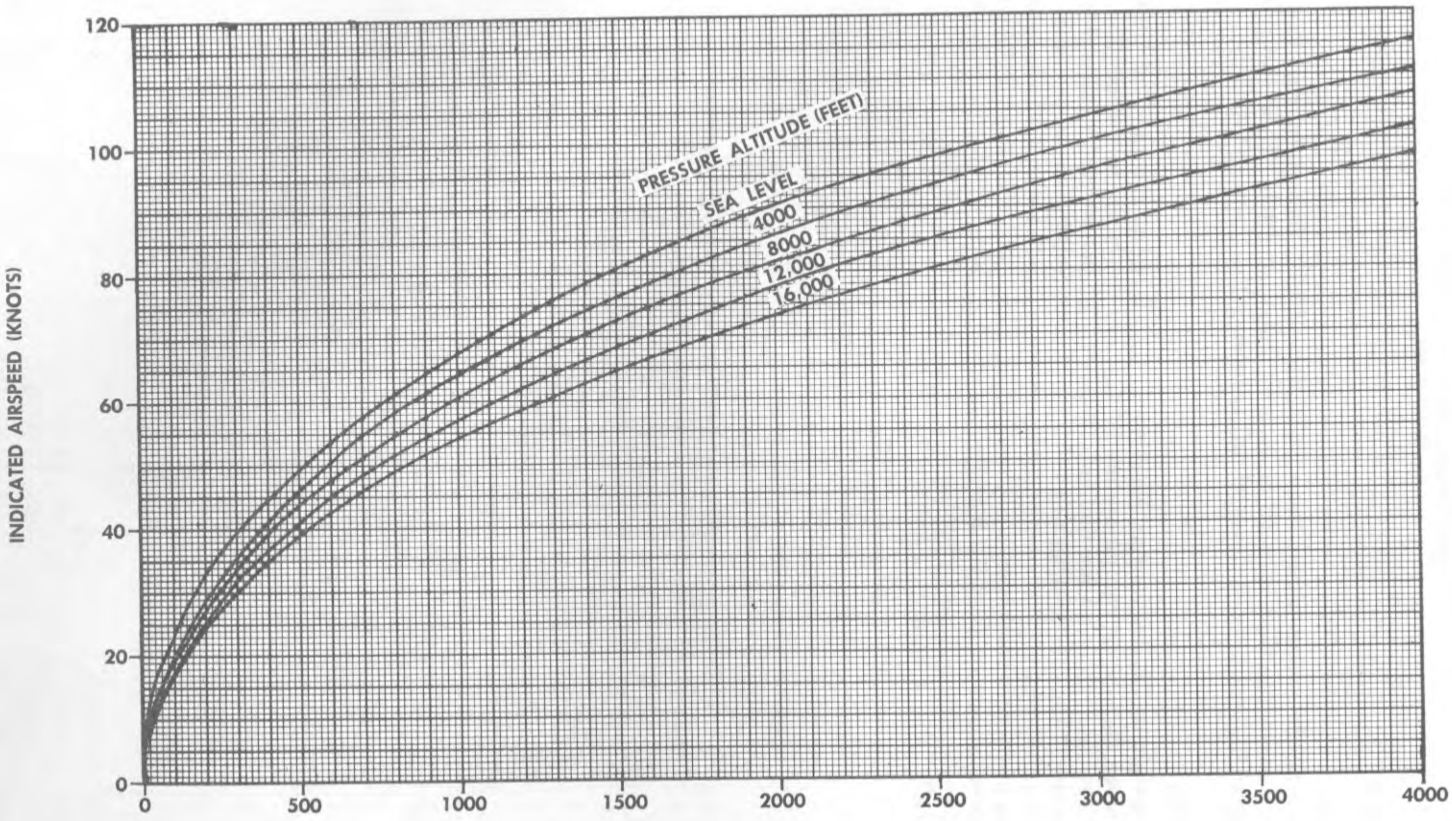
MODEL: C-54 AND R5D

## DISTANCE TO STOP—ABORTED TAKEOFF

PROPELLERS WINDMILLING
STANDARD ATMOSPHERIC CONDITIONS
TAKEOFF FLAP ANGLE — 15 DEGREES

ENGINE(S): (4) R2000-4

ZERO WIND




BASED ON: FLIGHT TEST DATA
DATA AS OF: 15 JANUARY 1959

FUEL GRADE: 100/130

Figure A3-8. Distance to Stop — Aborted Takeoff

# TAKE-OFF PATH — FOUR ENGINE

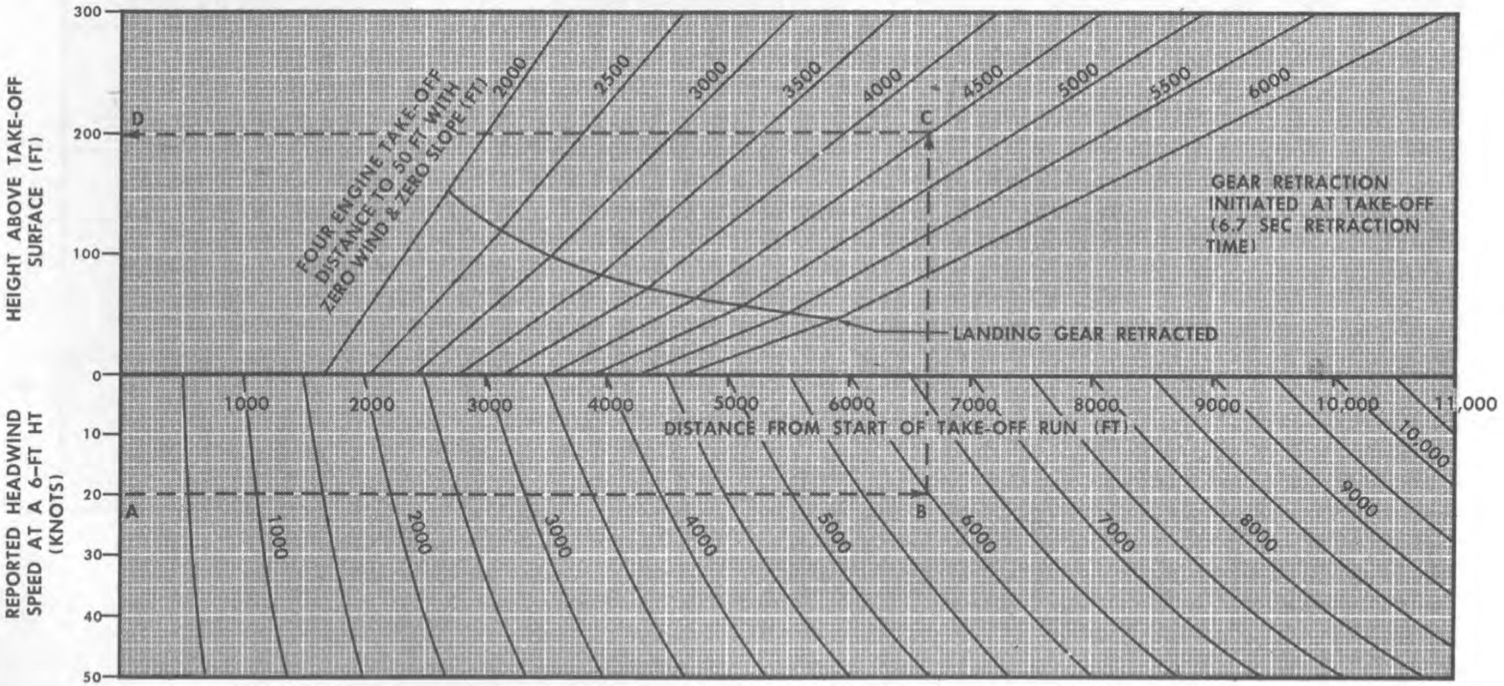
HAMILTON STANDARD PROPELLER NO. 23E50, BLADE NO. 6507A
HARD SURFACE RUNWAY
NO RUNWAY SLOPE
STANDARD ATMOSPHERIC CONDITIONS
WING FLAP SETTING = 15 DEGREES

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND -9M2

## SAMPLE PROBLEM

A. Reported headwind = 20 knots
B. Distance from start of take-off run = 6000 ft
C. Take-off distance to a 50 foot height = 4500 ft
D. Height above take-off surface = 200 ft




BASED ON: FLIGHT TEST DATA
DATA AS OF: 9-16-56

Note:
50% of reported headwind used in construction of this chart.

X1-B9

Figure A3-9. Takeoff Path—Four Engine

## TAKEOFF PATH – THREE-ENGINE

HAMILTON STANDARD PROPELLER NO. 23E50, BLADE NO. 6507A

HARD RUNWAY SURFACE

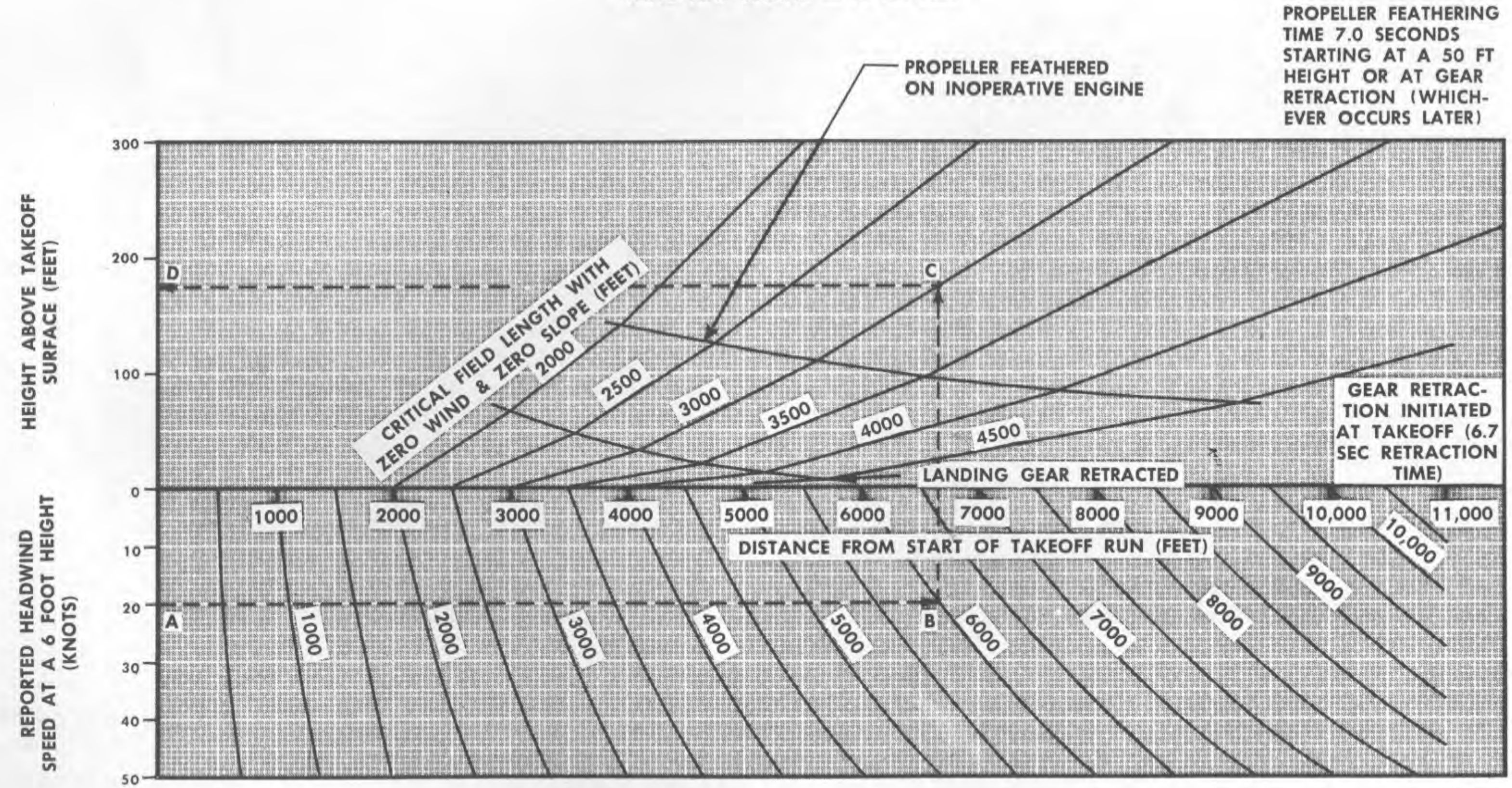
NO RUNWAY SLOPE

STANDARD ATMOSPHERIC CONDITIONS

WING FLAP SETTING = 15 DEGREES

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4




### SAMPLE PROBLEM

A. Reported headwind = 20 knots

B. Distance from start of takeoff run = 6000 feet

C. Takeoff distance with engine failure = 3000 feet

D. Height above takeoff surface = 175 feet

Note:
50% of reported headwind used in construction of this chart.

DATA AS OF: 1-15-59
BASED ON: FLIGHT TEST DATA

X1-14B

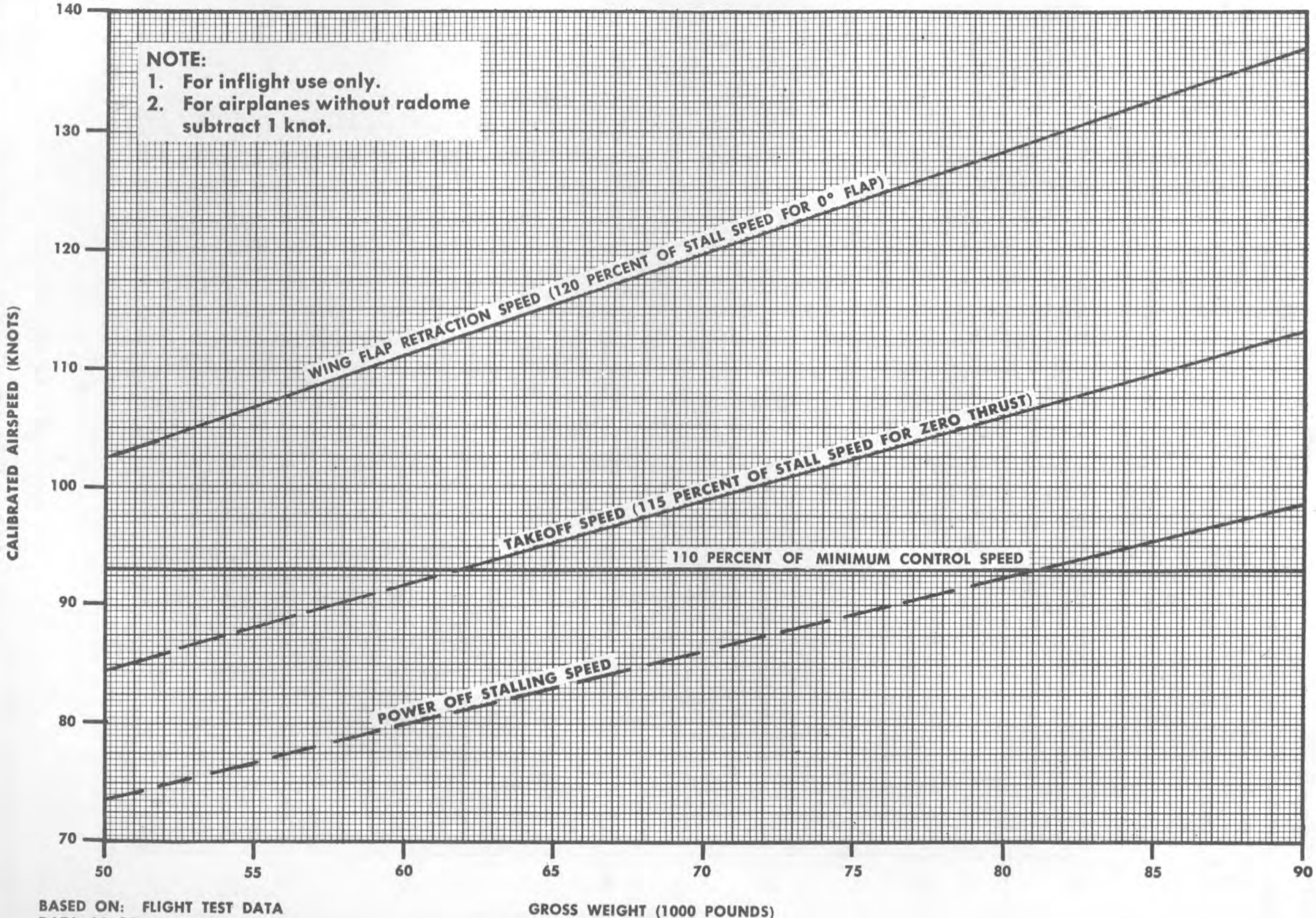
Figure A3-10. Takeoff Path – Three Engine

## CHARACTERISTIC TAKEOFF SPEEDS

FLAP ANGLE = 15 DEGREES

MODEL: C54 AND R5D

ENGINE(S): (4) R2000-4




BASED ON: FLIGHT TEST DATA
DATA AS OF: 1-15-59

*Figure A3-11. Characteristic Takeoff Speeds*

## TAKE-OFF AND LANDING CROSSWIND

MODEL: C-54 AND R5D

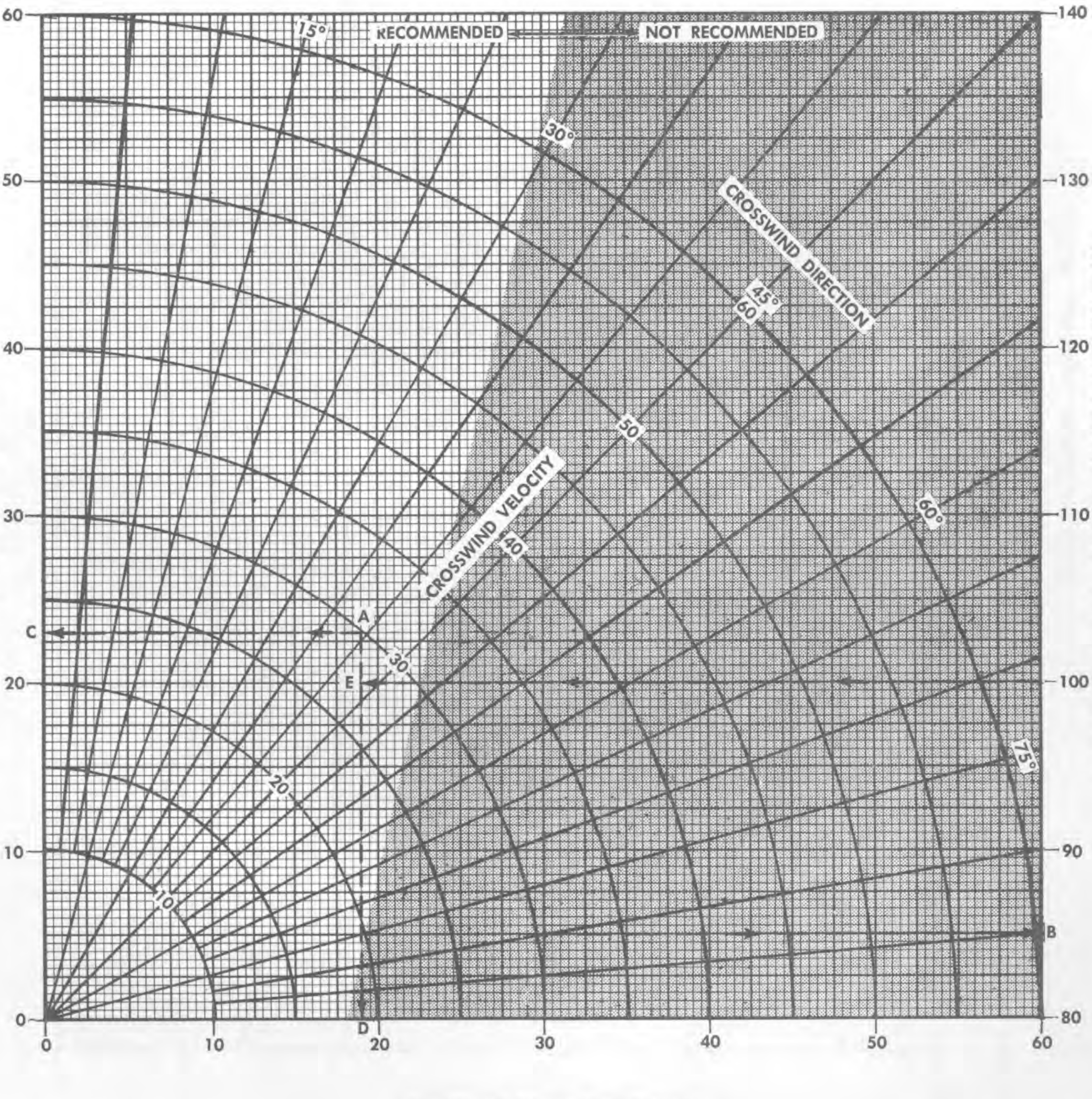
SAMPLE PROBLEM:

ENGINE(S): (4) R2000-4

Given conditions:
Take-off runway — 030°
Wind given 070° at 30 knots = 40° crosswind (point A)
Recommended take-off speed — 100 KIAS

Chart indicates:
Minimum nosewheel liftoff speed — 85 KIAS (point B)
Headwind component — 23 knots (point C)
Crosswind component — 19 knots (point D)
Take-off recommended (point E)

NOTE:
Maximum allowable nosewheel lift-off or touchdown speed is 127 KIAS because of landing gear limitations.




BASED ON: ESTIMATED DATA
DATA AS OF: 2-25-60

NOTE: ENTER CHART WITH MAXIMUM GUST VELOCITY

FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

*Figure A3-12. Takeoff Crosswind Chart*

# part 4 climb

## TABLE OF CONTENTS



## LIST OF ILLUSTRATIONS

## CLIMB.

## DISCUSSION OF CHARTS.

The Climb Charts *(figures A4-1 through A4-6)* are used for predicting time and fuel consumed during climb. Curves are indicated for METO power on a Standard Day and for 33 Hg MAP and 2300 rpm for both a Standard Day and an Army Hot Day.

Enroute Configuration Charts *(figures A4-7 and A4-8)* show the rate of climb for four and three engines operating at METO power.

Emergency Climb Charts *(figures A4-9 through A4-17)* show the sea level rate of climb versus calibrated airspeed for various landing gear and wing flap configurations. Emergency climb charts are included for four-, three-, and two-engine climb at sea level with 1450 bph per engine. Ground effect is not included in these rates of climb.

The Emergency Ceiling Chart *(figure A4-18)* presents the weights and altitudes at which the rate of climb is 100 feet per minute with METO power and with four, three, and two-engines operating.

### DISTANCE TO CLIMB CHARTS.

The Distance to Climb charts *(figures A4-1, A4-3, and A4-5)* show the distance traveled and the fuel consumed during a climb to a given altitude for four-engine operation at either METO power for Standard Day or climb power for Standard and Hot Day conditions. The recommended climb speed is 130 knots CAS. Enter the chart on the gross weight scale, with the aircraft gross weight at the start of climb, and project upward and parallel with the gross weight guide lines, until the desired pressure altitude curve is intersected. From this intersection point, by projecting horizontally to the right, the distance traveled during the climb may be determined in nautical miles. The gross weight at the end of the climb may be found by projecting a vertical line down from the intersection of the initial gross weight and pressure altitude. The weight at the end of the climb is read on the gross weight scale. Fuel consumed during the climb may be determined by subtracting the gross weight at the end of the climb from the gross weight at the beginning of the climb. A sample problem is included on the charts. For mission planning purposes, the necessary values may be found by reversing the procedure described previously (see sample problem, figure A4-3).

### TIME TO CLIMB CHARTS.

The Time to Climb charts *(figures A4-2, A4-4, and A4-6)* are analogous to the Distance to Climb charts. The foregoing discussion of the Distance to Climb charts applies equally well to the Time to Climb charts, when "time" is substituted for "distance."

### CLIMB PERFORMANCE IN THE ENROUTE CONFIGURATION CHARTS.

The Climb Performance in the Enroute Configuration charts *(figures A4-7 and A4-8)* are presented for four- and three-engine operation at METO power. The charts show the rate of climb in feet per minute that may be expected from the aircraft at a given gross weight and pressure altitude at 128 knots CAS under Standard Day atmospheric conditions, which is the recommended best climb speed for the enroute configuration. By entering the chart at the aircraft's pressure altitude, the rate of climb may be found by projecting horizontally to the intersection of the applicable gross weight curve and then vertically downward to the rate of climb in feet per minute.

### EMERGENCY CLIMB CHARTS.

The Emergency Climb charts *(figures A4-9 through A4-17)* show the predicted rate of climb or descent in feet per minute versus calibrated airspeed in knots for three aircraft gross weights for operation with four, three, and two engines at maximum power. Separate curves are included on each chart to show rates of climb for several configurations. The charts, based on standard atmospheric conditions at sea level, are designed to show the effects of airspeed and configuration on rate of climb.

### EMERGENCY CEILING CHART.

The Emergency Ceiling Chart *(figure A4-18)* 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. Three curves, labeled two-, three-, and four-engine operation, are shown.

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## DISTANCE TO CLIMB — FOUR ENGINE

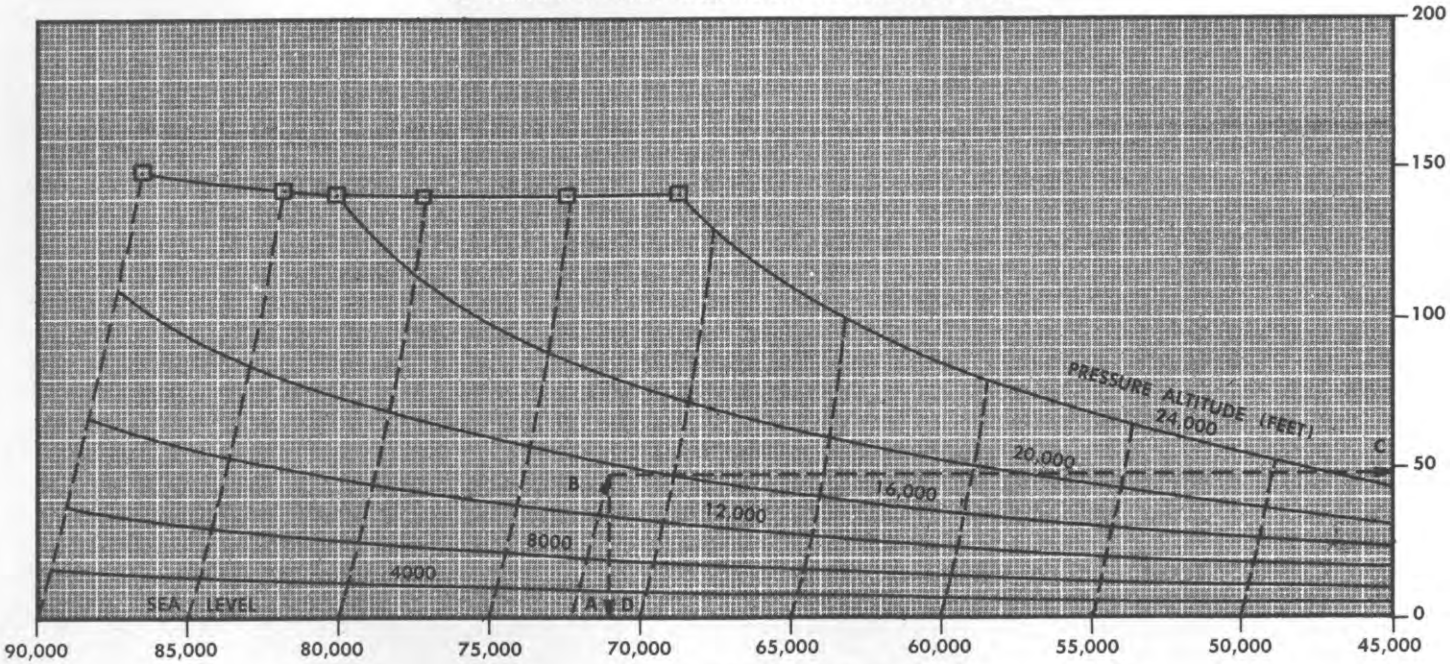
23E50 HAMILTON STANDARD PROPELLER, 6507A-0 BLADES
ENGINES OPERATING AT METO POWER
WING FLAP RETRACTED, LANDING GEAR RETRACTED
STANDARD ATMOSPHERIC CONDITIONS

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND -9M2

⊡ RATE OF CLIMB = 100 FT/MIN

RECOMMENDED CLIMB SPEED (CAS): 130 KNOTS (150 MPH)




### SAMPLE PROBLEM

A. Gross weight at start of climb at sea level = 72,290 pounds

B. Pressure altitude = 15,000 feet

C. Distance flown during climb = 48 Nautical Miles

D. Fuel burned equals the difference between the weight at start of climb indicated at point A, and weight at end of climb indicated at point D (72,290-71,000 = 1190 pounds)

BASED ON: FLIGHT TEST DATA
DATA AS OF: 1-15-59

FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

X1-92

Figure A4-1. Distance to Climb — Four-Engine — METO Power — Standard Day

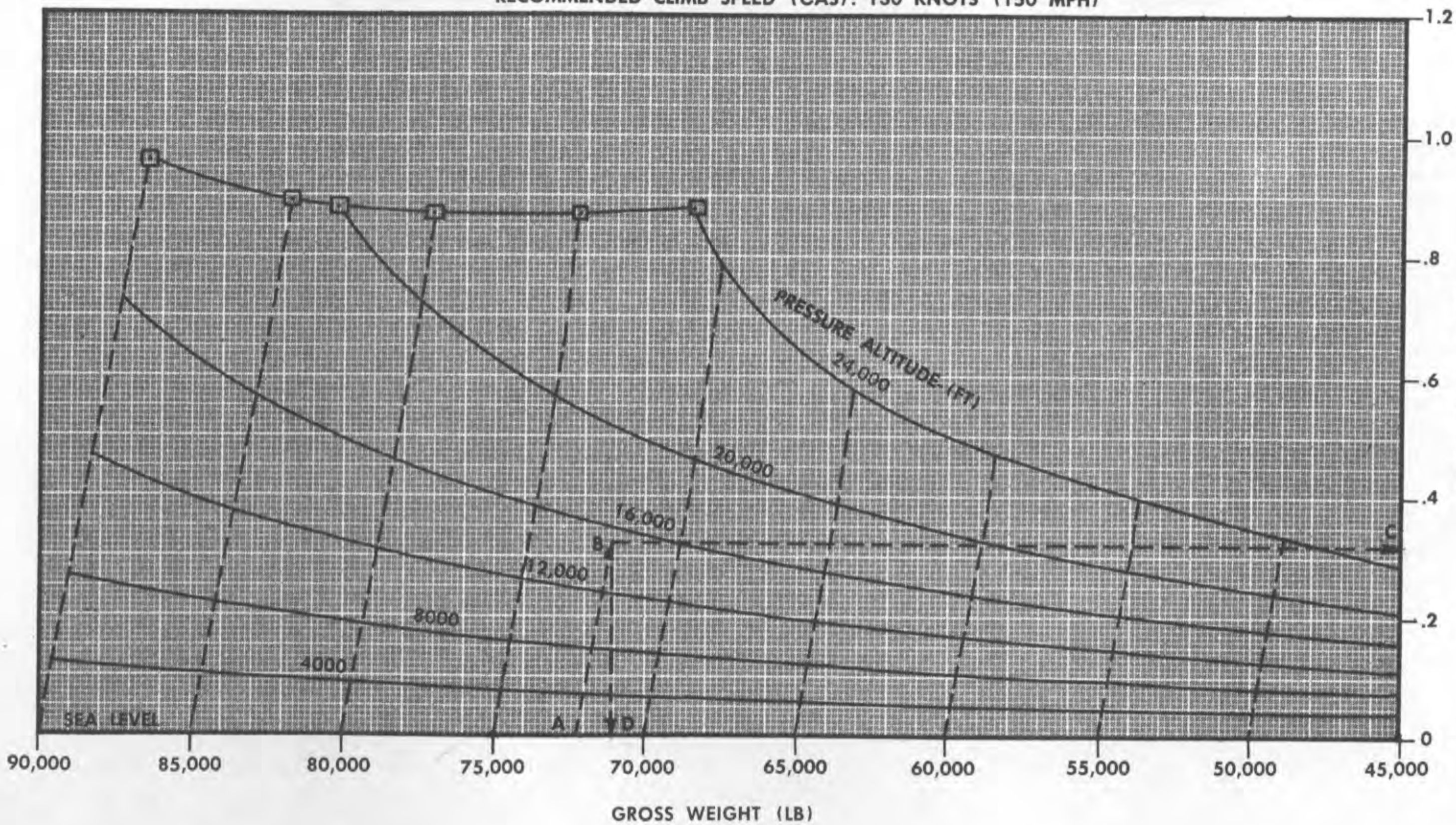
## TIME TO CLIMB — FOUR ENGINE

23E50 HAMILTON STANDARD PROPELLER, 6507A-0 BLADES
ENGINES OPERATING AT METO POWER
WING FLAPS RETRACTED, LANDING GEAR RETRACTED

MODEL: C-54 AND R5D

STANDARD DAY
⊡ RATE OF CLIMB = 100 FT/MIN
RECOMMENDED CLIMB SPEED (CAS): 130 KNOTS (150 MPH)

ENGINE(S): (4) R2000-4 AND -9M2




### SAMPLE PROBLEM

A. Gross weight at start of climb at sea level = 72,390 pounds

B. Pressure altitude = 15,000 feet

C. Time to climb = .32 hour

D. Fuel burned equals the difference between the weight at start of climb indicated at point A and the weight at end of climb indicated at point D (72,390-71,100 = 1290 pounds)

BASED ON: FLIGHT TEST DATA
DATA AS OF: 1-15-59

FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

X1-93

Figure A4-2. Time to Climb — Four-Engine — METO Power — Standard Day

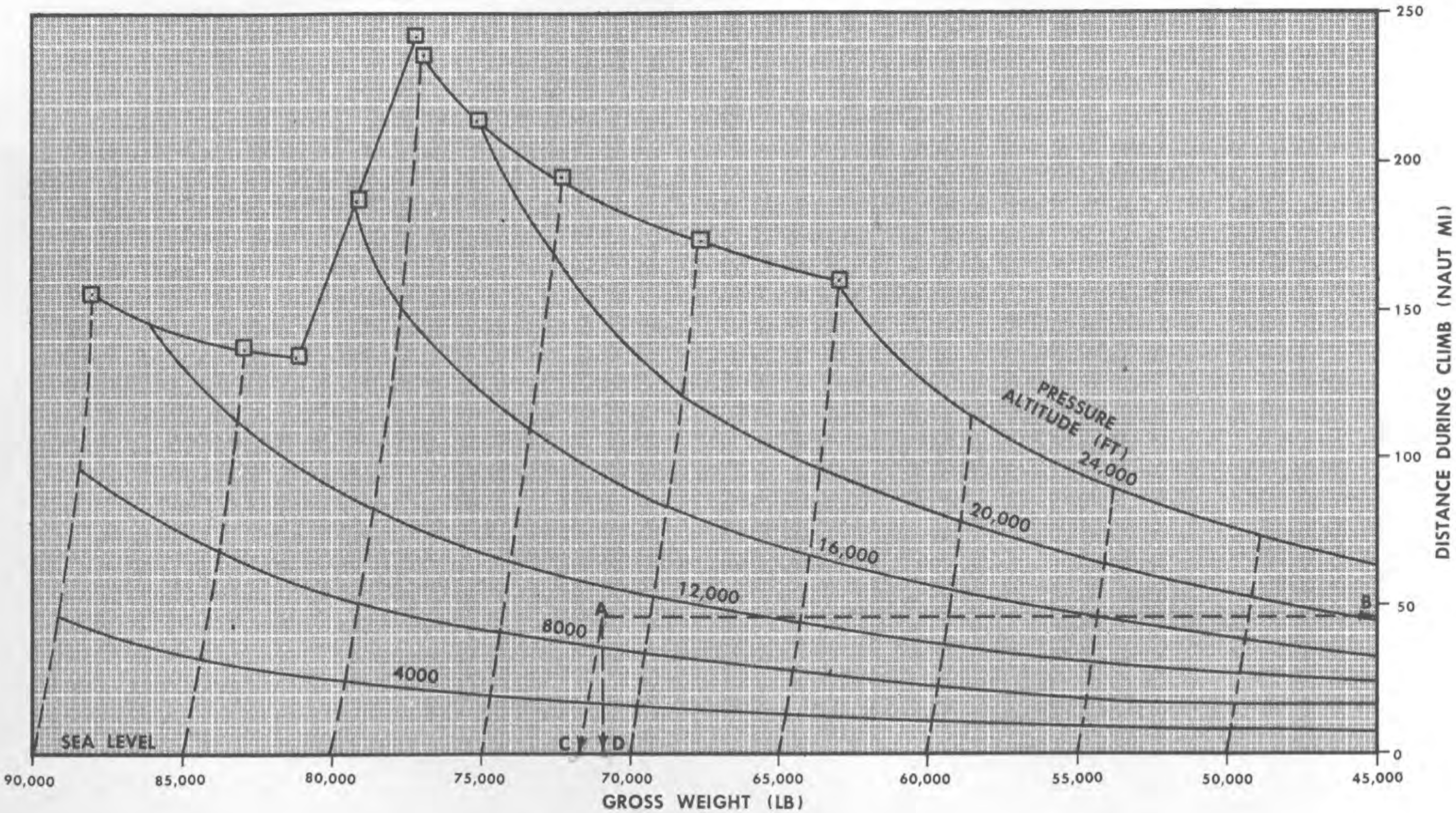
# DISTANCE TO CLIMB — FOUR ENGINE

23E50 HAMILTON STANDARD PROPELLER, 6507A-O BLADES
ENGINES OPERATING AT 2300 RPM AND 33 INCH MAP
STANDARD ATMOSPHERIC CONDITIONS
WING FLAPS RETRACTED, LANDING GEAR RETRACTED
⊡ RATE OF CLIMB = 100 FT/MIN

**MODEL: C-54 AND R5D**

RECOMMENDED CLIMB SPEED (CAS):
130 KNOTS (150 MPH)

**ENGINE(S): (4) R2000-4 AND -9M2**




## SAMPLE PROBLEM

A. Gross weight at end of climb = 70,940 lb at an altitude of 10,000 ft
B. Distance flown during climb = 46 naut mi
C. Gross weight at start of climb = 71,700 lb
D. Fuel burned equals the difference between the weight at start of climb indicated at point C and the weight at end of climb, indicated at point D (71,700-70,940 = 760 lb)

BASED ON: FLIGHT TEST DATA
DATA AS OF: 9-16-56

FUEL GRADE: 100/130
FUEL DENSITY = 6.0 LB/GAL

D6-1X

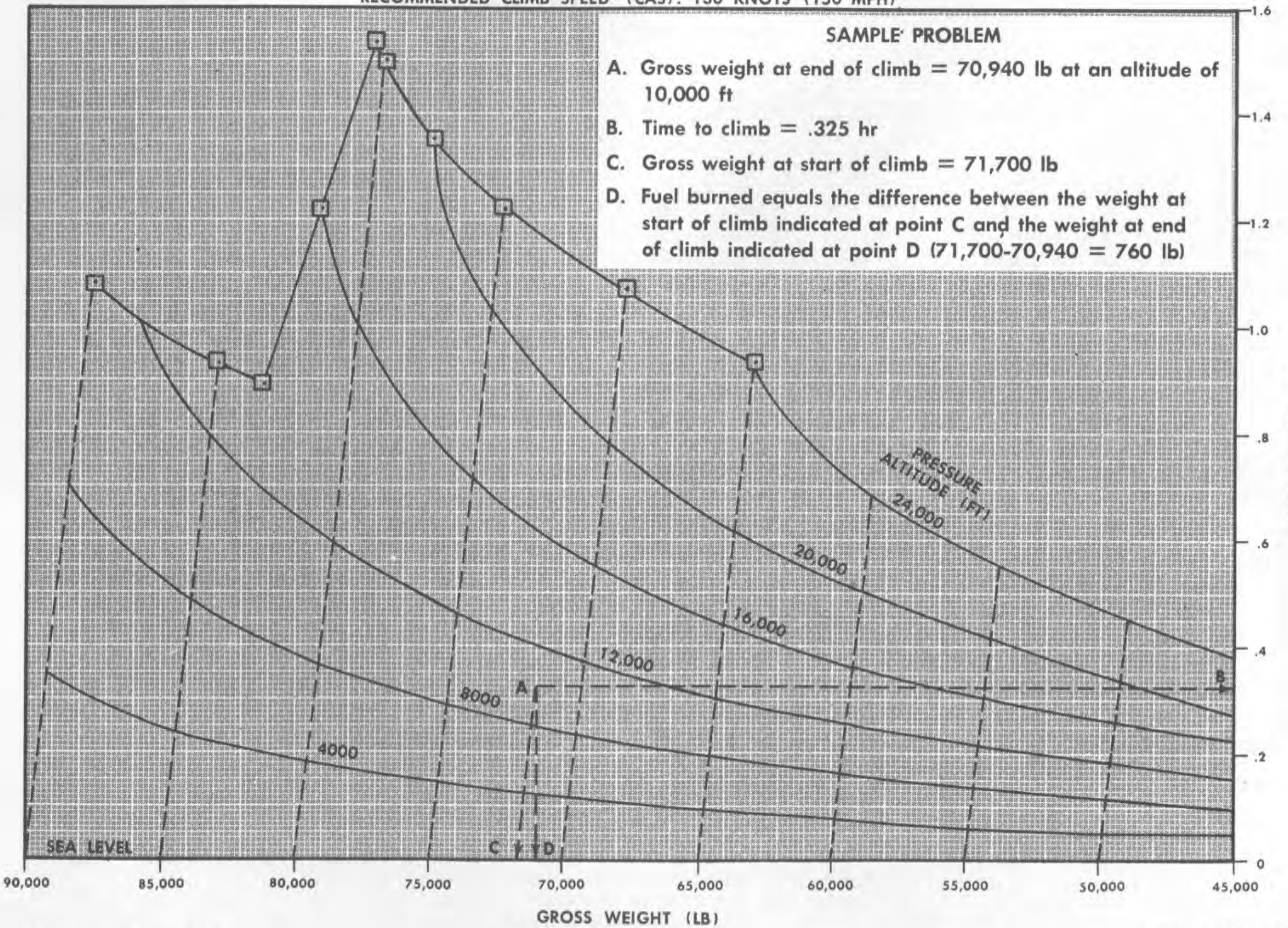
Figure A4-3. Distance to Climb — Four-Engine — Climb Power — Standard Day

**TIME TO CLIMB — FOUR ENGINE**

23E50 HAMILTON STANDARD PROPELLER
6507A-0 BLADES
ENGINES OPERATING AT 2300 RPM AND 33 INCH MAP
WING FLAPS RETRACTED, LANDING GEAR RETRACTED
STANDARD ATMOSPHERIC CONDITIONS
⊡ RATE OF CLIMB = 100 FT/MIN
RECOMMENDED CLIMB SPEED (CAS): 130 KNOTS (150 MPH)

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND -9M2




BASED ON: FLIGHT TEST DATA
DATA AS OF: 9-16-56

FUEL GRADE: 100/130
FUEL DENSITY = 6.0 LB/GAL

X1-94

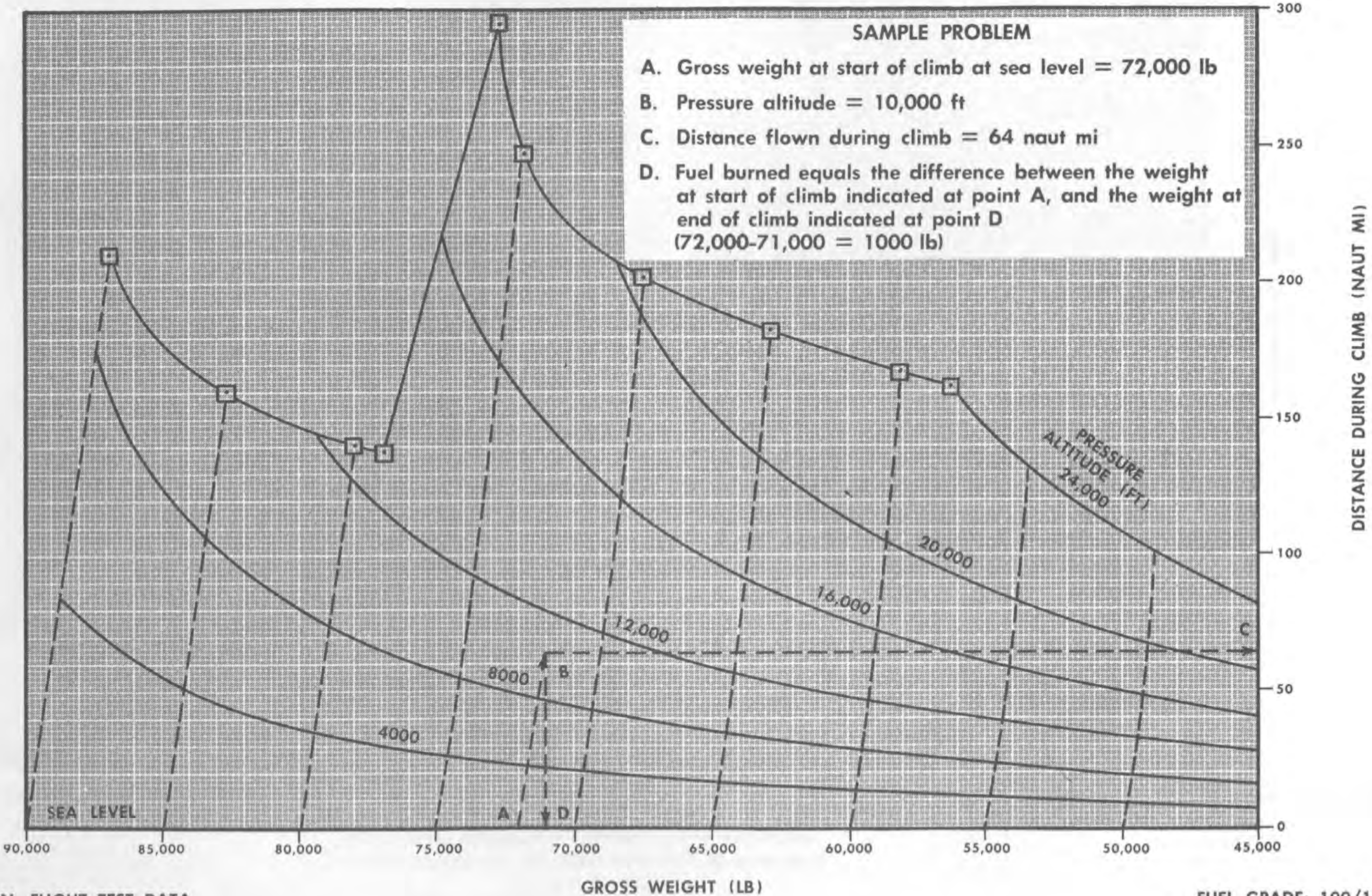
Figure A4-4. Time to Climb – Four-Engine – Climb Power – Standard Day

## DISTANCE TO CLIMB — FOUR ENGINE

23E50 HAMILTON STANDARD PROPELLER, 6507A-0 BLADES
ENGINES OPERATING AT 2300 RPM AND 33 INCH MAP
WING FLAPS RETRACTED, LANDING GEAR RETRACTED
HOT DAY
⊡ RATE OF CLIMB = 100 FT /MIN
RECOMMENDED CLIMB SPEED (CAS):
130 KNOTS (150 MPH)

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND -9M2




BASED ON: FLIGHT TEST DATA
DATA AS OF: 9-16-56

FUEL GRADE: 100/130
FUEL DENSITY = 6.0 LB /GAL

X1-91

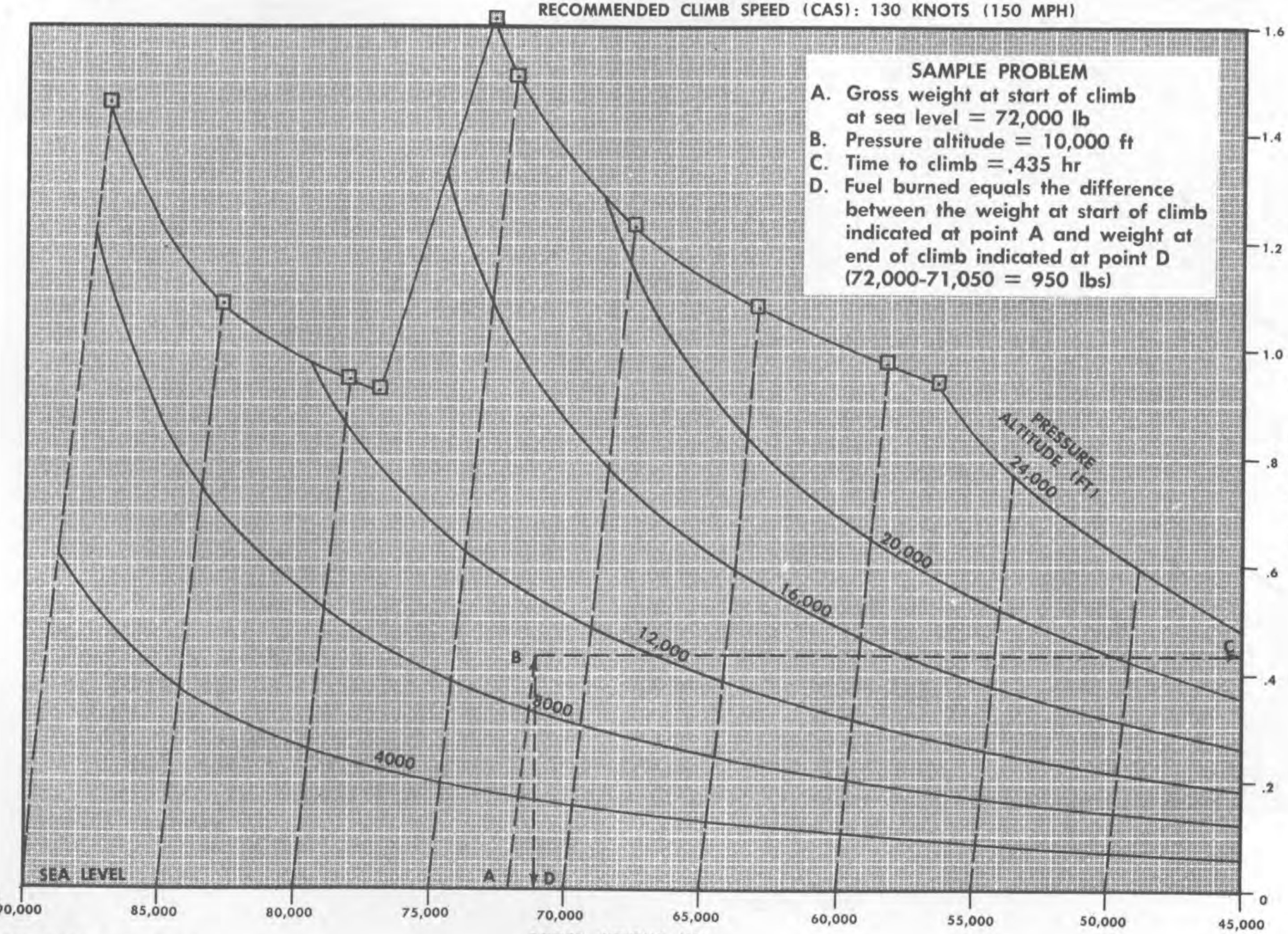
*Figure A4-5. Distance to Climb — Four-Engine — Climb Power — Hot Day*

# TIME TO CLIMB — FOUR ENGINE

23E50 HAMILTON STANDARD PROPELLER
6507A BLADES
ENGINES OPERATING AT 2300 RPM AND 33 INCH MAP
WING FLAPS RETRACTED, LANDING GEAR RETRACTED
HOT DAY
⊡ RATE OF CLIMB = 100 FT/MIN
RECOMMENDED CLIMB SPEED (CAS): 130 KNOTS (150 MPH)

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND -9M2




BASED ON: FLIGHT TEST DATA
DATA AS OF: 9-16-56

FUEL GRADE: 100/130
FUEL DENSITY = 6.0 LB /GAL

X1-95

Figure A4-6. Time to Climb — Four-Engine — Climb Power — Hot Day

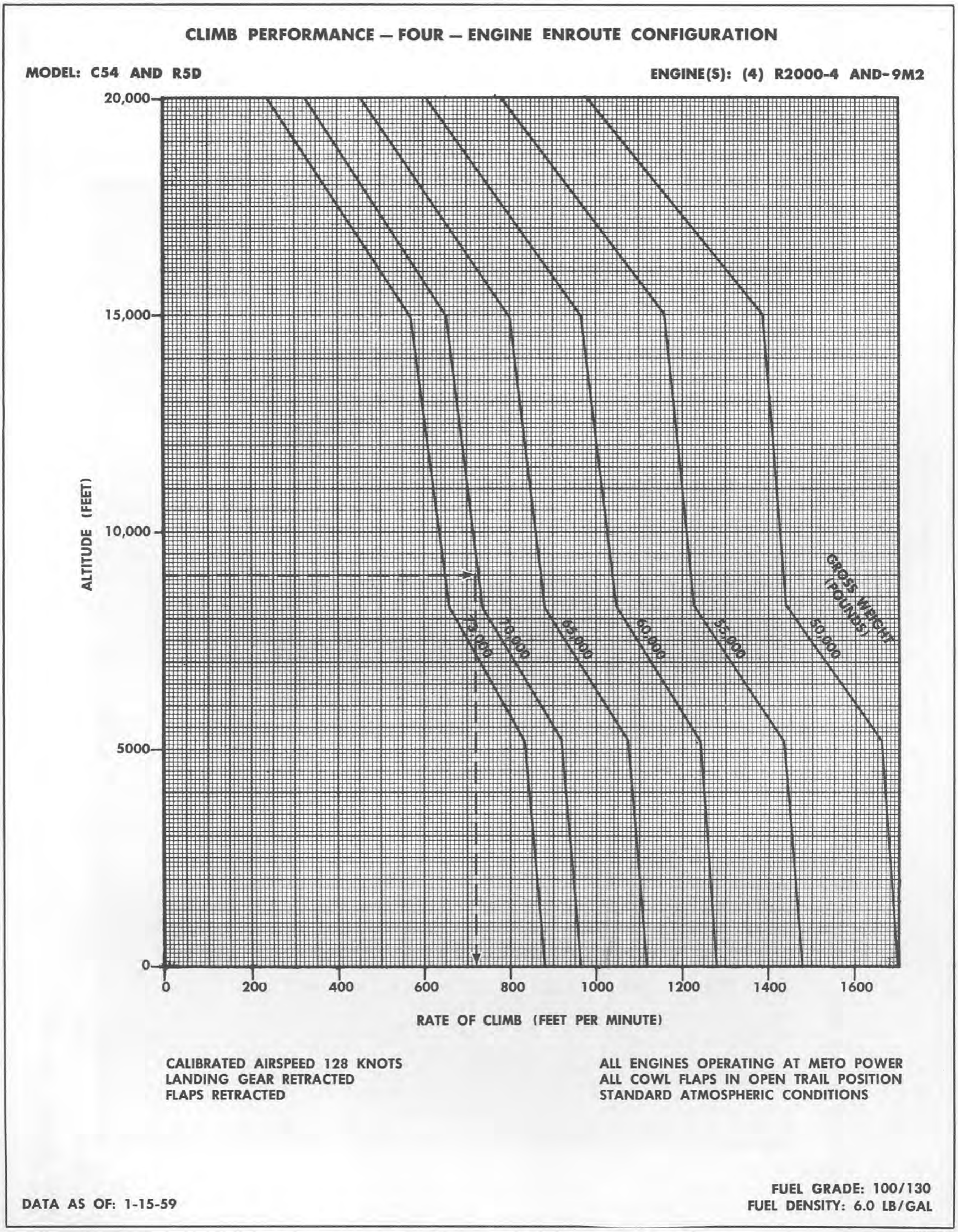
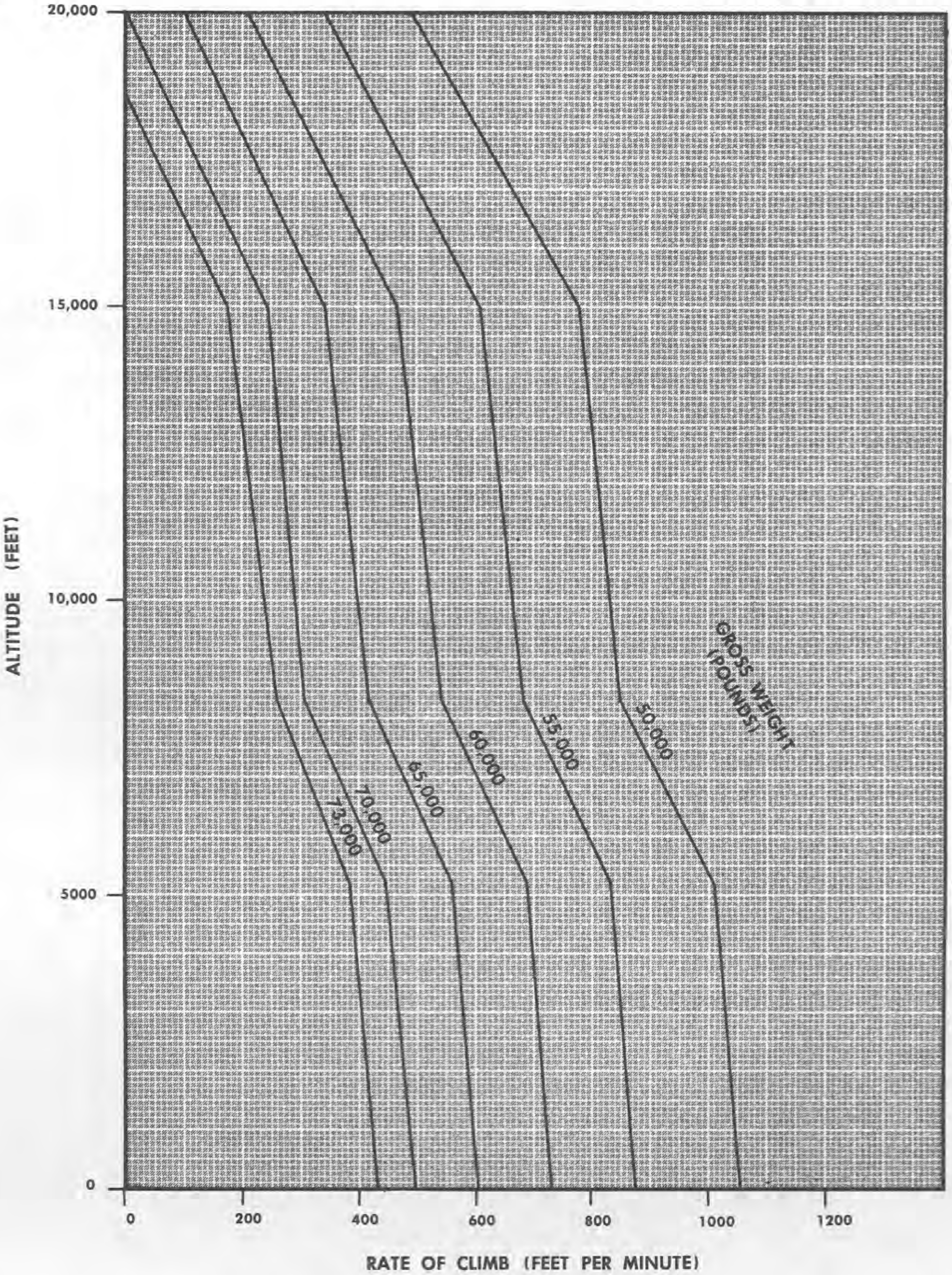



*Figure A4-7. Climb Performance — Four-Engine Enroute Configuration*

## CLIMB PERFORMANCE — 3-ENGINE EN ROUTE CONFIGURATION

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND -9M2




CALIBRATED AIRSPEED 128 KNOTS
LANDING GEAR RETRACTED
FLAPS RETRACTED
ONE ENGINE INOPERATIVE,
PROPELLER FEATHERED, COWL
FLAPS CLOSED

3 ENGINES OPERATING AT
METO POWER,
COWL FLAPS IN OPEN TRAIL
POSITION
STANDARD ATMOSPHERIC
CONDITIONS

BASED ON FLIGHT TEST DATA
DATA AS OF: 9-16-56

FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

X1-96

*Figure A4-8. Climb Performance — Three-Engine Enroute Configuration*

## TWO ENGINE EMERGENCY CLIMB

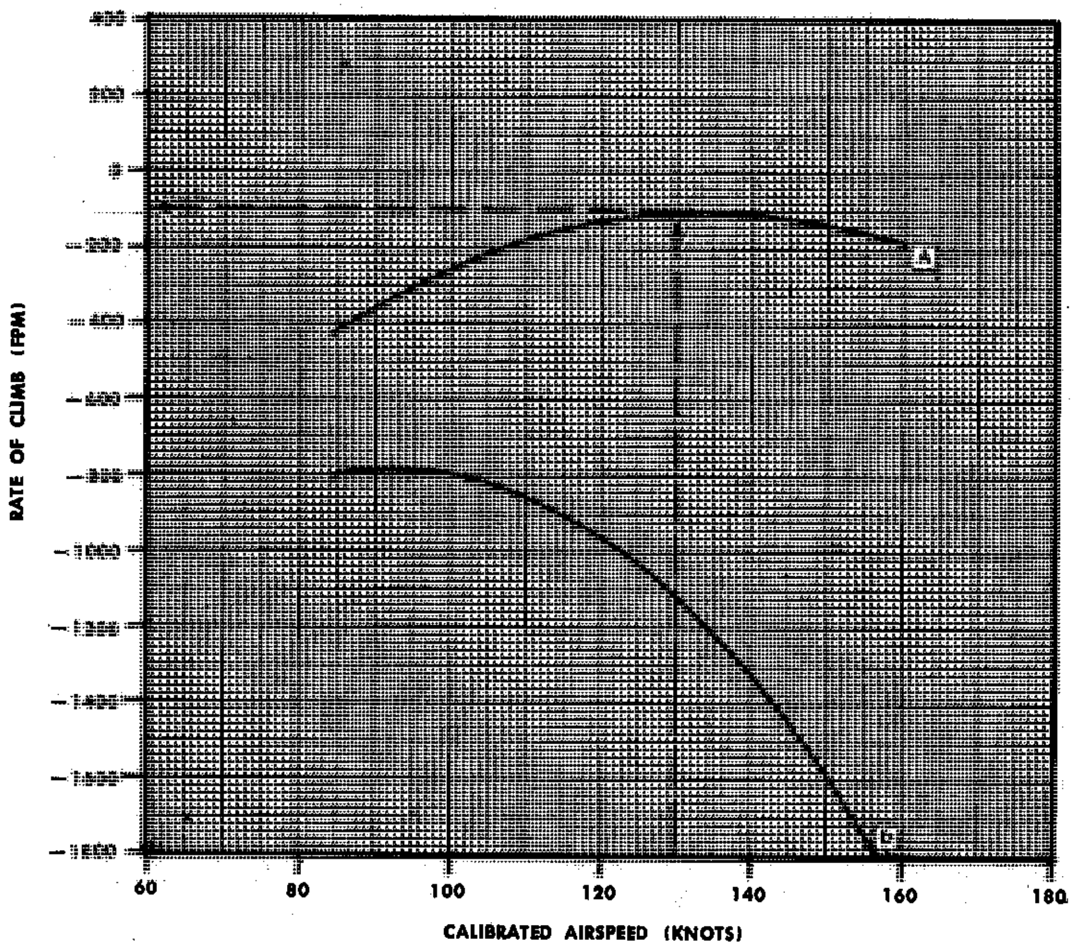
**MAXIMUM POWER**
**STANDARD ATMOSPHERIC CONDITIONS**
**SEA LEVEL**
**GROSS WEIGHT=90,200 POUNDS**

**MODEL: C-54 AND R5D**

**Note:**
**Maximum design takeoff gross weight is 83,500 pounds.**

**ENGINE(S): (4) R2000-4 AND -9M2**

| CURVE | FLAP SETTING | GEAR POSITION | INOPERATIVE ENGINES | |
|---|---|---|---|---|
| | | | PROPELLER | COWL FLAP |
| A<br>D | UP<br>40 DEGREES | UP<br>DOWN | FEATHERED<br>FEATHERED | CLOSED TRAIL<br>CLOSED TRAIL |




BASED ON: FLIGHT TEST DATA
DATA AS OF: 1-15-59

X1-79

*Figure A4-9. Two-Engine Emergency Climb—Gross Weight 90,200 Pounds*

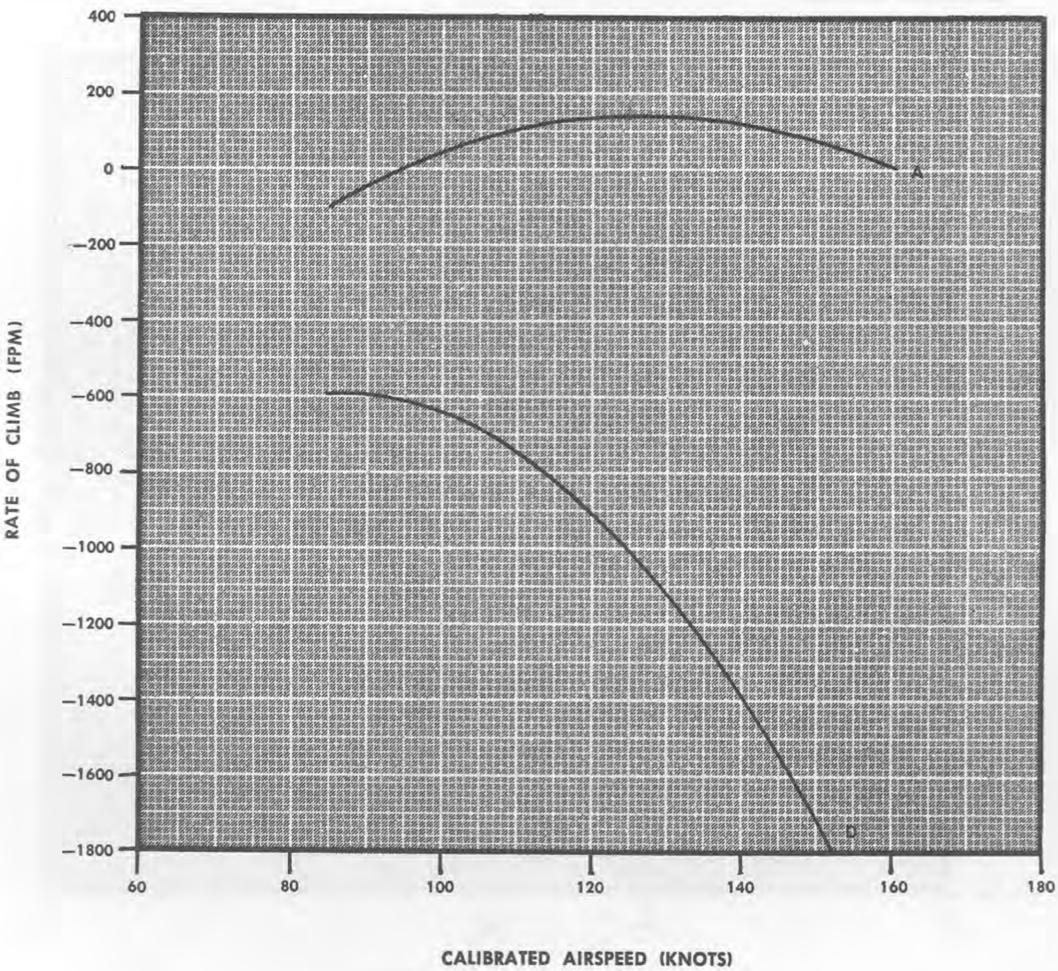
## TWO ENGINE EMERGENCY CLIMB

MAXIMUM POWER
STANDARD ATMOSPHERIC CONDITIONS
SEA LEVEL
GROSS WEIGHT = 73,000 LB

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND -9M2

| CURVE | FLAP SETTING | GEAR POSITION | INOPERATIVE ENGINES | |
|---|---|---|---|---|
| | | | PROPELLER | COWL FLAP |
| A | UP | UP | FEATHERED | CLOSED TRAIL |
| D | 40 DEGREES | DOWN | FEATHERED | CLOSED TRAIL |




BASED ON: FLIGHT TEST DATA
DATA AS OF: 9-16-56

X1-80

*Figure A4-10. Two-Engine Emergency Climb — Gross Weight 73,000 Pounds*

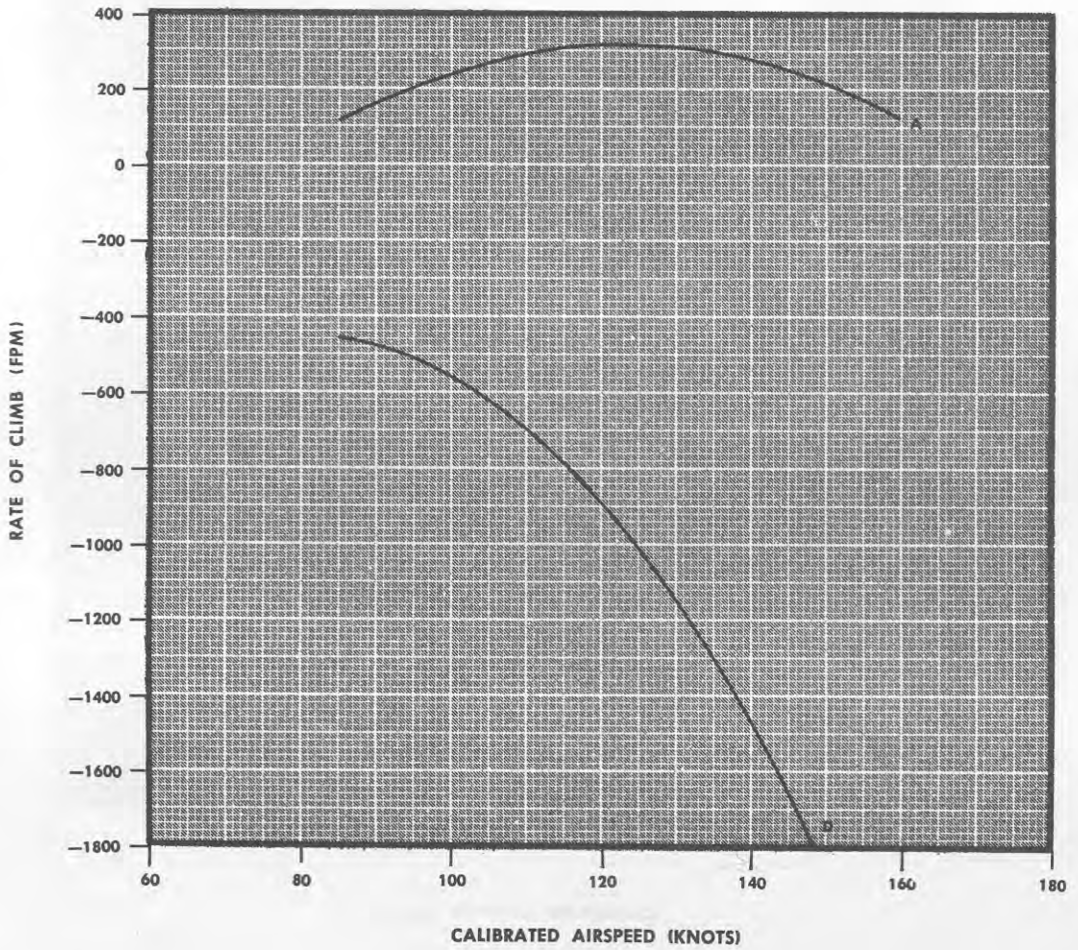
# TWO ENGINE EMERGENCY CLIMB

MAXIMUM POWER
STANDARD ATMOSPHERIC CONDITIONS
SEA LEVEL
GROSS WEIGHT = 63,500 LB

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND -9M2

| CURVE | FLAP SETTING | GEAR POSITION | INOPERATIVE ENGINES | |
|---|---|---|---|---|
| | | | PROPELLER | COWL FLAP |
| A | UP | UP | FEATHERED | CLOSED TRAIL |
| D | 40 DEGREES | DOWN | FEATHERED | CLOSED TRAIL |




BASED ON: FLIGHT TEST DATA

DATA AS OF: 9-16-56

X1-81

*Figure A4-11. Two-Engine Emergency Climb — Gross Weight 63,500 Pounds*

# THREE-ENGINE EMERGENCY CLIMB

MAXIMUM POWER

STANDARD ATMOSPHERIC CONDITIONS

SEA LEVEL

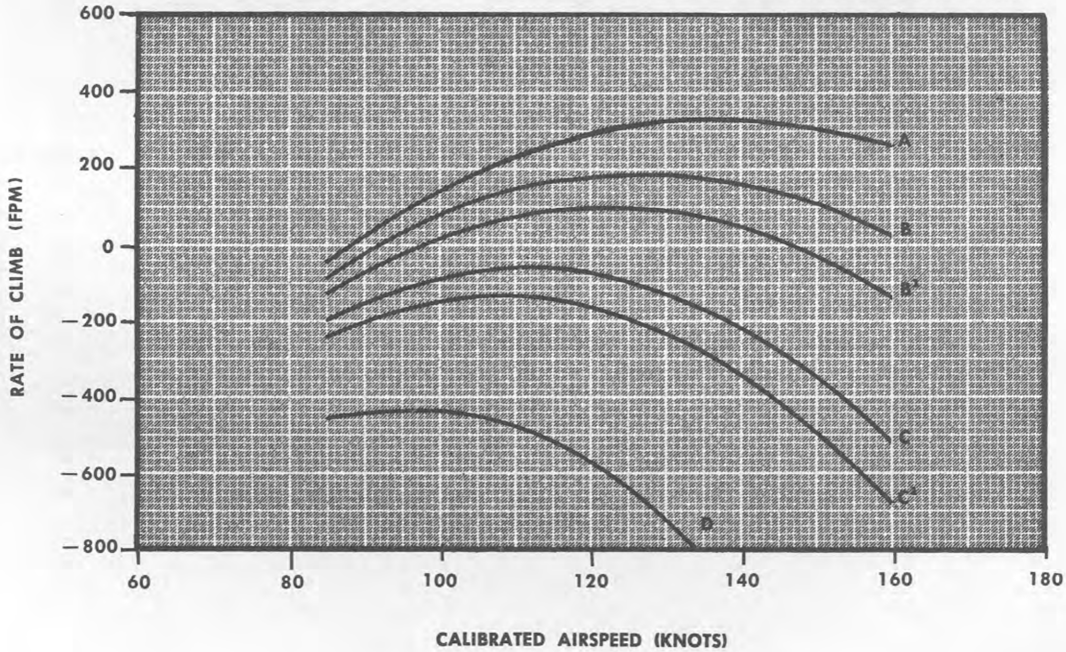
GROSS WEIGHT=90,200 POUNDS

MODEL: C-54 AND R5D

Note:
Maximum design takeoff gross weight is 83,500 pounds.

ENGINE(S): (4) R2000-4 AND-9M2

| CURVE | FLAP SETTING | GEAR POSITION | INOPERATIVE ENGINE | |
|---|---|---|---|---|
| | | | PROPELLER | COWL FLAPS |
| A | UP | UP | FEATHERED | CLOSED TRAIL |
| B | DOWN 15 DEG | UP | FEATHERED | CLOSED TRAIL |
| B[1] | DOWN 15 DEG | UP | WINDMILLING | OPEN TRAIL |
| C | DOWN 15 DEG | DOWN | FEATHERED | CLOSED TRAIL |
| C[1] | DOWN 15 DEG | DOWN | WINDMILLING | OPEN TRAIL |
| D | DOWN 40 DEG | DOWN | FEATHERED | CLOSED TRAIL |




BASED ON: FLIGHT TEST DATA

DATA AS OF: 1-15-59

X1-76

*Figure A4-12. Three-Engine Emergency Climb—Gross Weight 90,200 Pounds*

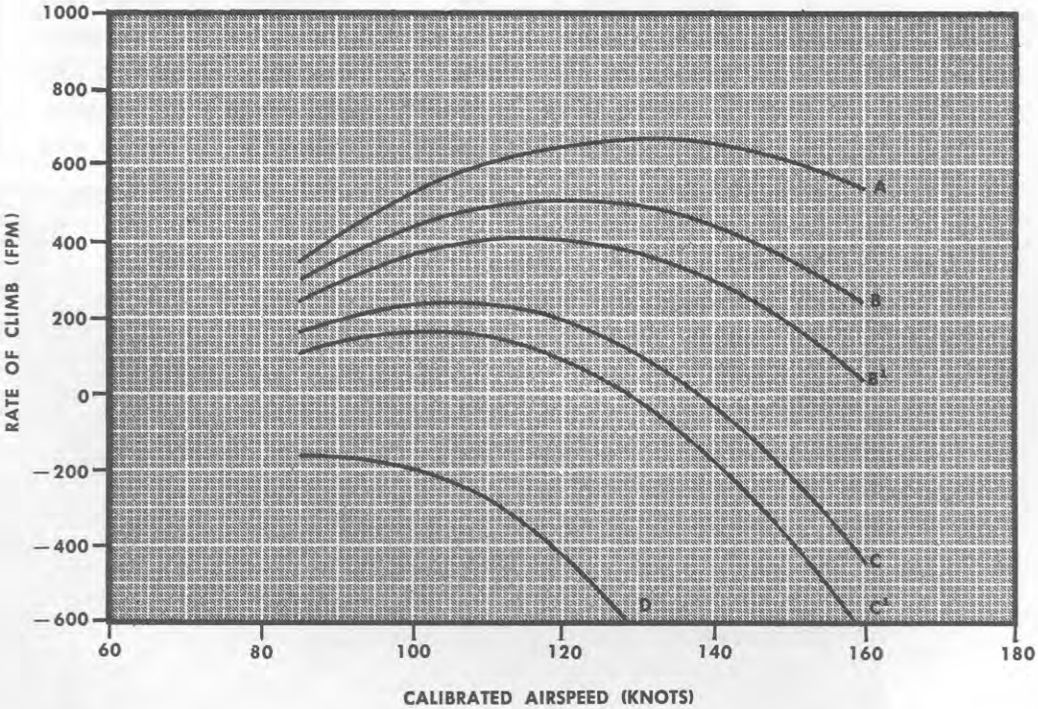
## THREE-ENGINE EMERGENCY CLIMB

MAXIMUM POWER
STANDARD ATMOSPHERIC CONDITIONS
SEA LEVEL
GROSS WEIGHT=73,000 POUNDS

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND -9M2

| CURVE | FLAP SETTING | GEAR POSITION | INOPERATIVE ENGINE | |
|---|---|---|---|---|
| | | | PROPELLER | COWL FLAPS |
| A | UP | UP | FEATHERED | CLOSED TRAIL |
| B | DOWN 15 DEG | UP | FEATHERED | CLOSED TRAIL |
| B[1] | DOWN 15 DEG | UP | WINDMILLING | OPEN TRAIL |
| C | DOWN 15 DEG | DOWN | FEATHERED | CLOSED TRAIL |
| C[1] | DOWN 15 DEG | DOWN | WINDMILLING | OPEN TRAIL |
| D | DOWN 40 DEG | DOWN | FEATHERED | CLOSED TRAIL |




BASED ON: FLIGHT TEST DATA
DATA AS OF: 1-15-59

X1-77

*Figure A4-13. Three-Engine Emergency Climb—Gross Weight 73,000 Pounds*

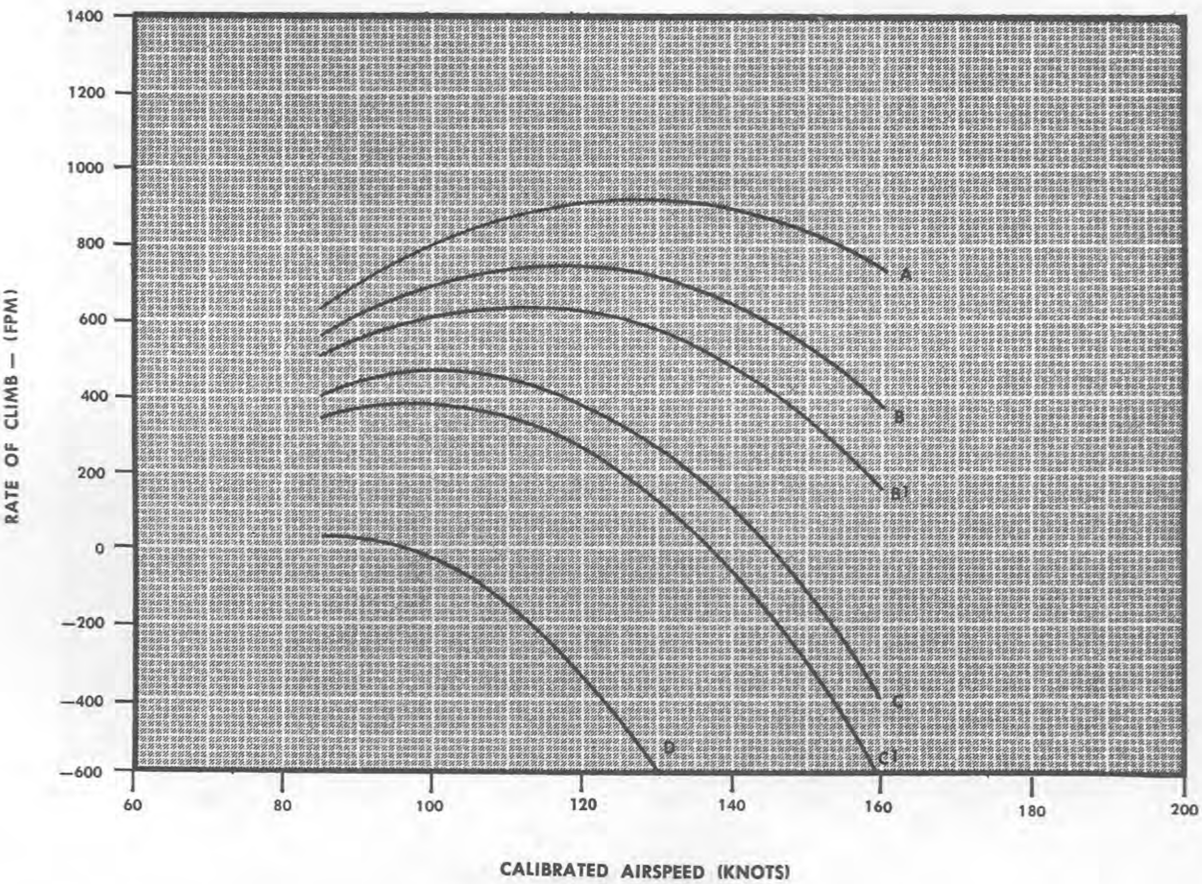
## THREE ENGINE EMERGENCY CLIMB

MAXIMUM POWER
STANDARD ATMOSPHERIC CONDITIONS
SEA LEVEL
GROSS WEIGHT = 63,500 LB

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND -9M2

| CURVE | FLAP SETTING | GEAR POSITION | INOPERATIVE ENGINE | |
|---|---|---|---|---|
| | | | PROPELLER | COWL FLAPS |
| A | UP | UP | FEATHERED | CLOSED TRAIL |
| B | DOWN 15 DEG | UP | FEATHERED | CLOSED TRAIL |
| B[1] | DOWN 15 DEG | UP | WINDMILLING | OPEN TRAIL |
| C | DOWN 15 DEG | DOWN | FEATHERED | CLOSED TRAIL |
| C[1] | DOWN 15 DEG | DOWN | WINDMILLING | OPEN TRAIL |
| D | DOWN 40 DEG | DOWN | FEATHERED | CLOSED TRAIL |




BASED ON: FLIGHT TEST DATA

DATA AS OF: 9-16-56

X1-78

*Figure A4-14. Three-Engine Emergency Climb — Gross Weight 63,500 Pounds*

## FOUR-ENGINE EMERGENCY CLIMB

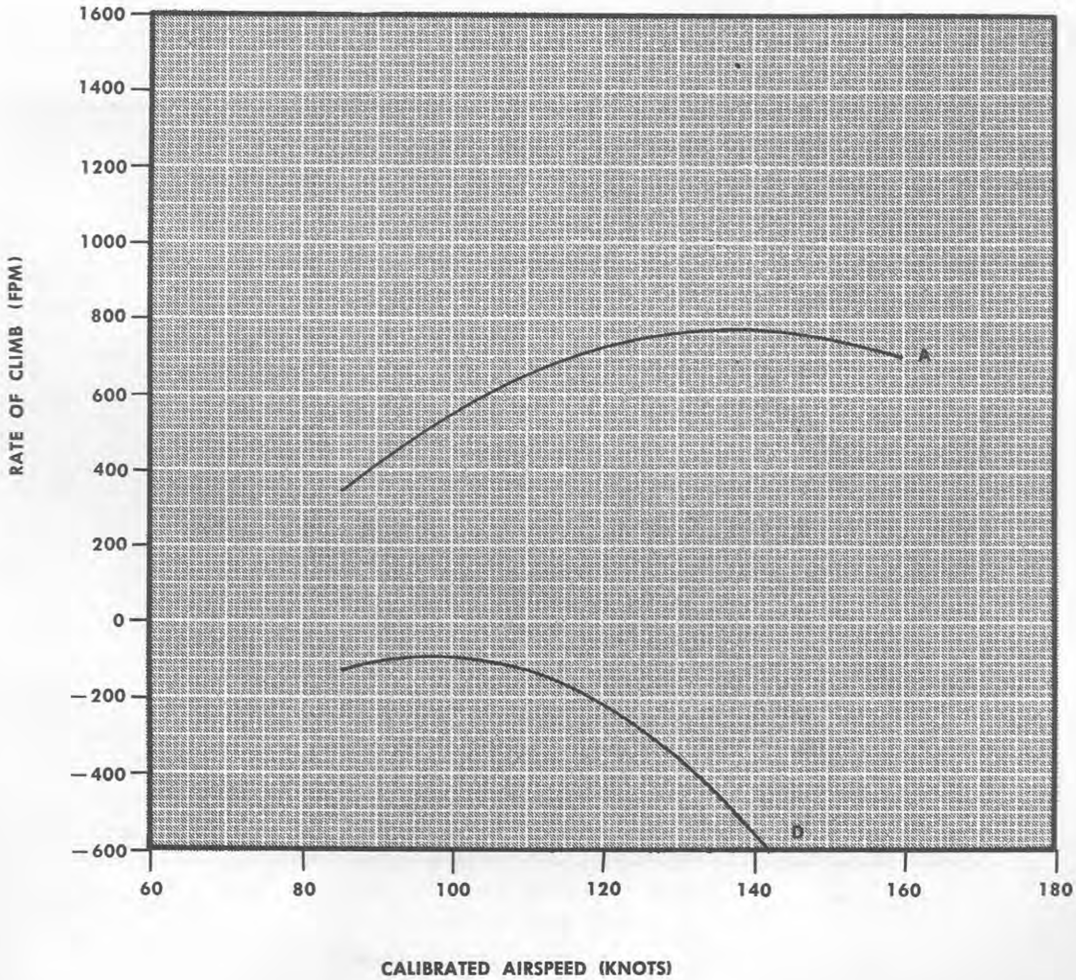
METO POWER
STANDARD ATMOSPHERIC CONDITIONS
SEA LEVEL
GROSS WEIGHT = 90,200 POUNDS

MODEL: C-54 AND R5D

Note:
Maximum design takeoff gross weight is 83,500 pounds.

ENGINE(S): (4) R200-4 AND -9M2

| CURVE | FLAP SETTING | GEAR POSITION |
|---|---|---|
| A | UP | UP |
| D | 40 DEGREES | DOWN |




BASED ON: FLIGHT TEST DATA
DATA AS OF: 1-15-59

X1-73

*Figure A4-15. Four-Engine Emergency Climb — Gross Weight 90,200 Pounds*

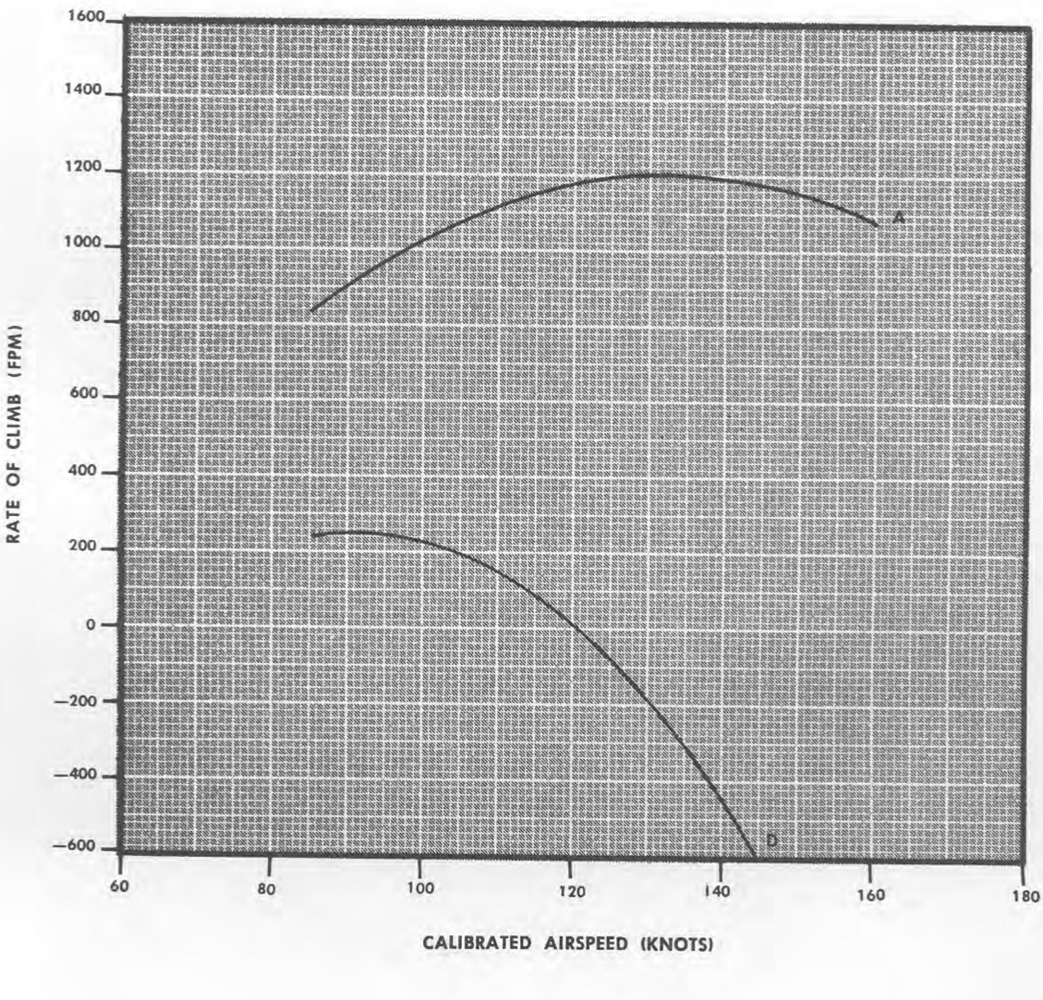
# FOUR ENGINE EMERGENCY CLIMB

MAXIMUM POWER
STANDARD ATMOSPHERIC CONDITIONS
SEA LEVEL
GROSS WEIGHT = 73,000 LB

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND -9M2

| CURVE | FLAP SETTING | GEAR POSITION |
|---|---|---|
| A<br>D | UP<br>40 DEGREES | UP<br>DOWN |




BASED ON: FLIGHT TEST DATA
DATA AS OF: 9-16-56

X1-74

*Figure A4-16. Four-Engine Emergency Climb—Gross Weight 73,000 Pounds*

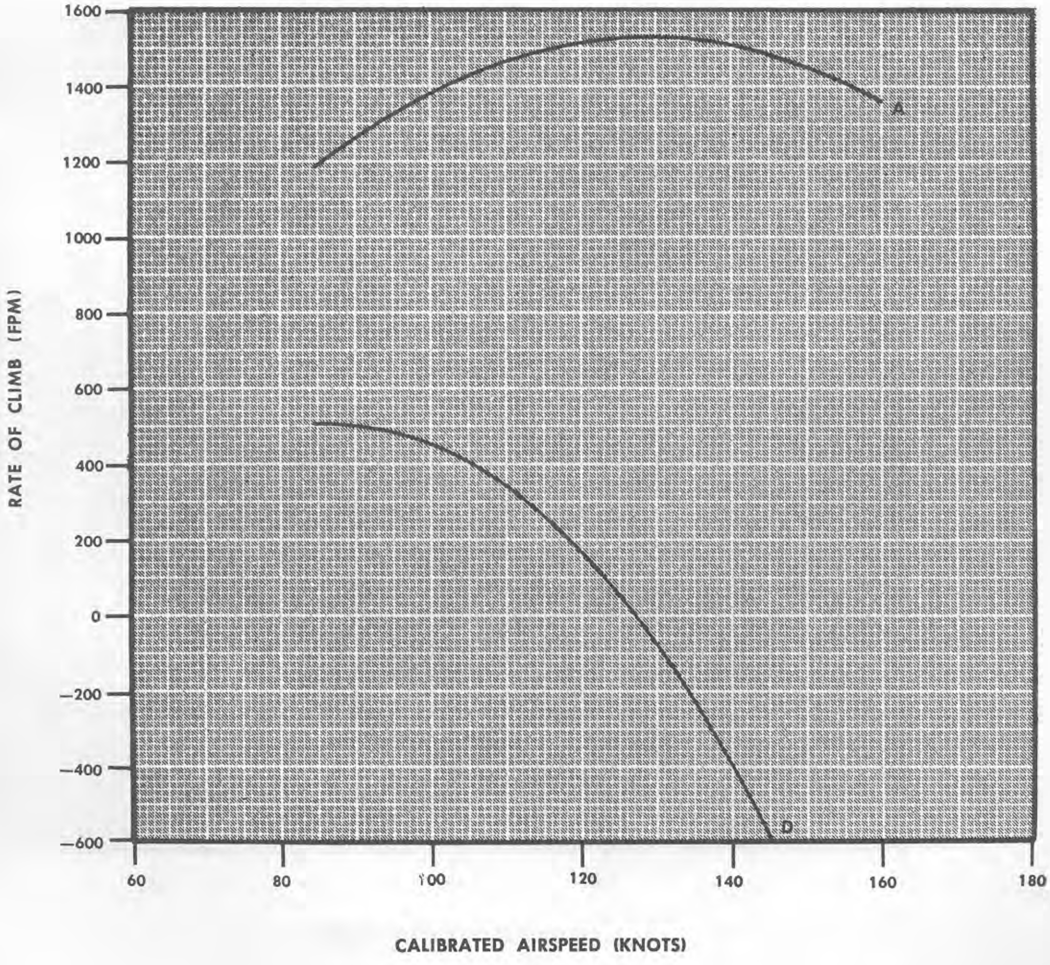
## FOUR ENGINE EMERGENCY CLIMB

MAXIMUM POWER
STANDARD ATMOSPHERIC CONDITIONS
SEA LEVEL
GROSS WEIGHT = 63,500

MODEL: C-54 AND R5D

ENGINE(S): (4) R2000-4 AND -9M2

| CURVE | FLAP SETTING | GEAR POSITION |
|---|---|---|
| A | UP | UP |
| D | 40 DEGREES | DOWN |




BASED ON: FLIGHT TEST DATA
DATA AS OF: 9-16-56

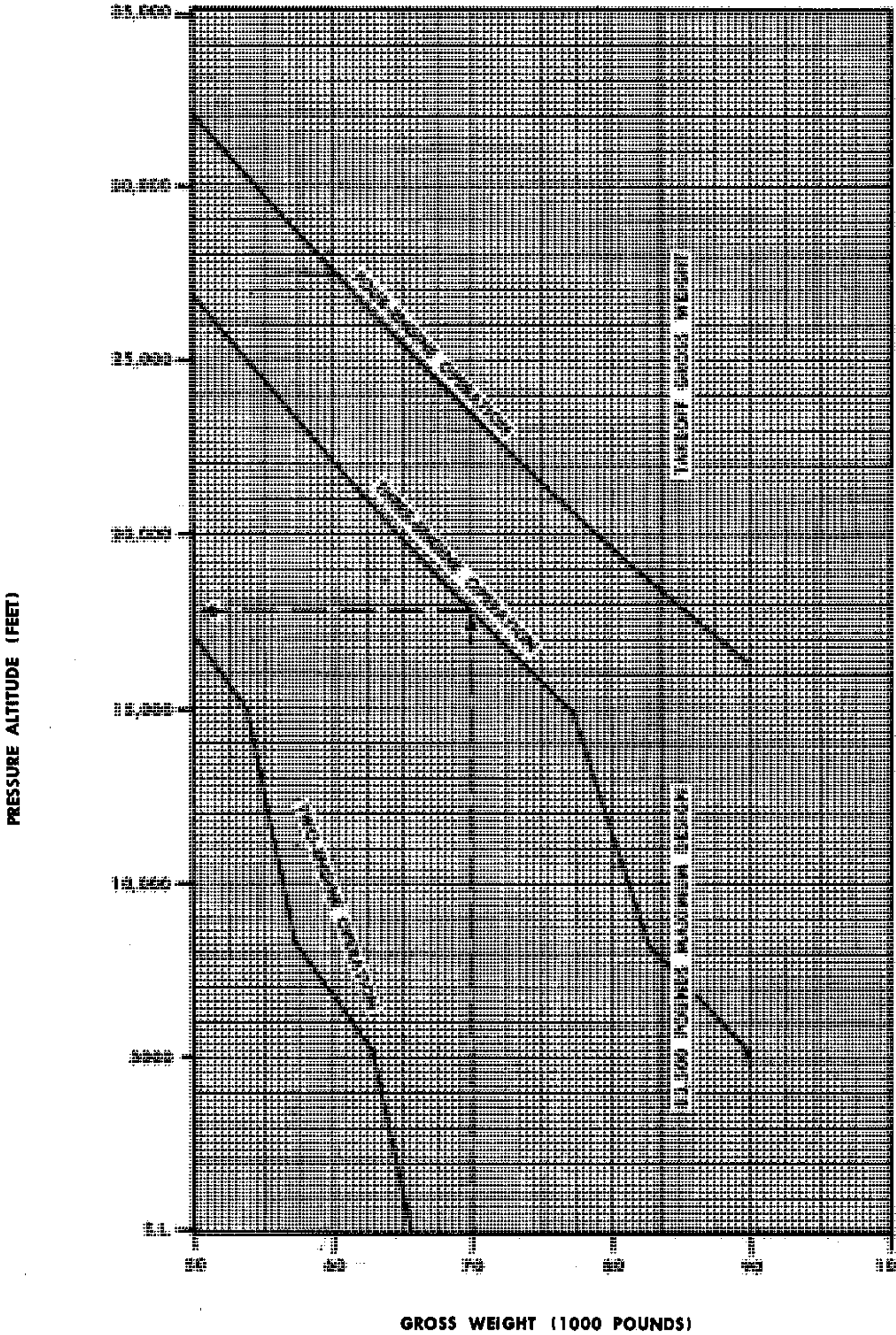
X1-75

*Figure A4-17. Four-Engine Emergency Climb—Gross Weight 63,500 Pounds*

## EMERGENCY CEILING

**100 FT/MIN RATE OF CLIMB AT METO POWER — 128 KNOTS CAS — CLEAN CONFIGURATION**
**HAMILTON STANDARD PROPELLER NO. 23E50, BLADE NO. 6507A**

**MODEL: C-54 AND R5D** | **STANDARD DAY** | **ENGINE(S): (4) R2000-4 AND -9M2**




BASED ON: FLIGHT TEST DATA
DATA AS OF: 1-15-59

X1-98

*Figure A4-18. Emergency Ceiling*