

part 5

range

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RANGE.

SPECIFIC RANGE CHARTS.

DISCUSSION OF CHARTS.

The range performance part of this Appendix is presented as three types of charts: Specific Range charts (nautical miles per pound of fuel), Long Range Power Condition charts, and Flight Planning Charts for Long Range Cruise Conditions. Maximum Endurance charts are also provided.

The Specific Range charts (*figures A5-1 through A5-18*) indicate the nautical miles that can be traveled for each pound of fuel consumed and the airspeed that can be expected for various gross weights, altitudes, and power settings. Curves are included for four-, three-, and two-engine operation. Dashed lines are plotted on each chart and are coded to show 99 percent maximum range operation or maximum endurance. The straight

lines of constant brake horsepower per engine are identified with the appropriate engine rpm and manifold pressure. Curved lines are plotted on each chart showing aircraft gross weight. At the intersection of the applicable curved gross weight line and the dashed 99 percent maximum range line the desired power setting and brake horsepower developed may be read, interpolating if necessary. Expected airspeed and nautical miles per pound of fuel may then be read from their appropriate scale. The fuel flow in pounds per hour may then be determined by dividing the true airspeed in knots by the nautical miles per pound of fuel. It is recommended that the charts be reentered once every hour while cruising to obtain optimum range performance.

LONG-RANGE POWER CONDITION CHARTS.

The Long-Range Power Condition charts (*figures A5-19 through A5-21*) show recommended calibrated airspeed (CAS), brake horsepower, rpm, manifold pressure, fuel flow (pounds per hour), and nautical miles per pound of fuel for long-range operation with four, three, and two engines at various gross weights in low or high blower, auto-rich or auto-lean carburetor setting. Enter the chart at the aircraft's initial cruise gross weight (or any desired intermediate gross weight) and move vertically from the bottom to the top to determine the power settings, CAS, and specific fuel consumption. To gain maximum range efficiency from use of the chart, reenter it at least once each hour at the new gross weight (decreased as fuel is consumed) to establish the new power settings. These charts are based on the recommended long-range speed line (99 percent maximum range) located on each Specific Range chart.

FLIGHT PLANNING CHARTS FOR LONG RANGE CRUISE CONDITIONS.

These charts (*figures A5-22 through A5-27*) make it possible to determine the fuel used and the time elapsed for a cruise operation when either initial or final aircraft cruise gross weight and required distance to cruise are known. In the event initial and final cruise gross weights are known, both the range and time to cruise may be obtained from the charts. The charts are constructed for use with four-, three-, and two-engine power conditions. The vertical scales plotted on the charts labeled range and time are presented only to find the difference in nautical miles (aircraft range) or time in hours due to fuel consumed between initial and final cruise gross weights. A sample problem is included in figure A5-24.

MAXIMUM ENDURANCE POWER CONDITION CHARTS.

The Maximum Endurance Power Condition charts (*figures A5-28 through A5-30*) present the calibrated airspeed (CAS), brake horsepower, rpm, manifold pressure, and fuel flow for maximum endurance conditions at various gross weights for operation with four, three, and two engines. Where applicable, the charts contain altitude curves which are coded to show operation in auto-rich or auto-lean mixture in low or high blower. To determine CAS, power, rpm, manifold pressure and fuel flow values, enter the chart at the bottom with the aircraft's gross weight and plot a straight line upward. The desired values may then be read to the right or left as the vertical line intersects the particular curve. The endurance in hours is obtained by dividing the amount of fuel remaining to be used by the average total fuel flow pounds per hour occurring between the initial and final gross weights. Where sudden changes occur in the fuel flow curve, the endurance calculation should be separated into parts at the gross weight where the break occurs, and the separate endurance times added together.

FOUR ENGINE SPECIFIC RANGE

SEA LEVEL

LOW BLOWER STANDARD DAY

MODEL: C-54 AND R5D

ENGINE(5): (4) R2000-4 AND -9M2

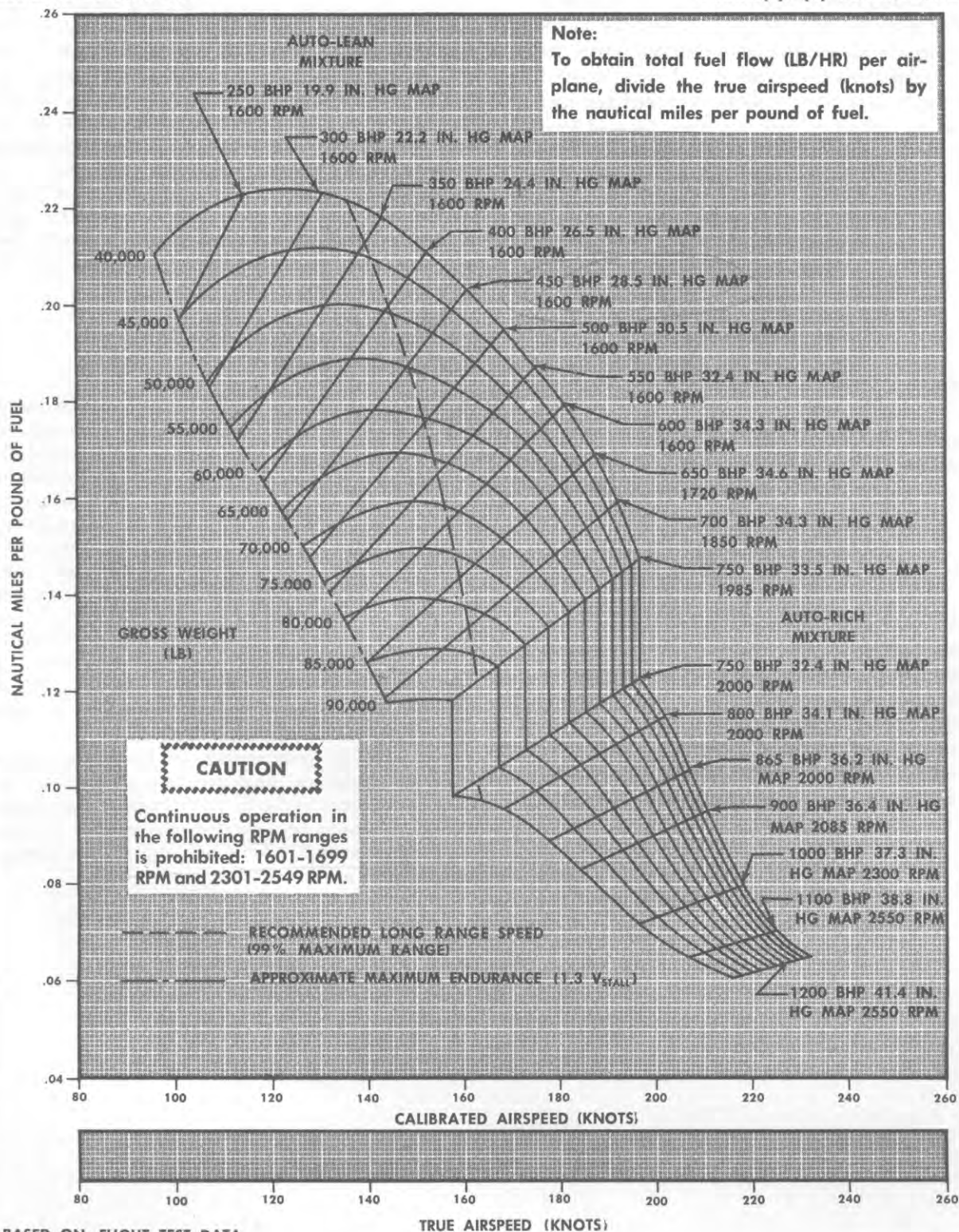


Figure A5-1. Four-Engine Specific Range — Sea Level — Low Blower — Standard Day

X1-44

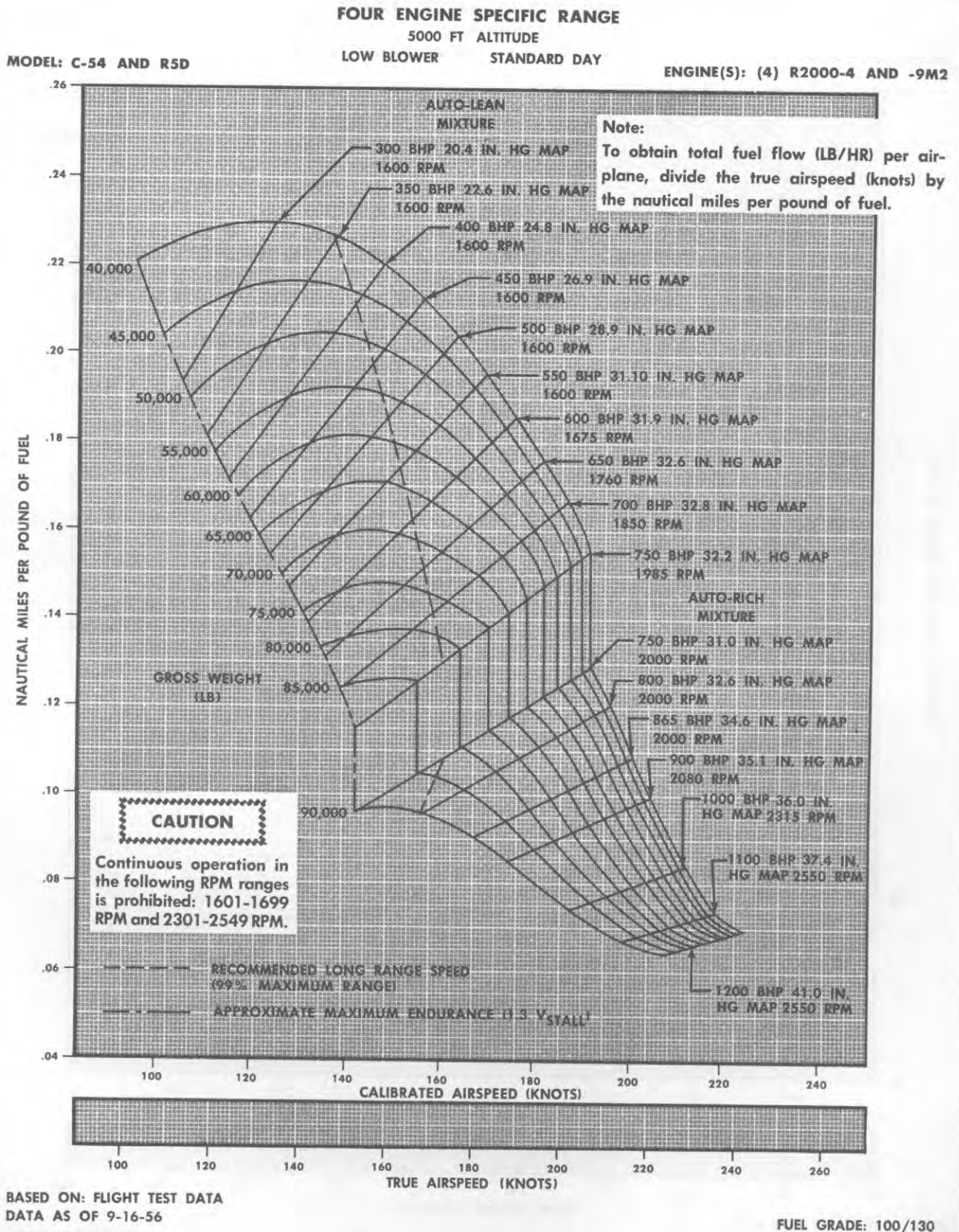


Figure A5-2. Four-Engine Specific Range – 5000 Feet Altitude – Low Blower – Standard Day

X1-45

FOUR ENGINE SPECIFIC RANGE

10,000 FT ALTITUDE

MODEL: C-54 AND R5D

LOW BLOWER

STANDARD DAY

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

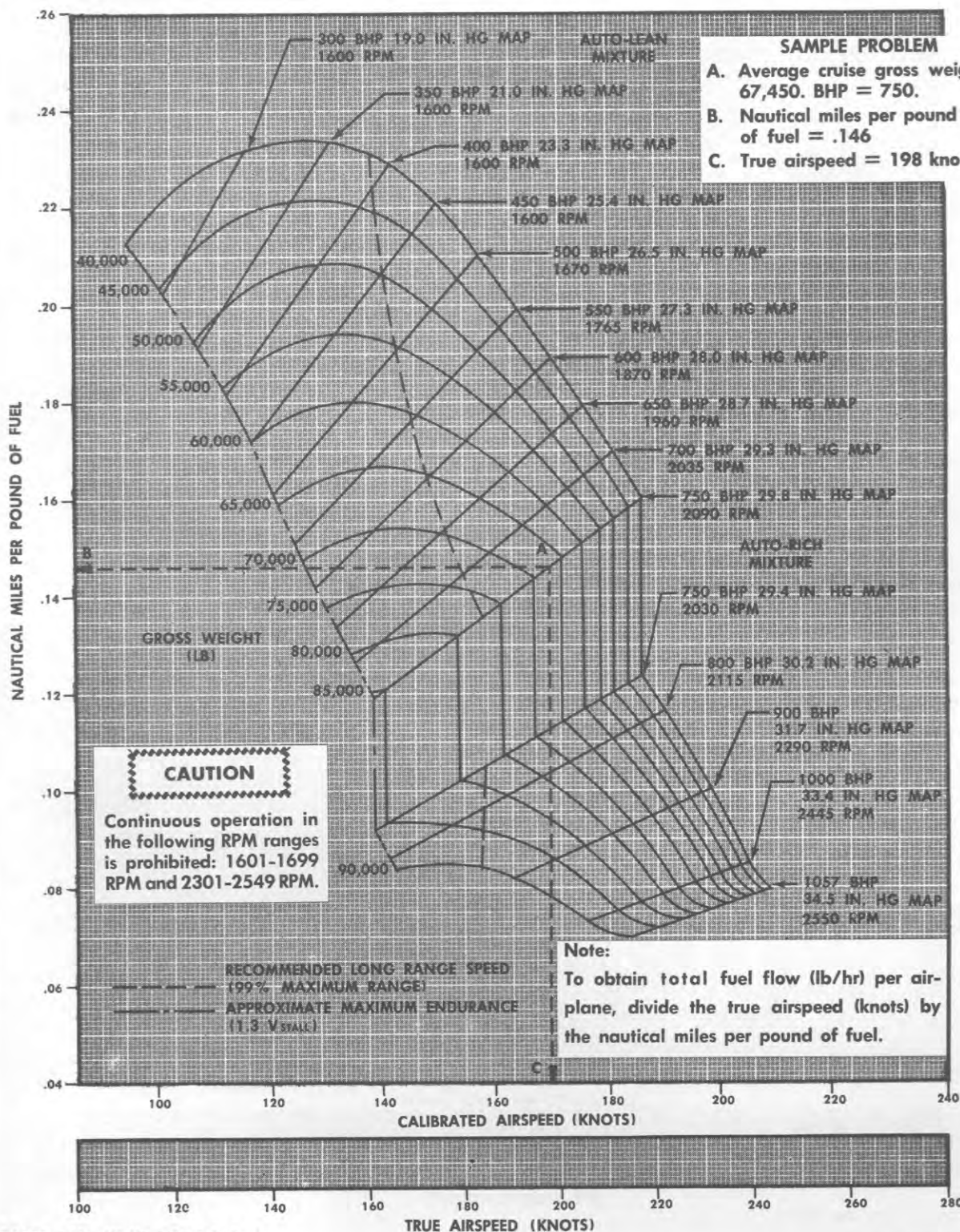


Figure A5-3. Four-Engine Specific Range — 10,000 Feet Altitude — Low Blower — Standard Day

FOUR ENGINE SPECIFIC RANGE

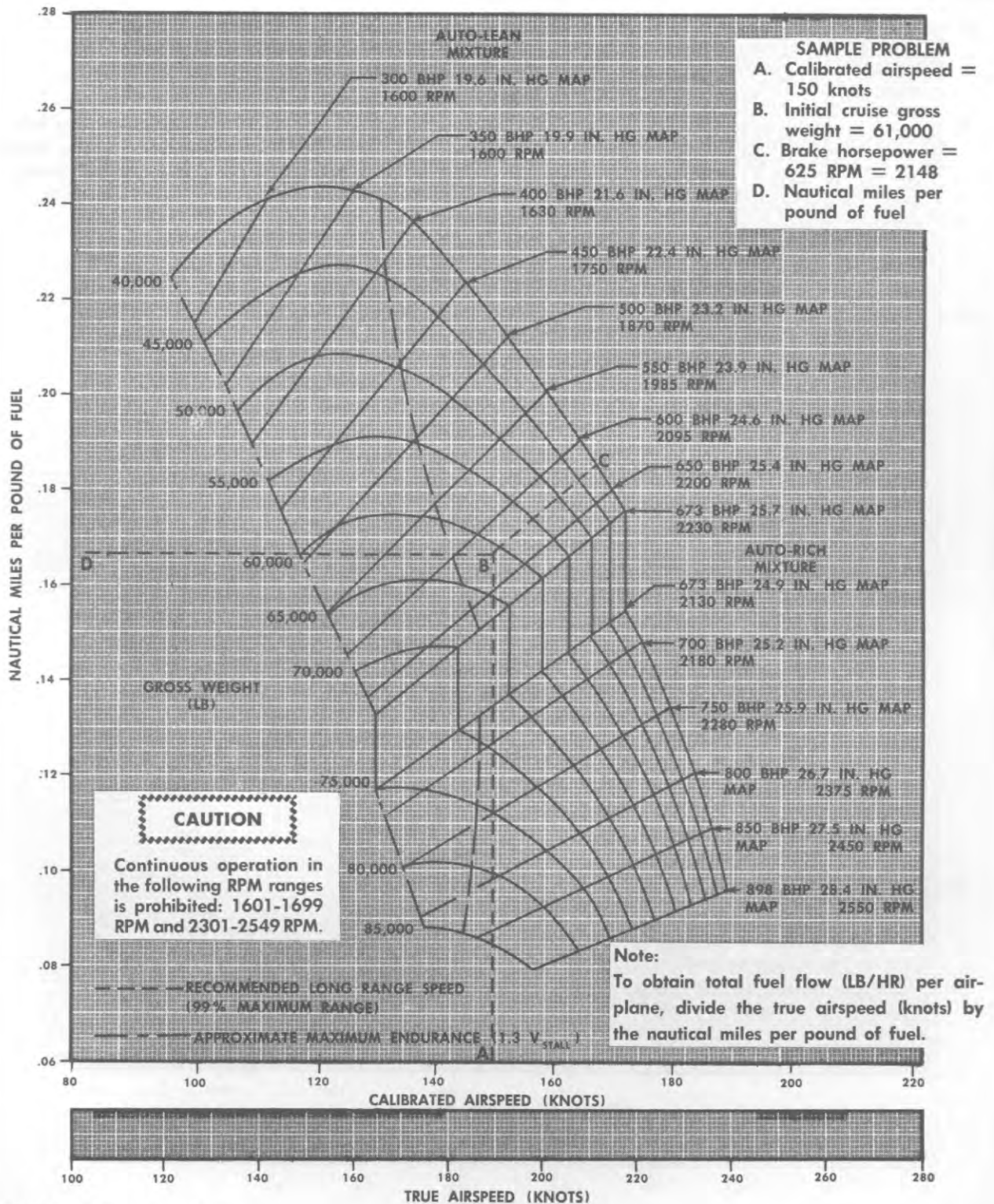
15,000 FT ALTITUDE

MODEL: C-54 AND R5D

LOW BLOWER

STANDARD DAY

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



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

FUEL GRADE: 100/130

Figure A5-4. Four-Engine Specific Range – 15,000 Feet Altitude – Low Blower – Standard Day

X1-47

A5-7

FOUR ENGINE SPECIFIC RANGE

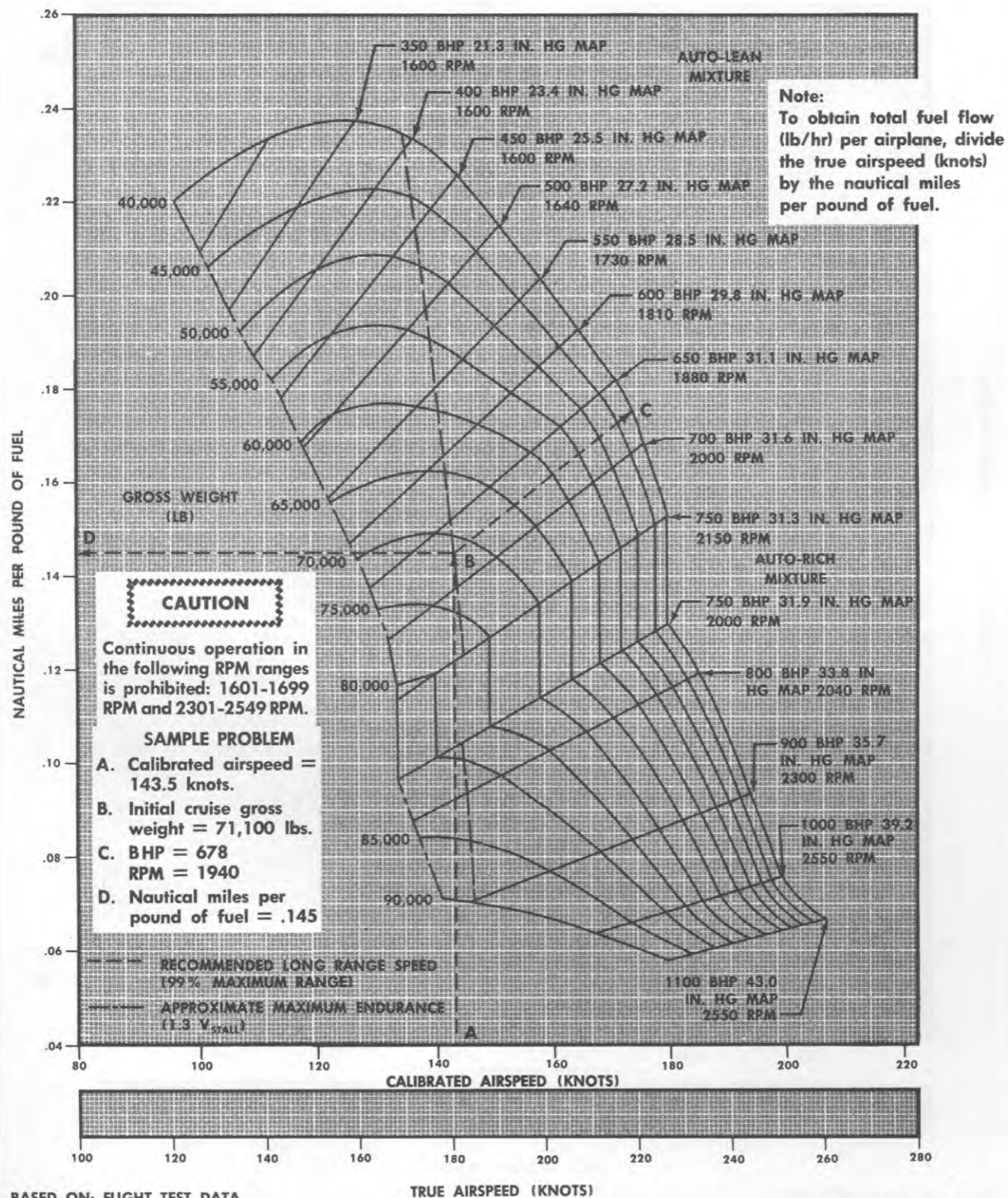
15,000 FT ALTITUDE

MODEL: C-54 AND R5D

HIGH BLOWER

STANDARD DAY

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



**Figure A5-5. Four-Engine Specific Range – 15,000 Feet Altitude –
 High Blower – Standard Day**

X1-4B

FOUR ENGINE SPECIFIC RANGE

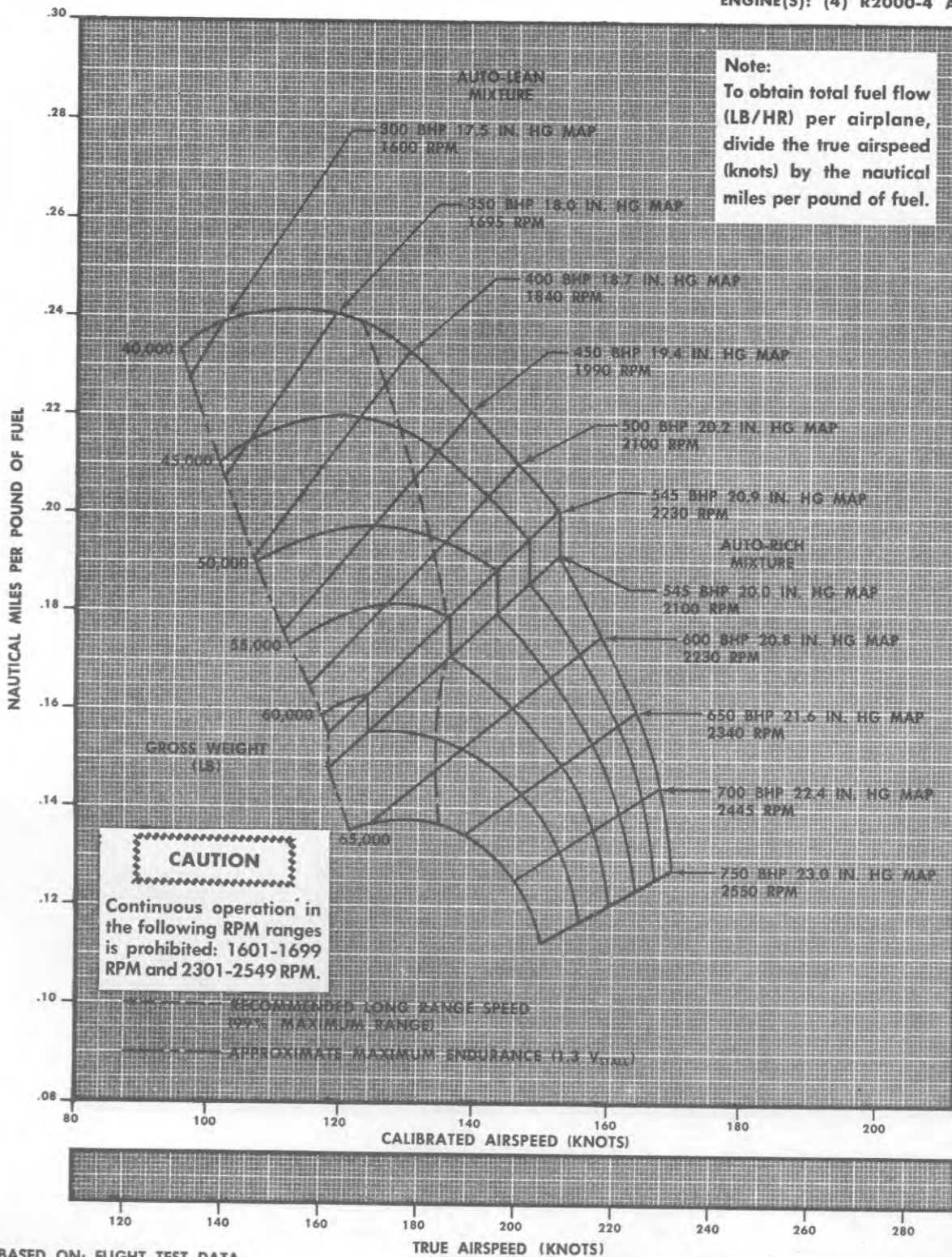
20,000 FT ALTITUDE

MODEL: C-54 AND R5D

LOW BLOWER

STANDARD DAY

ENGINE(5): (4) R2000-4 AND -9M2



**Figure A5-6. Four-Engine Specific Range – 20,000 Feet Altitude –
Low Blower – Standard Day**

X1-49

FOUR ENGINE SPECIFIC RANGE

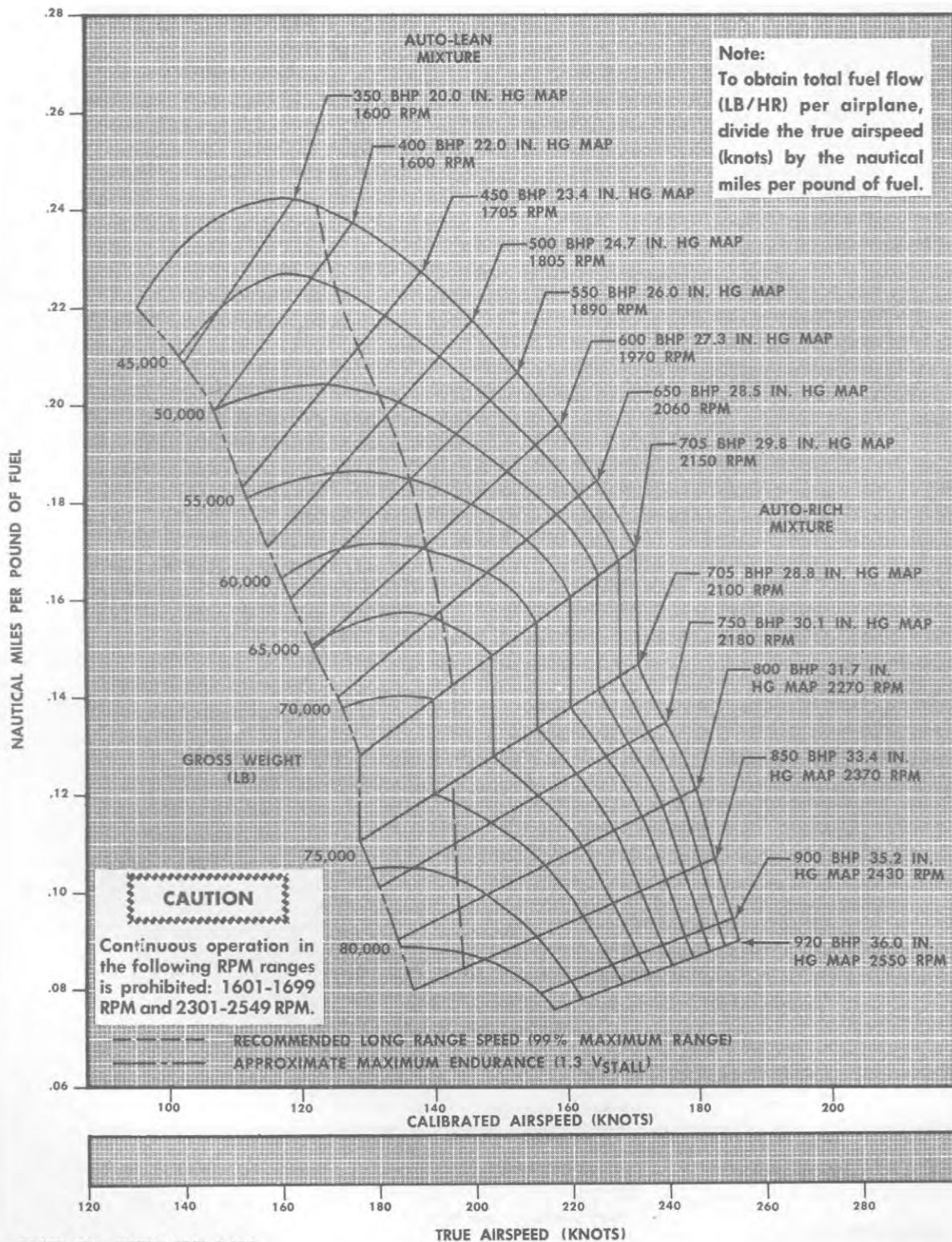
20,000 FT ALTITUDE

MODEL: C-54 AND R5D

HIGH BLOWER

STANDARD DAY

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



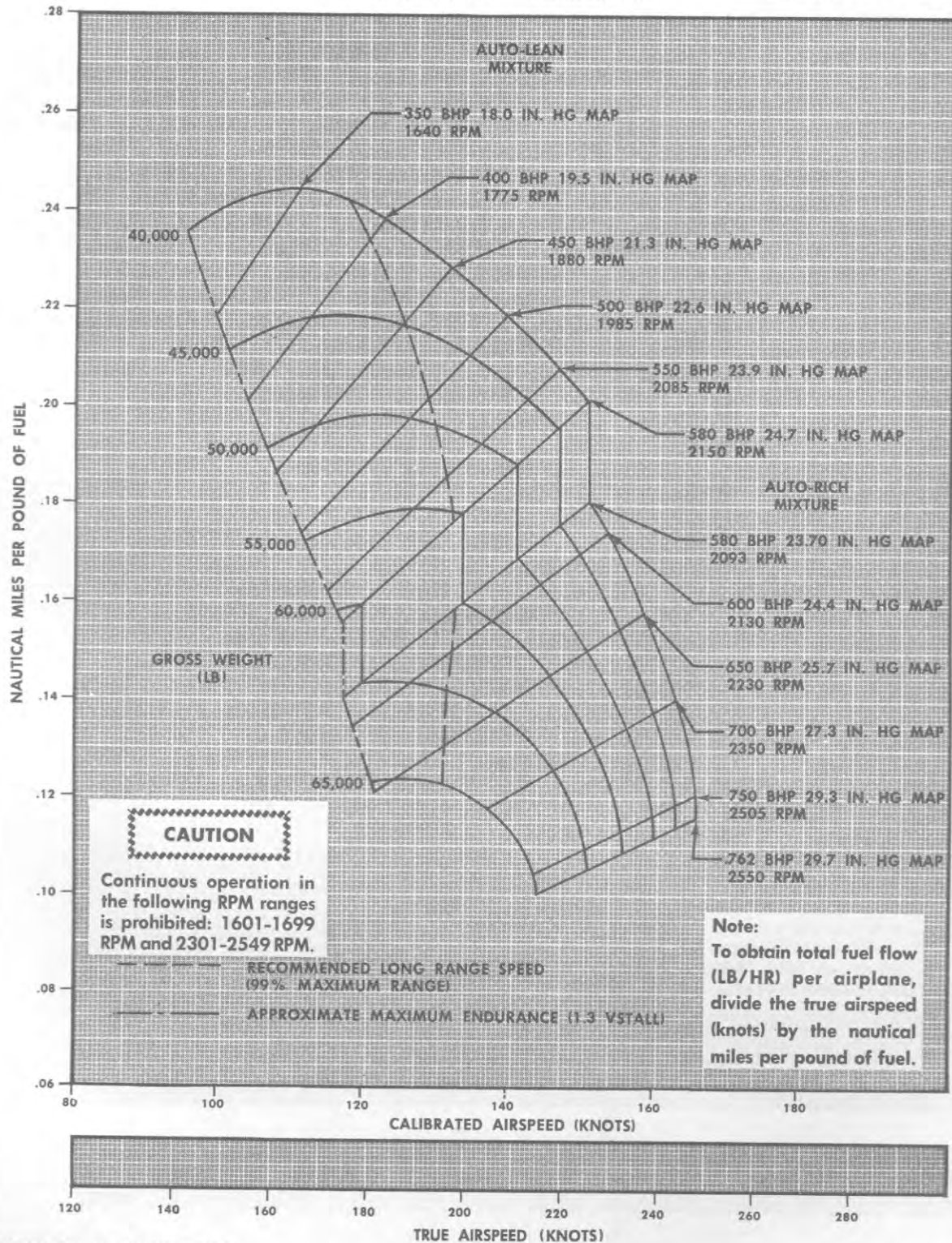
BASED ON: FLIGHT TEST DATA
DATA AS OF 9-16-56

FUEL GRADE: 100/130

**Figure A5-7. Four-Engine Specific Range – 20,000 Feet Altitude –
High Blower – Standard Day**

X1-50

FOUR-ENGINE SPECIFIC RANGE
 25,000 FT ALTITUDE
 MODEL: C-54 AND R5D HIGH BLOWER STANDARD DAY ENGINE(S): (4) R2000-4 AND -9M2



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

FUEL GRADE: 100/130

Figure A5-8. Four-Engine Specific Range — 25,000 Feet Altitude — High Blower — Standard Day

X1-51

THREE ENGINE SPECIFIC RANGE

SEA LEVEL

MODEL: C-54 AND R5D

LOW BLOWER

STANDARD DAY

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

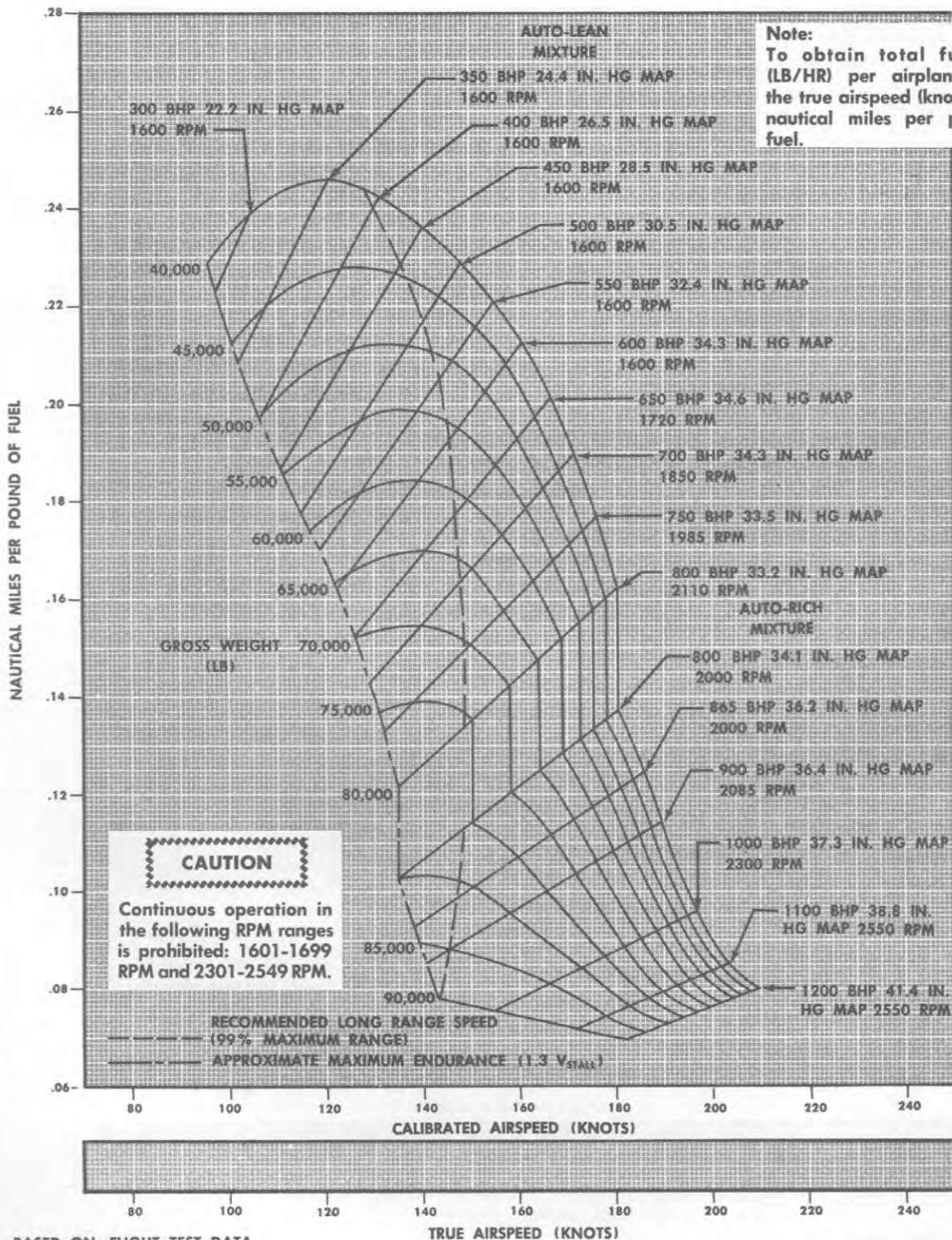


Figure A5-9. Three-Engine Specific Range – Sea Level – Low Blower – Standard Day

X1-52

THREE ENGINE SPECIFIC RANGE
 5000 FT ALTITUDE
 LOW BLOWER STANDARD DAY
 MODEL C-54 AND R5D ENGINE(5): (4) R2000-4 AND -9M2

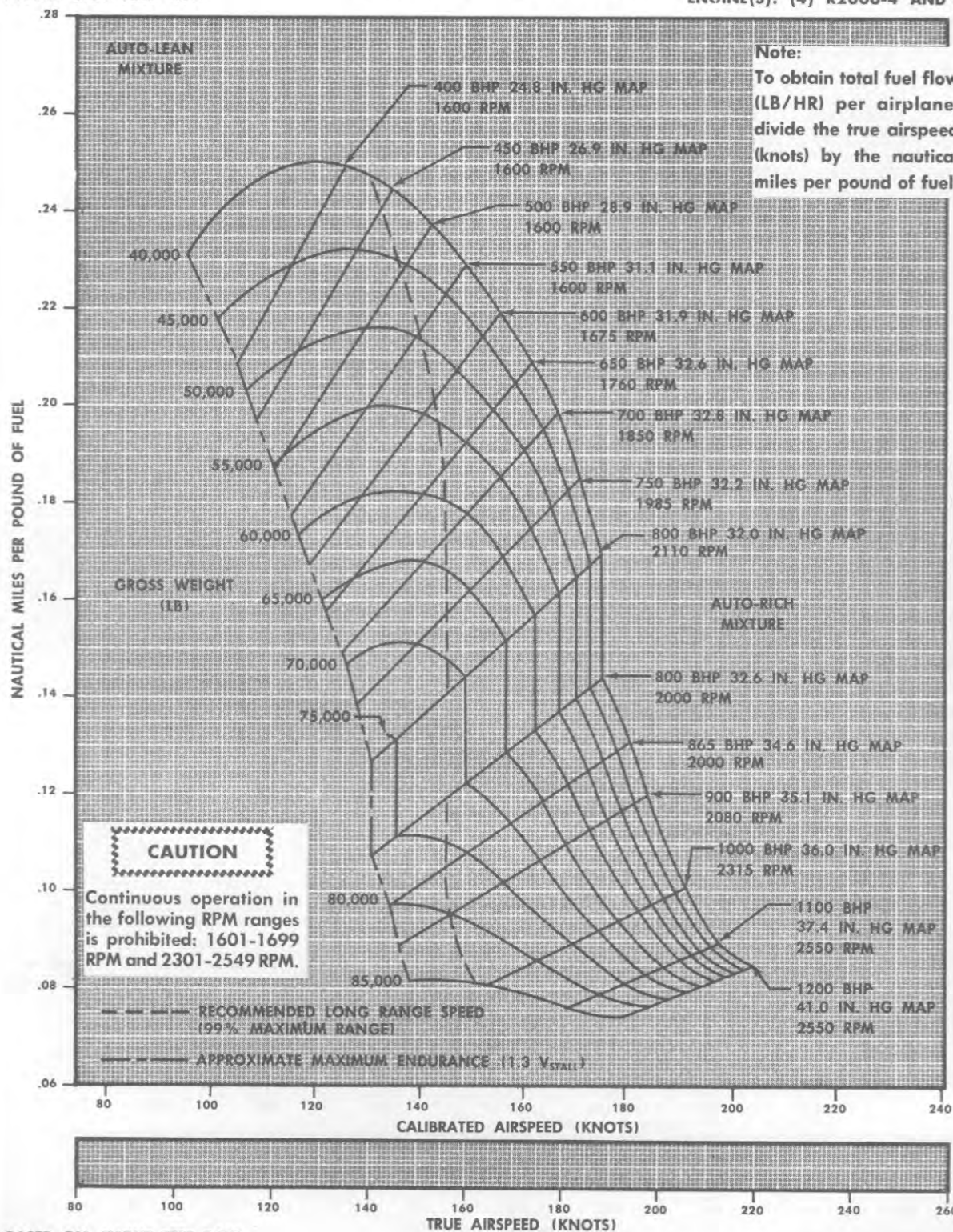


Figure A5-10. Three-Engine Specific Range – 5000 Feet – Low Blower – Standard Day

X1-53

THREE ENGINE SPECIFIC RANGE

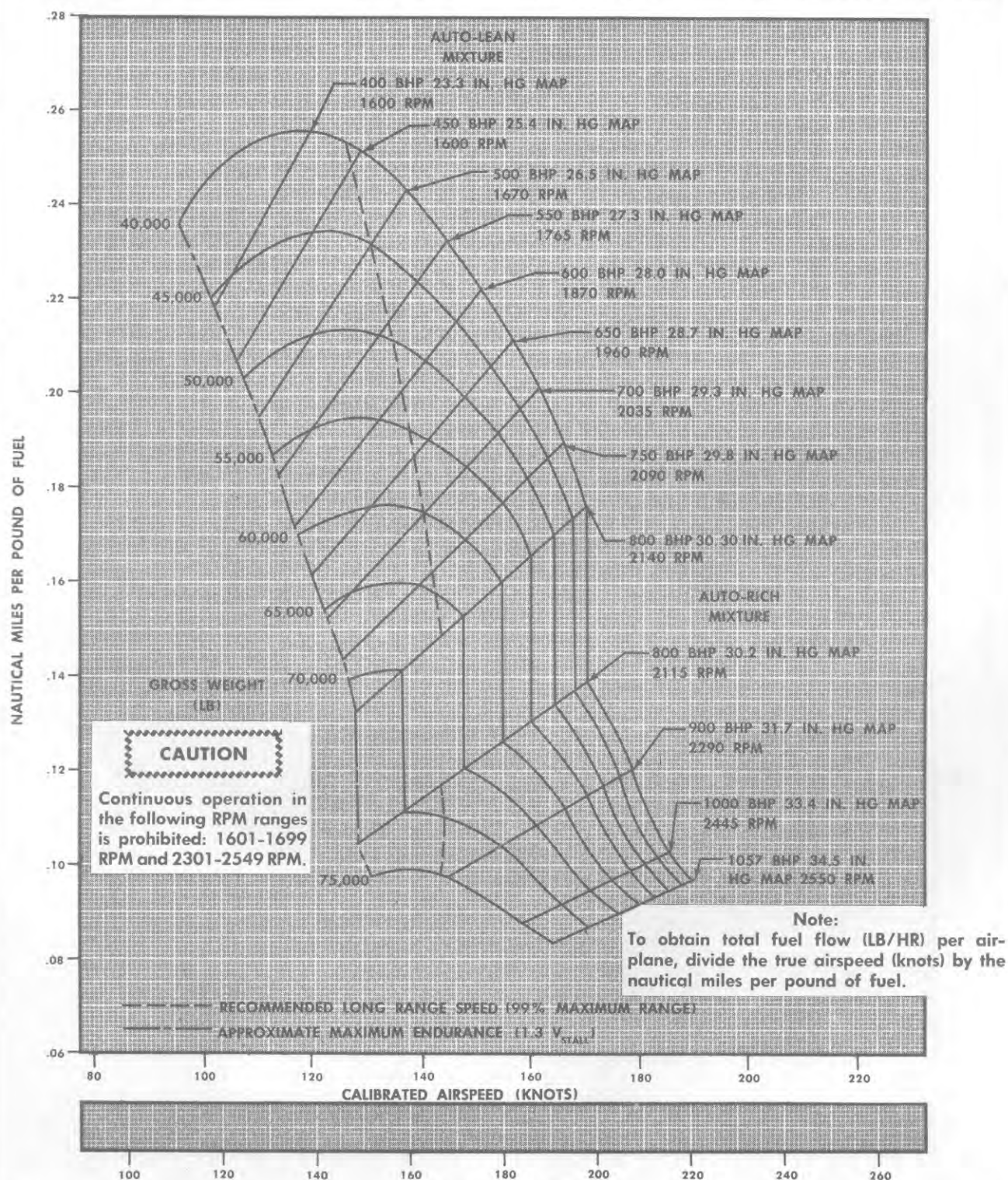
10,000 FT. ALTITUDE

MODEL: C-54 AND R5D

LOW BLOWER

STANDARD DAY

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



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

TRUE AIRSPEED (KNOTS)

FUEL GRADE: 100/130

Figure A5-11. Three-Engine Specific Range – 10,000 Feet – Low Blower – Standard Day

X1-54

THREE ENGINE SPECIFIC RANGE
 15,000 FT ALTITUDE
 MODEL: C-54 AND R5D LOW BLOWER STANDARD DAY ENGINE(S): (4) R2000-4 AND -9M2

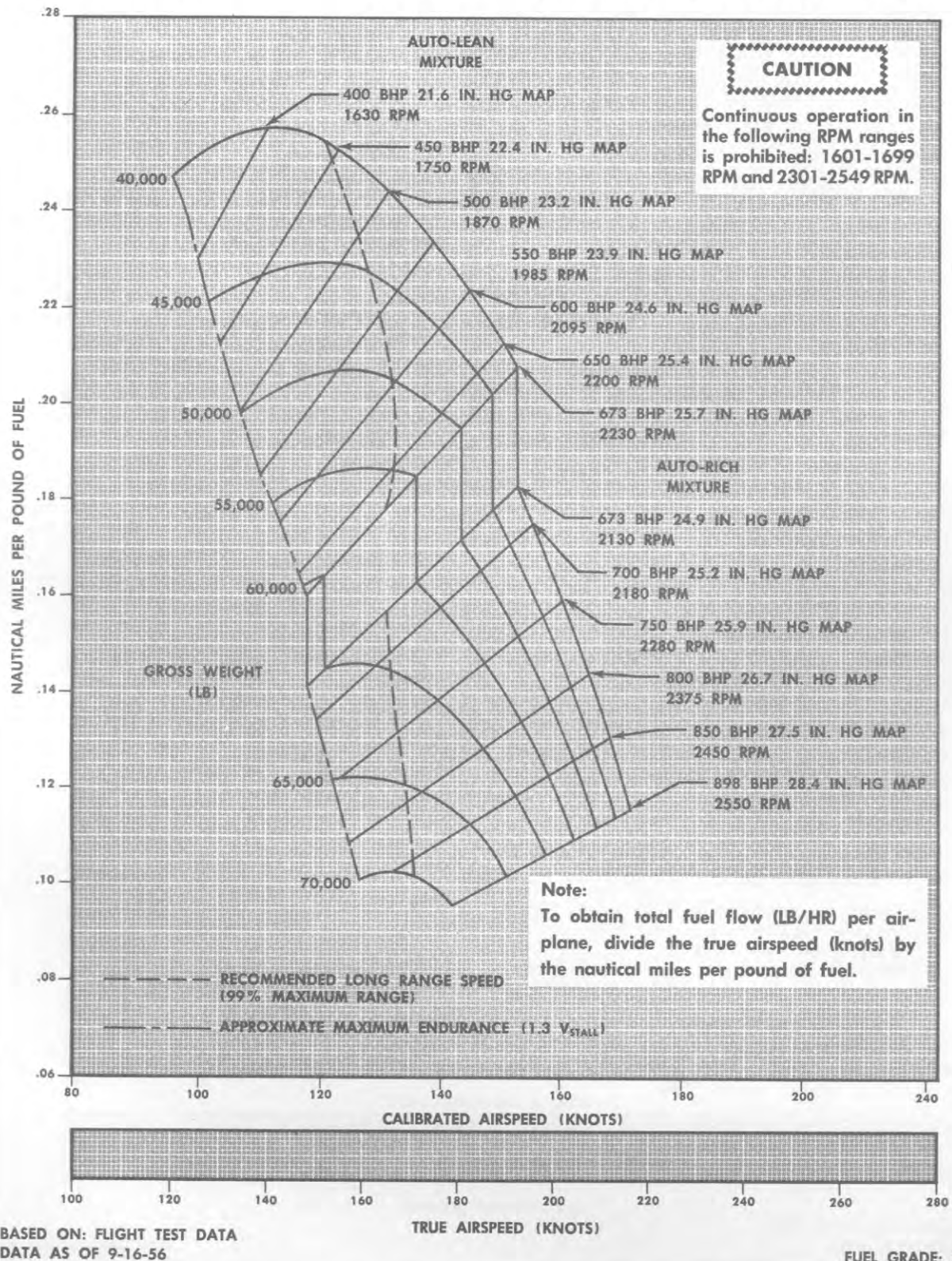


Figure A5-12. Three-Engine Specific Range – 15,000 Feet – Low Blower – Standard Day

X1-55

THREE ENGINE SPECIFIC RANGE

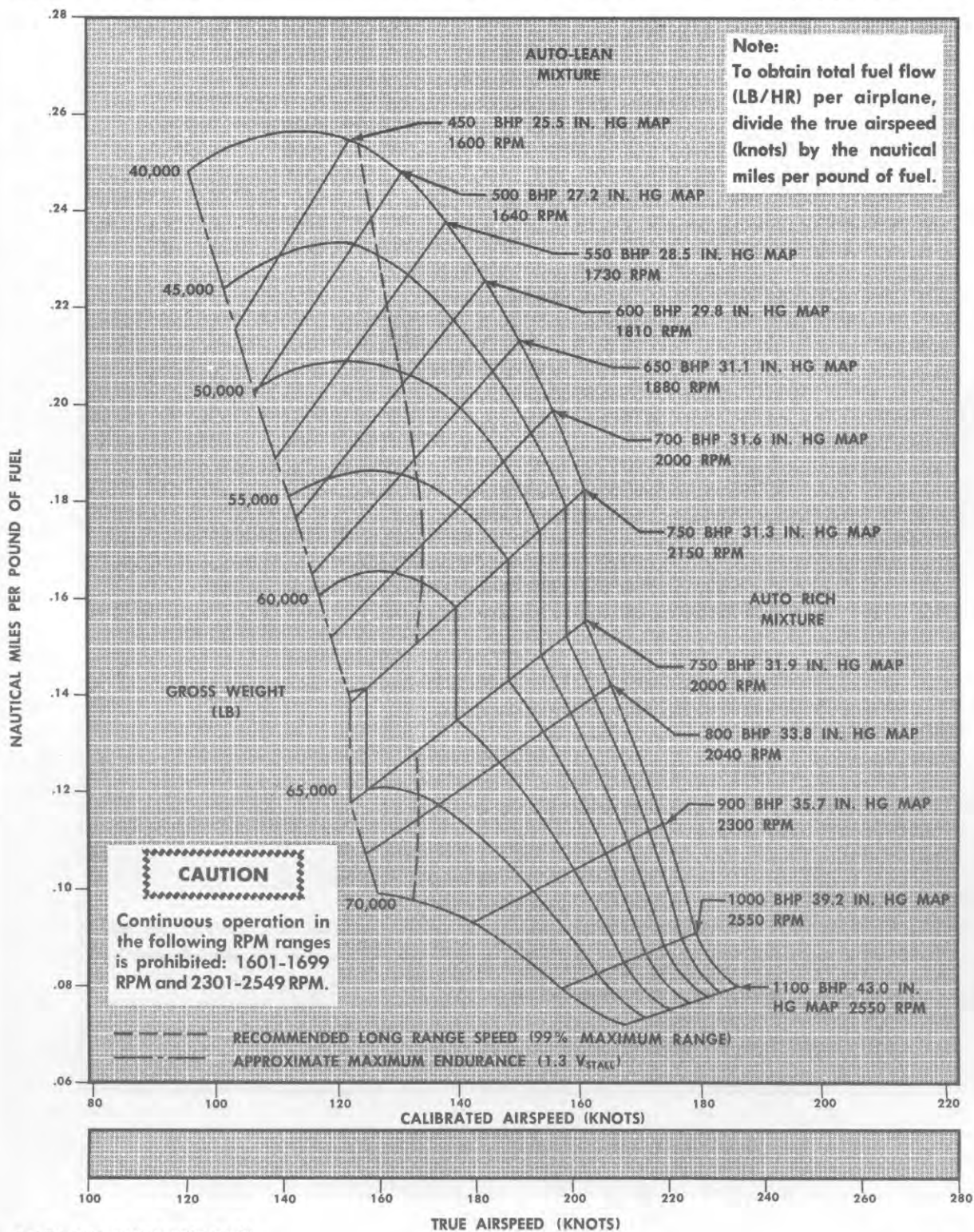
15,000 FT ALTITUDE

MODEL: C-54 AND R5D

HIGH BLOWER

STANDARD DAY

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



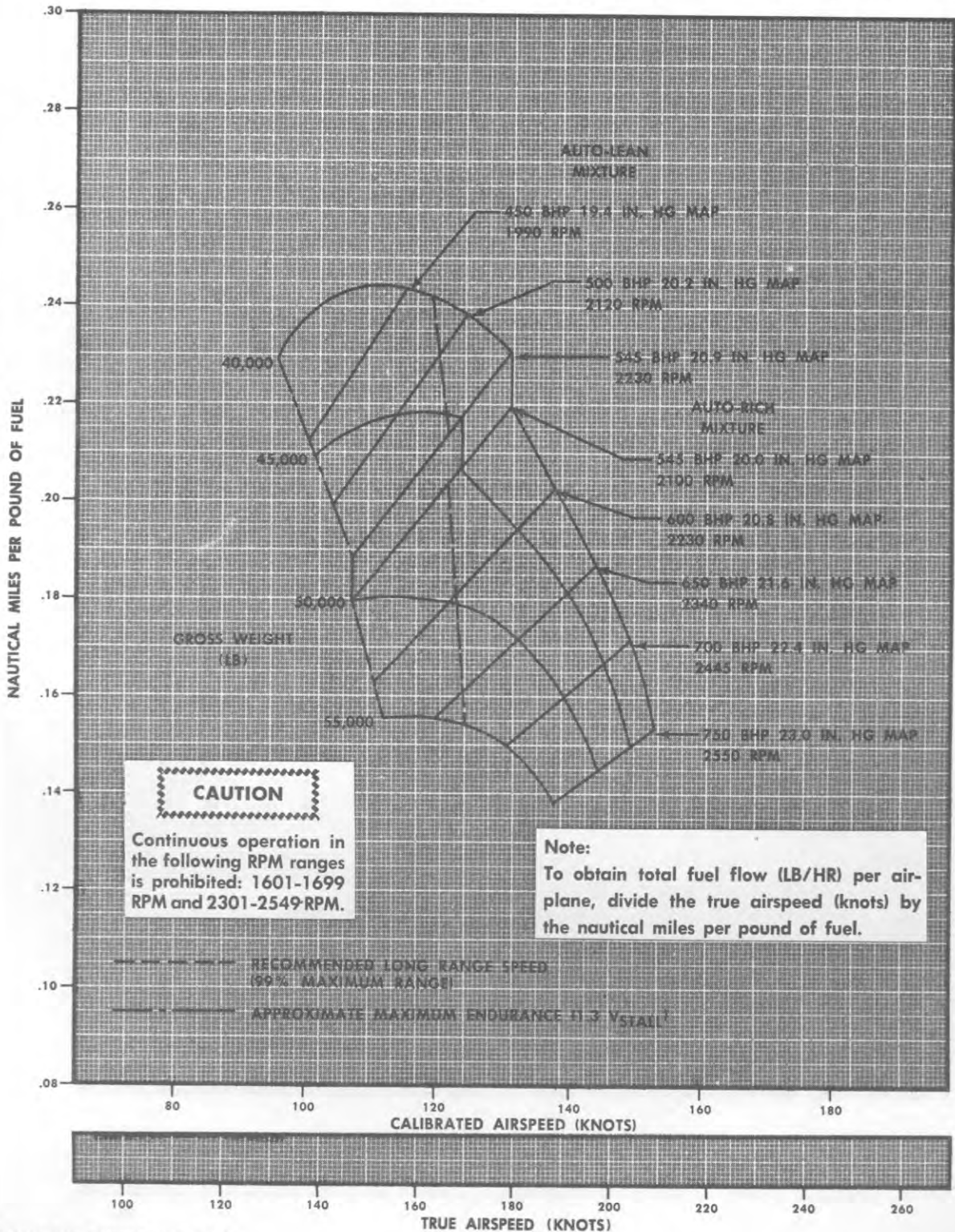
BASED ON: FLIGHT TEST DATA
DATA AS OF 9-16-56

FUEL GRADE: 100/130

Figure A5-13. Three-Engine Specific Range — 15,000 Feet — High Blower — Standard Day

X1-56

THREE ENGINE SPECIFIC RANGE
 20,000 FT. ALTITUDE
 MODEL: C-54 AND R5D LOW BLOWER STANDARD DAY ENGINE(S): (4) R2000-4 AND -9M2



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

FUEL GRADE: 100/130

Figure A5-14. Three-Engine Specific Range – 20,000 Feet – Low Blower – Standard Day

X1-57

THREE ENGINE SPECIFIC RANGE

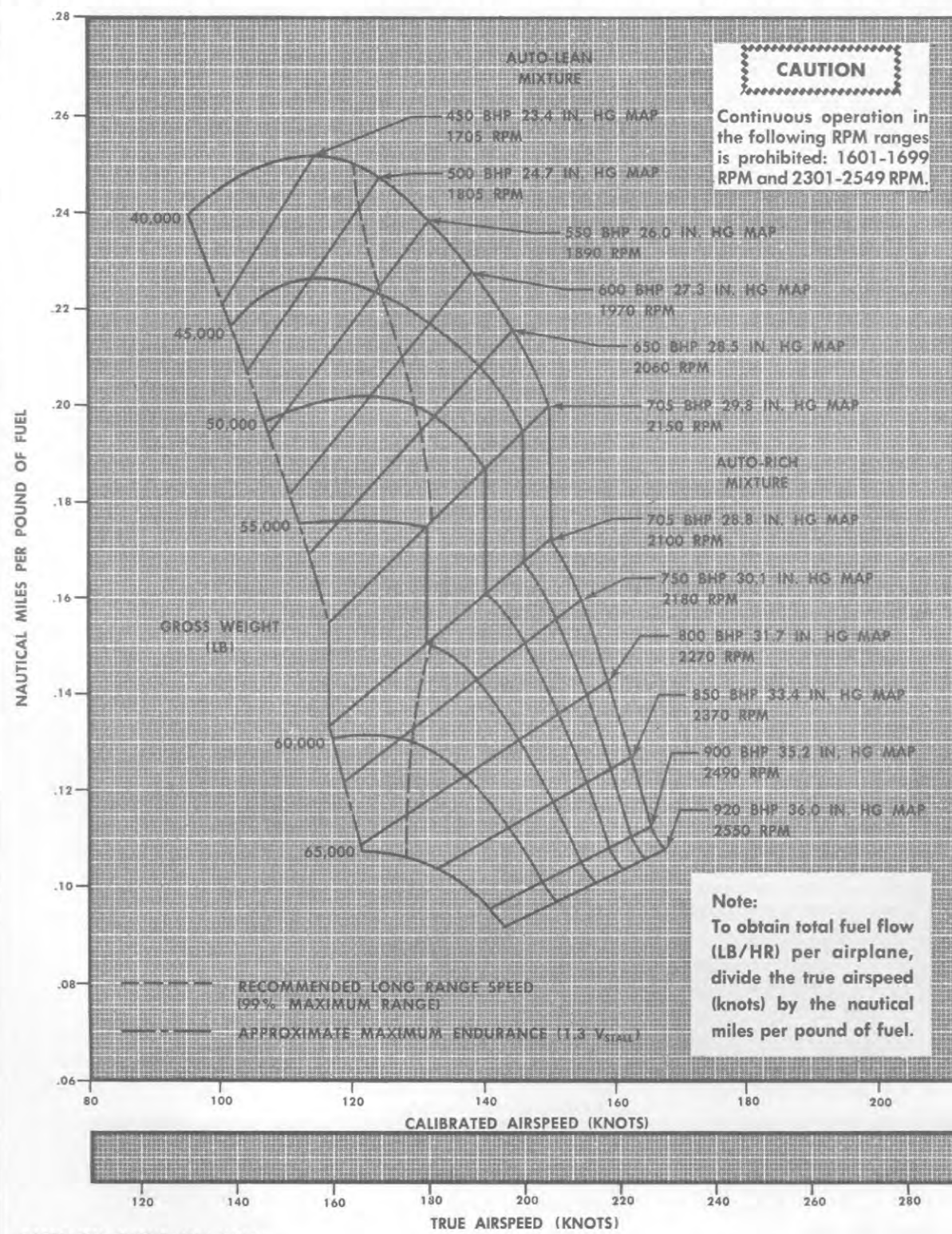
20,000 FT ALTITUDE

MODEL: C-54 AND R5D

HIGH BLOWER

STANDARD DAY

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



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

FUEL GRADE: 100/130

Figure A5-15. Three-Engine Specific Range – 20,000 Feet – High Blower – Standard Day

X1-5B

TWO ENGINE SPECIFIC RANGE

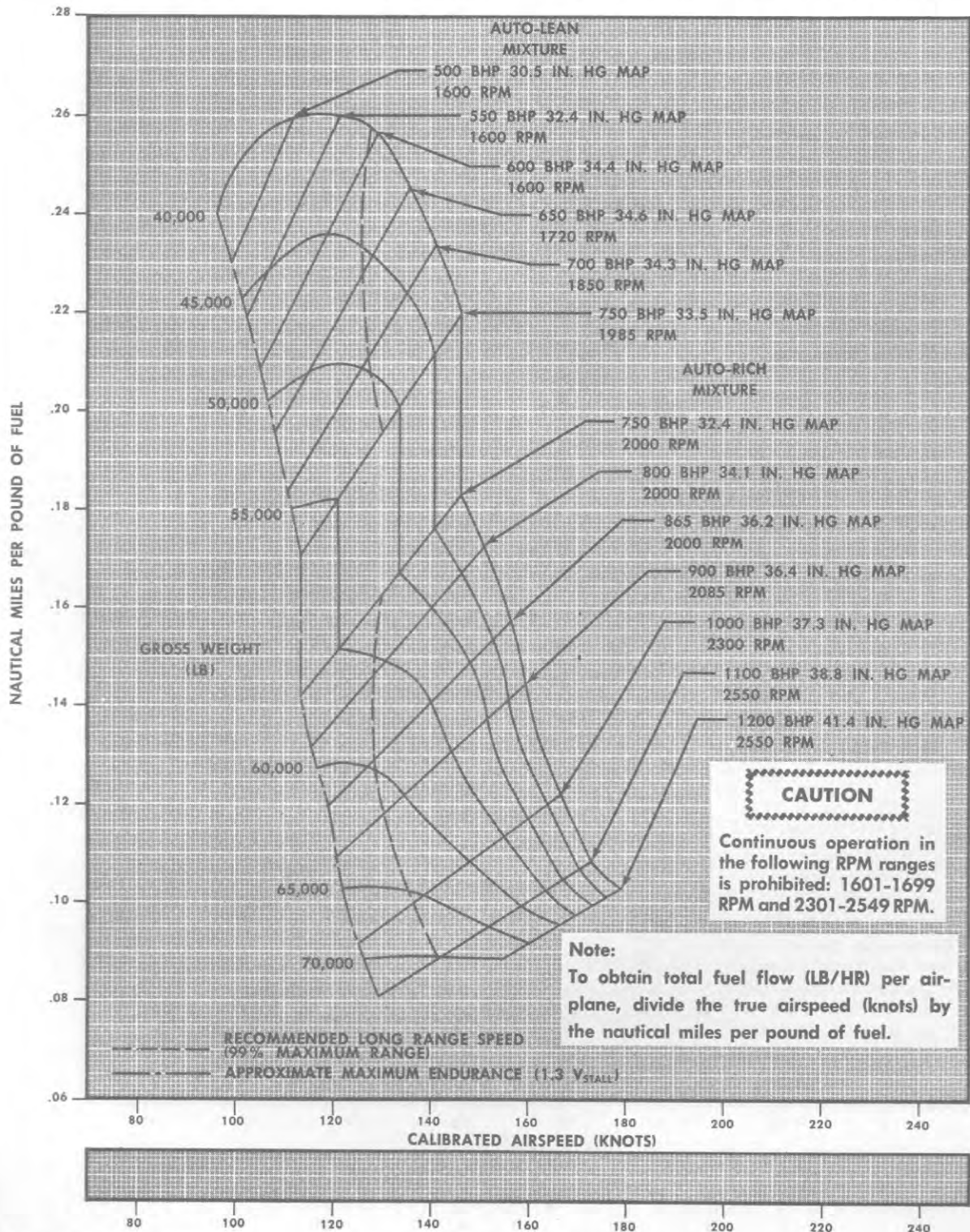
SEA LEVEL

MODEL: C-54 AND R5D

LOW BLOWER

STANDARD DAY

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



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

FUEL GRADE: 100/130

Figure A5-16. Two-Engine Specific Range – Sea Level – Low Blower – Standard Day

X1-59

TWO ENGINE SPECIFIC RANGE

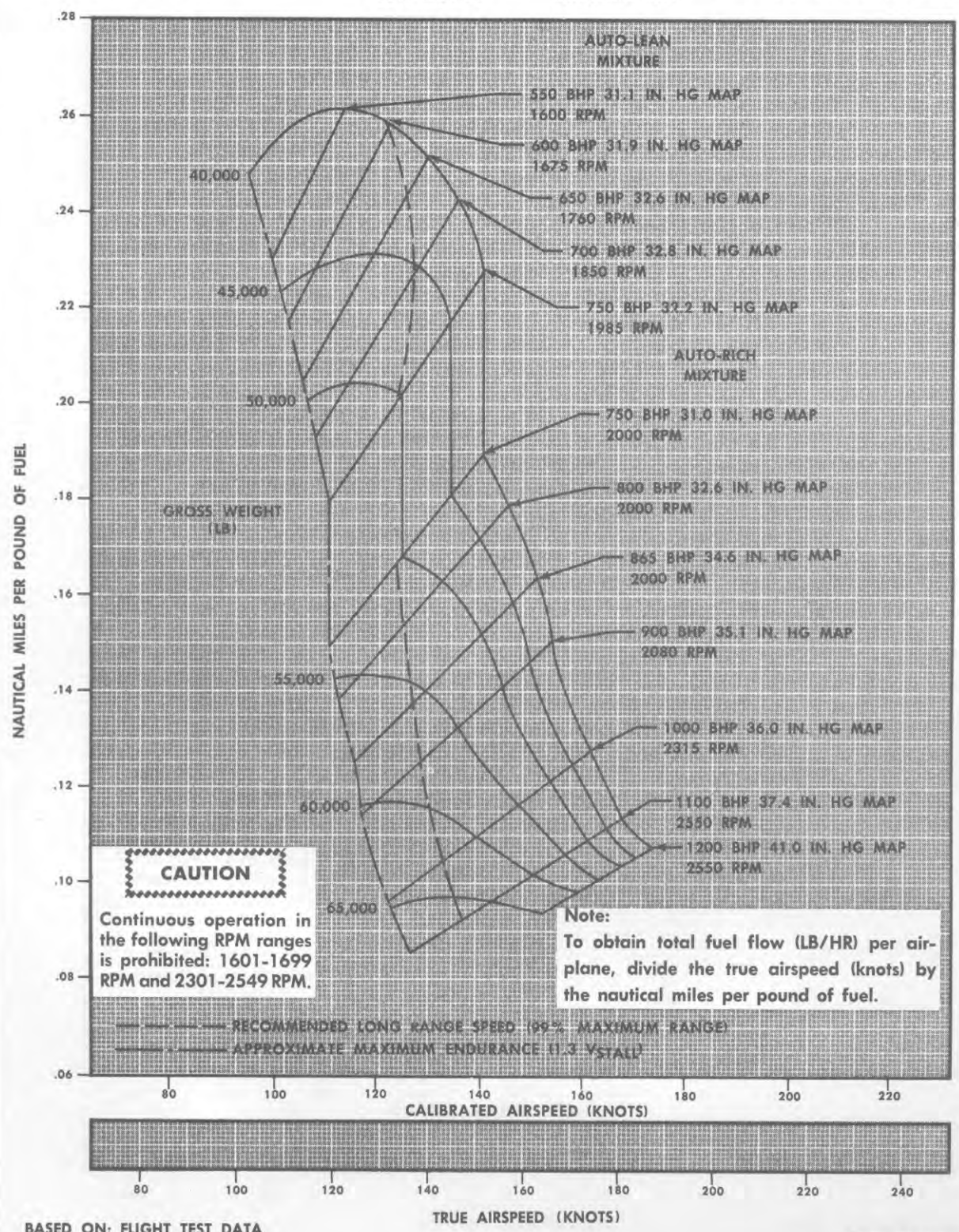
5,000 FT ALTITUDE

MODEL: C-54 AND R5D

LOW BLOWER

STANDARD DAY

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



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

FUEL GRADE: 100/130

Figure A5-17. Two-Engine Specific Range – 5000 Feet – Low Blower – Standard Day

X1-60

TWO ENGINE SPECIFIC RANGE

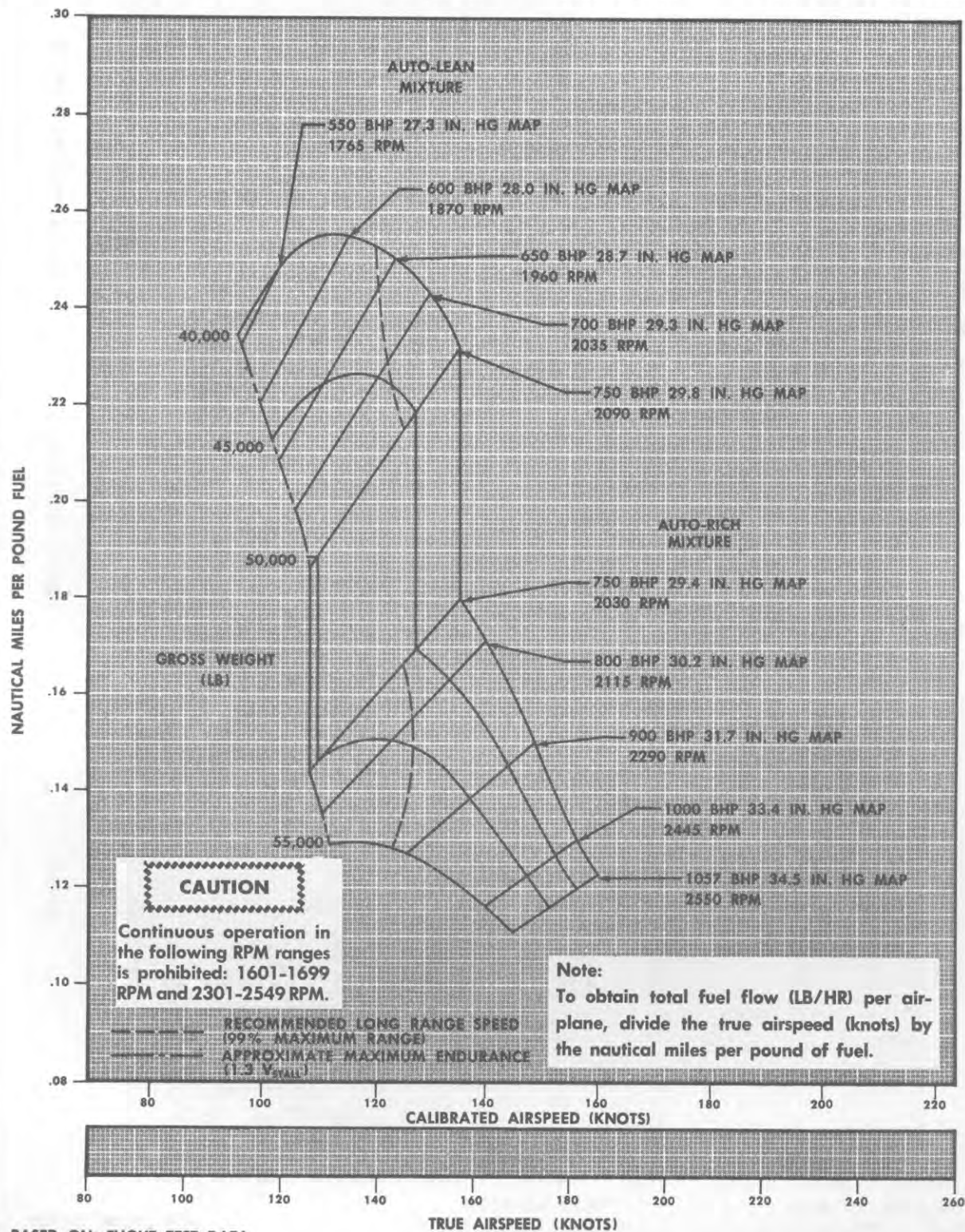
10,000 FT ALTITUDE

MODEL: C-54 AND R5D

LOW BLOWER

STANDARD DAY

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



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

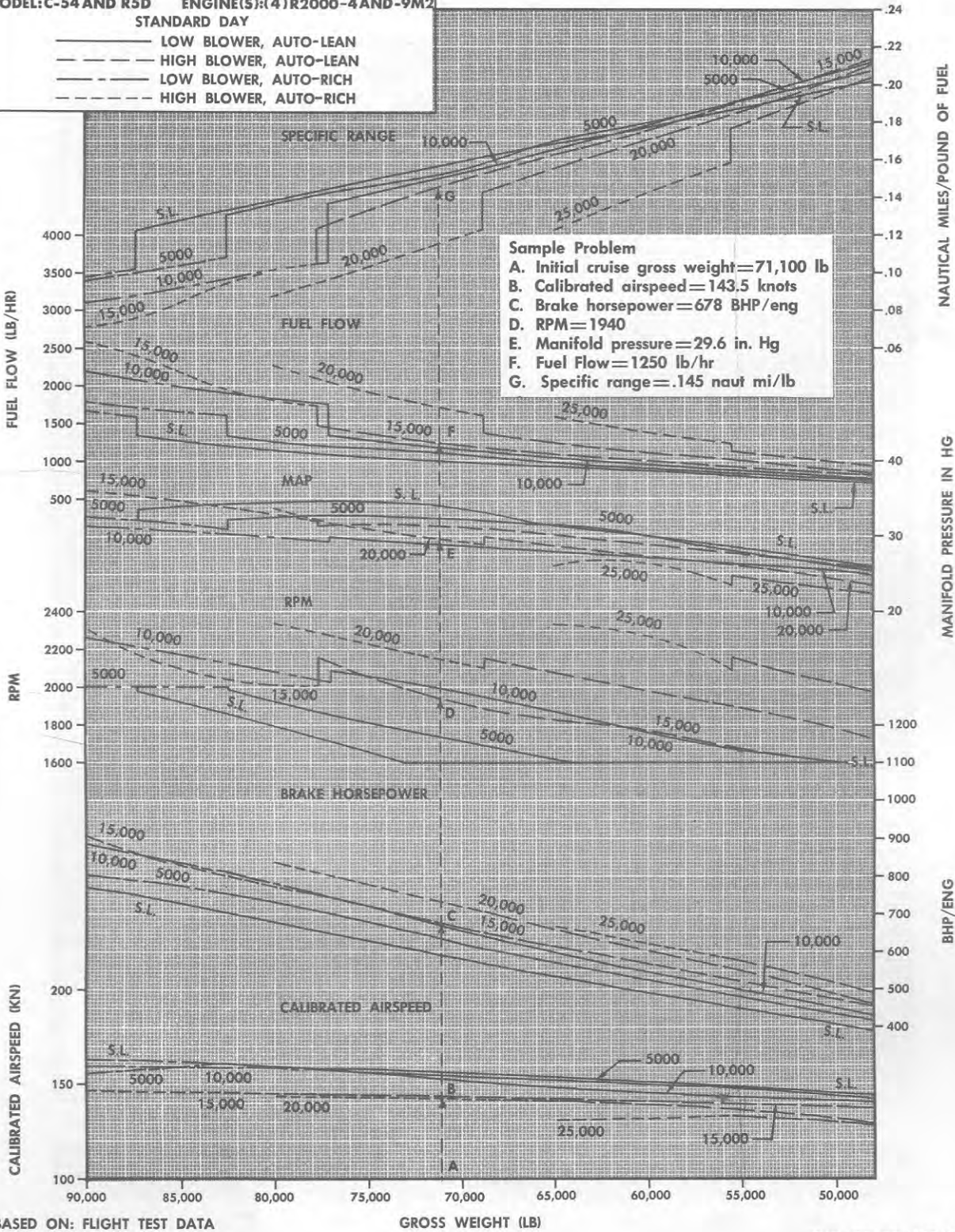
FUEL GRADE: 100/130

Figure A5-18. Two-Engine Specific Range - 10,000 Feet - Low Blower - Standard Day

X1-61

FOUR ENGINE LONG RANGE POWER CONDITION
MODEL:C-54 AND R5D ENGINE(S):(4)R2000-4AND-9M2
STANDARD DAY

- LOW BLOWER, AUTO-LEAN
- - - HIGH BLOWER, AUTO-LEAN
- LOW BLOWER, AUTO-RICH
- - - HIGH BLOWER, AUTO-RICH



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

FUEL GRADE: 100/130

Figure A5-19. Four-Engine Long-Range Power Condition

X1-62

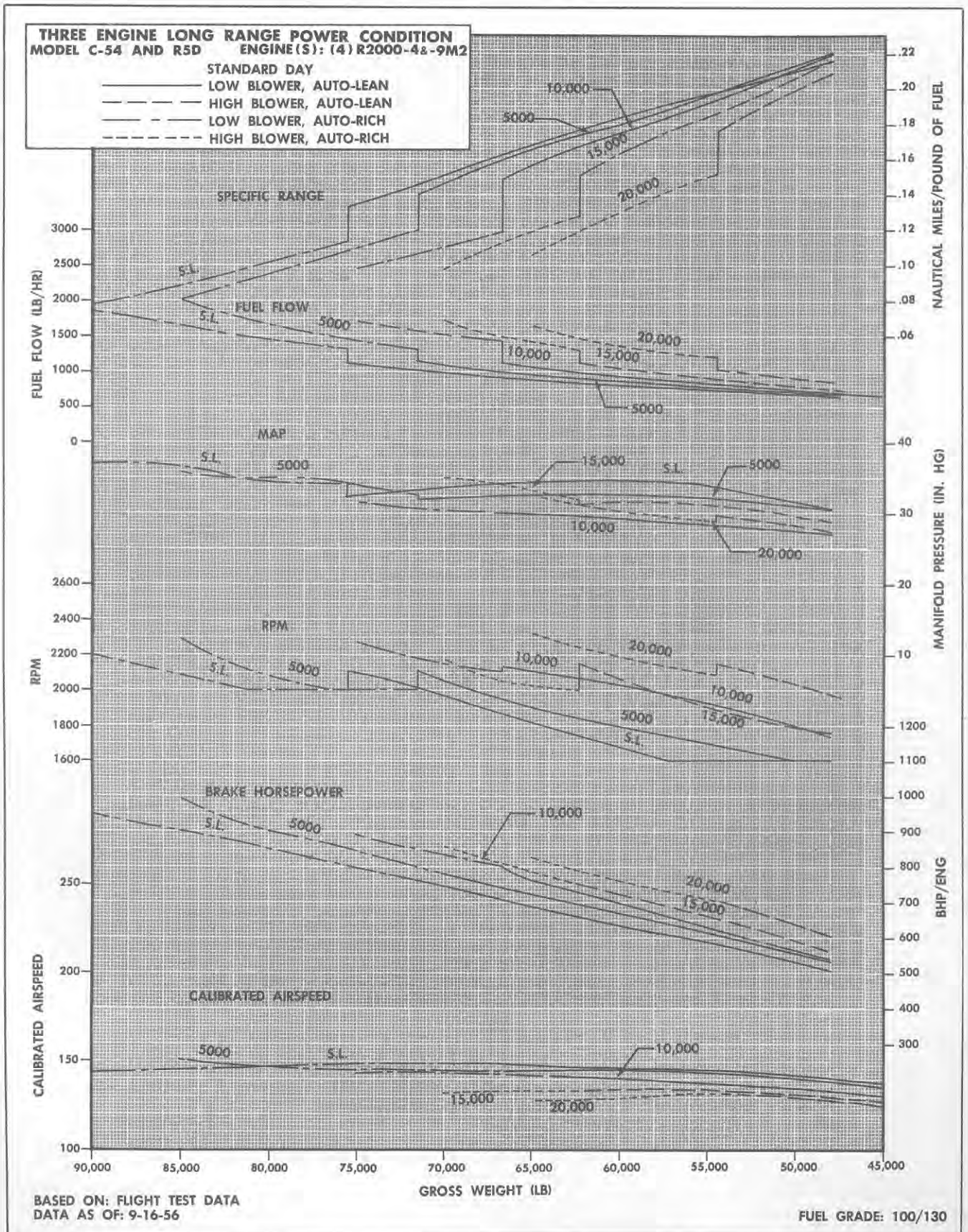


Figure A5-20. Three-Engine Long-Range Power Condition

X1-97

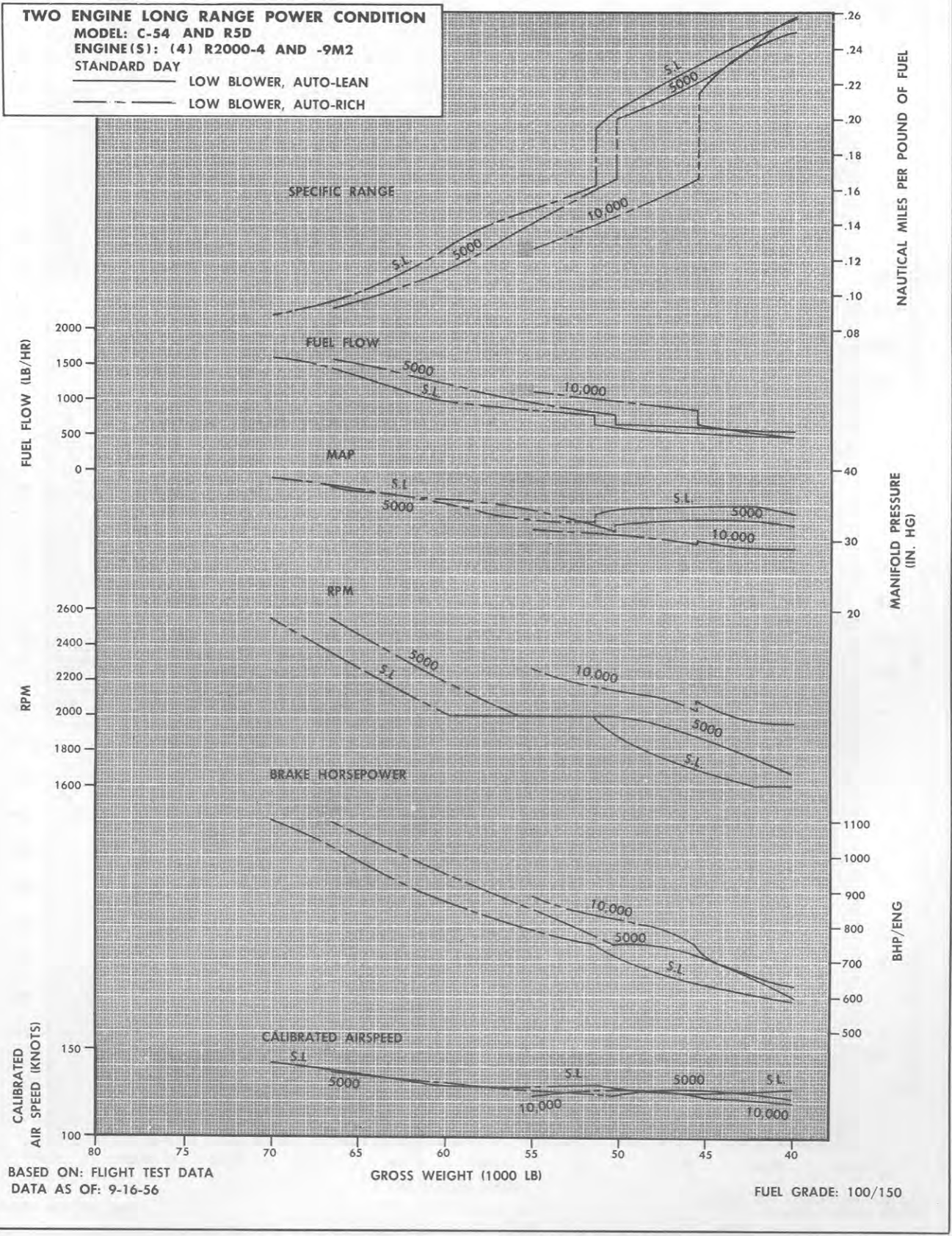


Figure A5-21. Two-Engine Long-Range Power Condition

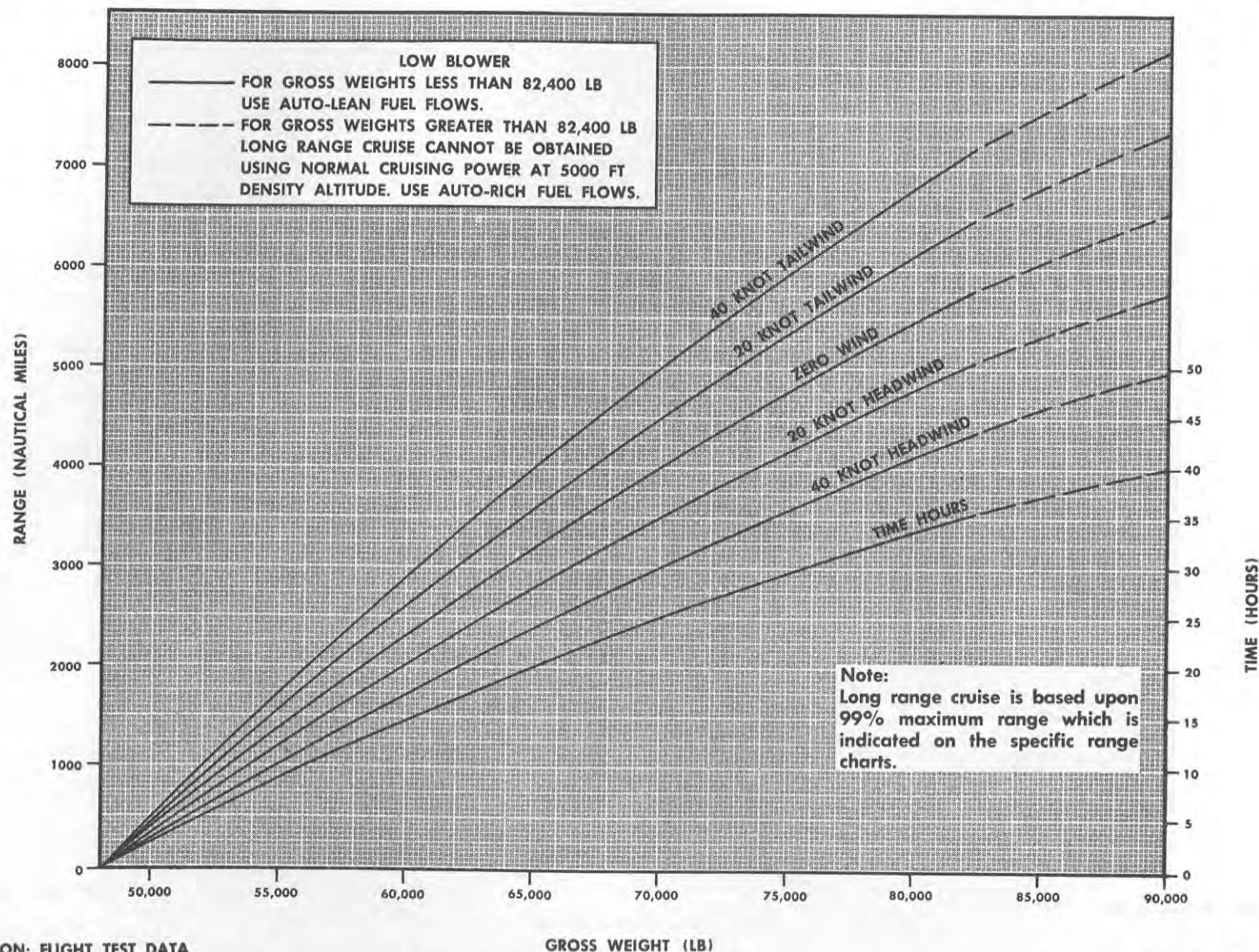
X1-63

FLIGHT PLANNING CHART FOR LONG RANGE CRUISE CONDITION (FOUR ENGINE)

MODEL: C-54 AND R5D

5000 FEET DENSITY ALTITUDE

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



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

FUEL GRADE: 100/130

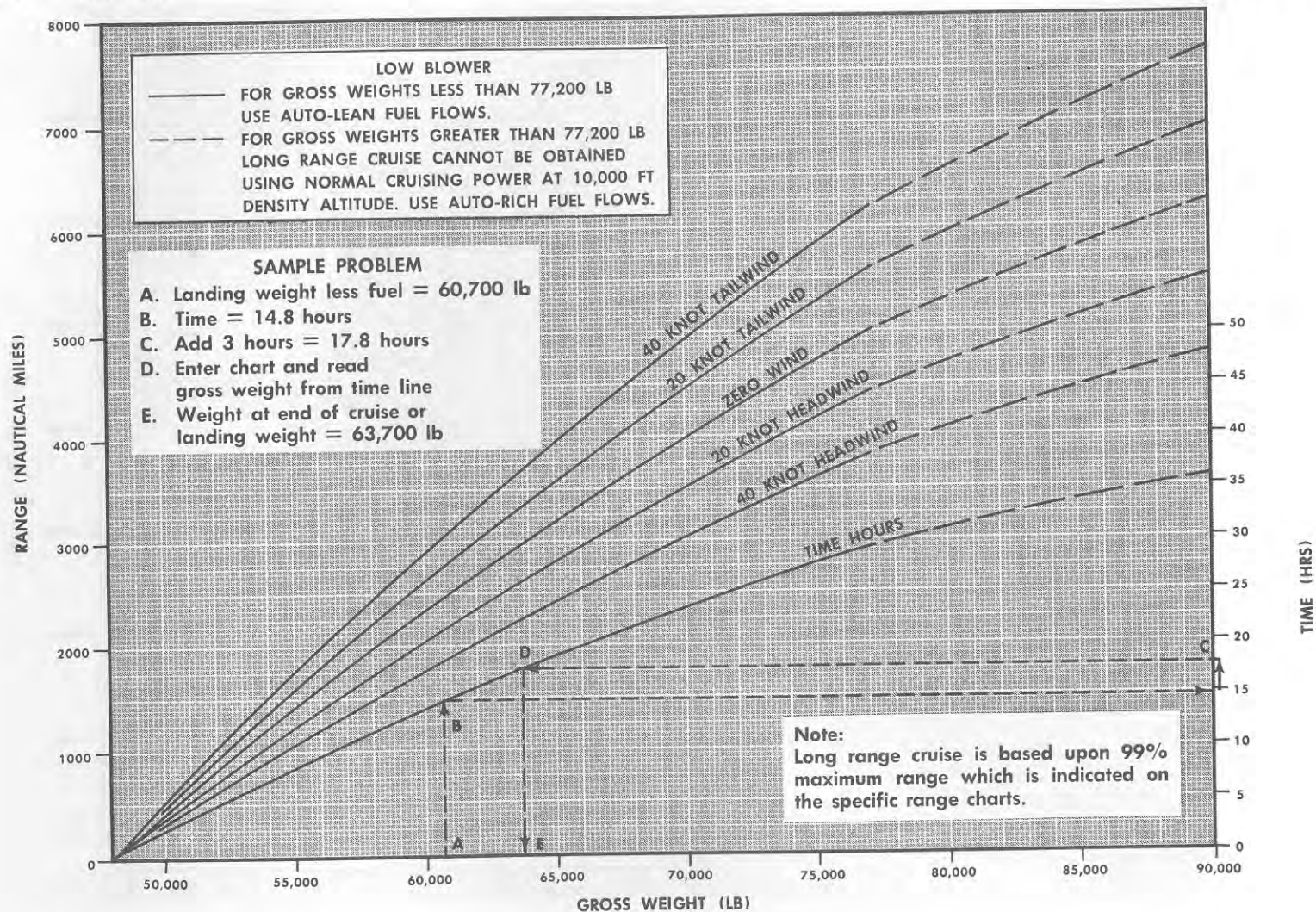
Figure A5-22. Flight Planning Chart for Long-Range Cruise Condition — 5000 Feet — Four Engines — Low Blower

FLIGHT PLANNING CHART FOR LONG RANGE CRUISE CONDITION (FOUR ENGINE)

10,000 FEET DENSITY ALTITUDE

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

MODEL: C-54 AND R5D



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

FUEL GRADE: 100/130

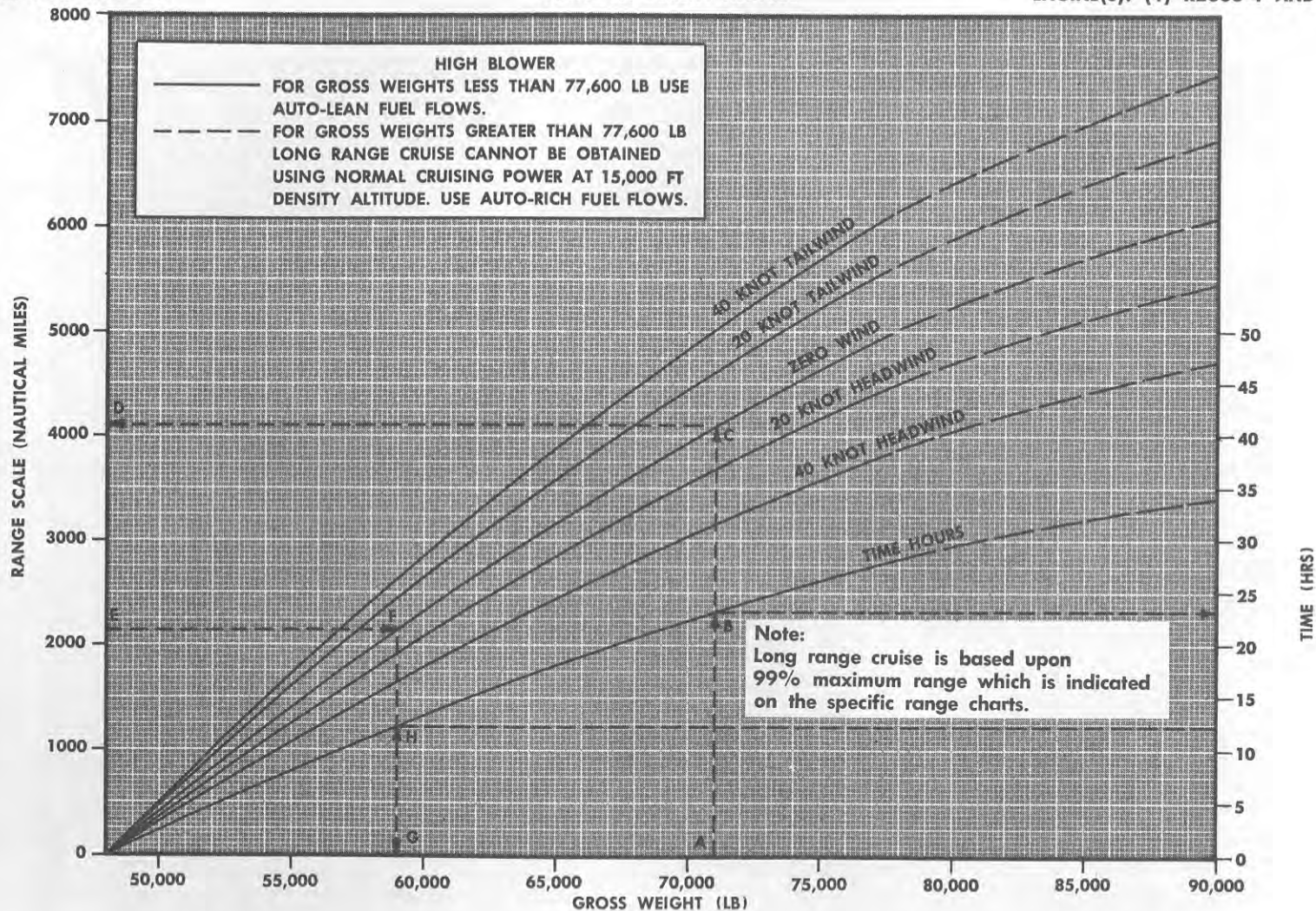
Figure A5-23. Flight Planning Chart for Long-Range Cruise Condition — 10,000 Feet — Four Engines — Low Blower

FLIGHT PLANNING CHART FOR LONG RANGE CRUISE CONDITION (FOUR ENGINE)

MODEL: C-54 AND R5D

15,000 FEET DENSITY ALTITUDE

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



SAMPLE PROBLEM

- | | |
|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| A. Gross weight at start of cruise = 71,100 lb | F. Zero wind |
| B. Time = 23.2 hrs | G. Final cruise gross weight = 59,000 lb |
| C. Zero wind | H. Time elapsed = $23.2 - 12.4 = 10.8$ hours |
| D. Range = 4100 naut mi | J. Fuel consumed during cruise is weight at start of cruise minus weight at end of cruise = 12,000 lb |
| E. Subtract desired range from maximum range $4100 - 1952 = 2148$ naut mi and enter chart | |

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

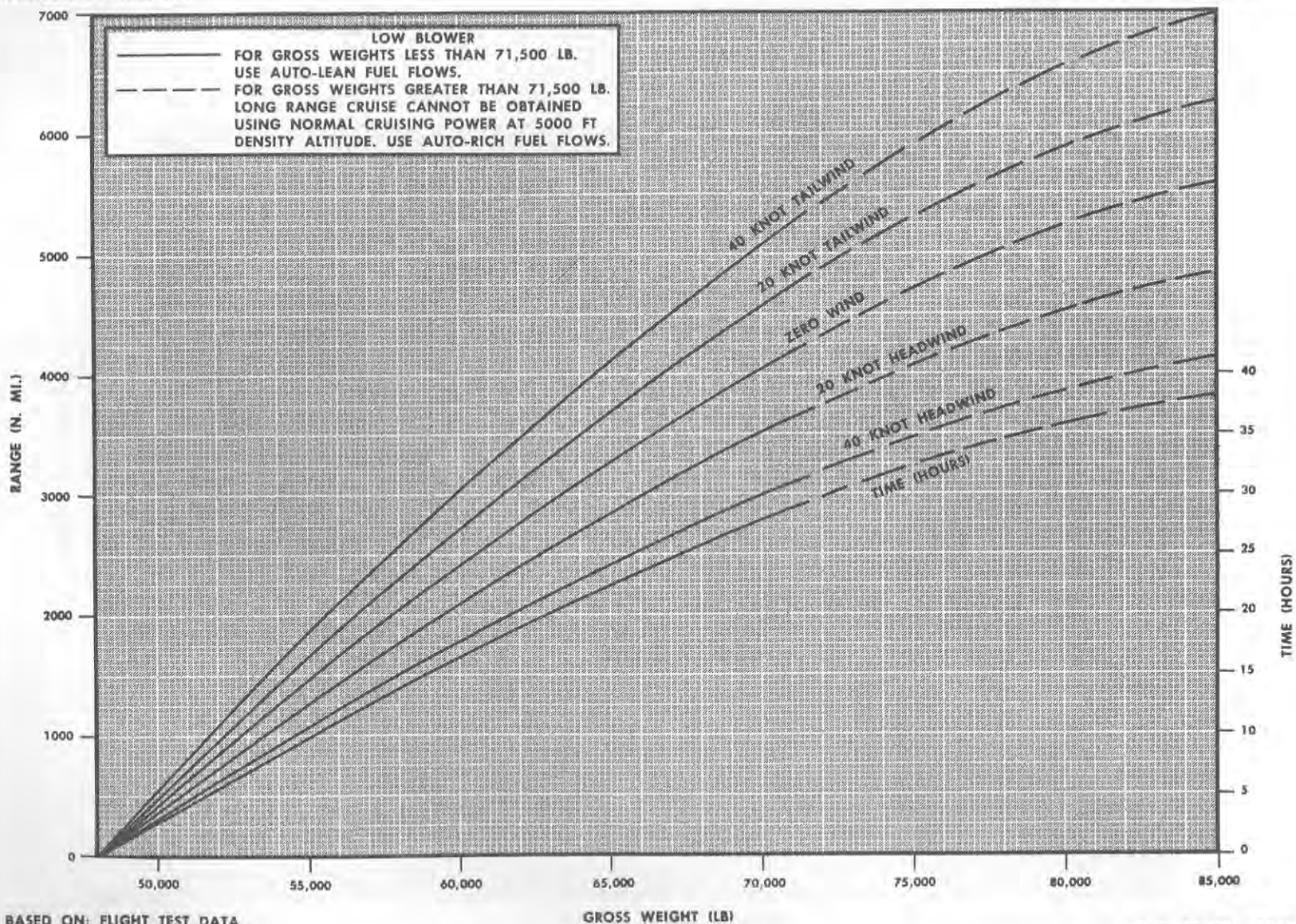
Figure A5-24. Flight Planning Chart for Long-Range Cruise Condition — 15,000 Feet — Four Engines — High Blower

FLIGHT PLANNING CHART FOR LONG RANGE CRUISE CONDITION (THREE ENGINE)

5000 FEET DENSITY ALTITUDE

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

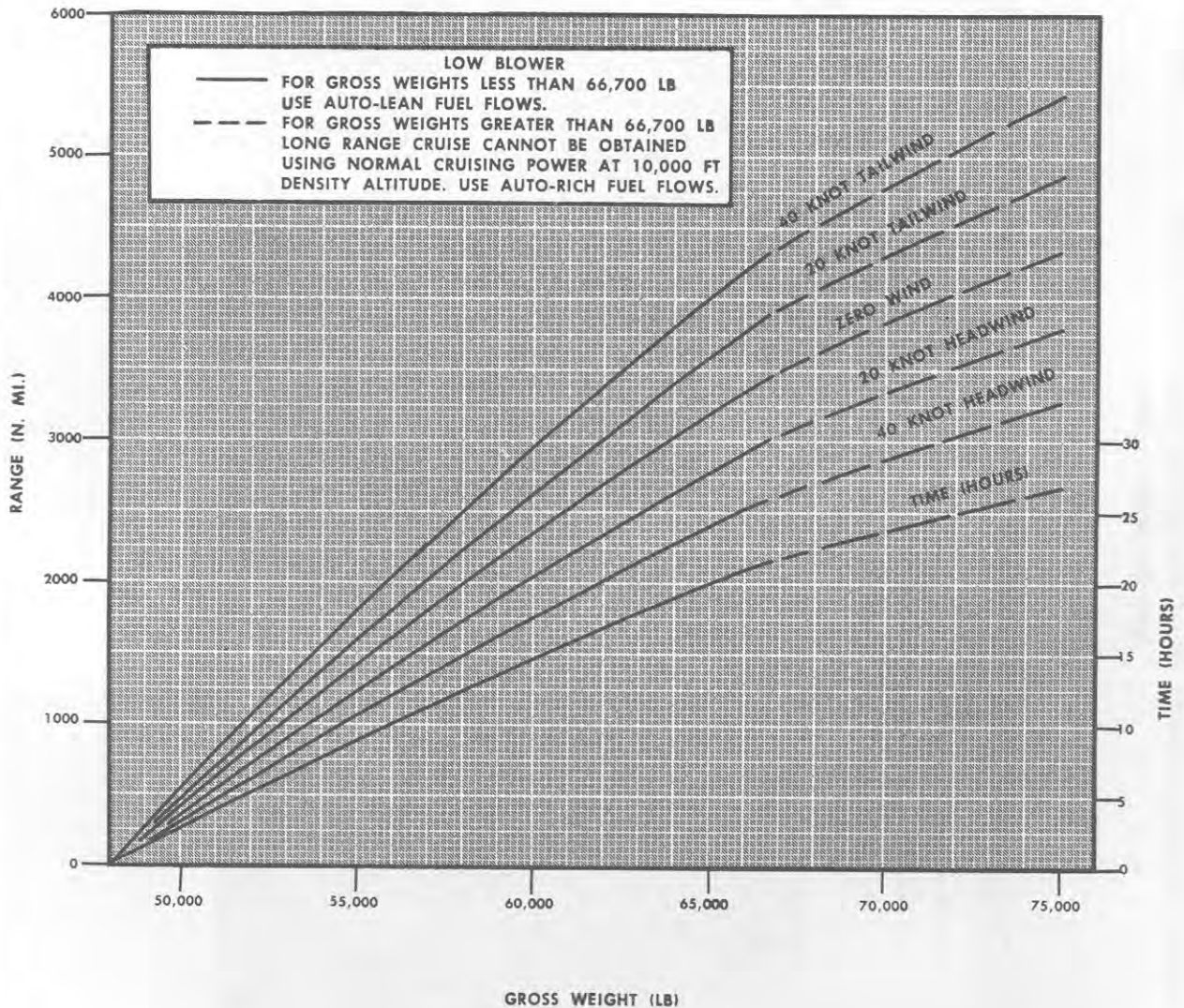
Figure A5-25. Flight Planning Chart for long-Range Cruise Condition —
5000 Feet — Three Engines — Low Blower

FLIGHT PLANNING CHART FOR LONG RANGE CRUISE CONDITION (THREE ENGINE)

10,000 FEET DENSITY ALTITUDE

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

Figure A5-26. Flight Planning Chart for Long-Range Cruise Condition — 10,000 Feet — Three Engines — Low Blower

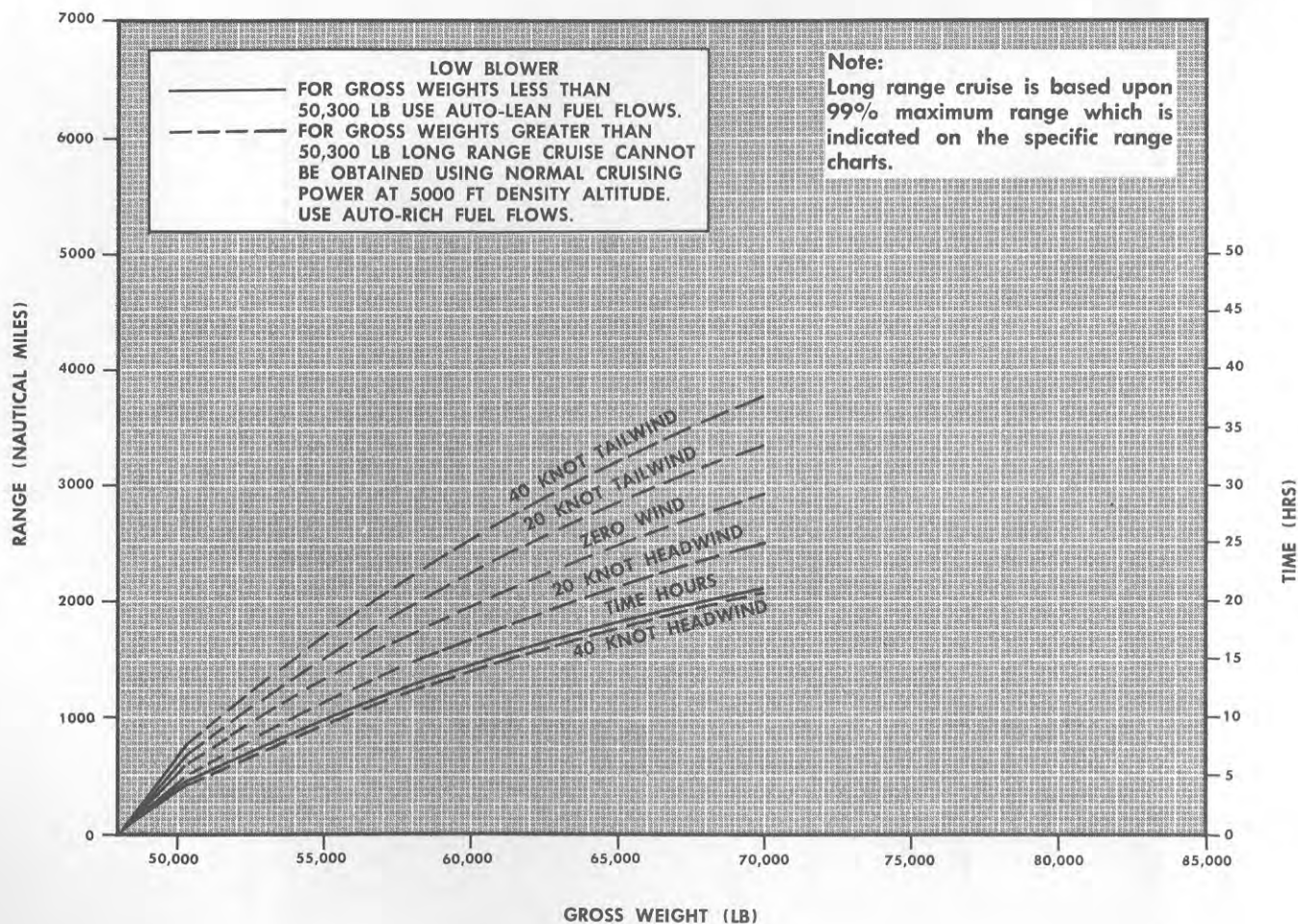
X1-6B

FLIGHT PLANNING CHART FOR LONG RANGE CRUISE CONDITION (TWO ENGINE)

5000 FEET DENSITY ALTITUDE

MODEL: C-54 AND R5D

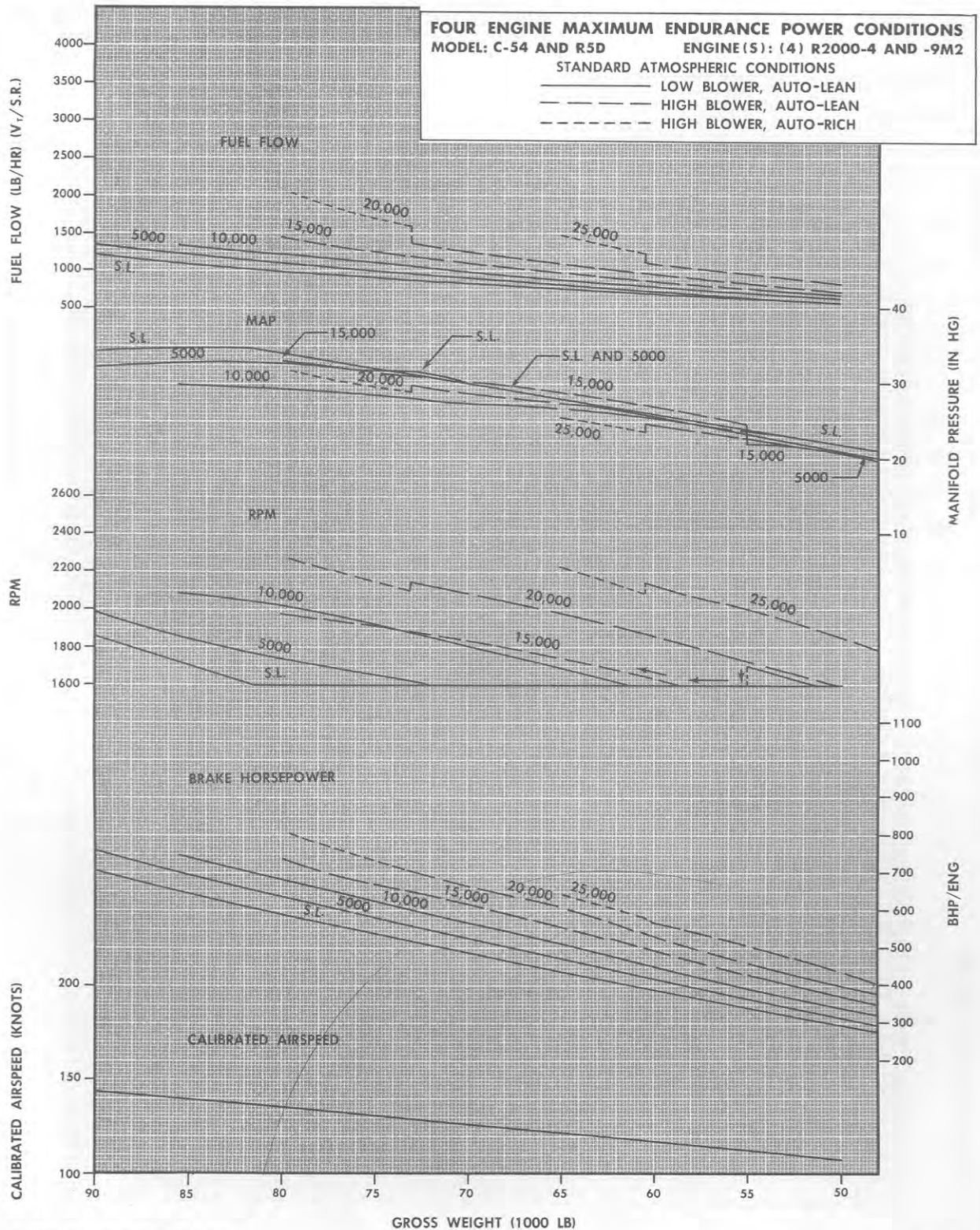
ENGINE(S): (4) R2000-4 AND -9M2



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

FUEL GRADE: 100/130

Figure A5-27. Flight Planning Chart for Long-Range Cruise Condition —
 5000 Feet — Two Engines — Low Blower



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

FUEL GRADE: 100/130

Figure A5-28. Four-Engine Maximum Endurance Power Conditions

X1-70

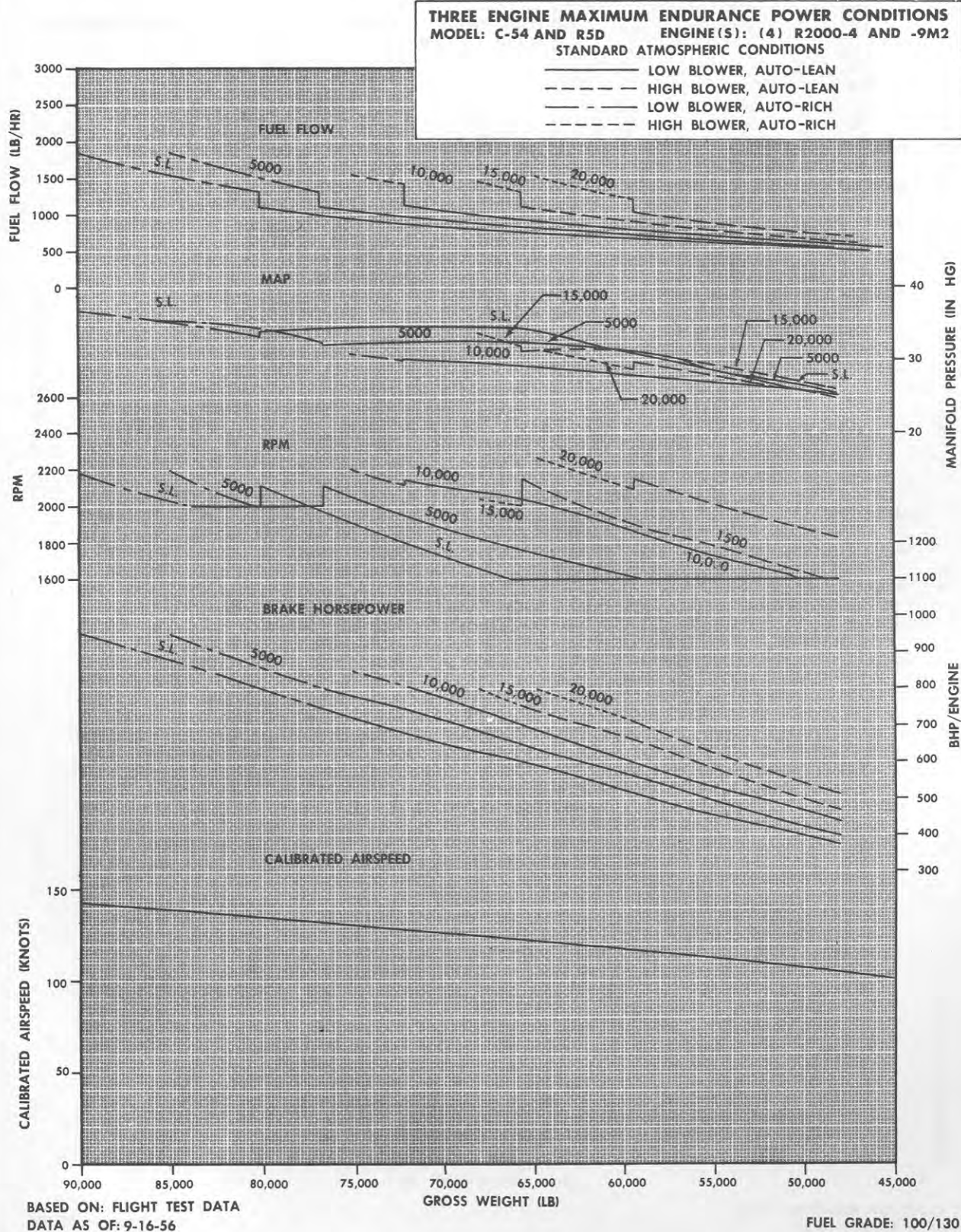


Figure A5-29. Three-Engine Maximum Endurance Power Conditions

X1-71

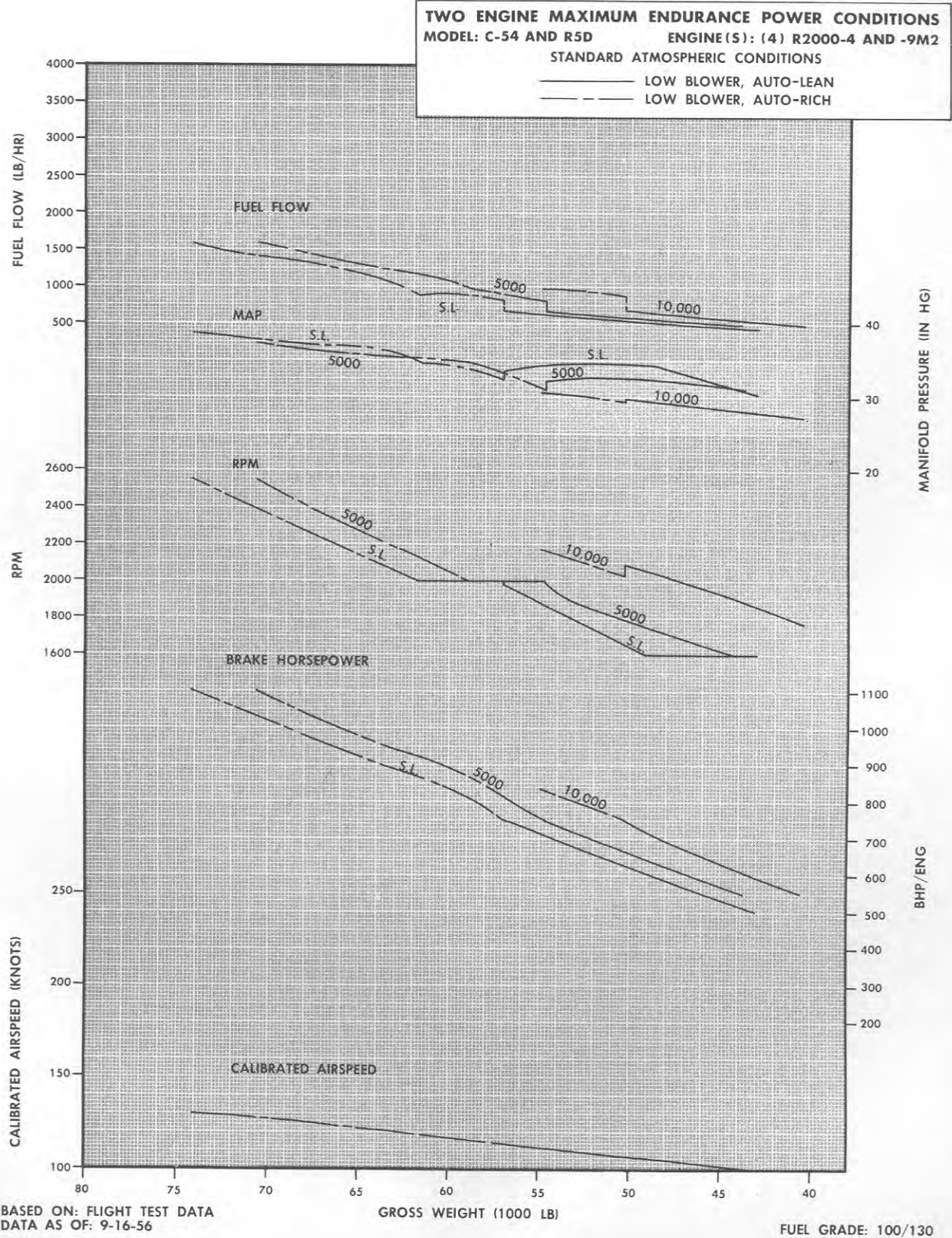


Figure A5-30. Two-Engine Maximum Endurance Power Conditions

X1-72