APPENDIX I

MODEL HH-3F PERFORMANCE DATA

TABLE OF CONTENTS

INTRODUCTION

This section contains performance data pertinent to HH-3F helicopters with the T58-GE-5 engines. The charts presented in this Appendix are based on the use of JP-4 or JP-5 fuel which has a density of 6.5 lb/gal. and 6.8 lb/gal. respectively. A miniature chase-around is provided at the top of each chart to illustrate the manner of obtaining data from the chart.

PURPOSE OF PERFORMANCE CHARTS

The charts presented on the following pages are provided to aid in preflight and inflight planning. Through the use of the charts, the pilot is able to select the best power setting, altitude, and airspeed to be used to obtain optimum performance for the mission being flown.

COMPRESSIBILITY EFFECTS

Rotor compressibility effects have been encountered on this helicopter. This phenomenon is a result of the rotor tip approaching the speed of sound. compressibility causes an abrupt and large increase in drag and a slight decrease in lift when the velocity of some portion of an airfoil approaches the speed of sound. A convenient parameter to measure the degree of compressibility is Mach number, which is the ratio of the airfoil velocity to the local speed of sound. It is important to remember that the speed of sound is dependent on the ambient temperature. Thus, if the resultant rotor tip velocity remains constant (such as constant rotor rpm in hover), changes in the ambient temperature will change the speed of sound and thus change the tip Mach number. A cold day will produce higher tip Mach numbers than a warm day, all other things being equai. Consequently, the ambient temperature affects the degree of compressibility present and therefore also affects the power required. The charts in this Appendix have been corrected for the effects of rotor blade compressibility.

ALTITUDE DATA

PRESSURE ALTITUDE

Pressure altitude is the altitude indicated on the altimeter when the barometric scale is set on 29.92. It is the height above the theoretical plane at which the air pressure is equal to 29.92 inches of mercury.

DENSITY ALTITUDE

Density altitude is an expression of the density of the air in terms of height above sea level; hence, the less dense the air, the higher the density altitude. For standard conditions of temperature and pressure, density altitude is the same as pressure altitude. As temperature increases above standard for any altitude, the density altitude will also increase to values higher than pressure altitude.

DENSITY ALTITUDE CHART

The density altitude chart (figure A-1) provides a means of determining density altitude from a known pressure altitude and OAT. Along the right side of the chart, the reciprocal square root of the density ratio is given to provide a means of computing true airspeed at any altitude from CAS. Figure A-1 also provides a means to convert Fahrenheit temperatures to Celsius temperatures or vice versa.

Example Problem for Use of Density Altitude Chart

Given:

OAT 20°C

Pressure altitude 2000 feet

Determine:

Density altitude

Solution: (figure A-1.)

1. Enter chart at 20°C.

2. Move up to 2000 foot pressure altitude line, then move horizontally to the left to the density altitude scale and read 3000 feet.

AIRSPEED CALIBRATION CHART

An airspeed calibration chart (figure A-2) is provided to supply the correction required to determine calibrated airspeed (CAS). Indicated airspeed (IAS), as read from the instrument and corrected for instrument error, plus or minus installation correction, equals calibrated airspeed (CAS). Because of the speed range through which the helicopter operates, compressibility corrections to airspeed are negligible and were intentionally omitted.

EXAMPLE PROBLEM FOR USE OF AIRSPEED CALIBRATION CHART

Given:

AIRSPEED 60 KIAS

Flight condition Climb and acceleration takeoff

Determine:

Calibrated airspeed

Solution: (figure A-2.)

1. Enter chart at 60 KIAS.

2. Move up to the takeoff line, then move horizontally to the left to the calibrated airspeed scale and read 45 knots.

True Airspeed Correction

True airspeed (TAS) is obtained by multiplying CAS by the conversion factor $\frac{1}{\sqrt{\sigma}}$ shown in figure A-1, for the density altitude at which the CAS reading is taken.

Given:

OAT 20°C

Pressure altitude 2000 feet

Determine:

CAS and TAS.

Solution: (figures A-1 and A-2.)

1. Enter the density altitude chart (figure A-1) at 20°C and move up to intersect the 2000-foot pressure altitude line.

2. From this intersection, move horizontally to the right and read $\frac{1}{\sqrt{\sigma}}$ equal to 1.045.

3. Enter the airspeed calibration chart (figure A-2) at 60 KIAS and move up to intersect the takeoff line.

4. From this intersection, move horizontally to the left and read a CAS of 45 knots.

5. Multiply CAS X $\frac{1}{\sqrt{\sigma}}$ to obtain TAS, or 45 KCAS X 1.045 = 47 KTAS.

POWER AVAILABLE CHARTS

Various atmospheric conditions, such as OAT and pressure altitude, have an effect on the capability of the engine to produce power. Data for power available at three power settings is shown: maximum power available (figure A-3); military power available (figure A-4); and maximum continuous power available (figure A-5). OAT and pressure altitude effects on power available are shown on the charts. Also shown on the charts is a wheel height correction for engine exhaust recirculation effects that exist while hovering in a dead calm wind condition. Figures A-3, A-4, and A-5 provide power available data that is the maximum power output expected of a properly tuned specification T58-GE-5 engine operating at 721°C T_5 for figure A-3; 696°C T_5 for figure A-4; and 660°C T_5 for figure A-5. The performance of the charts in this Appendix are based on the power output shown in figures A-3, A-4, and A-5. No allowance for engine deterioration below a specification engine is contained in the charts.

CAUTION

The power output capability of the engine can exceed the structural limit of the transmission under certain conditions. Therefore, the power limitations in Section V should be observed to prevent exceeding the power limitations imposed by the transmissions. These limitations are also shown on the charts.

NOTE

Engines received from jet engine base maintenance facility may be 3% below maximum power available chart value. New or newly overhauled engines should meet maximum power available values during initial installation check. Maximum power available charts do not reflect engine operation with anti-icing on.

NOTE

If the power available is being computed in forward flight, OGE, reduce OAT by 2.5°C and adjust pressure altitude by the amount indicated when the selected factors are applied to figure A-7 Airspeed Effects on Power Available and Fuel Flow Charts.

EXAMPLE PROBLEM FOR USE OF POWER AVAILABLE CHARTS

The power available charts are illustrated in the same manner; therefore, figure A-3, Maximum Power Available - 5-Minute Limit-One Engine, is used to illustrate the example problem.

Given:

OAT	20°C
Wind	0 Knots
Wheel height	30 feet
Pressure altitude	2000 feet
N_r	103%N_r

Determine

Torque available at maximum power.

Solution: (figure A-3.)

1. Enter chart at 20°C OAT.

2. Move horizontally and follow the guideline to a point that intersects the 30-foot wheel height line, then continue to move horizontally to 2000 feet pressure altitude.

3. From this intersection, move vertically downward to the 103% N_r line.

4. From this point, move horizontally to the indicated torque scale and read 99%Q.

INDICATED TORQUE VS FUEL FLOW CHART

The indicated torque vs fuel flow chart (figure A-6) provides the means for computing fuel consumption for a selected altitude and power rating. To find the fuel flow in pounds-per-hour for one engine, enter the chart at the indicated torque on the bottom scale and proceed vertically to the proper altitude line. From this point of intersection move horizontally left to the scale and read the fuel flow in pounds-per-hour.

NOTE

> If fuel flow is being computed in forward flight, OGE, apply the indicated torque to a pressure altitude that has been adjusted by the factors computed from figure A-7, Airspeed Effects on Power Available and Fuel Flow Chart. If the fuel flow is being computed at zero airspeed no pressure altitude adjustment is necessary.

EXAMPLE PROBLEM FOR USE OF TORQUE VS FUEL FLOW CHART

Given:

Torque	99%Q
Pressure altitude	2000 feet
Airspeed	0 Knots

Determine:

Fuel flow per engine.

Solution: (figure A-6.)

1. Enter chart at 99%Q.

2. Move vertically up to the intersection of the 2000-foot altitude curve.

3. From this intersection, move horizontally to the fuel flow curve and read a fuel flow of 790 pounds-per-hour per engine.

AIRSPEED EFFECTS ON POWER AVAILABLE AND FUEL FLOW CHART

The airspeed effects on power available and fuel flow chart (figure A-7) graphically illustrates the effects of airspeed on power available and fuel flow, with the FOD shield on or off, at selected pressure altitudes and outside air temperatures. The chart presents the pressure altitude adjustment to be added or subtracted algebraically from the selected pressure altitude when being applied to the power available and fuel flow charts. Further, when applying the adjusted pressure altitude to the power available charts it will also be necessary to reduce the selected OAT by 2.5°C to compensate for the difference in engine inlet temperature rise between OGE hover and forward flight.

EXAMPLE PROBLEM FOR USE OF AIRSPEED EFFECTS ON POWER AVAILABLE AND FUEL FLOW CHART

Given:

Indicated airspeed	60 KIAS
OAT	20°C
Selected pressure altitude	2000 feet
FOD shield	ON

Determine:

Pressure altitude adjustment necessary to apply to power available and fuel flow charts.

Solution: (figure A-7.)

1. Enter the chart at 60 KIAS.

2. Follow the guideline to the baseline of the OAT scale, then continue to follow the guideline to a point that intersects the 20°C OAT line.

3. From this intersection, move vertically upward to the pressure altitude baseline, then follow the guideline to a point that intersects the 2000-foot pressure altitude line.

4. From this point, move vertically to a point that intersects the shield on line.

5. From this point, move horizontally to the left to the pressure altitude adjuster scale and read plus 175 feet.

HOVERING CHARTS

The hovering charts (figures A-8, A-9, A-10, and A-11) provide a means of computing the maximum gross weight and indicated torque required to hover at all wheel heights in ground effect, out of ground effect, and the effect of headwinds.

MAXIMUM GROSS WEIGHT FOR HOVERING - ZERO WIND - TWO ENGINES

The maximum gross weight for hovering - zero wind - two-engines chart (figure A-8) provides a means of computing the maximum gross weight at which the helicopter can be hovered in ground effect and out of ground effect. The gross weight is based on zero wind with various combinations of pressure altitude, OAT, rotor speed, and wheel height.

Example Problem for Use of Maximum Gross Weight for Hovering Chart

Given:

Pressure altitude	2000 feet
OAT	20°C
Rotor speed	103%Nr
Wheel height	30 feet

Determine:

Maximum gross weight for hovering at maximum power and 30-foot wheel height.

Solution: (figure A-8.)

1. Enter chart at 2000 feet pressure altitude.

2. Move horizontally to intersect the 20° C OAT line.

3. From this intersection, move downward through the rotor speed grid to the wheel height baseline. If the rotor speed had been other than that established for a baseline, movement would have been to the rotor speed baseline, the influence line followed to the appropriate rotor speed, then downward to the wheel height baseline.

4. From the wheel height baseline, follow the influence line to intersect the 30-foot wheel height line, then down to the gross weight scale and read 19,750 pounds.

TORQUE REQUIRED TO HOVER - ZERO WIND - TWO ENGINES

The torque required to hover zero wind - two engines chart (figure A-9), provides a means of computing the torque required to hover in ground effect and out of ground effect. The torque requirement indication is based on zero wind with various combinations of gross weight, density, altitude, rotor speed, tip Mach number, and wheel height.

Example Problem for Use of Torque Required to Hover Chart

Given:

Gross weight	20,000 pounds
Density altitude	sea level
Rotor speed	103%Nr
Air temperature	-10°C
Wheel height	20 feet

Determine:

Torque required to hover.

Solution: (figure A-9.)

1. Enter chart at 103% Nr, move upward to intersect the -10°C OAT line and read .632 tip MACH number. Retain this value.

2. Reenter the chart at 20,000 pounds gross weight and move horizontally to the right to intersect the sea level density altitude line.

3. From this intersection, move downward to the baseline of the compressibility influence lines, then follow the influence line to a .632 tip MACH number.

4. From this intersection, move downward to the rotor speed baseline, then downward to the wheel height baseline.

5. From the baseline, follow the influence line to the 20-foot wheel height line, then move downward to the torque scale and read 98%Q.

HEADWIND INFLUENCE ON MAXIMUM GROSS WEIGHT FOR HOVERING

The headwind influence on maximum gross weight for hovering chart (figure A-10), provides a means of computing the headwind influence on the maximum gross weight that can be hovered at various wheel heights.

Example Problem for Use of Headwind Influence on Maximum Gross Weight for Hovering Chart

Given:

Gross weight	19,750 pounds

Headwind 10 knots

Wheel height 30 feet

Determine:

Influence of 10-knot headwind on maximum gross weight to hover at 30-foot wheel clearance.

Solution: (figure A-10.)

1. Enter chart at the 30-foot wheel clearance graph where the 19,750-pound gross weight line intersects the baseline.

2. From this intersection, follow the influence line to intersect the 10-knot headwind line.

3. From this intersection, move downward to the gross weight scale and read 20,950 pounds.

HEADWIND INFLUENCE ON TORQUE REQUIRED TO HOVER

The headwind influence on torque required to hover chart (figure A-11), provides a means of computing the headwind influence on the torque required to hover at various wheel heights.

Example Problem for Use of Headwind Influence on Torque Required to Hover Chart

Given:

Torque 100%

Headwind 10 knots

Wheel height 30 feet

Determine:

Influence of 10 knot headwind on torque required to hover at 30-foot wheel height.

Solution: (figure A-11.)

1. Enter the chart at 30-foot wheel clearance graph where the 100% torque line intersects the baseline.

2. From this intersection, follow the influence line to intersect the 10 knot headwind line.

3. From this intersection, move downward to the torque scale and read 95% torque.

HEIGHT VELOCITY DIAGRAMS

Figures A-12 and A-13 are plots of minimum heights versus speed for a safe single engine or autorotative landing following failure of one or two engines. The single engine height velocity curve is based upon test points flown in low wind conditions at a mid CG and 17,000 and 19,500 pounds gross weight. The points obtained at the knee of the curve (low speed, low altitude) were simulated single-engine failure from a takeoff condition and others from level flight. The single-engine height-velocity capabilities of the helicopter, in the low speed range (0 to 24 knots), are a function of power remaining in the operating engine and the weight of the helicopter. The height-velocity capabilities in the high speed range (24 knots to Vmax) are less affected by power remaining and weight. The low speed portion of the H-V curve can be adjusted as a function of weight, temperature, and altitude. This is done by sliding the whole low speed portion of the H-V curve to the right until the part furthest to the right meets the computed airspeed. The height velocity diagram is meant to depict the capabilities of the helicopter, as flown by an average pilot over a paved runway, with zero wind. Under operational conditions, the altitude airspeed combination for a safe autorotative landing is dependent upon many variables such as pilot capabilities, density altitude, helicopter gross weight, proximity of suitable landing area, and wind direction and velocity in relation to flight path. This does not preclude any operation in the shaded areas under emergency or pressing operational requirements, as a controlled landing can usually be accomplished and minimum damage, if any, will occur to the helicopter.

EXAMPLE PROBLEM FOR USE OF HEIGHT VELOCITY DIAGRAM - ONE ENGINE FAILURE CHART

Given:

Gross weight 20,500 pounds

Pressure altitude 2000 feet

OAT 20°C

Determine:

Height velocity curve speed.

Solution:

1. Enter bottom of chart at 20,500 pounds gross weight and move vertically to intersect the 2000-foot pressure altitude line.

2. From this intersection, move horizontally to the right to intersect the 20°C OAT line.

3. From this intersection, move downward to the airspeed scale and read 30 KIAS.

4. Apply the 30 KIAS to the top portion of the chart to determine the avoid area.

TAKEOFF CHARTS

The takeoff charts (figures A-14 through A-19), each for a particular type takeoff, provide the takeoff distance required to clear a 50-foot obstacle at various combinations of gross weight, excess power margin, climb speed, and headwinds. The excess power margin is an index of the difference between the maximum power available at the 50-foot obstacle and the power required to hover at a 3-foot wheel height. (The numerical values on the charts are not percent Q.) This power margin is automatically compensated for on charts that do not have an additional excess power margin block on the right-hand side of the chart. However, when the additional excess power margin block is on the right-hand side of the chart, and operations are conducted within that region, excess power noted in the left-hand excess power margin grid is reduced by the amount indicated in the upper right-hand block, and the takeoff distance computed from that point. As all the takeoff charts are used in a similar manner, figure A-15, Distance to Clear a 50-Foot Obstacle - Climb and Acceleration Takeoff - Two Engines, is used for the example problem.

EXAMPLE PROBLEM FOR USE OF TAKEOFF CHARTS

Given:

Gross weight	20,500 pounds
Pressure altitude	2000 feet
OAT	20°C
Climb out airspeed	60 KIAS
Headwinds	10 Knots

Determine:

Takeoff distance to clear a 50-foot obstacle.

Solution: (figure A-15.)

1. Apply the 60 KIAS to figure A-2, Airspeed Calibration, to determine CAS so that true airspeed can be computed. Enter chart at 60 KIAS, move up to intersect the takeoff line, then move left to the CAS grid and read 45 knots CAS.

2. Refer to figure A-1, Density Altitude, to compute the true airspeed conversion factor. Enter the chart at 20°C OAT, move up to intersect the 2000-foot pressure altitude line, then move horizontally to the right to read a conversion factor of 1.045. Multiplying 45 knots CAS X 1.045 = 47 KTAS. (Retain this value.)

3. Enter chart at 20,500 pounds gross weight.

4. Move horizontally to intersect the 2000-foot pressure altitude line.

5. From this intersection, move upward to intersect the 20°C OAT line in the excess power margin grid.

6. From this intersection, move horizontally to the right to intersect the all other conditions deflector line, then move down to the climb out airspeed baseline.

7. From the climb out airspeed baseline, follow the influence line to intersect the 47 KTAS line, then move down to the headwind baseline.

8. From the headwind baseline, follow the influence line to the 10-knot headwind line, then move down to the takeoff distance scale and read 480 feet.

CLIMB CHARTS

The climb charts (figures A-20 through A-25) provide a means of computing the time to climb, the horizontal distance covered, the fuel consumed, and the rate-of-climb for various gross weights. These values are computed by applying the gross weights to various conditions of pressure altitude and temperature. The fuel used does not include the fuel used for warmup and takeoff (approximately 25 pounds for each engine). Also included is a climb speed schedule, based on a decrease of approximately one knot indicated airspeed for every thousand feet increase in altitude, to provide the climb speed for various pressure altitudes. A temperature scale is also provided to relate the OAT at various pressure altitudes. The temperature scale is either based on a warm day (0° to 40°C) or a cold day (-40° to 0°C), for each series of charts. Figures A-20 (warm day) and A-21 (cold day) provide climb data for two-engine operation at military power. Figures A-22 and A-23 provide data at comparable conditions for one-engine operation. Figures A-24 and A-25 provide climb data at comparable temperature conditions for two-engine operation at maximum continuous power.

NOTE

If OAT is 0°C, use the warm day charts. If OAT is colder than -40°C, use values determined at -40°C.

NOTE

Best climb performance is obtained at a constant 75 KTAS. The speed schedules on the climb charts provide appropriate indicated airspeeds to maintain best climb performance.

EXAMPLE PROBLEM FOR USE OF CLIMB CHARTS

Given:

Gross weight	20,500 pounds
Temperature (cruise)	18°C
Pressure altitude (cruise)	3000 feet
Temperature (takeoff)	20°C
Pressure altitude (takeoff)	2000 feet

Determine:

Rate-of-climb speed, rate-of-climb, time-to-climb, fuel consumed, and horizontal distance covered to climb from 2000 feet to 3000 feet pressure altitude at military power.

Solution: (Refer to figure A-20.) Since takeoff is from above sea level, it will be necessary to determine climb data from sea level to 2000 feet pressure altitude and from sea level to 3000 feet pressure altitude. The difference between the data necessary to climb to both altitudes will then be the data necessary to climb from 2000 feet pressure altitude to 3000 feet pressure altitude.

1. Enter the chart at 20,500 pounds gross weight.

2. From the intersection of the 20,500 pound gross weight line and the 3000-foot pressure altitude lines in the time, distance, fuel, and rate-of-climb grids, proceed horizontally to the left to the OAT baseline. Follow the influence line in each grid to the 18°C OAT line then proceed horizontally to the left to note the following values:

Time-to-climb	2.4 minutes
Distance covered	3.3 nautical miles
Fuel consumed	63 pounds
Rate-of-climb	1050 feet per minute

3. Repeat the procedures outlined in step 3, using the 2000-foot pressure altitude lines and 20°C OAT. However, as 20°C OAT is the temperature baseline, trace through the temperature grid to determine climb data and note the following values:

Time-to-climb	1.7 minutes
Distance covered	2.0 nautical miles
Fuel consumed	42 pounds
Rate-of-climb	1150 feet per minute

4. Subtract the climb data factors to determine climb data to climb from 2000 feet to 3000 feet pressure altitude as follows:

Time to climb (2.4 - 1.7) = .7 minute

Distance covered (3.3 - 2.0) = 1.3 nautical mile

Fuel consumed (63 - 42) = 21 pounds

5. Enter the climb speed schedule at 2000 and 3000 feet pressure altitude and note the climb speeds. When related to the rate-of-climb data, note that the initial rate-of-climb of 1150 fpm at 72 KIAS decreases to 1050 fpm at 71 KIAS.

SERVICE CEILING CHARTS

The service ceiling charts (figures A-26 and A-27) show the highest altitude at which a rate-of-climb of 100 feet per minute can be attained at a specific gross weight and temperature. Figure A-26 reflects the service ceiling for two-engine operation at maximum continuous power, and figure A-27 reflects the service ceiling for one-engine operation at military power. Since the service ceiling is affected by gross weight, it can be raised by reducing the gross weight.

EXAMPLE PROBLEM FOR USE OF SERVICE CEILING CHARTS

Given:

Gross weight	20,500 pounds
Temperature	10°C

Determine:

Service ceiling.

Solution: (figure A-26.)

1. Enter chart at 20,500 pounds gross weight.

2. Move vertically to intersect the 10°C OAT line.

3. From this intersection, move horizontally to the left and read 9500 feet.

CRUISE CHARTS

The cruise charts (figures A-28 through A-33) provide the means of computing cruise performance at various outside air temperatures. Cruise performance is computed by referencing the appropriate cruise chart for the operating outside air temperature and flight condition, then applying a gross weight to pressure altitude and true airspeed parameters to determine specific fuel consumption and fuel flow. The charts also contain a service ceiling line, optimum cruise altitude line, recommended cruise speed baseline, and a maximum endurance line. Maximum endurance is computed by decreasing true airspeed from the recommended cruise speed baseline.

EXAMPLE PROBLEM FOR USE OF CRUISE CHARTS

Given:

Gross weight	20,474 pounds
Pressure altitude	3000 feet
OAT	18°C

Determine:

Recommended airspeed and fuel flow and unit range.

Solution: (figure A-29.)

1. Enter the chart on sheet 1 at 20,475 pounds gross weight and move vertically to intersect the 3000-foot pressure altitude line.

2. From this intersection, move horizontally to the right to the recommended cruise speed baseline then down to the true airspeed scale and read 123 KTAS.

3. Continue to move down to the airspeed baseline then follow the influence lines to a point that intersects the 3000-foot pressure altitude line.

4. From this intersection, move down to the airspeed scale and read 116 KIAS.

5. From the intersection at the recommended cruise speed baseline, move horizontally to the right to the transfer scale and read 5.1.

6. Enter the transfer scale on sheet 2 at 5.1 and move horizontally to the right to intersect the 3000-foot pressure altitude line.

7. From this intersection, move down to the unit range scale and note a unit range of .101 NM/lb of fuel.

8. Continue to move down to intersect the true airspeed line, then move horizontally to the left and note a fuel flow of 1220 lbs/hr.

9. Determine fuel required for cruise by dividing the distance by the unit range.

SINGLE ENGINE CAPABILITY CHART

The single engine capability chart (figure A-34) illustrates the gross weight capability to maintain level flight at 70 KIAS for various pressure altitudes and temperatures with one engine at military power. The chart also portrays the indicated torque and fuel flows associated with military power for the various pressure altitudes and temperatures. If conditions of gross weight, pressure altitude, and temperature do not permit level flight at 70 KIAS, a rate of descent grid is provided for estimating rate of descent for actual flight conditions.

EXAMPLE PROBLEM FOR USE OF SINGLE ENGINE CAPABILITY CHART

Given:

Temperature	18°C
Pressure altitude	3000 feet

Gross weight 20,475 pounds

Determine:

Gross weight capability to maintain level flight at 70 KIAS and associated torque and fuel flow values. If capability does not exist for given gross weight, determine the resulting rate of descent.

Solution: (figure A-34.)

1. Enter the chart at 18°C OAT.

2. Move vertically to the 3000 foot pressure altitude line in the indicated torque grid.

3. From the intersection of the 18°C OAT line and the 3000-foot pressure altitude line in the gross weight, fuel flow, and indicated torque grids, move horizontally to the left and note the following values:

Gross weight	18,800 pounds
Fuel flow	740 pounds per hour
Torque	91%

4. As the aircraft gross weight is 20,475 pounds, and the gross weight capability to maintain level flight is 18,800 pounds, it is necessary to determine the resulting rate-of-descent in the following manner:

5. From the intersection of the 18°C OAT and 3000-foot pressure altitude lines in the gross weight grid, move horizontally to the right to the rate-of-descent baseline.

6. From the baseline, follow the influence line up to the 20,475-pound gross weight line then move downward to the rate-of-descent scale and read 220 feet per minute. This indicates a rate of descent will be realized at a gross weight of 20,475 pounds until the helicopter descends to a pressure altitude where level flight can be maintained at 70 KIAS.

BLADE STALL CHART

The function of the blade stall chart (figure A-35) is to provide a means of determining the speed at which blade stall occurs under various altitude, rotor rpm, gross weight, and angle of bank conditions.

EXAMPLE PROBLEM FOR USE OF BLADE STALL CHART

Given:

Pressure altitude	3000 feet
Temperature	18°C
Rotor speed	100%Nr
Gross weight	20,475 pounds
Angle of bank	20°

The indicated airspeed at which blade stall will occur.

Solution: (figure A-35.)

1. Enter the chart at 3000 feet pressure altitude.

2. Move horizontally to the right to intersect the 18°C OAT line.

3. From this intersection, move downward to the rotor speed baseline then follow the influence line to intersect the 100% rotor speed line.

4. From this intersection, move downward to the gross weight baseline then follow the influence line to intersect the 20,475 pound gross weight line.

5. From this intersection, move downward to the angle of bank baseline, then follow the influence line to intersect the 20° angle of bank line.

6. From this intersection, move downward to the airspeed scale and read 108 KIAS.

MAXIMUM AIRSPEED CHART

The maximum airspeed chart (figure A-36) provides a variation of maximum KIAS with density altitude, gross weight, and rotor speed.

EXAMPLE PROBLEM FOR USE OF MAXIMUM AIRSPEED CHART

Given:

Density altitude	4000 feet
Gross weight	20,475 pounds
Nr	100%

Determine:

KIAS.

Solution:

1. Enter the chart at 4000 feet density altitude.

2. Move horizontally to the right to intersect the 20,475 pound gross weight line.

3. From this intersection, move downward to the rotor speed baseline, follow the influence line to 100% Nr line, then move downward to read 113 KIAS.

CENTER OF GRAVITY LIMITATIONS CHART

The center of gravity limitations chart (figure A-37) shows the recommended center of gravity limits and the maximum weight that can be accommodated at these stations.

EXAMPLE PROBLEM FOR USE OF CENTER OF GRAVITY LIMITATIONS CHART

Given:

Gross weight	20,500 pounds
Center of gravity	Sta. 259.0

Determine:

If cargo is within the recommended CG limits.

Solution:

1. Enter left side of chart at 20,500 pounds.

2. Move horizontally to the right to intersect the 259 station line and note that intersection is within the recommended center of gravity limits.

MAXIMUM SINK RATE ON LANDING CHART

The maximum sink rate on landing chart (figure A-38) provides the maximum sink rate in fpm the helicopter can withstand at various gross weights. To find the maximum sink rate for 20,500 pounds enter the base of the chart with this weight, read up to the limiting curve, then left, and read 433 fpm.

MAXIMUM AUTOROTATIVE GLIDING DISTANCE

The maximum autorotative gliding distance chart (figure A-39) gives the gliding distance for two specific KIAS and sink rates.

EXAMPLE PROBLEM FOR USE OF MAXIMUM AUTOROTATIVE GLIDING DISTANCE CHART

Given:

Rotor rpm	212
Rotor speed	104%Nr
Altitude	750 feet

Determine:

Gliding distance

Solution:

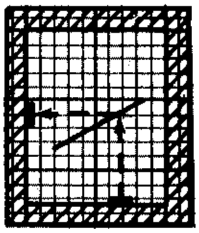
1. Enter chart at 750 feet altitude.

2. Move horizontally to the right to intersect the 70 KIAS and 1900 fpm sink rate curve.

3. From this intersection, move downward and read 0.46 nautical miles.

4. From the intersection noted in step 2, move horizontally to the right to intersect the 110 KIAS and 2300 fpm sink rate curve.

5. From this intersection, move downward and read 0.6 nautical miles gliding distance.



DENSITY ALTITUDE

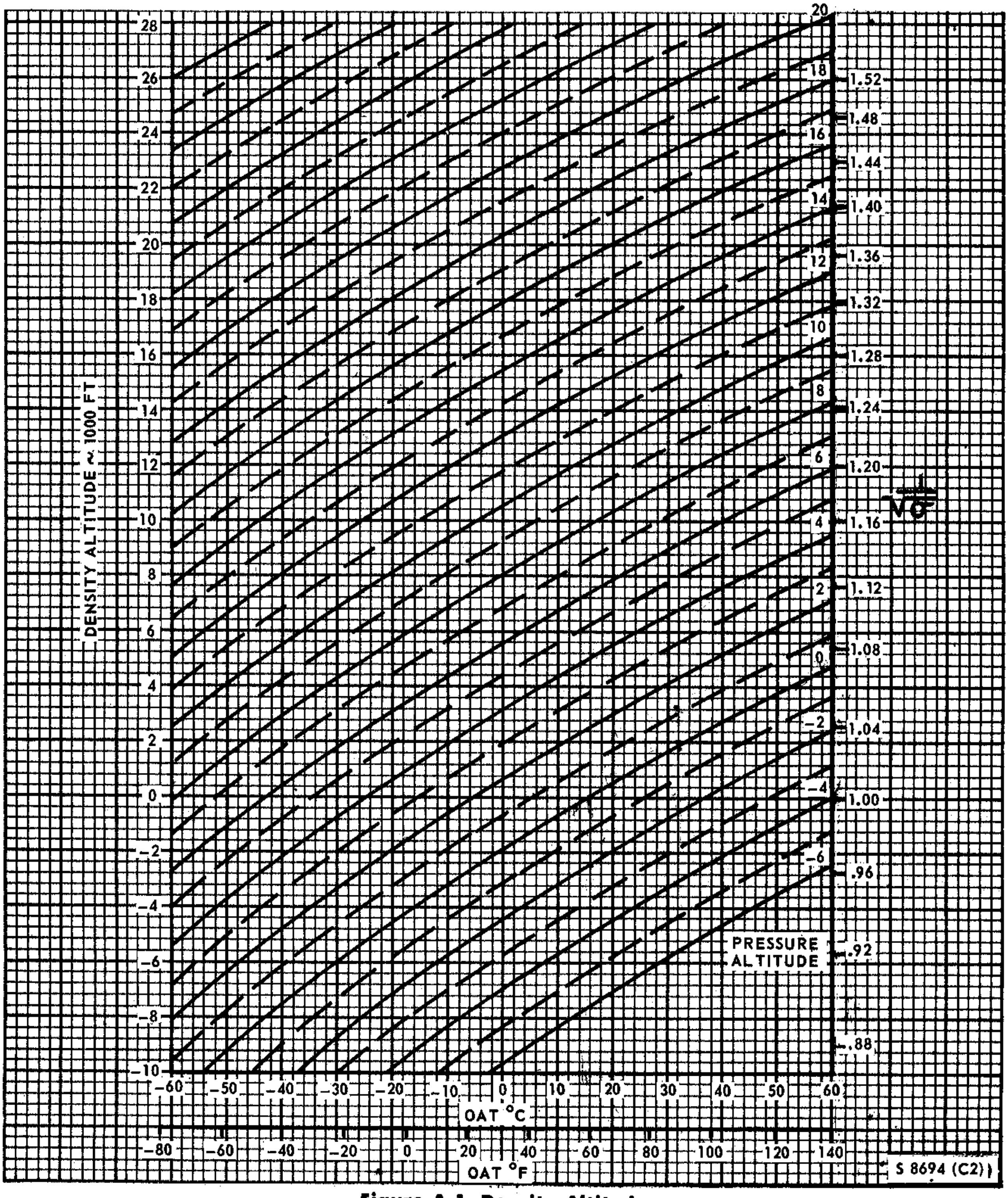
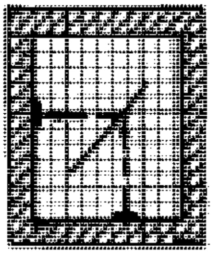


Figure A-1. Density Altitude

AIRSPEED CALIBRATION



CONDITIONS:
LANDING GEAR UP
EXCEPT FOR
TAKEOFF

DATE: 15 APRIL 1971
DATA BASIS: FLIGHT TEST (AIR FORCE)

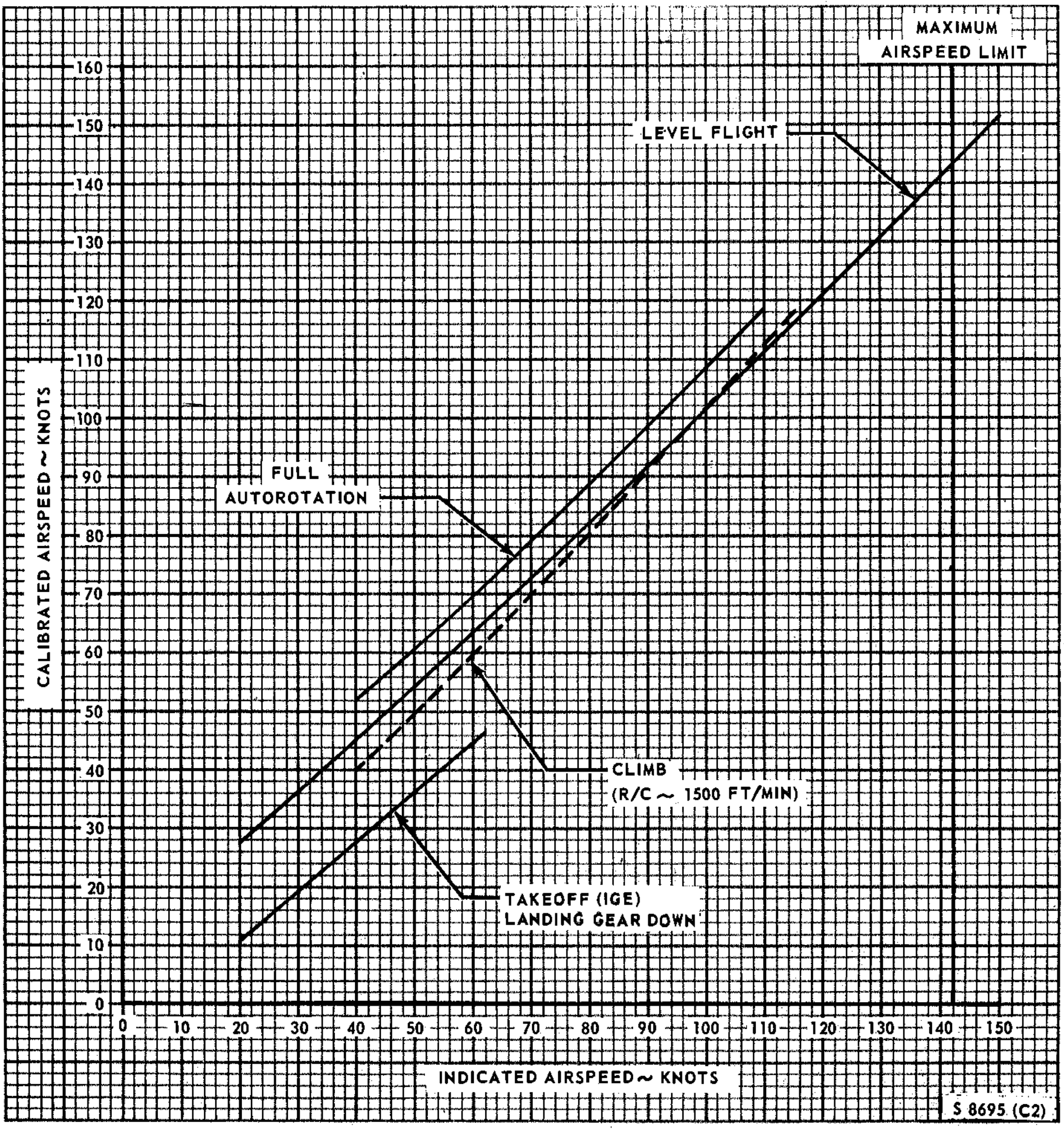


Figure A-2. Airspeed Calibration

CONDITIONS:
HOVER ZERO WIND
ZERO AIRSPEED
FOD SHIELD ON OR OFF
MAXIMUM POWER

MAXIMUM POWER AVAILABLE
ONE ENGINE

MODEL	ENGINE
HH-3F	T58-GE-5

DATE: 15 APRIL 1971
DATA BASIS: ENG MFG SPEC E1096-A

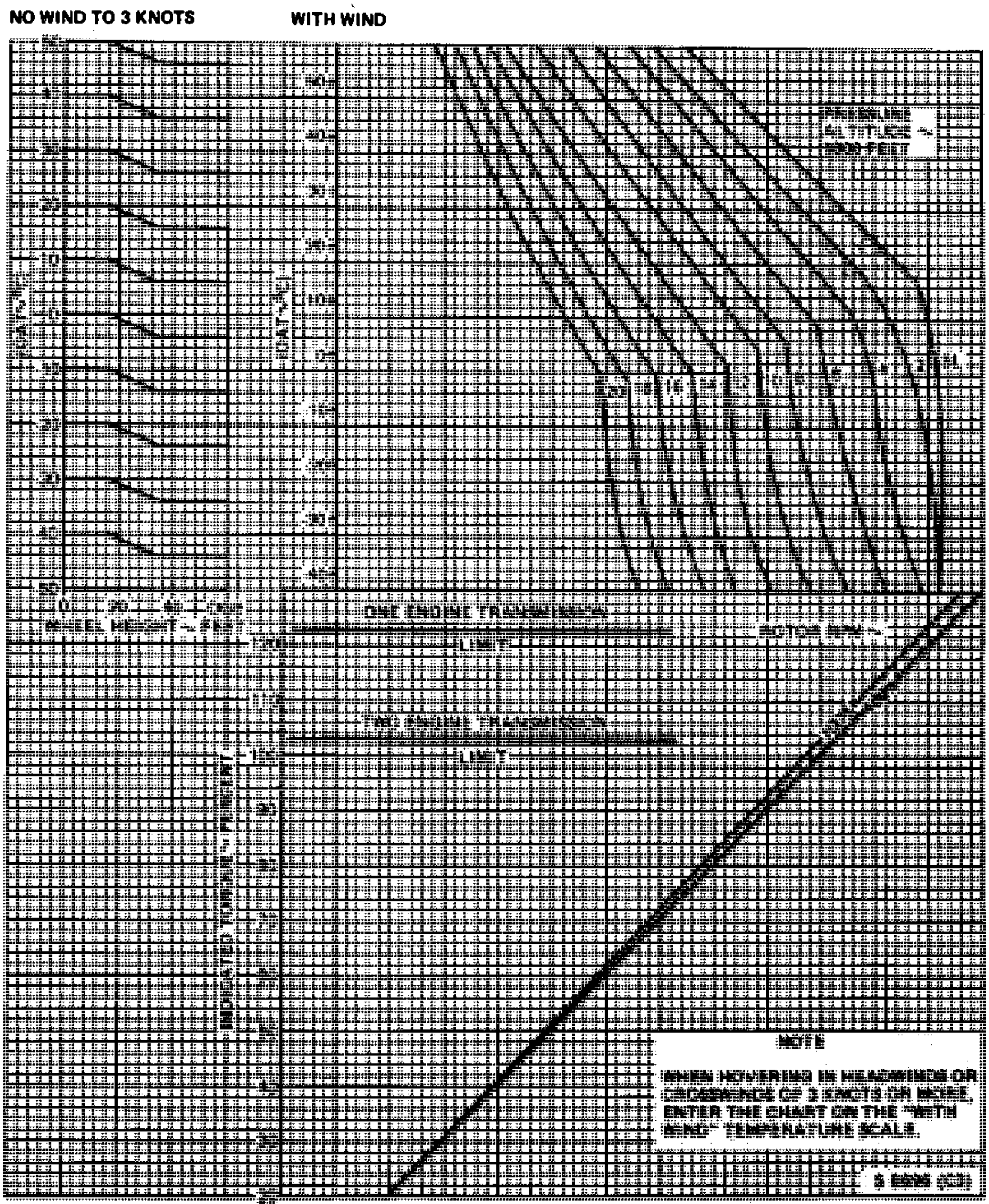


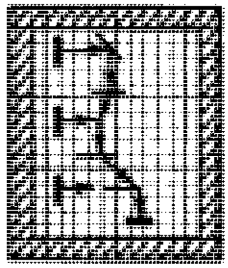
Figure A-3. Maximum Power Available - 5 Minute Limit - One Engine

MAXIMUM GROSS WEIGHT FOR HOVERING

TWO ENGINES

MODEL HH-3F

ENGINE T58-GE-5



CONDITIONS:
MAXIMUM POWER
ZERO AIRSPEED
FOD SHIELD ON OR OFF

DATE: 15 APRIL 1971
DATA BASIS: FLIGHT TEST (AIR FORCE)

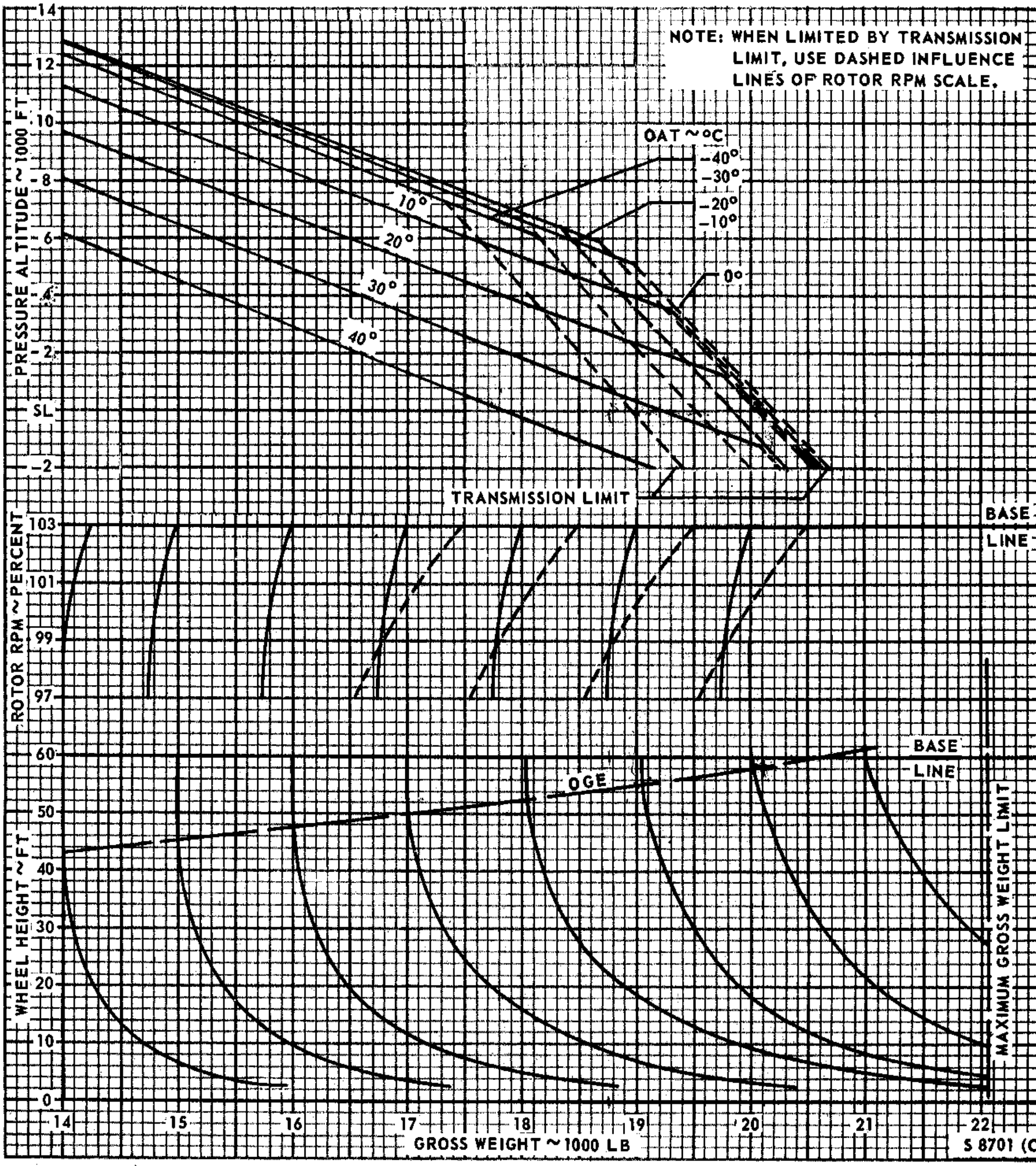


Figure A-8. Maximum Gross Weight for Hovering - Zero Wind - Two Engines

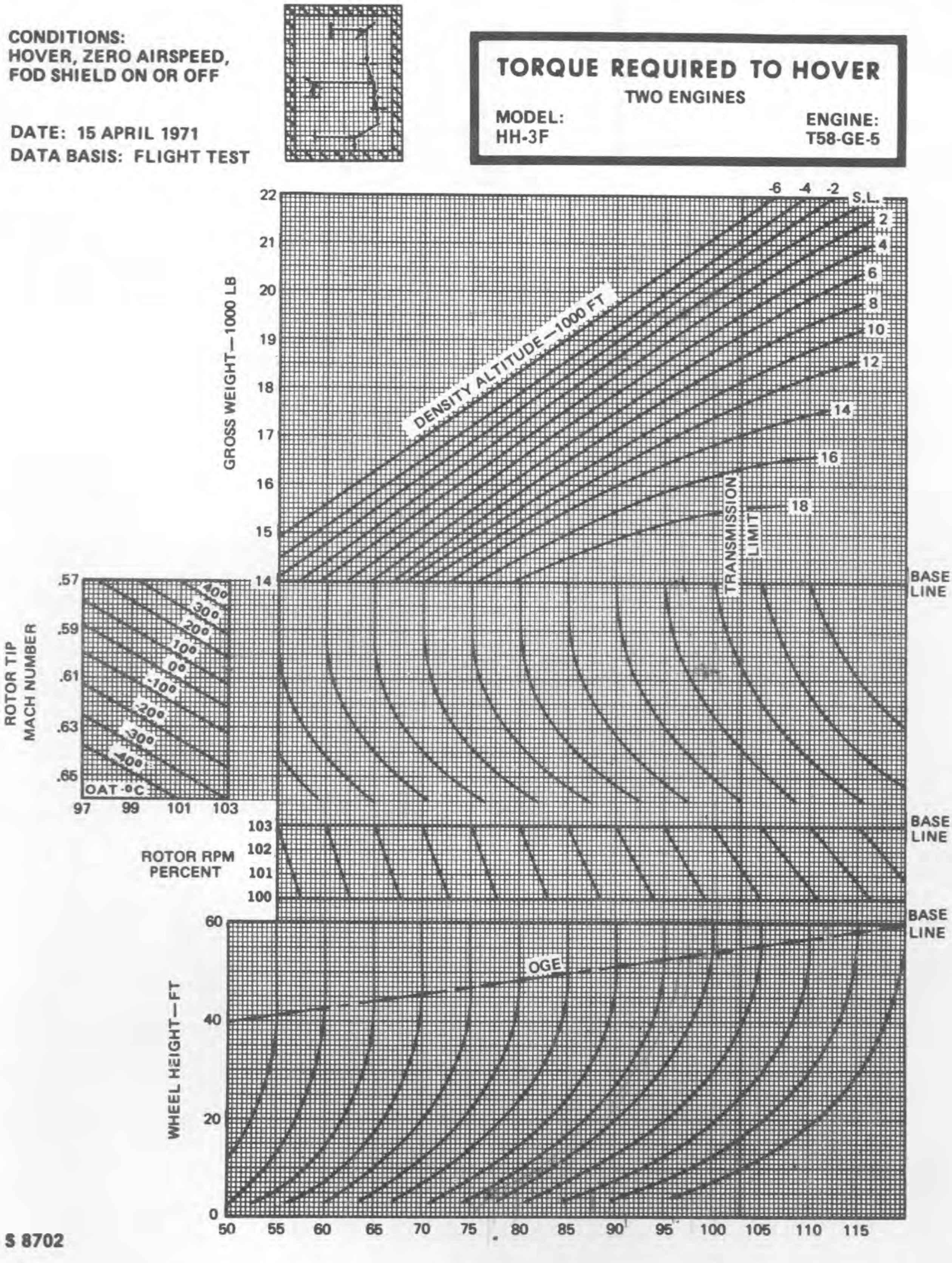


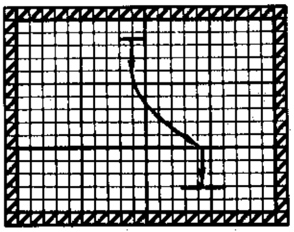
Figure A-9. Torque Required to Hover - Zero Wind - Two Engines

HEADWIND INFLUENCE ON MAXIMUM GROSS WEIGHT FOR HOVERING

TWO ENGINES

MODEL: HH-3F

ENGINE: T58-GE-5



DATE: 1 JULY 1974
DATA BASIS: ESTIMATED

NOTE: WEIGHT CORRECTION FOR HEADWINDS LESS THAN 3 KNOTS IS NEGLIGIBLE

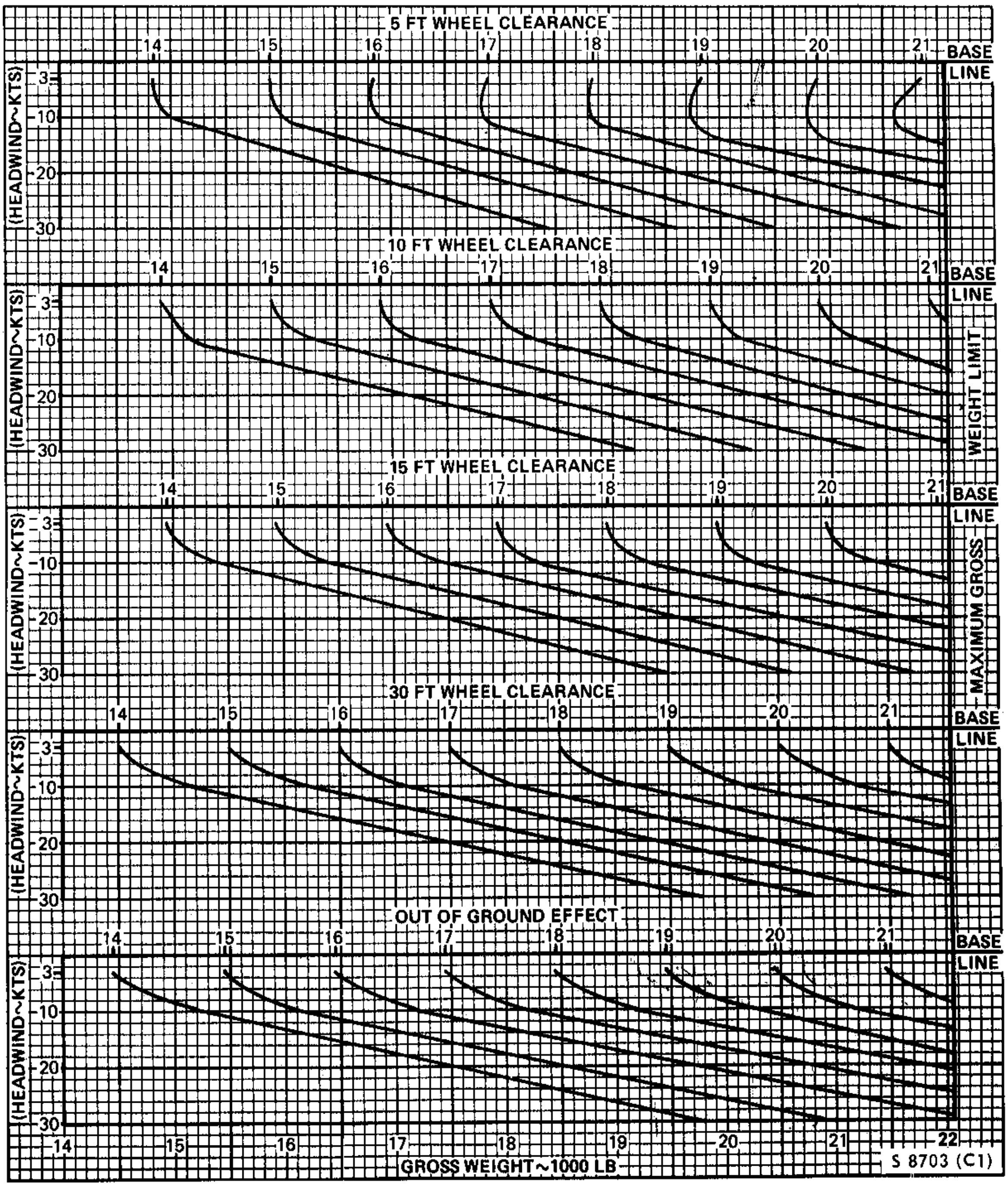
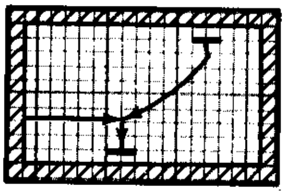


Figure A-10. Headwind Influence on Maximum Gross Weight for Hovering

CONDITIONS:
HOVER WITH WIND



HEADWIND INFLUENCE ON TORQUE REQUIRED FOR HOVERING

TWO ENGINES

MODEL HH-3F

ENGINE T58-GE-5

DATE: 15 APRIL 1971

DATA BASIS: ESTIMATED

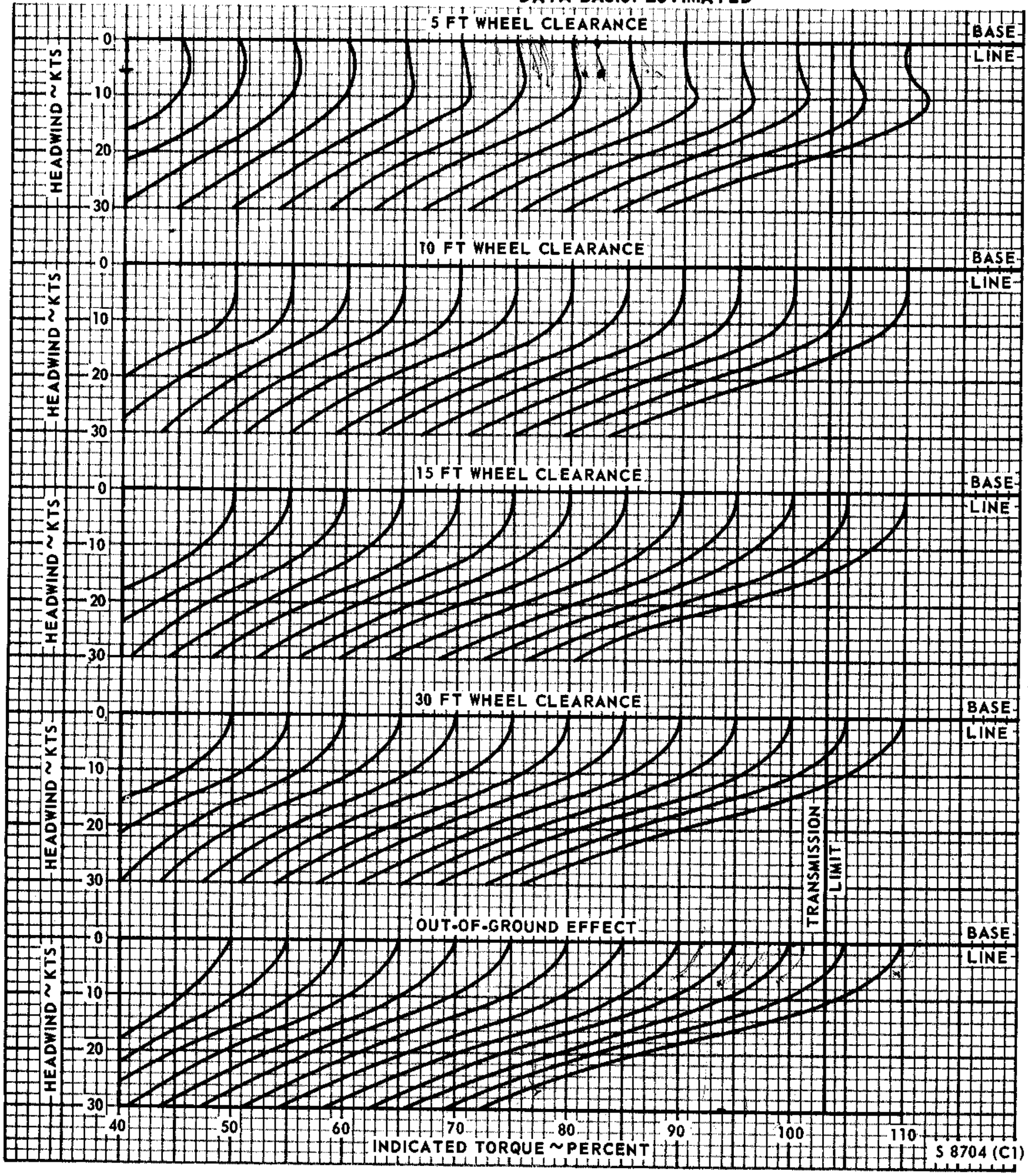


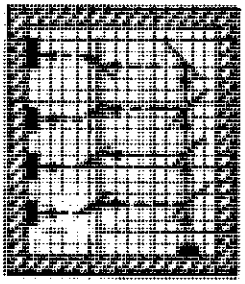
Figure A-11. Headwind Influence on Torque Required to Hover

Enter ↑

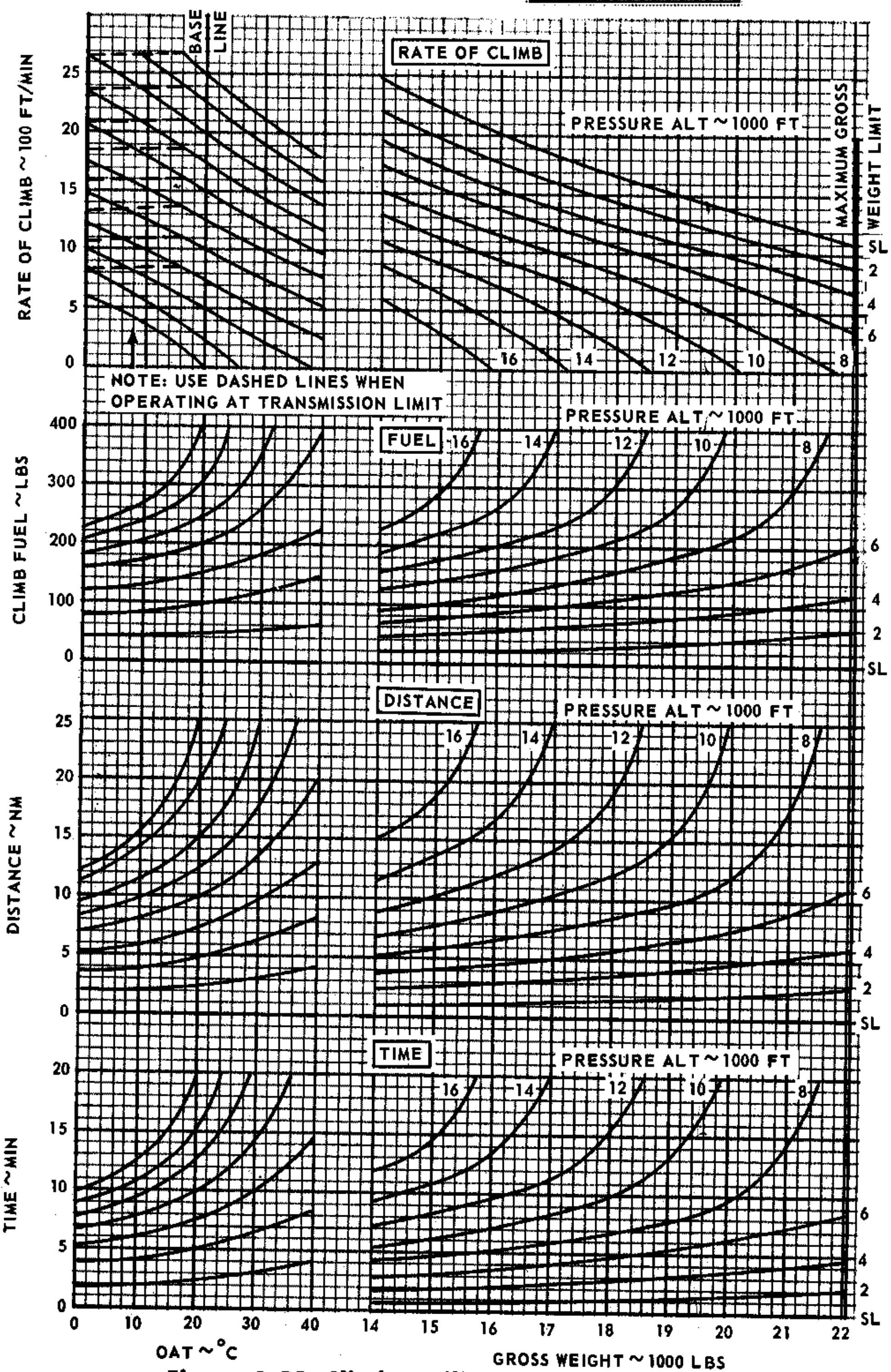
CLIMB
TWO ENGINES
WARM DAY

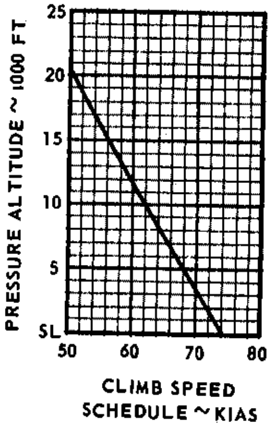
MODEL HH-3F — ENGINE T58-GE-5

DATE: 15 APRIL 1971
DATA BASIS: FLIGHT TEST (AIR FORCE)



CONDITIONS
103% N_r
MILITARY POWER
WARM UP AND TAKE OFF
FUEL NOT INCLUDED
ZERO WIND
FOD SHIELD ON OR OFF

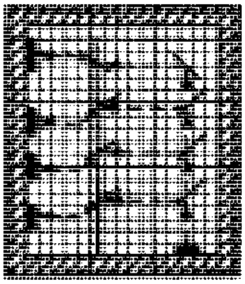




S 8714 (C2)

Figure A-20. Climb - Military Power (0° to 40°C OAT) - Two Engines

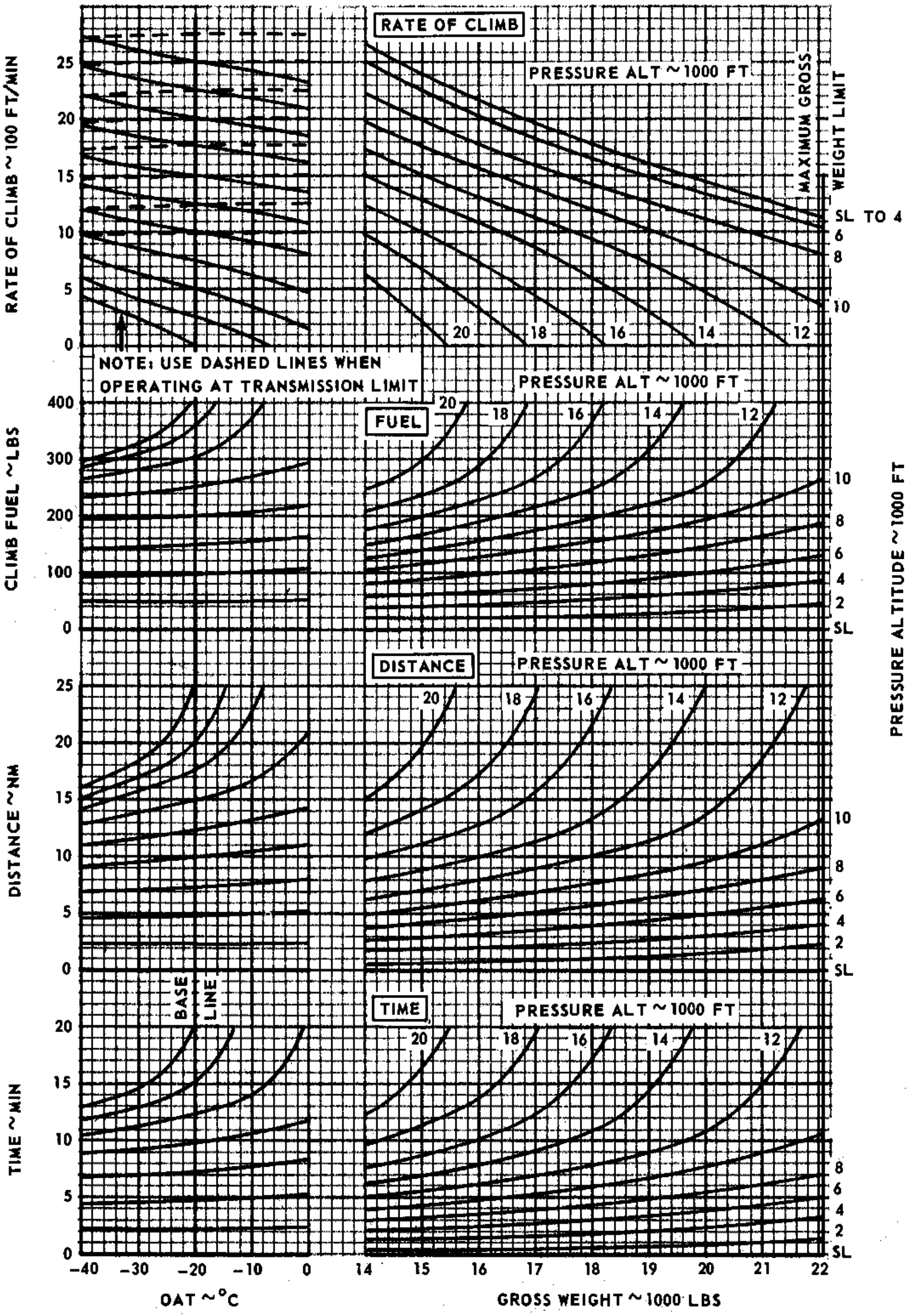
CONDITIONS:
103% N_r
MILITARY POWER
WARM UP AND TAKE OFF
FUEL NOT INCLUDED
ZERO WIND
FOD SHIELD ON OR OFF

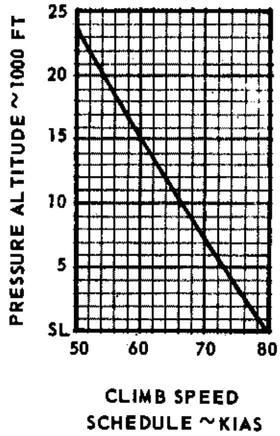


CLIMB
TWO ENGINES
COLD DAY

MODEL HH-3F | ENGINE T58-GE-5

DATE: 15 APRIL 1971
DATA BASIS: FLIGHT TEST (AIR FORCE)



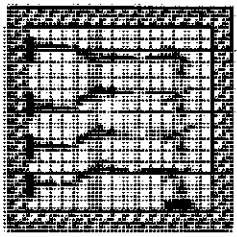


S 8715 (C2)

Figure A-21. Climb - Military Power (-40° to 0°C OAT) - Two Engines

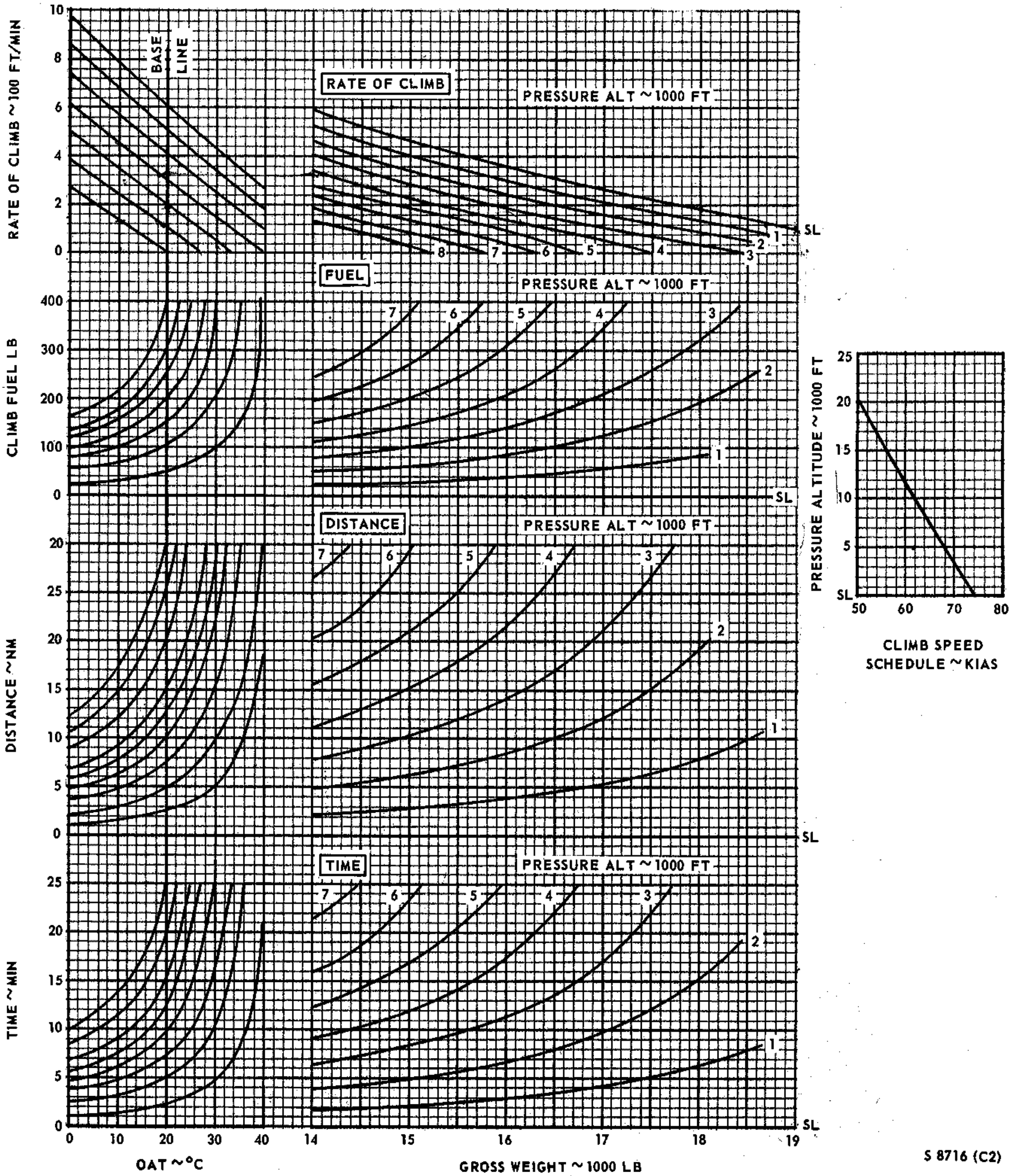
CLIMB
ONE ENGINE
WARM DAY

MODEL HH-3F — ENGINE T58-GE-5



CONDITIONS:
103% N_r
MILITARY POWER
WARM UP AND TAKE OFF
FUEL NOT INCLUDED
ZERO WIND
FOD SHIELD ON OR OFF

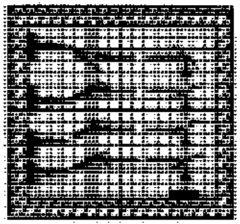
DATE: 15 APRIL 1971
DATA BASIS: FLIGHT TEST (AIR FORCE)



S 8716 (C2)

Figure A-22. Climb - Military Power (0° to 40°C OAT) - One Engine

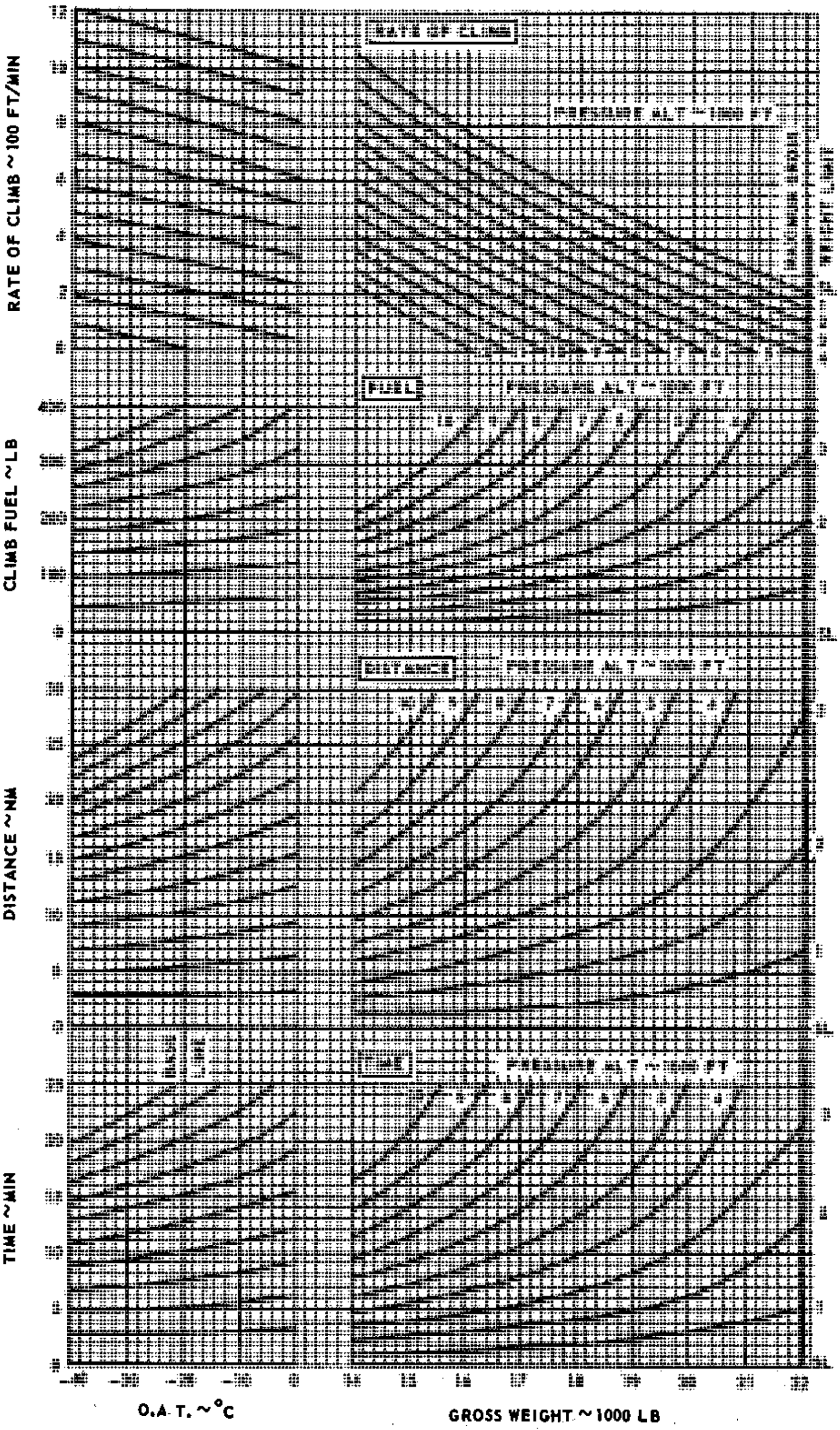
CONDITIONS:
103% N_r
MILITARY POWER
WARM UP AND TAKE OFF
FUEL NOT INCLUDED
ZERO WIND
FOD SHIELD ON OR OFF

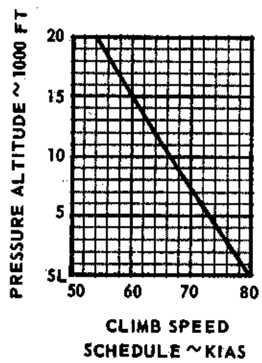


CLIMB
ONE ENGINE
COLD DAY

MODEL HH-3F — ENGINE T58-GE-5

DATE: 15 APRIL 1971
DATA BASIS: FLIGHT TEST (AIR FORCE)





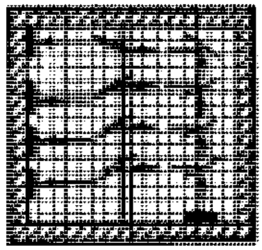
S 8717 (C2)

F[illegible]re A-23. Climb - Military Power (-40° to 0°C OAT) - One Engine

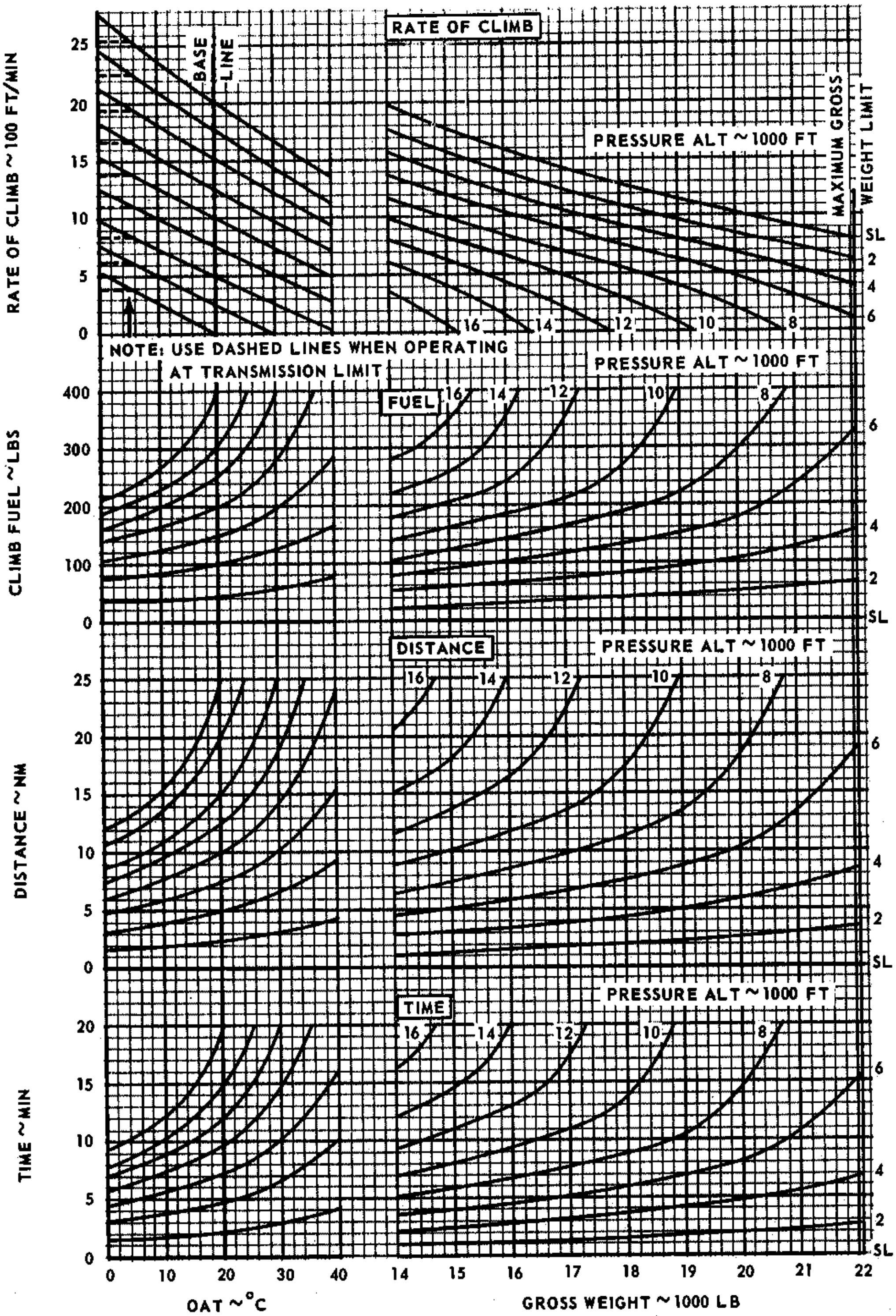
CLIMB
TWO ENGINES
WARM DAY

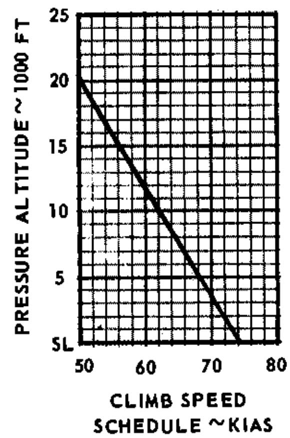
MODEL HH-3F — ENGINE T58-GE-5

DATE: 15 APRIL 1971
DATA BASIS: FLIGHT TEST (AIR FORCE)



CONDITIONS:
103% N_r
MAXIMUM CONTINUOUS POWER
WARM UP AND TAKE OFF
FUEL NOT INCLUDED
ZERO WIND
FOD SHIELD ON OR OFF
TRANSMISSION LIMIT IS
30 MIN AT 103% Q

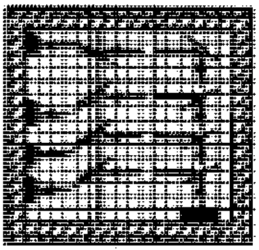




S 8718 (C2)

Figure A-24. Climb - Maximum Continuous Power (0° to 40°C OAT) - Two Engines

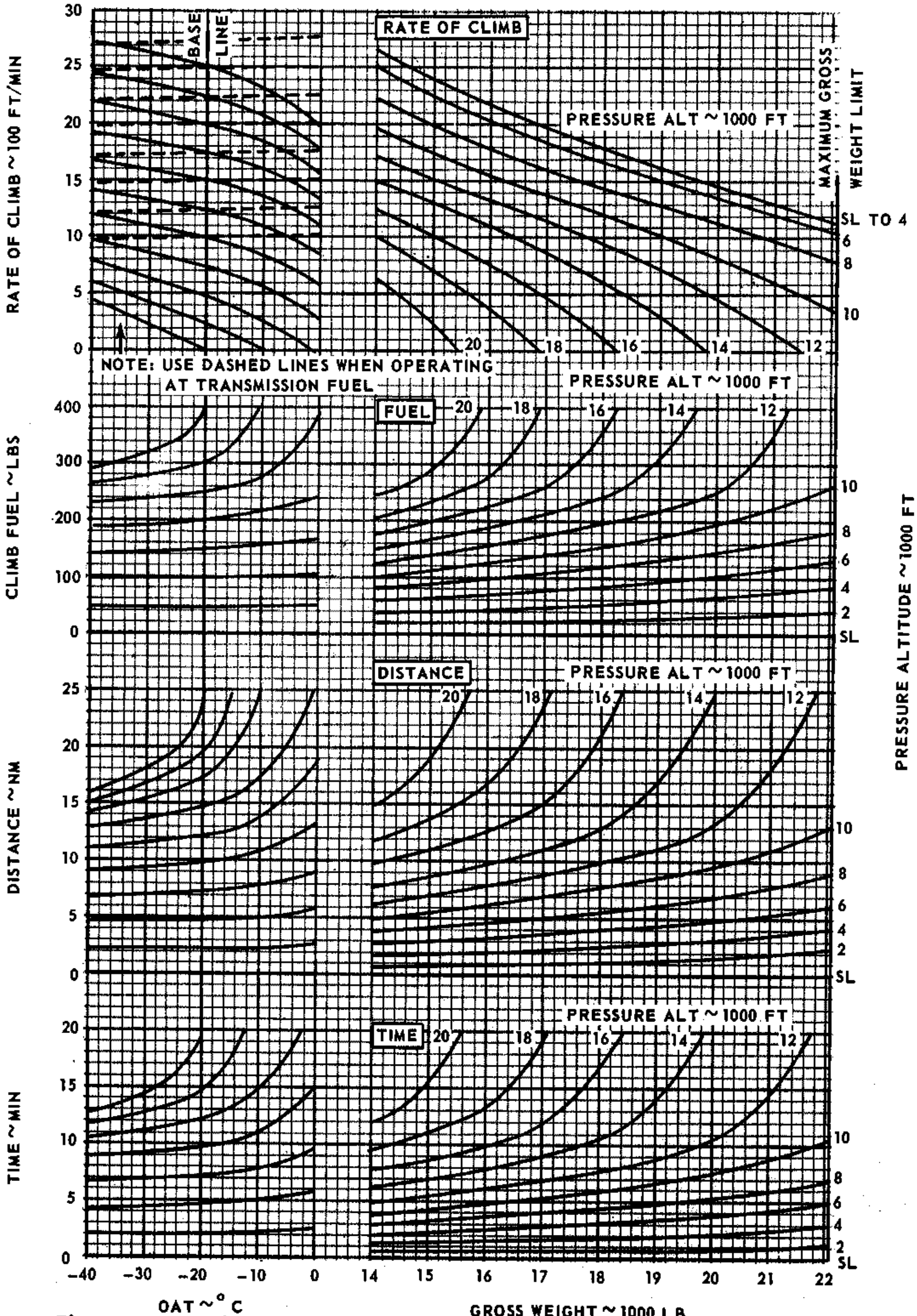
CONDITIONS
103% N_r
MAXIMUM CONTINUOUS POWER
WARM UP AND TAKE OFF
FUEL NOT INCLUDED
ZERO WIND
FOD SHIELD ON OR OFF
TRANSMISSION LIMIT IS
30 MIN AT 103% Q

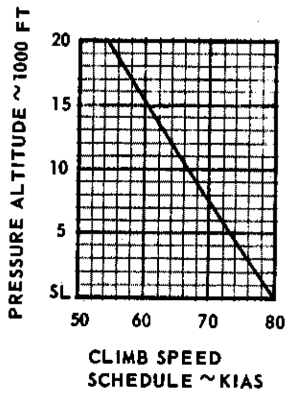


CLIMB
TWO ENGINES
COLD DAY

MODEL HH-3F | ENGINE T58-GE-5

DATE: 15 APRIL 1971
DATA BASIS: FLIGHT TEST (AIR FORCE)

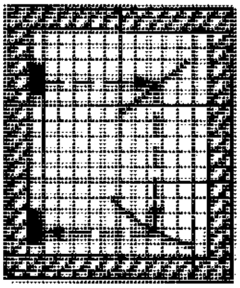




S 8719 (C2)

Figure A-25. Climb - Maximum Continuous Power (-40° to 0°C OAT) - Two Engines

CONDITIONS:
103% N_r
ZERO WIND
FOD SHIELD ON OR OFF

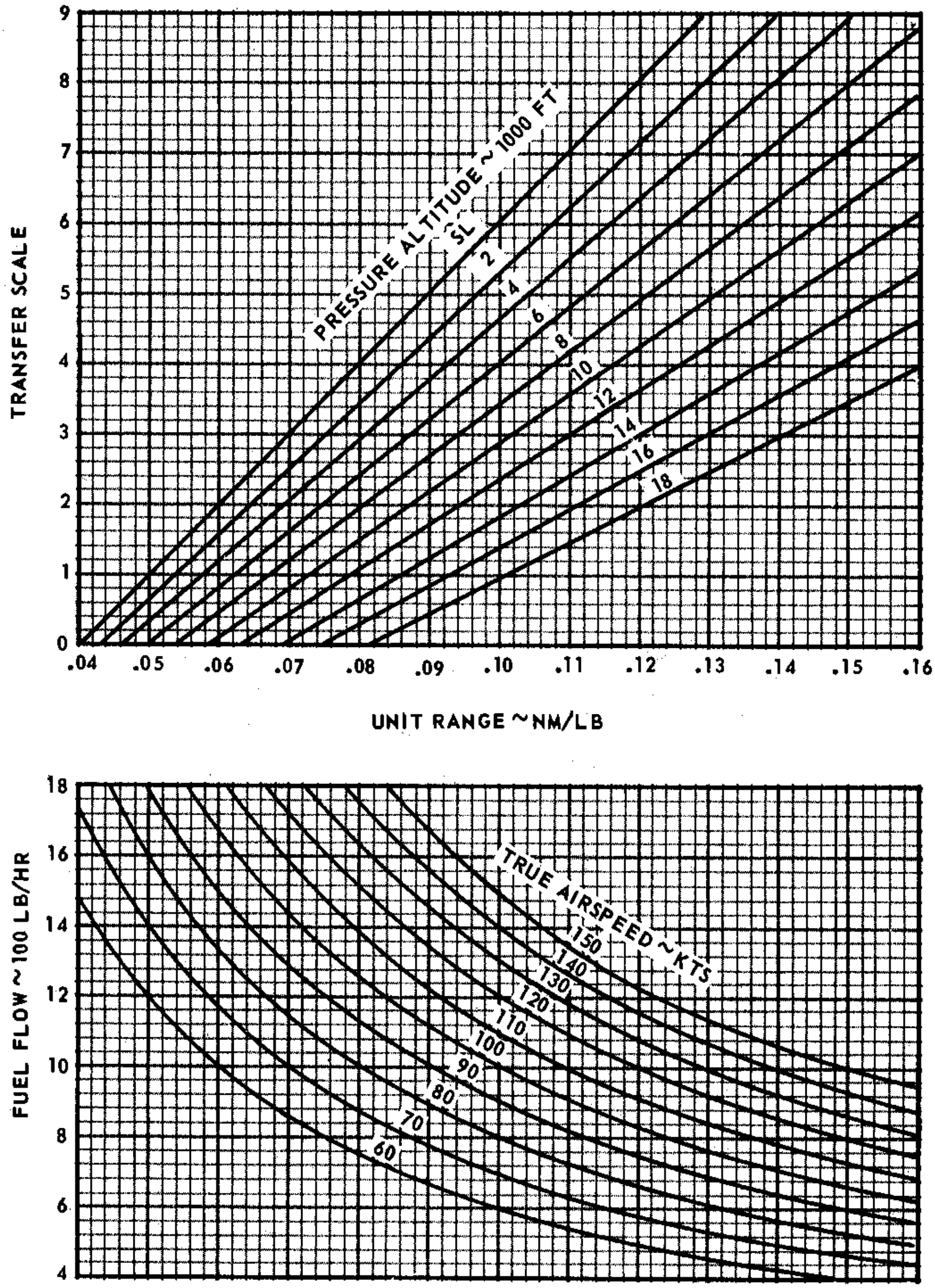


CRUISE

OAT BETWEEN −40°C AND 20°C
ONE ENGINE

MODEL	ENGINE
HH-3F	T58-GE-5

DATE: 15 APRIL 1971
DATA BASIS: FLIGHT TEST (AIR FORCE)



S 23152.2 (C2)

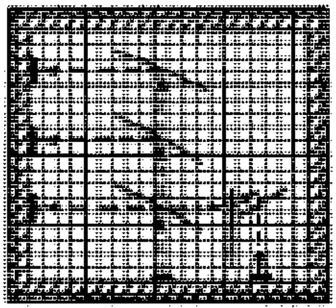
Figure A-33. Cruise (-40° to 20° OAT) - One Engine (Sheet 2 of 2)

SINGLE ENGINE CAPABILITY

ONE ENGINE

MODEL: HH-3F

ENGINE: T58-GE-5



CONDITIONS:
70 KTS IAS
MILITARY POWER
103% Nr
FOD SHIELD
ON OR OFF
LANDING GEAR UP

DATE: 15 APRIL 1971
DATA BASIS: FLIGHT TEST (AIR FORCE)

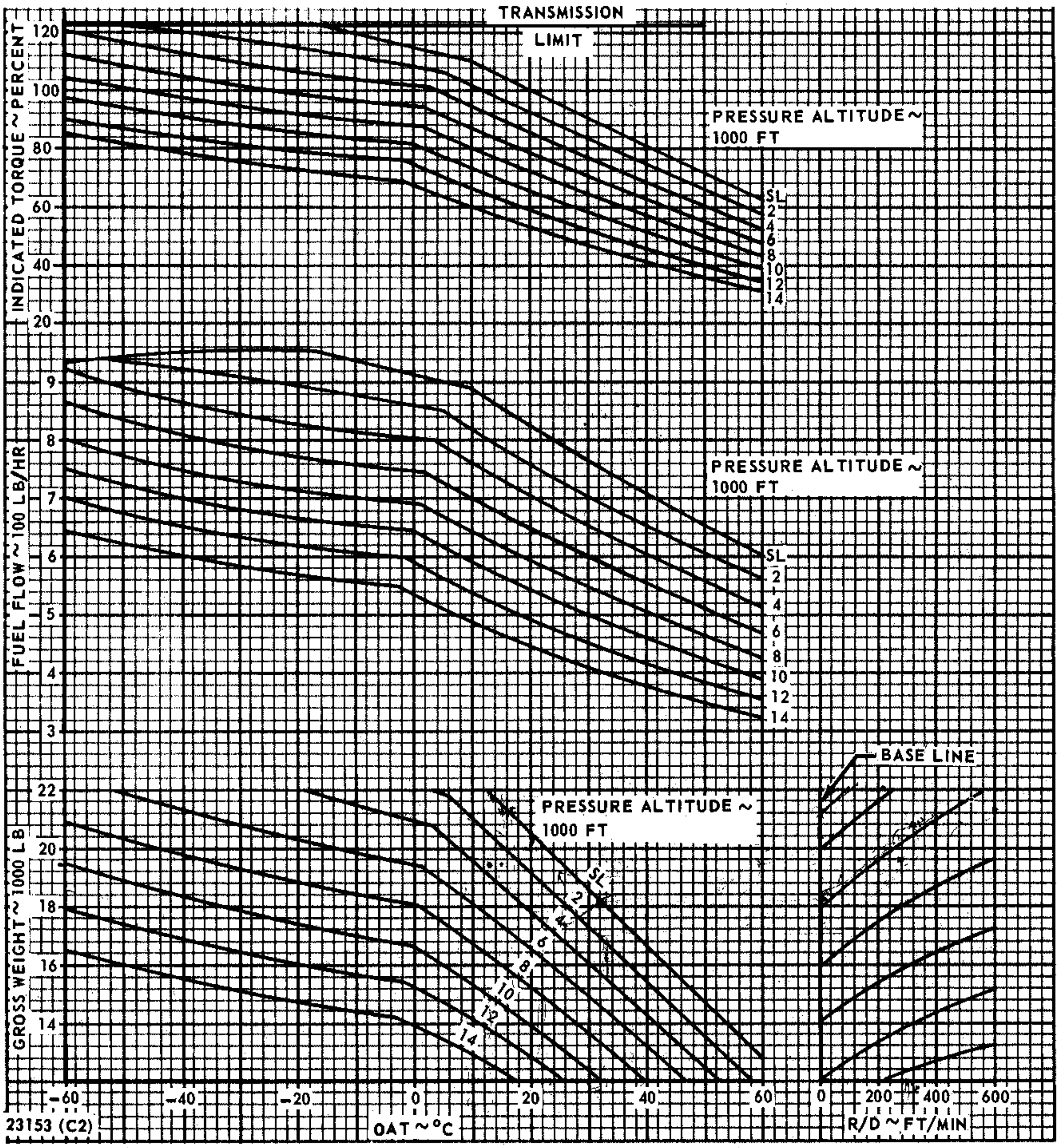
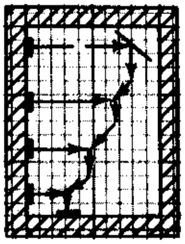


Figure A-34. Single Engine Capability - Military Power - One Engine



BLADE STALL

MODEL	ENGINE
HH-3F	T58-GE-5

DATE: 15 APRIL 1964
DATA BASIS: FLIGHT TEST (CONTRACTOR)

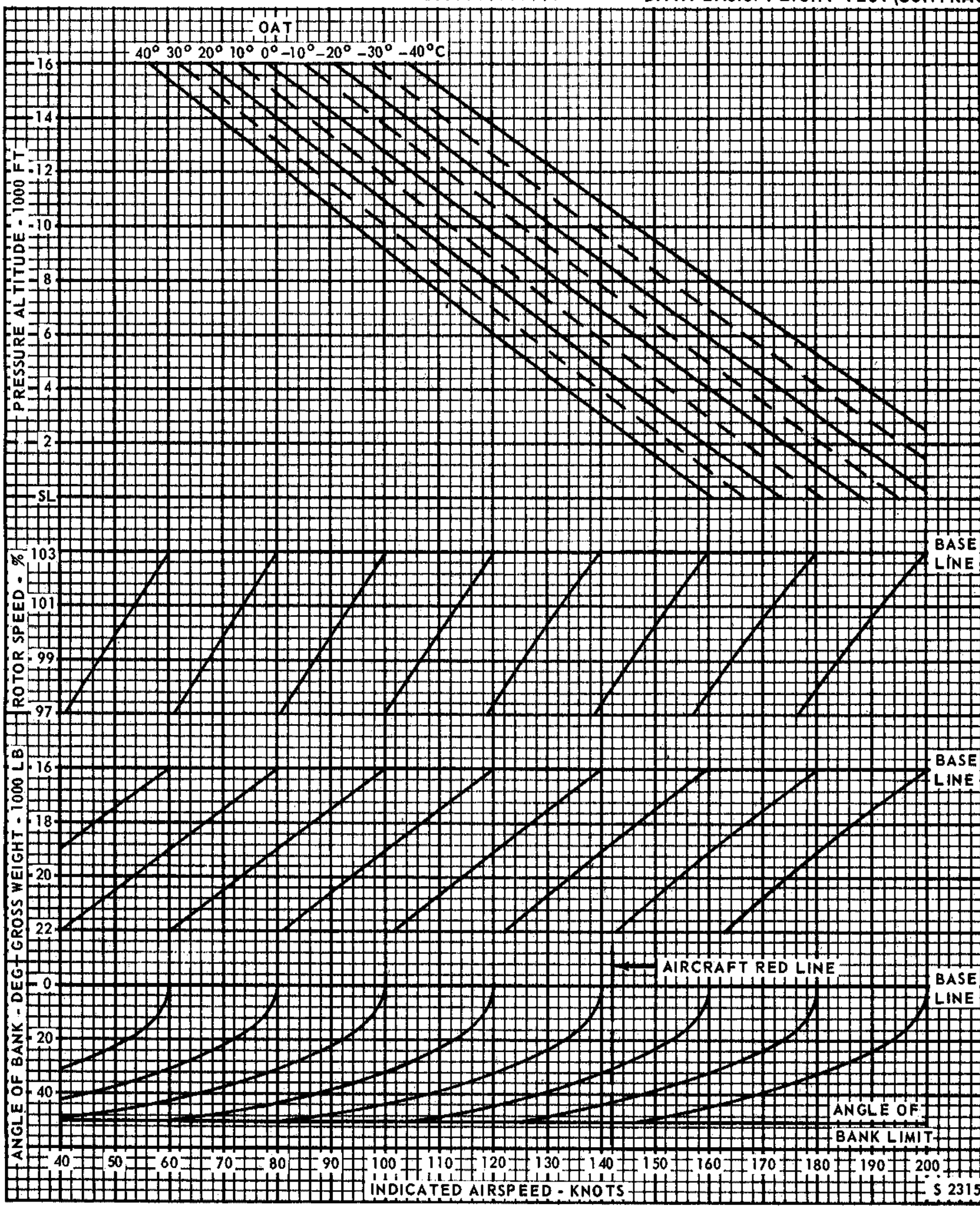
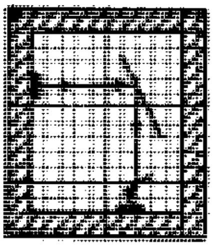


Figure A-35. Blade Stall

MAXIMUM AIRSPEED

MODEL	ENGINE
HH-3F	T58-GE-5

DATE: 1 DECEMBER 1967
DATA BASIS: ESTIMATED



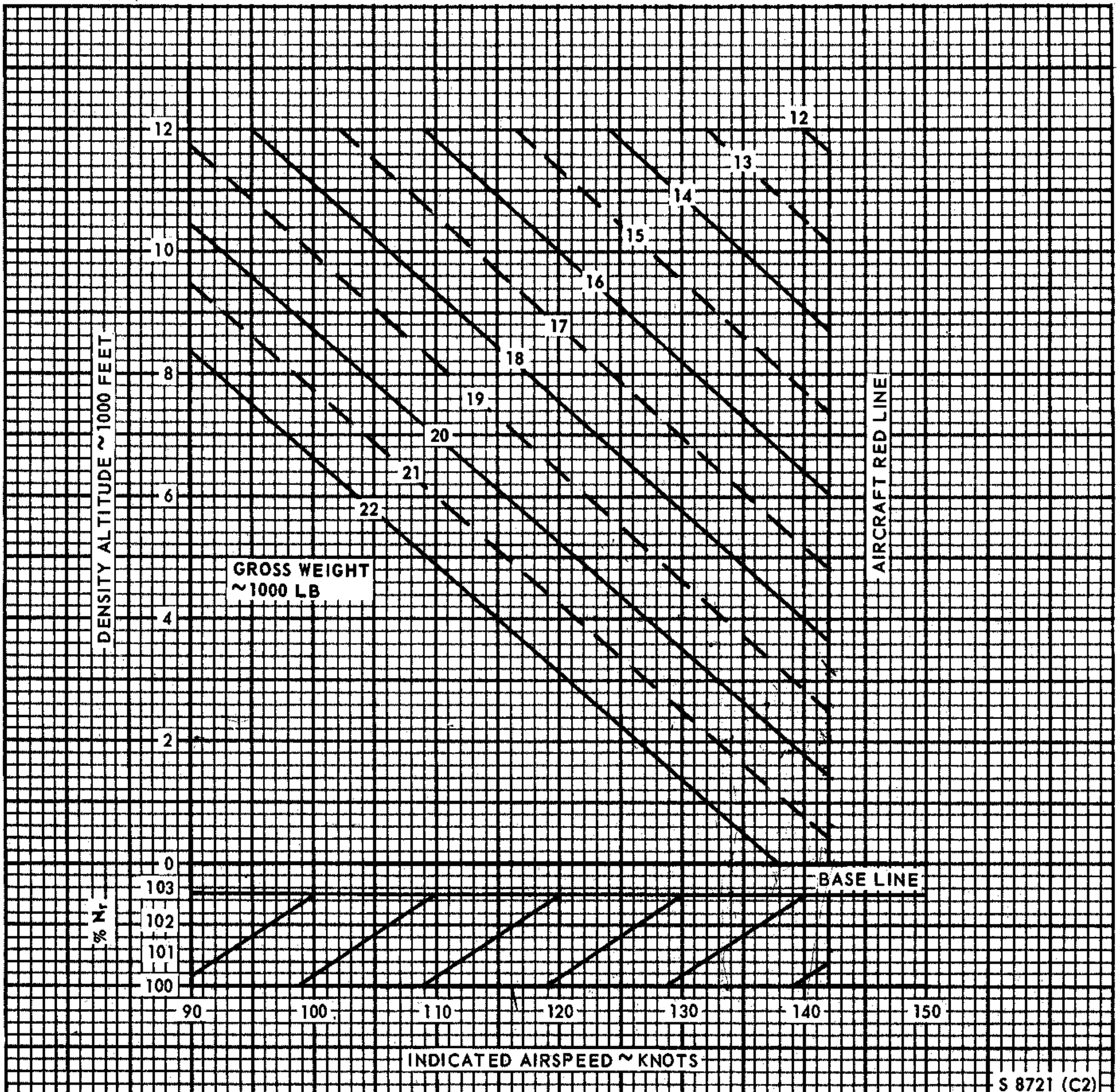
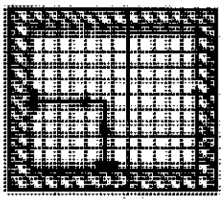


Figure A-36. Maximum Airspeed



CENTER OF GRAVITY LIMITATIONS

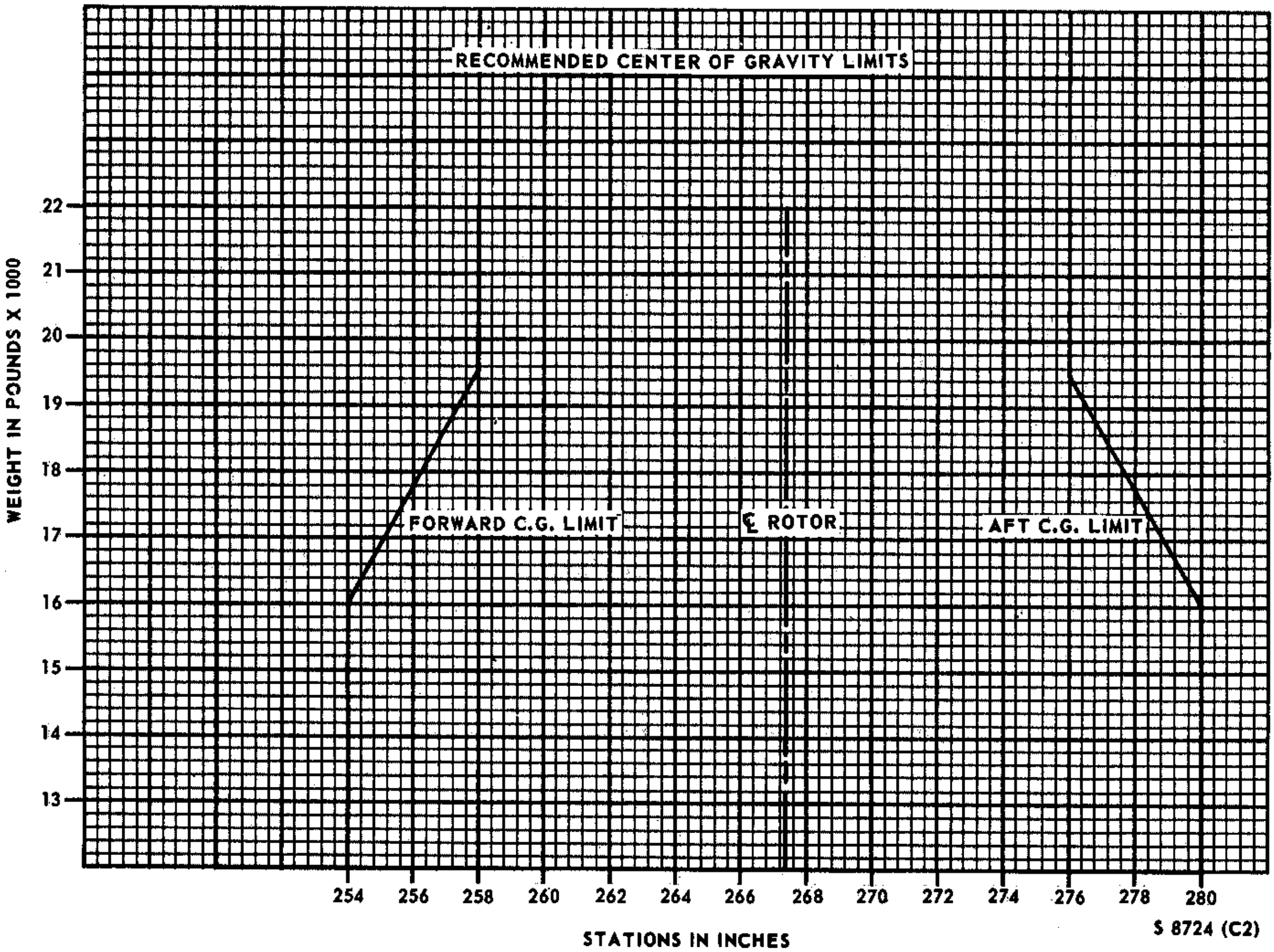
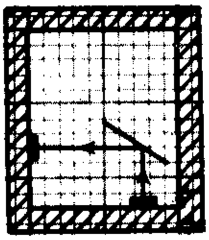


Figure A-37. Center of Gravity Limitations Chart

MAXIMUM SINK RATE ON LANDING



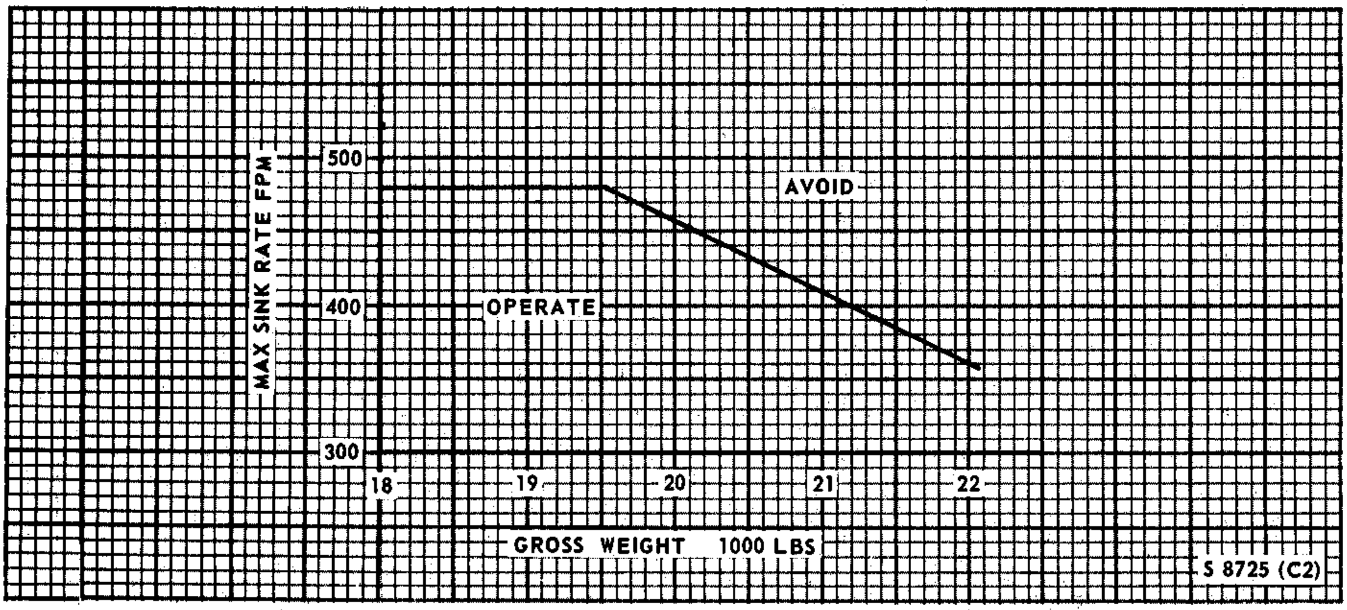
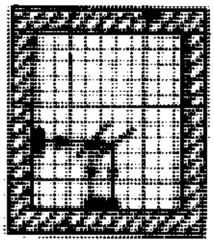


Figure A-38. Maximum Sink Rate on Landing Chart

CONDITIONS:
212 ROTOR RPM
104% ROTOR SPEED



MAXIMUM AUTOROTATIVE GLIDING DISTANCE

MODEL HH-3F

ENGINE T58-GE-5

DATE: 1 DECEMBER 1967
DATA BASIS: ESTIMATED

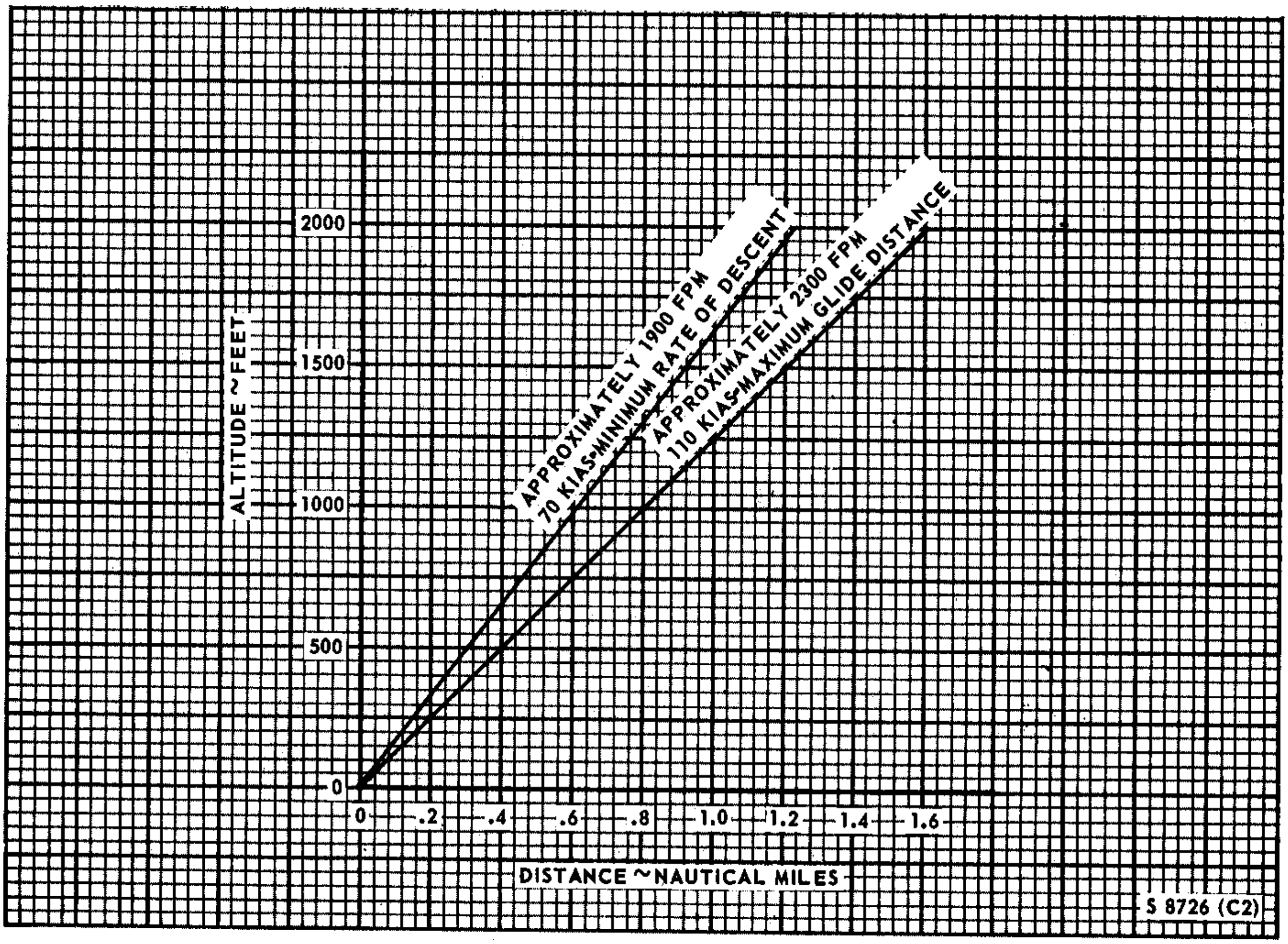


Figure A-39. Maximum Autorotative Gliding Distance

TAKEOFF AND LANDING DATA CARD HH-3F

HELO NO. ____________

DATE ____________

MISSION ____________

DATA	TAKEOFF/LANDING	
FIELD ELEVATION	____________	FT
PRESSURE ALTITUDE	____________	FT
FREE-AIR TEMP	____________	C
WIND	____________	KT
DENSITY ALTITUDE	(Figure A-1)	FT
OPERATING WT	____________	LB
EXTRA CREW/EQUIP	____________	LB
FUEL	____________	LB
MISSION GROSS WT	____________	LB
POWER AVAILABLE SE/DE	(Figure A-3)	%Q
POWER REQ HIGE 5FT	(Figures A-9, A-11)	%Q
POWER RESERVE	____________	%Q
MAX GROSS WT HOGE	(Figures A-8, A-10)	LB
POWER REQ HOGE MISSION GROSS WT	(Figures A-9, A-11)	%Q
SINGLE – ENGINE CLIMB	(Figures A-22, A-23, and A-34)	FPM
MAX AIRSPEED MISSION GWT	(Figure A-36)	KT

FUEL LOG

TIME						
FA						
FM						
AA						
AM						
TOT						

		LAT	LONG	VAR
DESTINATION	1			
	2			
	3			
	4			

SRCH TYPE ____________

IP ____________

CSE ____________ LG 1 ____________ LG 2 ____________

ETA ON SCENE ____________

ESTIMATED TIME TO COMPLETE SRCH ____________

ON SCENE ENDURANCE ____________

ON SCENE WX: ____________

S 8728 (C2)

Figure A-40. Takeoff and Landing Data Card

ALPHABETICAL INDEX

U

V

W