APPENDIX I

PERFORMANCE DATA

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PURPOSE OF DATA

The charts presented on the following pages are provided to aid in preflight and in-flight 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.

TYPE OF FUEL

The charts are based on JP-4 fuel with a fuel density of 6.5 lbs/gal.

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 a 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 equal. Consequently, the ambient temperature affects the power required. The charts 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 air temperature. A standard day temperature line for the altitude range shown is marked on the curves as a convenient guide. 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 calibrated airspeeed. Figure A-1 also provides a means to convert either fahrenheit temperatures to centrigrade temperatures or vice versa.

EXAMPLE:

If the ambient temperature is -10°C and the pressure altitude is 7000 feet, the density altitude is 5700 feet and $1/\sqrt{\sigma}$ is 1.088.

AIRSPEED CORRECTION CHART

An airspeed correction 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 the installation correction equals calibrated airspeed (CAS). Because of the speed range at which this helicopter operates, compressibility corrections to airspeed are negligible and hence intentionally omitted.

TRUE AIRSPEED CORRECTION

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

EXAMPLE:

The helicopter is cruising in level flight at 5000 feet pressure altitude at an IAS of 100 knots. The air temperature is plus 10°C. Find CAS and TAS.

SOLUTION:

Enter the chart (Figure A-2) at the bottom at the 100 knot line and move vertically until the line marked level flight is intersected. From this point, move horizontally to the left to CAS of 98 knots. Enter the density altitude chart vertically until the line marked 5000 feet pressure altitude is reached. Project horizontally to the right and read $1/\sqrt{\sigma}$ = 1.088. Multiply CAS x $1/\sqrt{\sigma}$ to obtain TAS, or 98 knots x 1.088 = 107 knots. This is the true airspeed.

AIRSPEED CONVERSION CHART

Airspeed conversion charts for true airspeed to indicated airspeed are shown in Figure A-3 for level flight and Figure A-4 for climb. These charts are used when the true airspeed, altitude, and outside air temperature are known and the helicopter's indicated airspeed is required.

EXAMPLE:

The following example describes the use of the indicated airspeed versus true airspeed conversion chart for level flight (Figure A-3). Assume the following conditions.

PROBLEM	CONDITION
Air temperature	-30°C.
Pressure altitude	10,000 feet
True airspeed	85 knots

1. Enter the chart (Figure A-3) at the bottom at the true airspeed of 85 knots.

2. Move upward parallel to the flow lines to the zero altitude point and continue the upward movement until the 10,000 foot altitude point is reached.

3. From the 10,000-foot point, project vertically upward to the temperature scale at plus 60°C.

4. From this point move upward parallel to the temperature flow lines to the minus 30°C temperature point.

5. Project vertically upward from this point and read an indicated airspeed of 78 knots.

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 two power settings is shown: military power available (Figure A-5), and maximum continuous power available (Figure A-6). Air temperature and pressure altitude effects on power available are shown on the charts. Figures A-5 and A-6 provide installed power available data that is the maximum power output expected of a properly tuned specification T400-CP-400 power package. The performance shown in Appendix I charts is based on the power output shown in Figures A-5 and A-6. Operation is allowed up to 810°C ITT for Military Power and 767°C ITT for Maximum Continuous Power (Figure 5-1, Sheet 2).

NOTE

The power output capability of the two engines can exceed the structural limit of the transmission under certain conditions. The limits shown in Section V should be observed to prevent exceeding the power limitations imposed by the transmission.

EXAMPLE:

The following example describes the use of the military power available chart (Figure A-5). Assume the following conditions.

PROBLEM	CONDITION
Air temperature	0°C
Pressure altitude	12,000 feet
Desired rotor rpm	100% rpm

1. Enter the air temperature scale of the chart at 0°C.

2. Move horizontally to the right until the pressure altitude curve representing 12,000 feet is intersected.

3. Move vertically down until the 100% rotor rpm line is intersected.

4. Move horizontally to the left to the torquemeter scale and read 43% Q which is the installed power available per engine for the conditions set forth in the example. This is also 86% Q total installed power available as seen on the Two Engine % Q scale at the right.

FUEL FLOW CHART

The fuel flow charts (Figures A-7 and A-8) show the fuel flow at 0°C for a given altitude and power setting for 97% NR and 100% NR. The fuel flow chart can also be used to determine endurance when the power required is known.

EXAMPLE:

Determine the fuel flow in pounds per hour when flying at 5000 feet pressure altitude, OAT – 0°C, with torque pressure at 40 percent per engine (97% NR).

SOLUTION

Enter the 97% NR chart (figure A-7) at the bottom at 40 percent torquemeter pressure and move vertically to the 5000 foot pressure altitude line. From this point, move horizontally to the left and read 360 pounds per hour fuel flow per engine.

MAXIMUM GROSS WEIGHT TO HOVER CHART

The maximum gross weight to hover chart (Figure A-9) shows the maximum gross weight at which the helicopter may hover at military power for both twin and single engine operation. The chart shows OGE hover performance with tradeoff curves for IGE operation and rotor rpm variation.

EXAMPLE:

At Military Power

PROBLEM	CONDITION
Pressure altitude	7500 feet
Air temperature	30°C
RPM	97%
Skid Height	40 feet

Enter the upper chart (Figure A-9) at 7500 feet pressure altitude and move to the right to intersect the 30°C temperature curve. From this point, drop vertically to the rotor rpm baseline. Follow the guide line on the rotor rpm scale to the 97% rpm line. Drop vertically to the baseline of the skid height correction chart. Follow the guide line on the baseline of the skid height scale to the 40-foot line. Drop vertically from the 40-foot point to the gross weight scale and read 8650 pounds maximum hovering weight for the given conditions.

POWER REQUIRED TO HOVER CHART

The power required to hover chart (Figure A-10) is used to determine the power required to hover at desired rotor rpm and skid height. The power required is shown in terms of percent torque and can be determined at various gross weights, temperatures, and altitudes. Curves are shown on the charts for various rpm settings and skid heights.

EXAMPLE:

The following example describes the use of the power required to hover chart. Assume the following conditions.

PROBLEM	CONDITION
Gross weight	8000 pounds
Pressure altitude	10,000 feet
Air temperature	0°C
Desired skid height	20 feet
Desired rotor rpm	97%

1. Enter the rotor rpm plot at 97% NR. Move vertically to 0°C air temperature. Mark this horizontal line.

2. Enter the gross weight scale of the chart at 8000 pounds. Move horizontally to the right until the 10,000 foot pressure altitude line is intersected.

3. Move down vertically until the base of the rotor rpm plot is intersected. Follow the trend of the correction curve until the horizontal line from step 1 is intersected.

4. Move down vertically to the skid height plot baseline and follow the trend of the curve until the horizontal line representing 20-feet skid height is intersected.

5. Move down vertically to the percent torque scale and read 71% Q which is the power required for the conditions set forth in the problem.

HEADWIND INFLUENCE ON MAXIMUM GROSS WEIGHT AND PERCENT TORQUE FOR HOVER

The headwind influence chart (Figure A-11) is used to show the effects of headwind on maximum gross weight and percent torque required to hover.

EXAMPLE:

The following example describes the use of headwind chart. Assume the following conditions.

PROBLEM	CONDITION
Gross Weight	8000 pounds
Percent torque required	67% Q
Desired skid height	OGE
Headwind	15 knots

1. To determine the effect of headwind on maximum gross weight for hover, enter the gross weight scale at the baseline of the OGE chart at 8000 pounds. Follow the flow lines to 15 knots headwind and read 9000 pounds maximum gross weight for hover.

2. To determine the effect of headwind on percent torque required for hover, enter the percent torque scale at the baseline of the OGE chart at 67% Q. Follow the flow lines to 15 knots headwind and read 56% Q required for hover.

3. Therefore, hover can be performed either at 8000 pounds with 56% Q, or at 9000 pounds with 67% Q.

MINIMUM HEIGHT FOR SAFE LANDING AFTER TWO ENGINE FAILURE

The minimum height for safe landing after a two engine failure is shown in Figure A-12.

EXAMPLE:

At 15 KIAS, the minimum skid height for a safe landing after a two engine failure is 525 feet (Figure A-12). For 35 KIAS, the minimum height for a safe landing after a two engine failure is 363 feet.

WARNING

Do not practice autorotation at any skid height airspeed combination within the enclosed area of Figure A-12.

MINIMUM HEIGHT FOR SAFE LANDING AFTER SINGLE ENGINE FAILURE

The minimum height for safe landing after a single engine failure is shown in Figure A-13.

EXAMPLE:

The following example describes the use of the height-velocity chart.

PROBLEM	CONDITION
Gross Weight	8600 pounds
Air temperature	0°C
Pressure altitude	4000 feet

FIND

1. Minimum and Maximum Skid Height at 0 Airspeed.
2. Minimum Airspeed for no Height-Velocity restrictions.

SOLUTION

Sheet 1 of Figure A-13 provides the necessary data to enter Sheet 2 in terms of the given parameters. For various gross weight and pressure altitudes at five air temperatures, Sheet 1 gives the ratio of one engine power available to the power required to hover out of ground effect (Q ratio). It also provides a conversion of pressure altitude and air temperature to density altitude in order to give on one page all of the information required to do the problem.

Enter A-13 (Sheet 1) on the portion 0°C at 8600 pounds (left hand side) and move to the right and intersect 4000 feet pressure altitude. At this point read 0.85 Q ratio. Using upper right hand graph, enter at 0°C and project up to 4000 feet, then to the right and read a density altitude of 3200 feet.

Enter A-13 (Sheet 2) at 0 velocity and read skid height x density ratios of 12 and 45 feet. Then entering the upper chart from the top at these numbers and following the flow lines down to intersection of 3200 feet density altitude, read vertically downward skid heights of 13 and 48 feet.

To find the minimum airspeed without restriction, interpolate on the lower position of A-13 (Sheet 2) at 0.85 Q ratio and intersect the minimum speed line at 8 KTAS.

TAKE OFF DISTANCE CHARTS

The Takeoff Charts present data for the following techniques:

1. Level acceleration from a four-foot skid height to climbout airspeed, two engines (Figure A-14).

2. Climb and accelerate from light on skids to climbout airspeed, two engines (Figure A-15).

3. Level acceleration from a 15-foot skid height to climbout airspeed, two engines, for sling load. (Figure A-16).

4. Level acceleration from a four-foot skid height to climbout airspeed, one engine (Figure A-17).

The first technique, level acceleration from a four-foot hover, yields successful takeoffs when the power available is sufficient to hover at skid heights above four feet. The takeoff is accomplished by applying full power while accelerating through translational lift at a skid height of four feet. Climbout airspeed is maintained at 5 to 10 knots above translation lift speed when the minimum distance over a 50-foot obstacle is required. This takeoff technique is recommended for normal, heavy weight takeoffs when excess power available is limited.

The second technique, climb and accelerate from light on skids, yields the best takeoff performance at light weights. The power available has to be sufficient to climb and accelerate simultaneously. As skid height increases, the ground effect augmentation decreases which requires more power to continue the climb. When sufficient power is not available, the helicopter will stop climbing and gradually begin to settle. Before resuming the climb, altitude must be traded for airspeed. As airspeed increases, the power required for level flight decreases and sufficient excess power becomes available to continue the climb. When hovering capability is limited, this technique results in increased distance to clear an obstacle.

The standard airspeed system is inaccurate in the climbout airspeed range required for maximum performance (minimum distance) takeoffs. Airspeed is maintained by reference to the helicopter's attitude. Also, the airspeeds required for maximum performance places the helicopter in the "avoid" area of the height-velocity curve and should not be used unless maximum performance is required.

The takeoff distance charts (Figures A-14 through A-17) show takeoff distances for speeds from 10 to 60 knots, pressure altitudes from sea level to 20,000 feet, air temperatures of plus 60°C to minus 60°C, and minimum and maximum allowable gross weights. (Corrections for headwind effect are also included in the charts.) At certain air temperature and pressure altitude conditions the engine is capable of producing more power than the present transmission limit allows. When operating under these conditions, the power decrease as shown in the upper right-hand corner of the chart must be utlized.

EXAMPLE:

The following example describes the use of the takeoff distance chart. Assume the following conditions:

PROBLEM	CONDITION
Gross Weight	9000 pounds
Pressure altitude	10,000 feet
Air temperature	20°C
Wind velocity	20 knots
Climb out speed desired	30 knots TAS
Technique desired	Level acceleration from a four-foot skid height

1. Enter the gross weight scale of the chart (Figure A-14) at 9000 pounds. Move horizontally to the right until the 10,000-foot pressure altitude line is intersected.

2. Move up vertically until 20°C air temperature line is intersected. Project horizontally to the right until the reflector line is encountered. (At this point, one must check to see if the transmission limit will affect takeoff performance.) At the given conditions, it does not affect the power available.

3. Move down vertically until the base of the climbout airspeed plot is intersected. Follow the trend of the correction curve until the horizontal line representing 30-knots climbout airspeed is intersected.

4. Move down vertically until the baseline of the headwind correction is intersected. Follow the guidelines until the horizontal line representing 20-knots is intersected.

5. Move down vertically to the distance scale and read 290 feet which is the total distance required to clear a 50-foot obstacle for the conditions set forth in the problem.

Takeoff distance for the other technique is found in the same manner.

CLIMB PERFORMANCE CHARTS

The climb performance charts are used to determine time, distance, and fuel used in climb at either military rated power (Figure A-18) or maximum continuous power (Figure A-20) or during single engine military rated power conditions (Figure A-22). For each climb parameter, various curves are shown for temperatures from -40°C to +50°C. Charts are based on 50 KIAS to achieve the best rate of climb. Use of climbing airspeeds other than 50 KIAS will result in reduced rates of climb and increased fuel and time consumed for all altitudes.

Figures A-18, A-20 and A-22 do not include the fuel used for warm-up and takoff, which is 26 pounds (2 minutes at maximum continuous power). This amount must be added to the climb fuel to determine the total fuel required to reach cruise altitude.

EXAMPLE: (See Figure A-20)

PROBLEM	CONDITION
Takeoff pressure altitude	4000 feet
Cruise pressure altitude	8000 feet
Gross weight	7500 pounds
Power setting	Maximum continuous power
Air temperature	+30°C

1. Enter the gross weight scale of Figure A-20 (maximum continuous power) at 7500 pounds. Move horizontally to the right and intersect the 4000-foot pressure altitude curve. Move vertically upward to intersect the +30°C line of the time plot. Move horizontally to the time scale and read 1.7 minutes.

2. Enter the gross weight scale of Figure A-20 again at 7500 pounds. Move horizontally to the right and intersect 8000-feet pressure altitude. Move vertically upward to intersect the +30°C line of the time plot. Move horizontally to the time scale and read 4.2 minutes.

3. To obtain the time to climb from 4000 feet to 8000 feet, subtract the time to climb to 4000 feet from the time to climb to 8000 feet. For this example the time to climb would be (4.2 - 1.7) = 2.5 minutes.

4. Distance and climb fuel are obtained by entering the gross weight scale at 7500 pounds and moving horizontally to the applicable grid area of the chart and the procedure described above. Using the same conditions as above, distance in climb from 4000 feet to 8000 feet would be (4.7 - 1.8) = 2.9 nautical miles and climb fuel (including fuel for warm-up and takeoff) from 4000 feet to 8000 feet would be (51 - 22) + 26 = 55 pounds.

MAXIMUM RATE OF CLIMB CHARTS

Two maximum rate of climb charts are provided for rates of climb. One chart (Figure A-19) is for military rated power at 97% NR for both twin and single engine operation. Another chart (Figure A-21) is for maximum continuous rated power at 97% NR for twin engine operation. These charts encompass flight parameters of pressure altitude, air temperature, and gross weight.

NOTE

When using the maximum rate of climb charts, transmission limits are encountered under twin engine operation. No transmission limit is observed for single engine operation. Two examples are shown; one with transmission limiting conditions and one without transmission limiting conditions.

EXAMPLE:

The following example describes the use of the maximum rate of climb charts when a transmission limit is encountered for twin engine operation. Assume the following conditions:

PROBLEM	CONDITION
Power setting	Military Rated Power
Gross weight	8000 pounds
Air temperature	0°C
Pressure altitude	8000 feet
Rotor rpm	97% NR

1. Enter the pressure altitude scale at 8000 feet on Figure A-19.

2. Move up vertically to the 0°C air temperature line.

3. It is found that under these conditions the flight regime is under the transmission derate border (dashed portion of the curves).

4. Proceed to the transmission limited rate of climb plot in the upper right hand corner of the figure.

5. Enter the gross weight scale at 8000 pounds.

6. Move vertically downward to the dashed line.

7. Proceed horizontally to the right and read a rate of climb of 2520 feet per minute.

EXAMPLE:

The following example describes the use of the maximum rate of climb charts when no transmission limit is encountered for twin engine operation. Assume the following conditions:

PROBLEM	CONDITIONS
Power setting	Military Rated Power
Gross weight	8000 pounds

PROBLEM	CONDITION
Air temperature	0°C
Pressure altitude	12,000 feet
Rotor rpm	97% NR

1. Enter the pressure altitude scale at 12000 feet on Figure A-19.

2. Move up vertically to the 0°C air temperature line.

3. Under these conditions the flight regime is above the transmission derate border and not transmission limited (solid portions of the curves). Proceed horizontally to the right and intersect the 8000 pound gross weight line.

4. Move vertically upward to the twin engine reflector line.

5. Move horizontally to the left to intersect the temperature base line.

6. Follow the flow lines until a temperature of 0°C is reached and read a rate of climb of 1800 feet per minute.

SERVICE CEILING CHART

Service ceiling is the altitude at which the rate of climb is 100 feet per minute. The service ceiling of the helicopter may be obtained from the charts (Figure A-23 and A-24) for various gross weight and temperature conditions. The following example problem demonstrates the use of the chart.

EXAMPLE: Two Engines

PROBLEM	CONDITION
Power setting	Maximum Continuous
Gross weight	9200 pounds
Air temperature	30°C
Rotor rpm	97%

1. Enter the chart at 9200 pounds and move vertically upward until the 30°C temperature line is intersected.

2. Project horizontally to the left and read a pressure altitude of 12000 feet.

NOTE

Temperature lapse rate is not included in the service ceiling charts.

OAT ESTIMATION AT ALTITUDE

To estimate the OAT at flight altitude, first determine the OAT at the ground pressure altitude. Enter the chart at the gross weight scale and move vertically upward to intersect the ground pressure altitude. Note the chart OAT value. If the ground OAT is higher than the OAT from the chart, service ceiling is less than ground pressure altitude. If ground OAT is lower than the chart OAT, proceed as follows: Move vertically up the required gross weight line. Reduce the ground OAT by 2 °C for each 1000 ft that you go above ground pressure altitude. The service ceiling is found when the reduced ground OAT is approximately equal to the chart OAT. The pressure altitude where this occurs is the service ceiling.

CRUISE CHARTS

The specific range charts for the twin engine UH-1N (Figures A-25 through A-29) present specific range and fuel flow information as a function of gross weight, pressure altitude, air temperature, and airspeed. Performance for speeds at maximum airspeed, and recommended airspeeds for best range are shown. The high tip speeds of the UH-1N at low air temperature result in high tip Mach numbers. This causes rotor blade compressibility that increases power required above that required on a hot day. The increase in power required reduces range by more than five percent from hot-day operation. For this reason charts have been provided to account for range differences at various outside air temperatures. Figure A-25 is to be used when the air temperature during cruise is above +30°C. Figure A-26 is to be used when air temperature is between +10°C and +30°C. Figure A-27 is used when air temperature is between -10°C and +10°C. Figure A-28 is to be used when air temperature is between -10°C and -30°C. Figure A-29 is to be used when air temperature is colder than -30°C. Because Figures A-25 through A-29 are identical in format, only two examples are given for their use. The first example is long range cruise (LRC) airspeed and maximum endurance airspeed at a given cruise altitude. The second example is for long range cruise airspeed and optimum cruise altitude.

EXAMPLE: No. 1

PROBLEM	CONDITION
Gross weight at start of cruise	7500 pounds
Air temperature during cruise	0°C
Cruise pressure altitude	4000 feet
Cruise airspeed condition	LRC and maximum endurance

1. The air temperature (0°C) is between -10°C and +10°C; therefore, use Figure A-27.

2. Enter the gross weight scale at 7500 pounds and proceed vertically upward to intersect the 4000-foot pressure altitude line.

3. Move horizontally to the right to intersect the baseline.

NOTE

The baseline represents Long Range Cruise (LRC). LRC is 99 percent of maximum nautical miles per pound of fuel on the high-speed side.

Move vertically downward from the intersection of the baseline and read 128 KTAS. Enter the scale at 128 KTAS and move vertically downward to the 4000-feet pressure altitude line, then move horizontally to the left and read 128 KIAS.

4. Return to the point of intersection of the 4000-feet pressure altitude line and baseline in Step 3. Then continue to move horizontally to the right and read 5.20 in the transfer scale.

5. Move to the corresponding transfer scale on the facing page. Enter the scale at 5.20 and move horizontally to the right to the 4000-feet pressure altitude line. Drop vertically and read 0.190 nautical miles per pound of fuel.

6. Drop vertically to the fuel flow chart and enter at 0.190 nautical miles per pound of fuel. Drop vertically again to the 128 KTAS curve. Move left and read 675 pounds per hour fuel flow at LRC speed.

7. Return to the point of intersection of the 4000-feet pressure altitude line and the baseline in Step 3 and move to the left parallel to the flow curve to the intersection of the maximum endurance line. Drop vertically and read 65 KTAS. Move horizontally to the right from the intersection of the maximum endurance line and read 3.10 on the transfer scale.

8. Move to the corresponding transfer scale on the facing page. Enter the scale at 3.10 and move horizontally to the right to intersect the 4000-feet pressure altitude curve then drop vertically and read 0.142 nautical miles per pound of fuel.

9. Drop vertically to the fuel flow chart and center at 0.142 nautical miles per pound of fuel. Drop vertically again to the 65 KTAS curve. Move left and read 425 pounds per hour fuel flow at maximum endurance speed.

EXAMPLE: No. 2

PROBLEM	CONDITION
Gross weight at start of cruise	7500 pounds
Air temperature during	0°C
PROBLEM	CONDITION
Cruise pressure altitude	Optimum
Cruise airspeed condition	LRC

1. The air temperature (0°C) is between +10°C and -10°C, therefore use Figure A-27.

2. Enter the gross weight scale at 7500 pounds and proceed vertically upward to intersect the optimum cruise altitude line and read 14,000 feet pressure altitude. This is the desired pressure altitude for cruise to obtain best range for the assumed conditions, but is above the 10,000 feet altitude based on oxygen requirements. Since the helicopter is not equipped with oxygen, the example will be based on cruise at 10,000 feet. Thus, continue upward to intersect the 10,000 feet pressure altitude curve.

3. Proceed horizontally to the right to intersect the baseline. Drop vertically and read 124 KTAS.

4. Return to the intersection of the baseline and move horizontally to the right and read 4.70 on the transfer scale.

5. Move to the corresponding transfer scale on the facing page. Enter the scale at 4.70 and move horizontally to the right to intersect the 10,000-feet pressure altitude curves.

6. Drop vertically to the nautical miles per pound of fuel scale and read 0.224 nautical miles per pound of fuel.

7. Drop vertically to the fuel flow chart and enter at 0.224 nautical miles per pound of fuel. Drop vertically again to the 128 KTAS curve. Move left and read 550 pounds per hour fuel flow at LRC speed.

NOTE

When operating with both cargo doors open, both M-93's or M-94's extended, and both LAU-59's installed; at pressure altitudes from 1,000 to 4,000 feet, and air temperatures above +10°C:

a. Decrease range (increase fuel flow) by 15 percent for 100 KIAS cruise.

b. Increase fuel flow by 3 percent for 65 KIAS.

CRUISE CHARTS SINGLE ENGINE

Specific range for single engine operation is presented in ten charts. Figures A-30 through A-34 are shown for military rated power and Figures A-35 through A-39 are shown for maximum continuous power. Figures A-30 and A-35 are to be used when air temperature during cruise is above +30°C. Figures A-31 and A-36 are to be used when air temperature is between +10°C and +30°C. Figures A-32 and A-37 are used when air temperature is between -10°C and +10°C. Figures A-34 and A-39 are to be used for air temperature colder than -30°C. Specific range, fuel flow, speed and torquemeter pressure are presented as a function of gross weight and altitude, at military rated power (97% NR), maximum continuous power (97% NR), or component life limited speeds, whichever is lower.

EXAMPLE:

The following example describes the use of the specific range charts. Assume the following conditions at military rated power:

Figure A-32

PROBLEM	CONDITION
Gross Weight	8000 pounds
Air temperature	0°C
Altitude	4000 feet
Rotor rpm	97% NR

1. Enter the gross weight scale at 8000 pounds.

2. Move up vertically to the 4000 feet line and read 23.4 nautical miles per 100 pounds of fuel.

3. Move horizontally to the right to intersect the 4000 feet fuel flow line and read 522 pounds per hour fuel flow.

4. Continue to move up vertically to the 4000 feet speed line and read a speed of 118 KIAS.

5. Move up vertically to the 4000 feet torquemeter pressure curve and read 64% Q.

LEVEL FLIGHT CAPABILITY CHART, SINGLE ENGINE

The Single Engine Level Flight Capability Chart (Figure A-40) enables one to find the minimum and maximum airspeed limitations at military power at 97% NR for a variety of flight parameters including pressure altitude, air temperature and gross weight.

EXAMPLE:

The following example describes the use of the level flight capability chart (Figure A-40). Assume the following conditions:

PROBLEM	CONDITION
Air temperature	0°C
Pressure altitude	9000 feet
Gross Weight	9000 pounds

1. Enter the pressure altitude scale at 9000 feet.

2. Move up vertically until the 0°C air temperature line is intersected.

3. Move horizontally to the right to the 9000 pounds gross weight line.

4. Move up vertically to the maximum airspeed side of the reflector line at 0°C (minimum airspeed is obtained in the same manner by intersecting the minimum airspeed side of the reflector line).

5. Proceed horizontally to left and read a true airspeed of 97 KTAS.

6. Enter the true airspeed baseline at 97 KTAS and follow the flow lines until 9000 feet pressure altitude is intersected.

7. Move horizontally to the left and enter the temperature baseline.

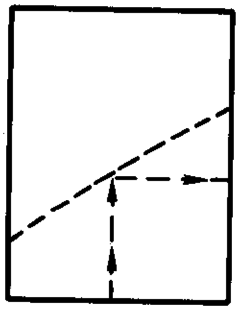
8. Follow the flow lines until a temperature of 0°C is reached.

9. Move horizontally to the left and read an indicated airspeed of 86 KIAS.

DENSITY ALTITUDE

MODEL
UH-1N

ENGINE
T400-CP-400



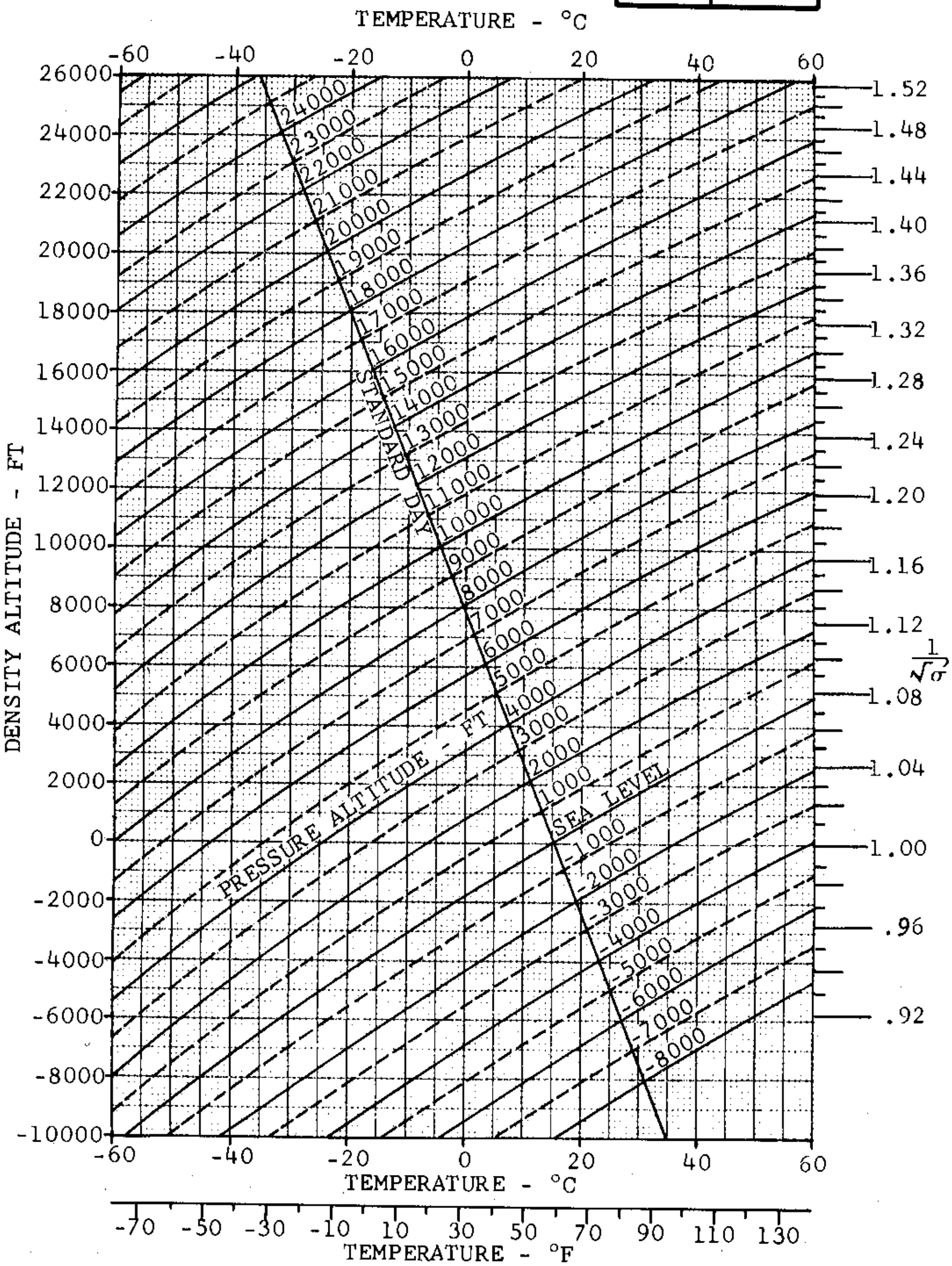
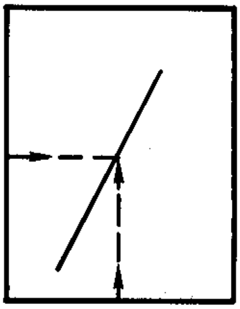


Figure A-1.



AIRSPEED CORRECTION

MODEL
UH-1N

ENGINE
T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST
(AIR FORCE)

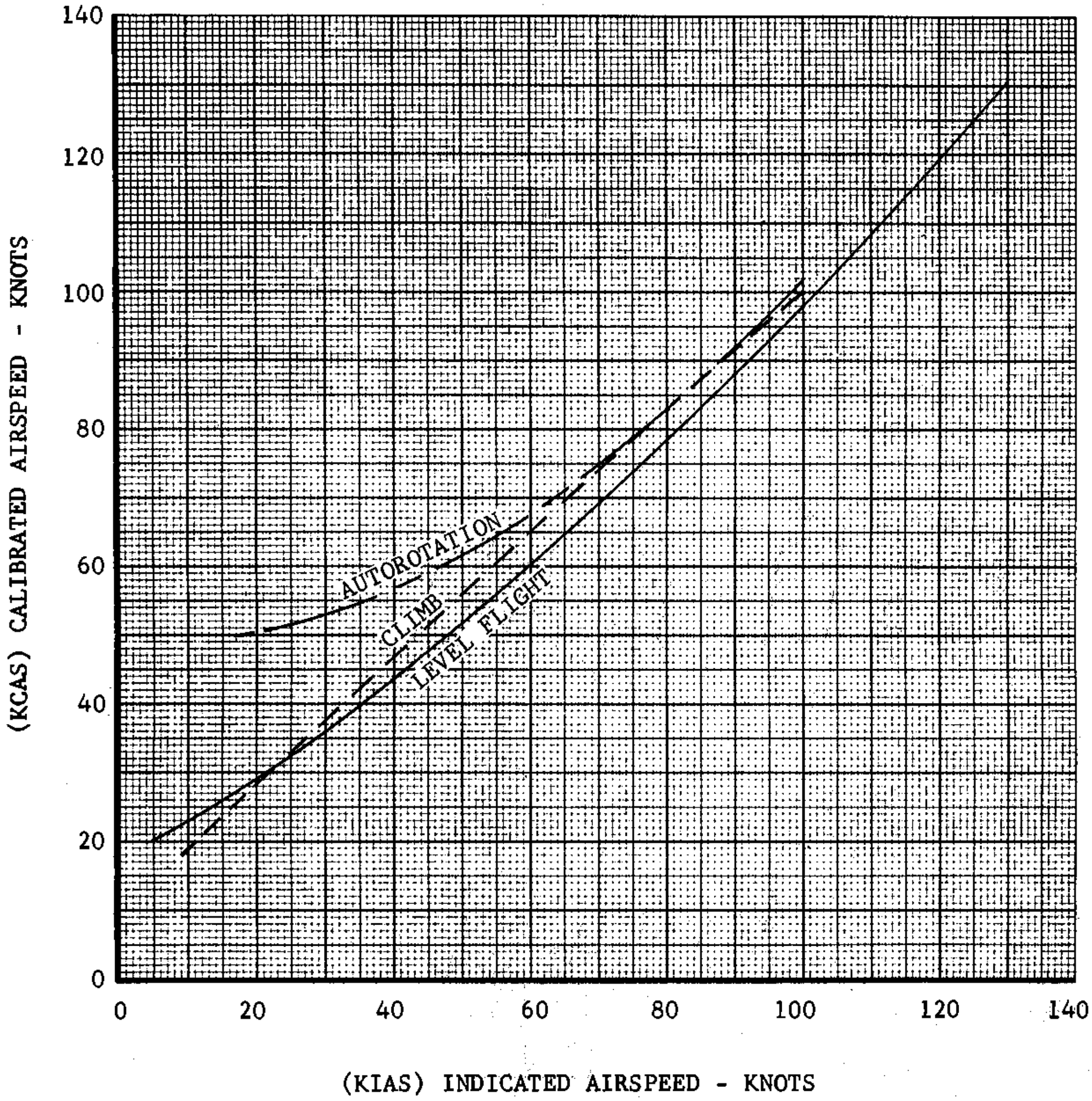


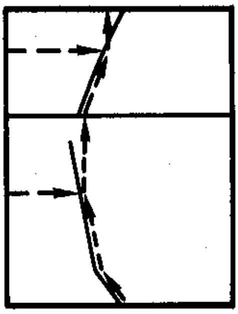
Figure A-2.

AIRSPEED CONVERSION - LEVEL FLIGHT

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)



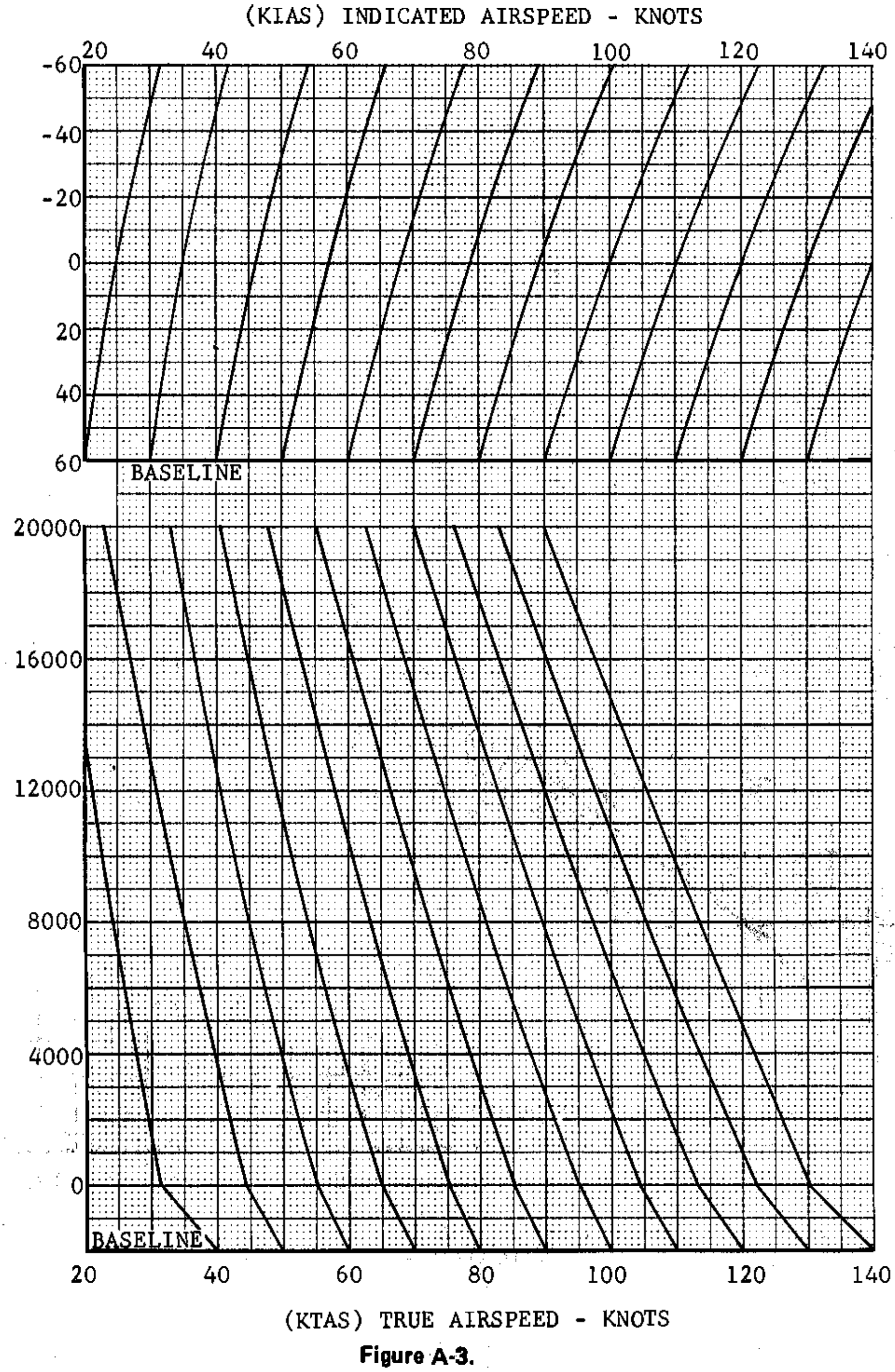
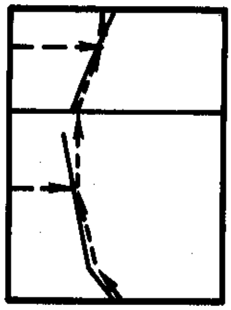


Figure A-3.



AIRSPEED CONVERSION - CLIMB

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)

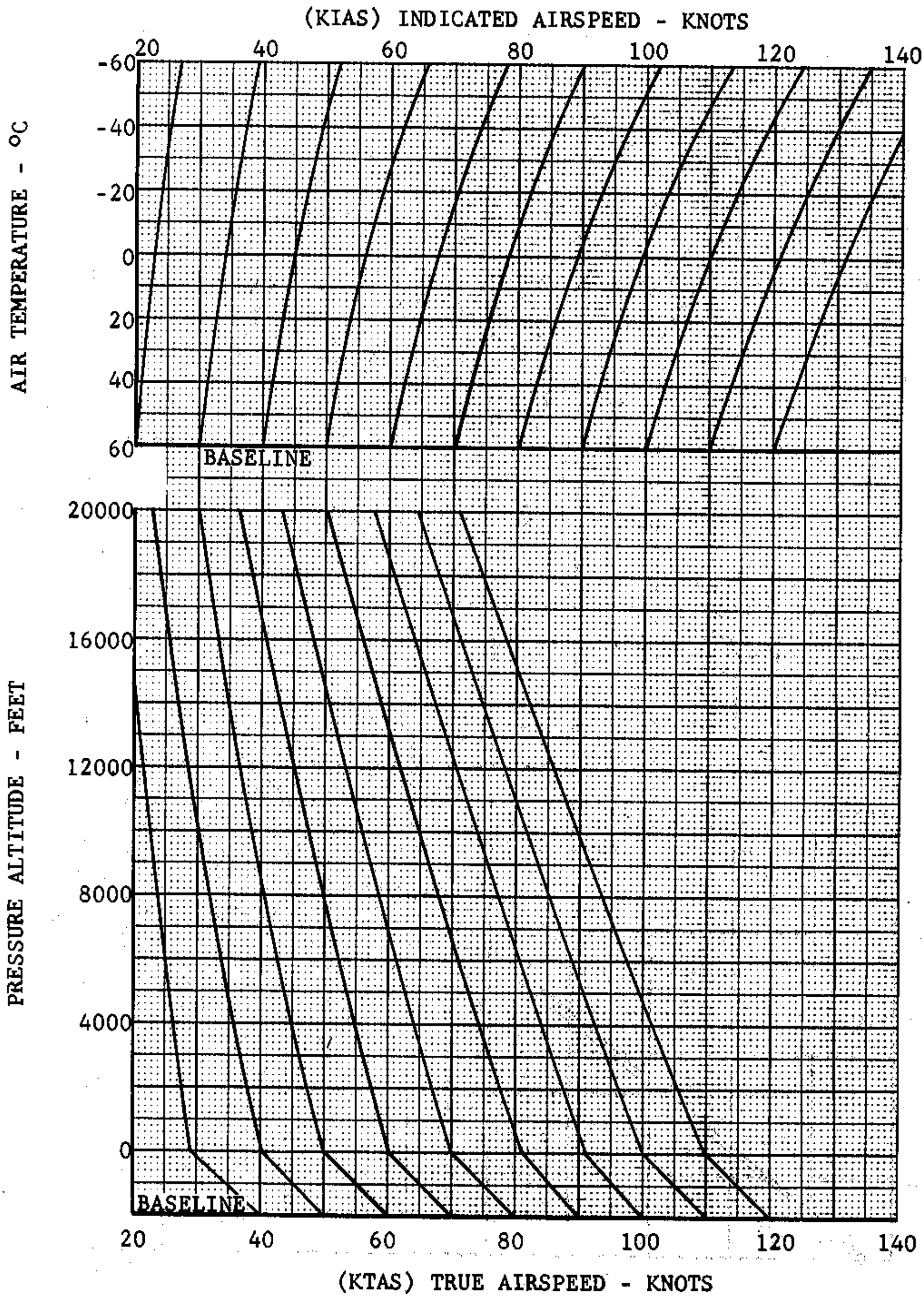


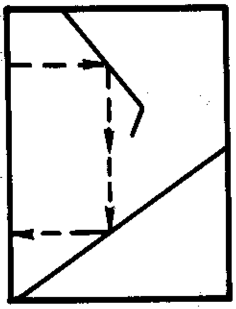
Figure A-4.

MILITARY POWER AVAILABLE

MODEL
UH-1N

ENGINE
T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: UACL SPEC 712C



WARNING

WHEN TEMPERATURE IS BELOW 0°C AND PRESSURE ALTITUDE IS BELOW 4000 FEET, SINGLE ENGINE MILITARY POWER AVAILABLE MAY BE AS MUCH AS 10% TORQUE LESS THAN COMPUTED FROM THIS CHART BECAUSE OF INADEQUATE FUEL FLOW.

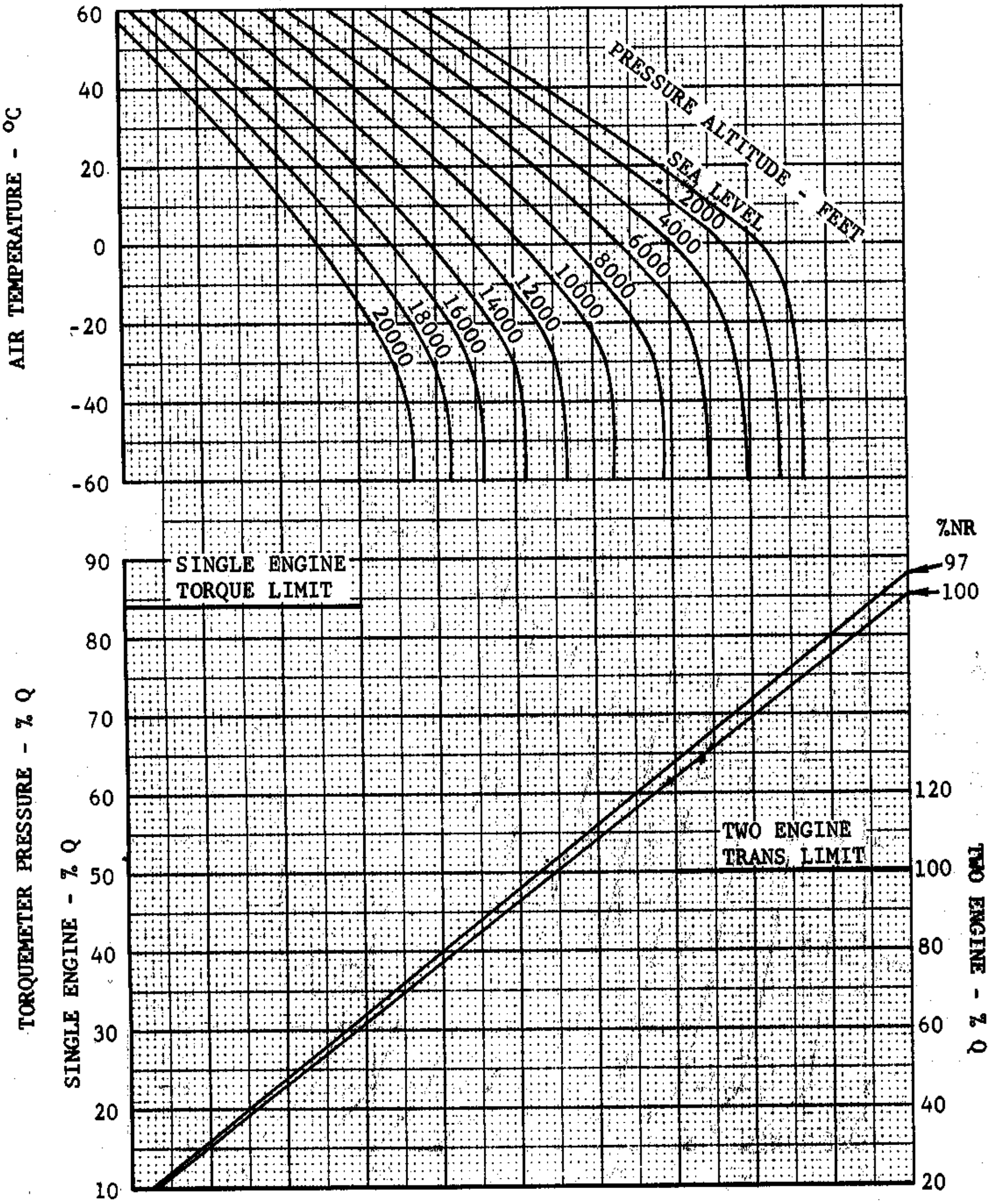
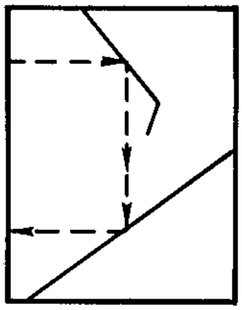


Figure A-5.



MAXIMUM CONTINUOUS POWER AVAILABLE

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: UACL SPEC 712C

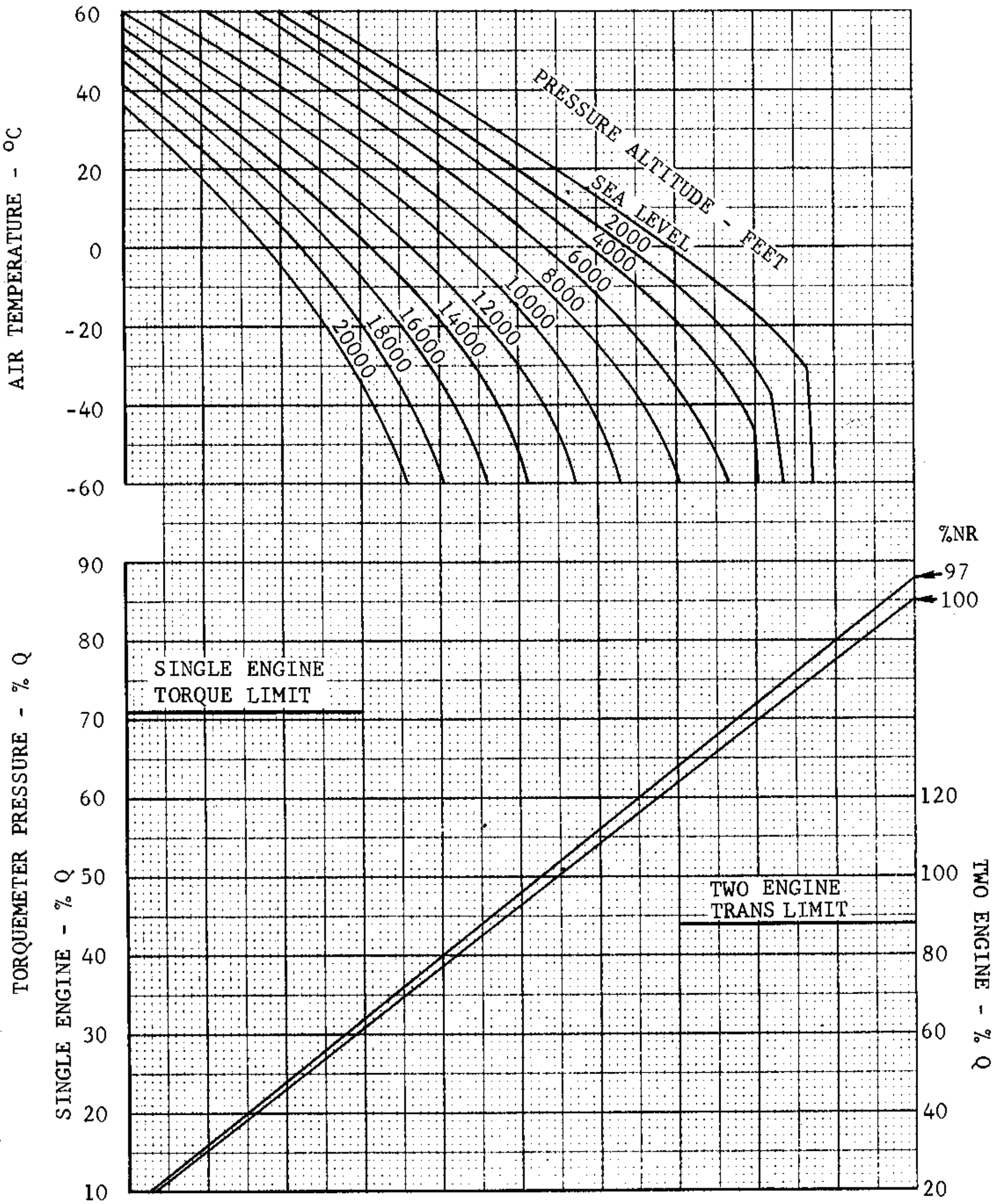


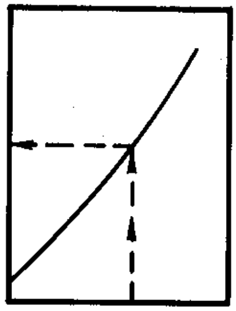
Figure A-6.

SINGLE ENGINE FUEL FLOW - 97% NR

MODEL
UH-1N

ENGINE
T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: UACL SPEC 712C



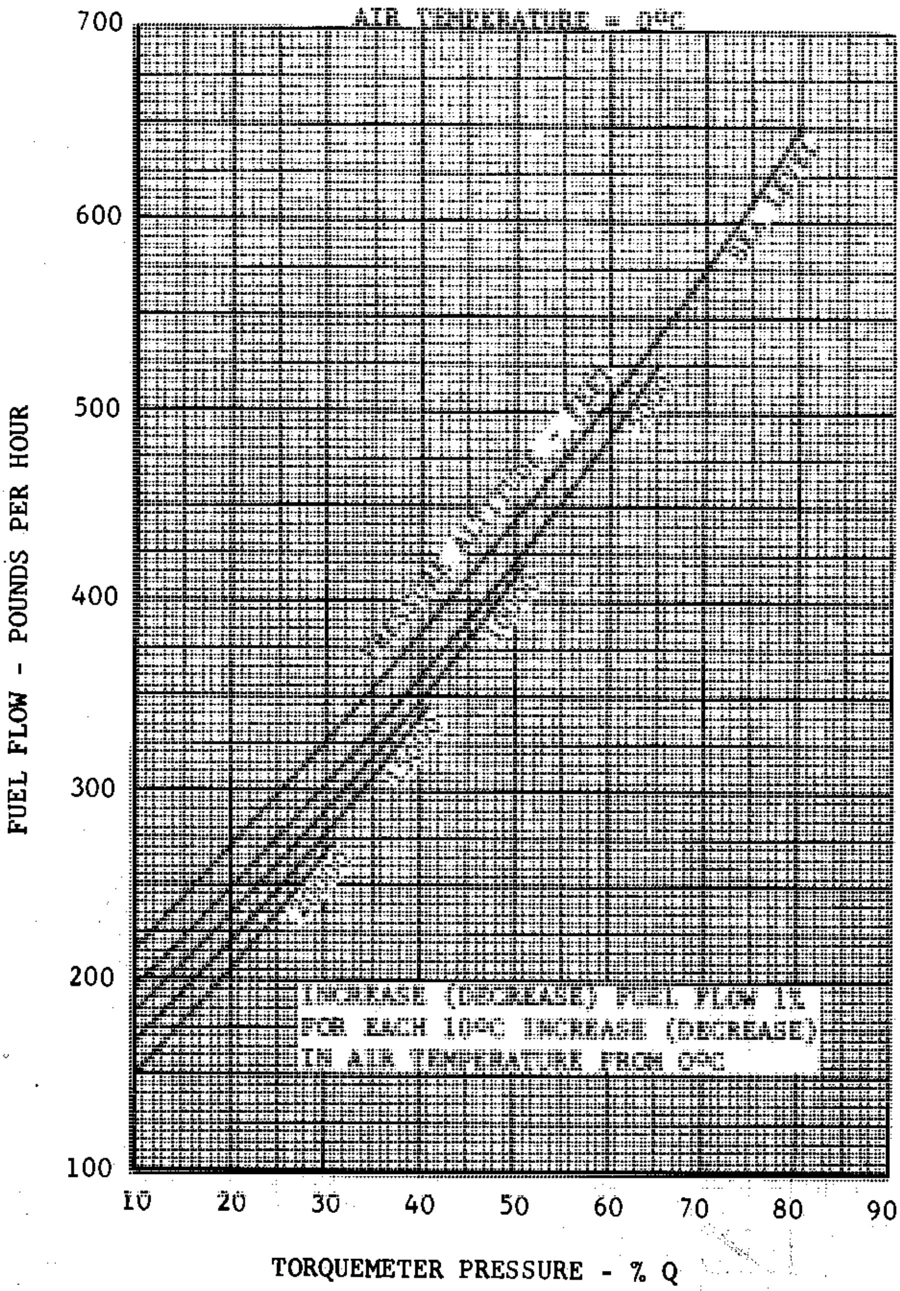
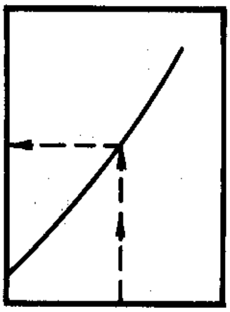


Figure A-7.



SINGLE ENGINE FUEL FLOW - 100% NR

MODEL	ENGINE
UH-1N	T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: UACL SPEC 712C

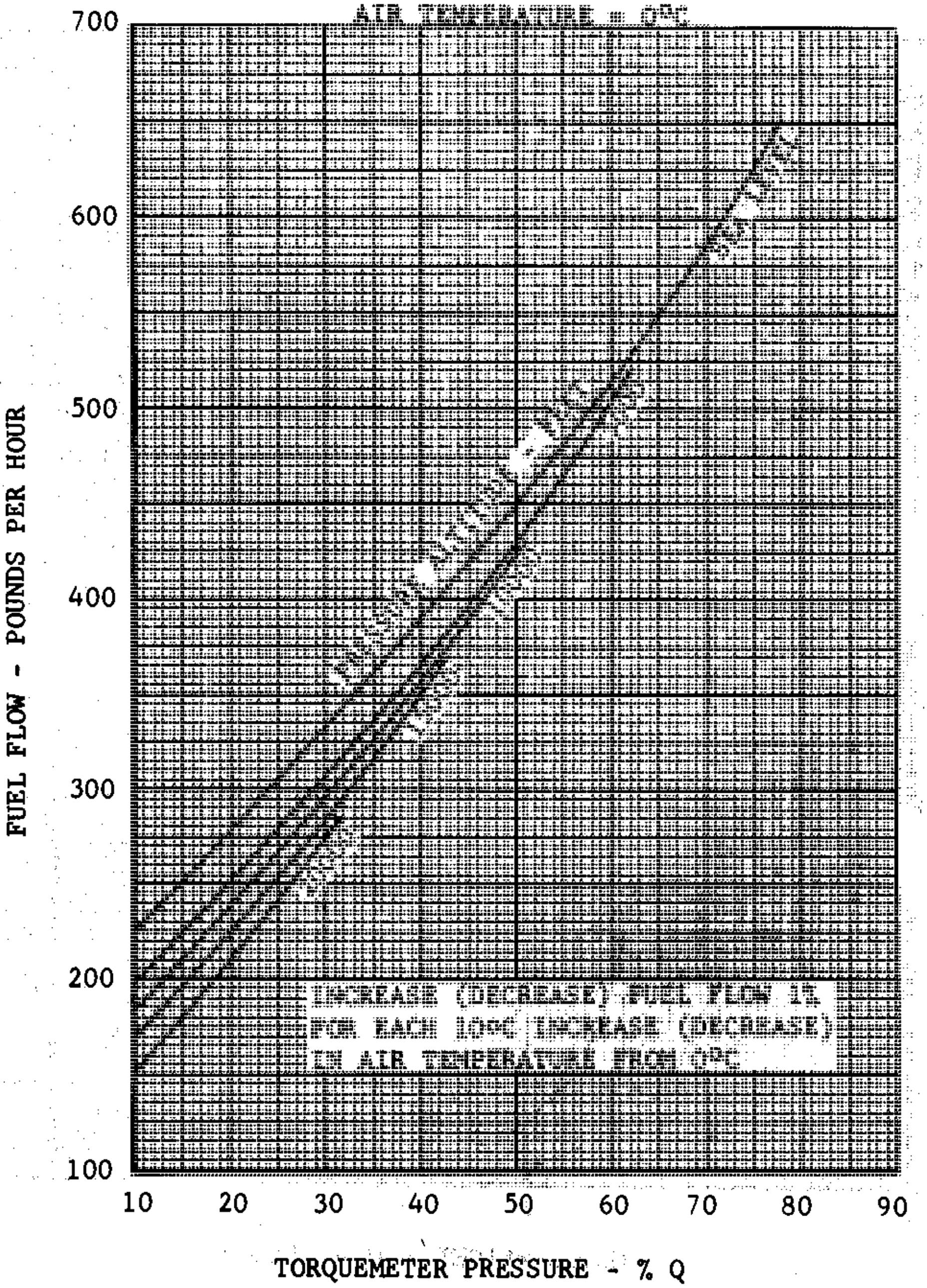


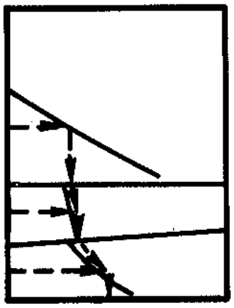
Figure A-8.

MAXIMUM GROSS WEIGHT FOR HOVERING (ZERO WIND)

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)



CONDITIONS: MILITARY POWER

WARNING

WHEN TEMPERATURE IS BELOW 0°C AND PRESSURE ALTITUDE IS BELOW 4000 FEET, SINGLE ENGINE MILITARY POWER AVAILABLE MAY BE AS MUCH AS 10% TORQUE LESS THAN COMPUTED FROM FIGURE A-5 BECAUSE OF INADEQUATE FUEL FLOW. WHEN IT IS NECESSARY TO PLAN FOR A SINGLE ENGINE HOVER UNDER THESE CONDITIONS, REDUCE AIRCRAFT GROSS WEIGHT 1000 POUNDS BELOW THE SINGLE ENGINE HOVER CAPABILITY DETERMINED FROM THIS CHART.

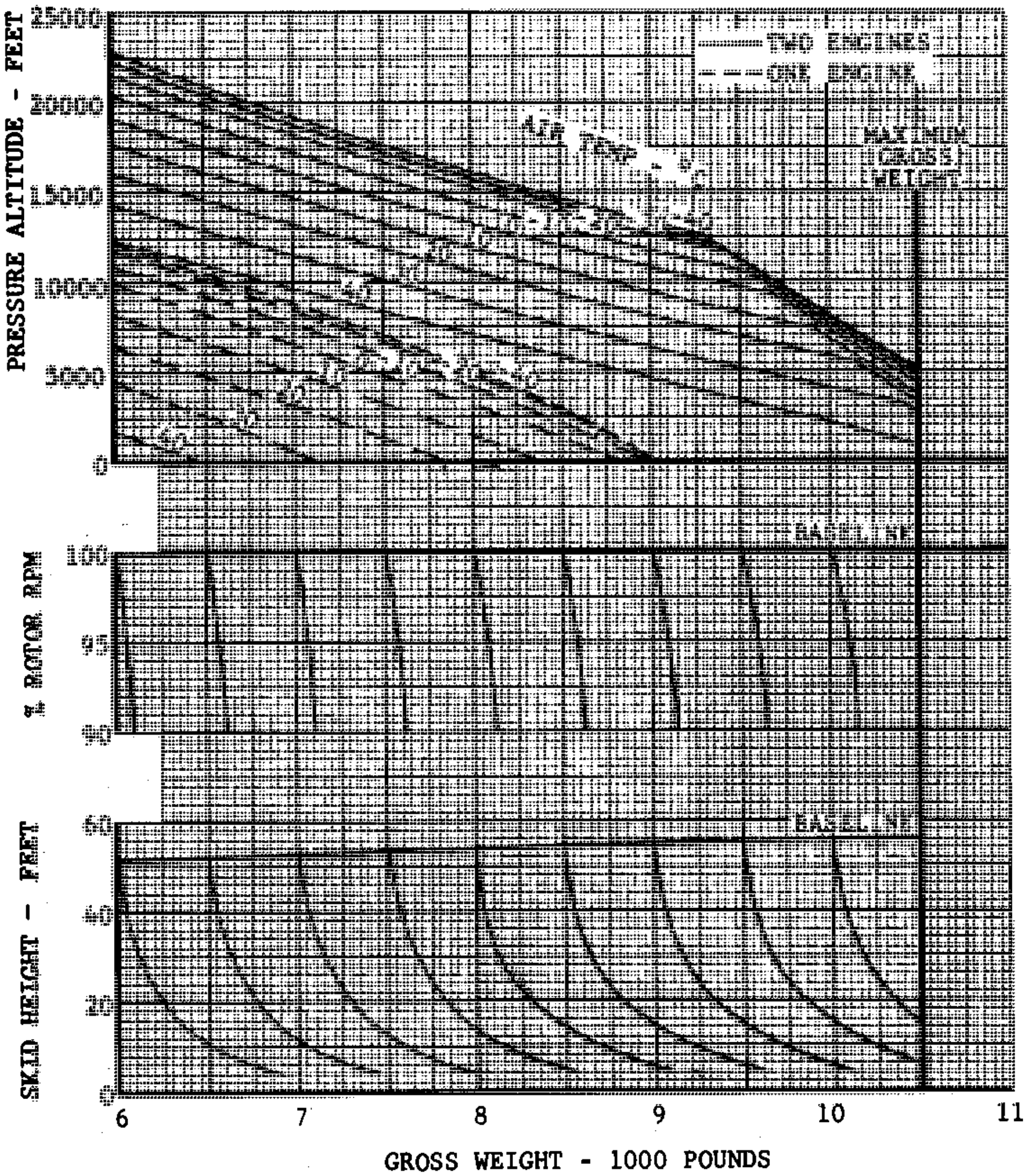


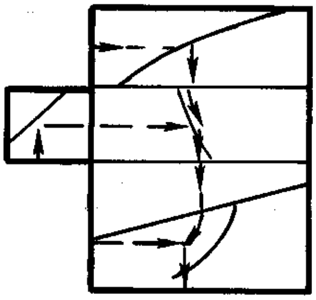
Figure A-9.

POWER REQUIRED TO HOVER (ZERO WIND)

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)



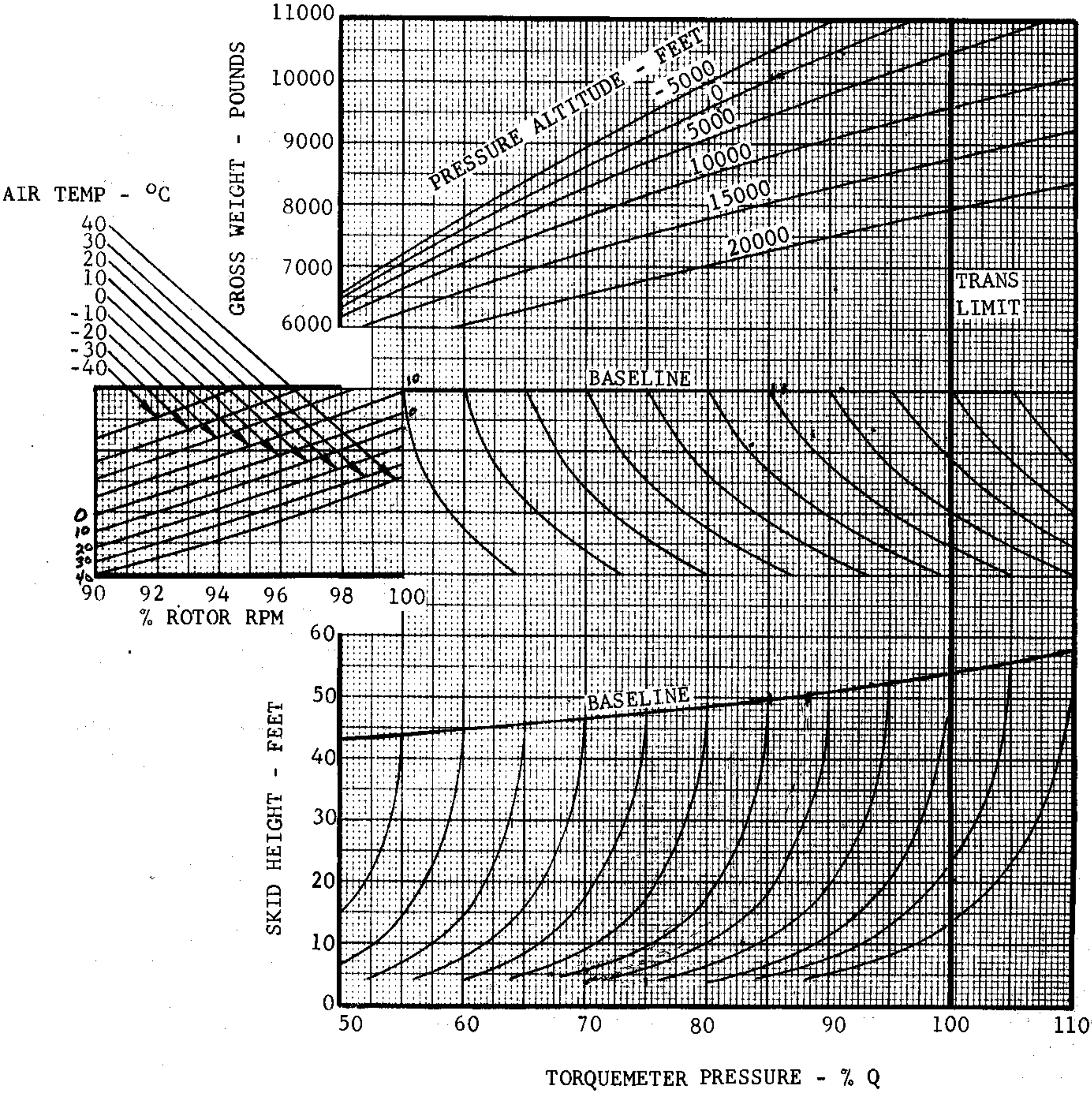


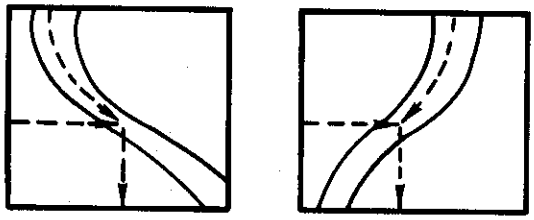
Figure A-10.

HEADWIND INFLUENCE ON HOVER

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIC: ESTIMATED



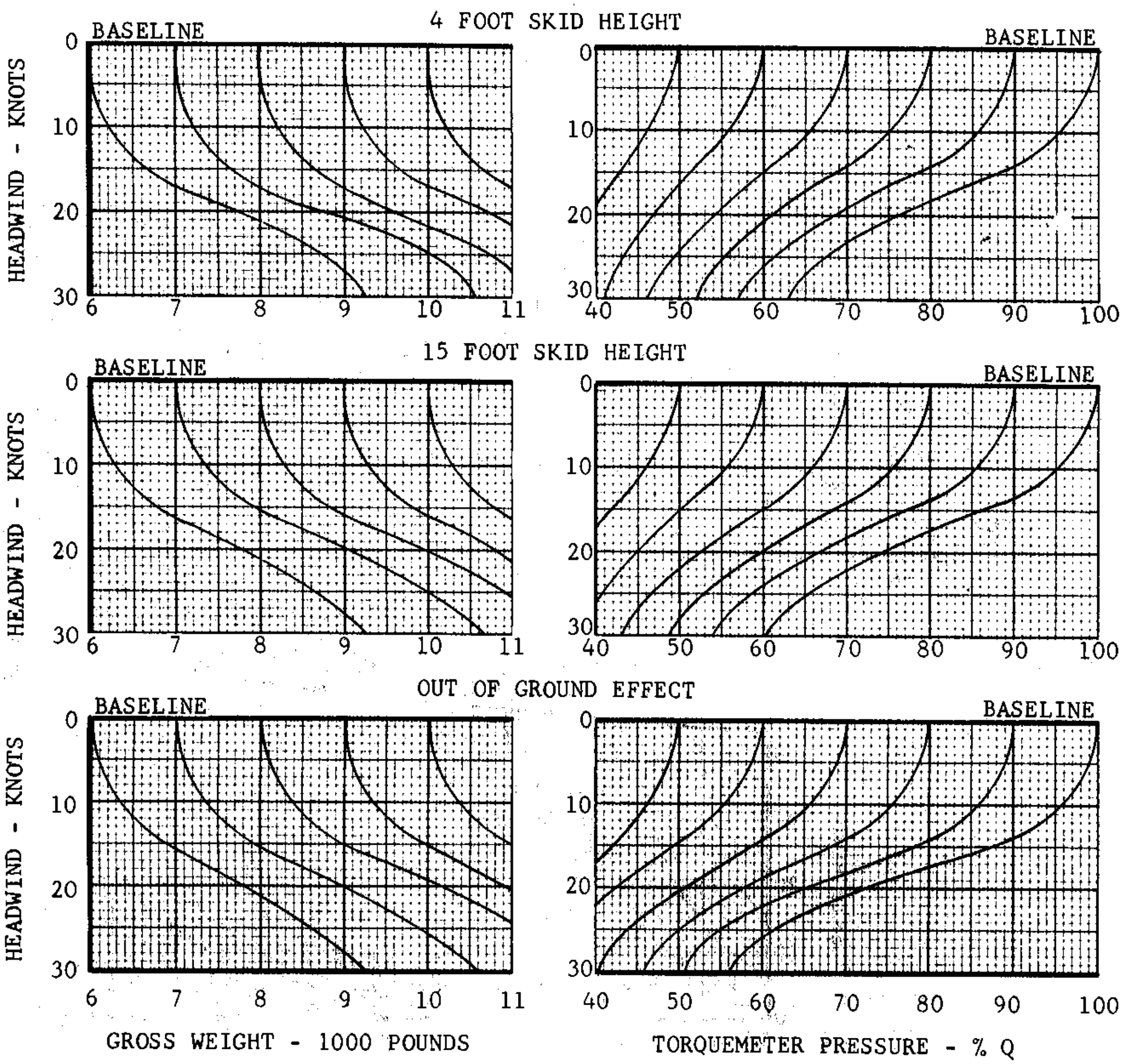
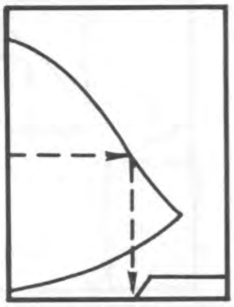


Figure A-11.

CONDITIONS:

9000 POUNDS GROSS WEIGHT
5000 FEET DENSITY ALTITUDE



MINIMUM HEIGHT FOR SAFE LANDING AFTER 2 ENGINE FAILURE

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIC: ESTIMATED

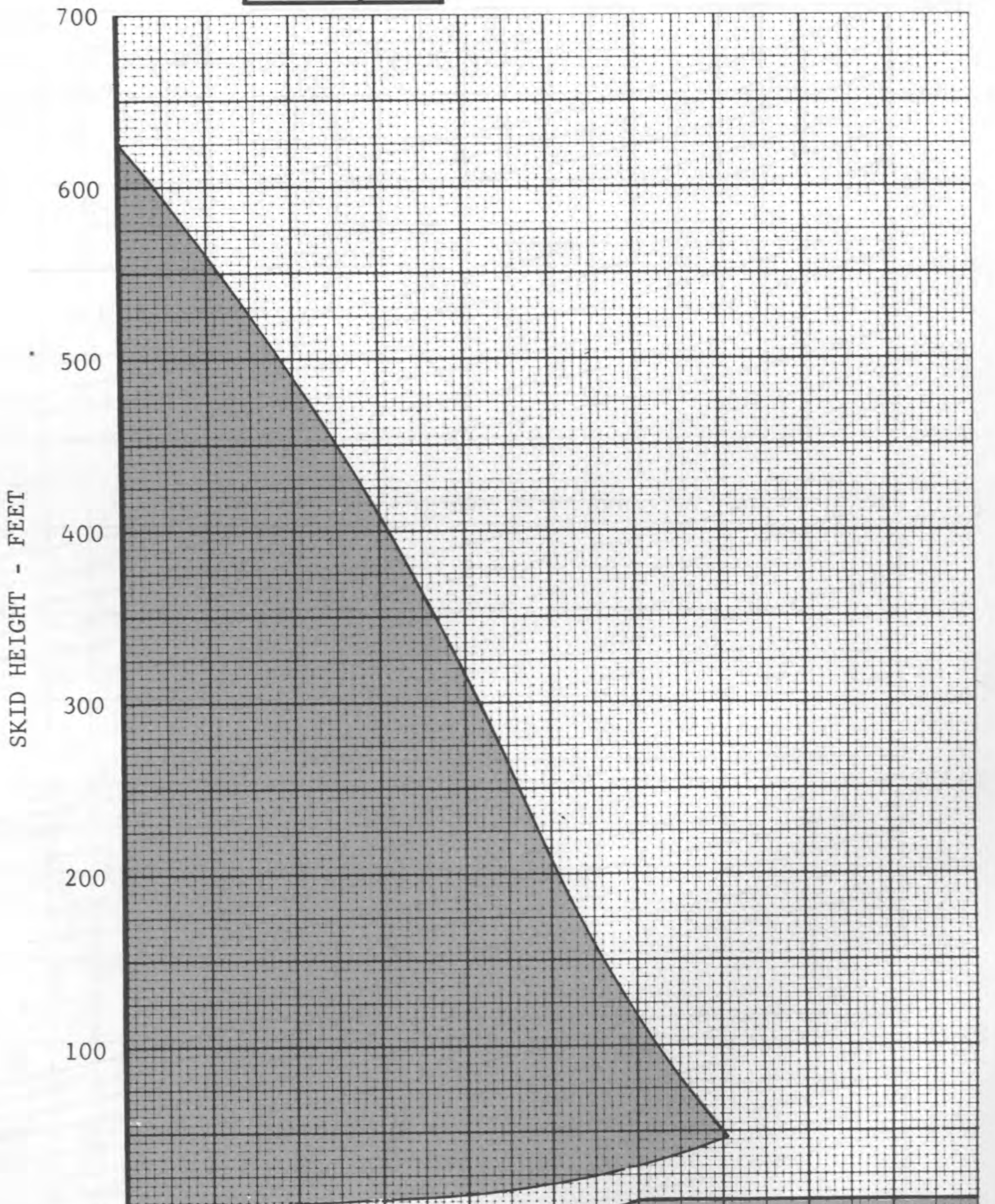


Figure A-12.

MINIMUM HEIGHT FOR SAFE LANDING AFTER SINGLE ENGINE FAILURE

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)

CONDITIONS:

100% Nr
MILITARY POWER
ON OPERATING ENGINE

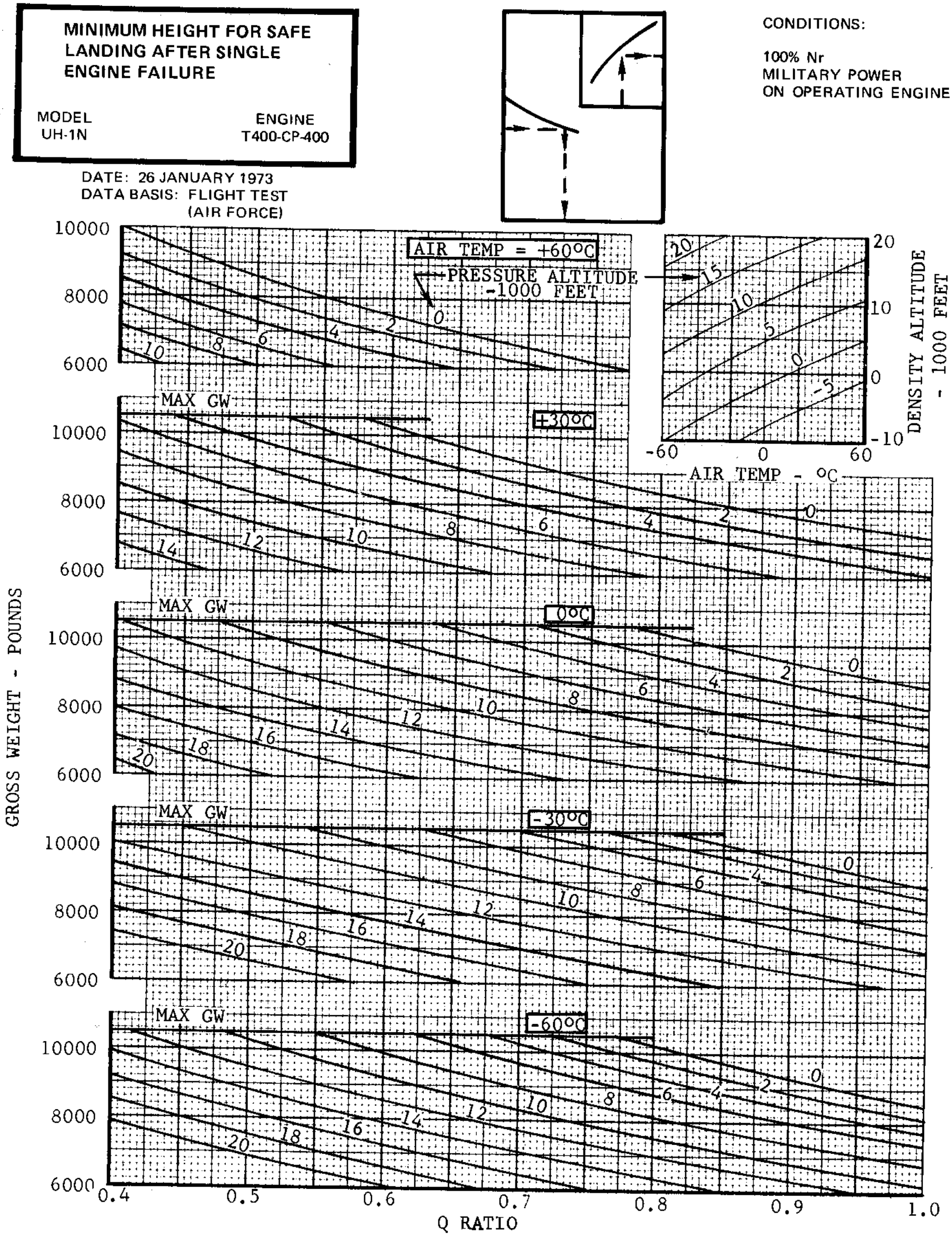


Figure A-13. (Sheet 1 of 2)

MINIMUM HEIGHT FOR SAFE LANDING AFTER SINGLE ENGINE FAILURE

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)

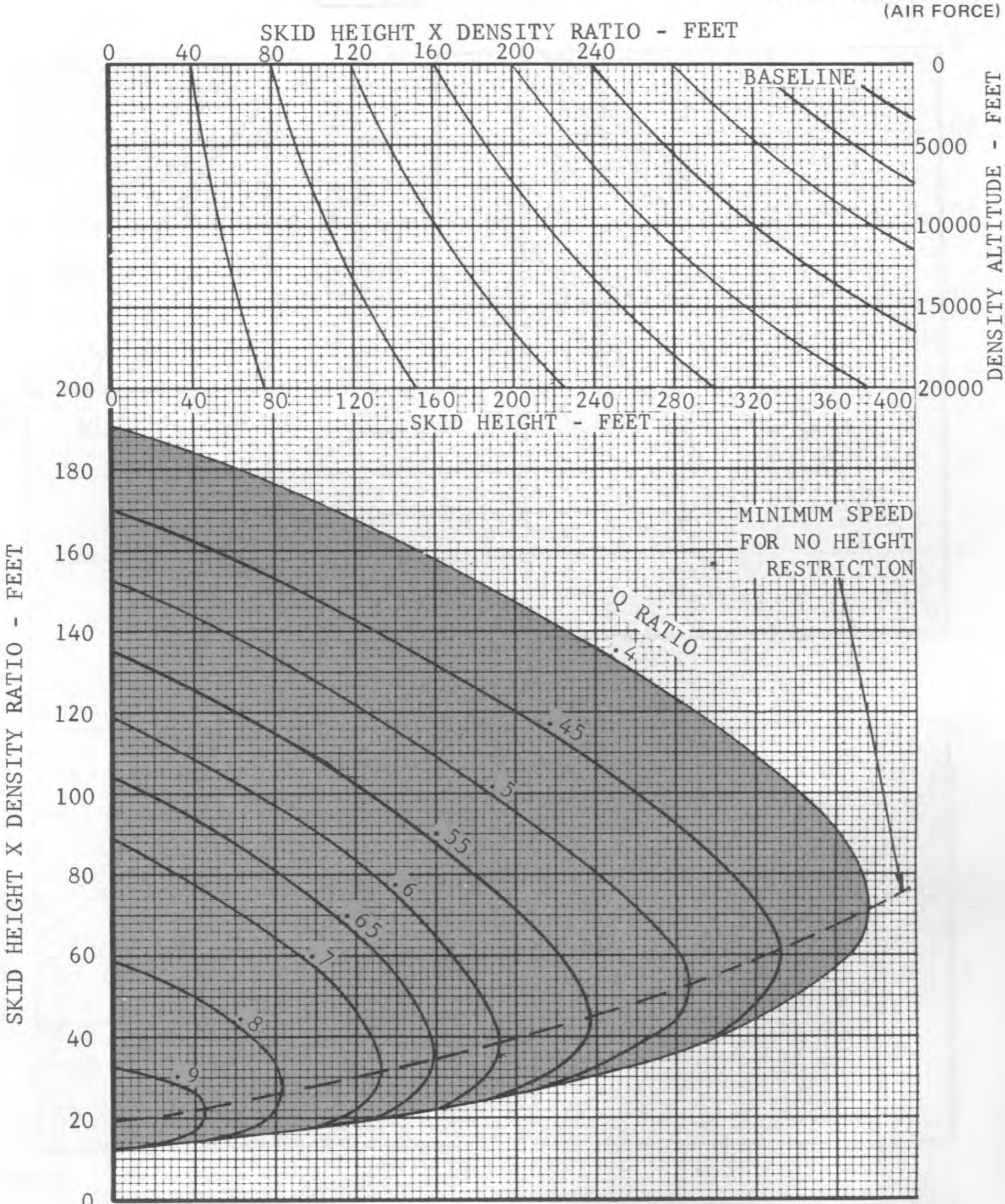


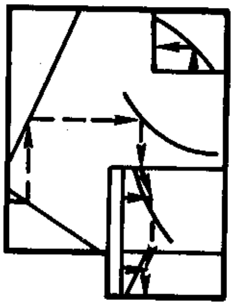
Figure A-13. (Sheet 2 of 2)

DISTANCE TO CLEAR 50 FT OBSTACLE – LEVEL ACCELERATION AT 4 FT SKID HEIGHT TAKEOFF – TWO ENGINES

MODEL
UH-1N

ENGINE
T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST
(AIR FORCE)



CONDITIONS:

100% NR
MILITARY POWER

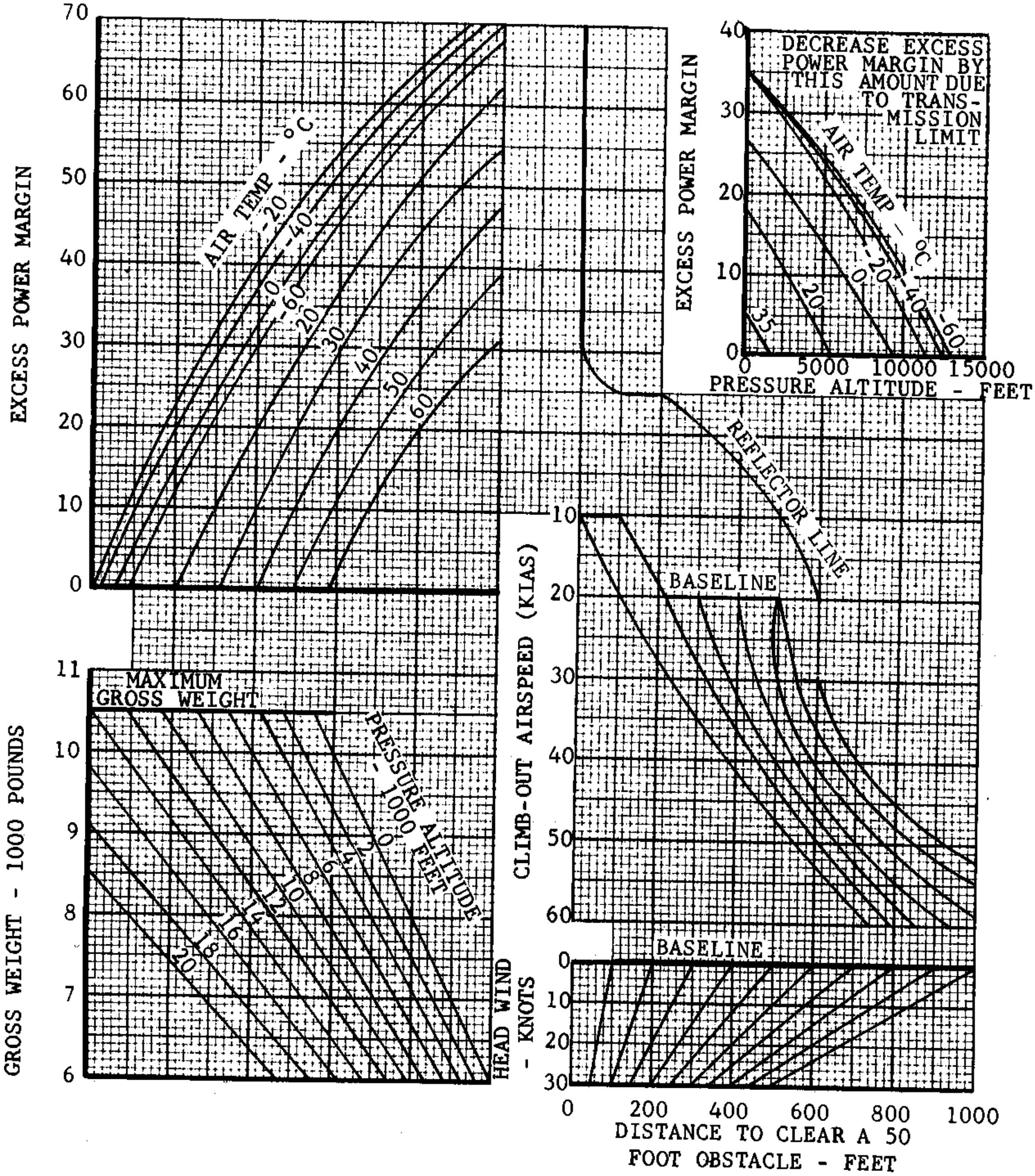


Figure A-14.

CONDITIONS:

100% NR
MILITARY POWER

DISTANCE TO CLEAR 50 FT OBSTACLE – CLIMB AND ACCELERATION FROM LIGHT ON SKIDS TAKEOFF – TWO ENGINES

MODEL UH-1N — ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)

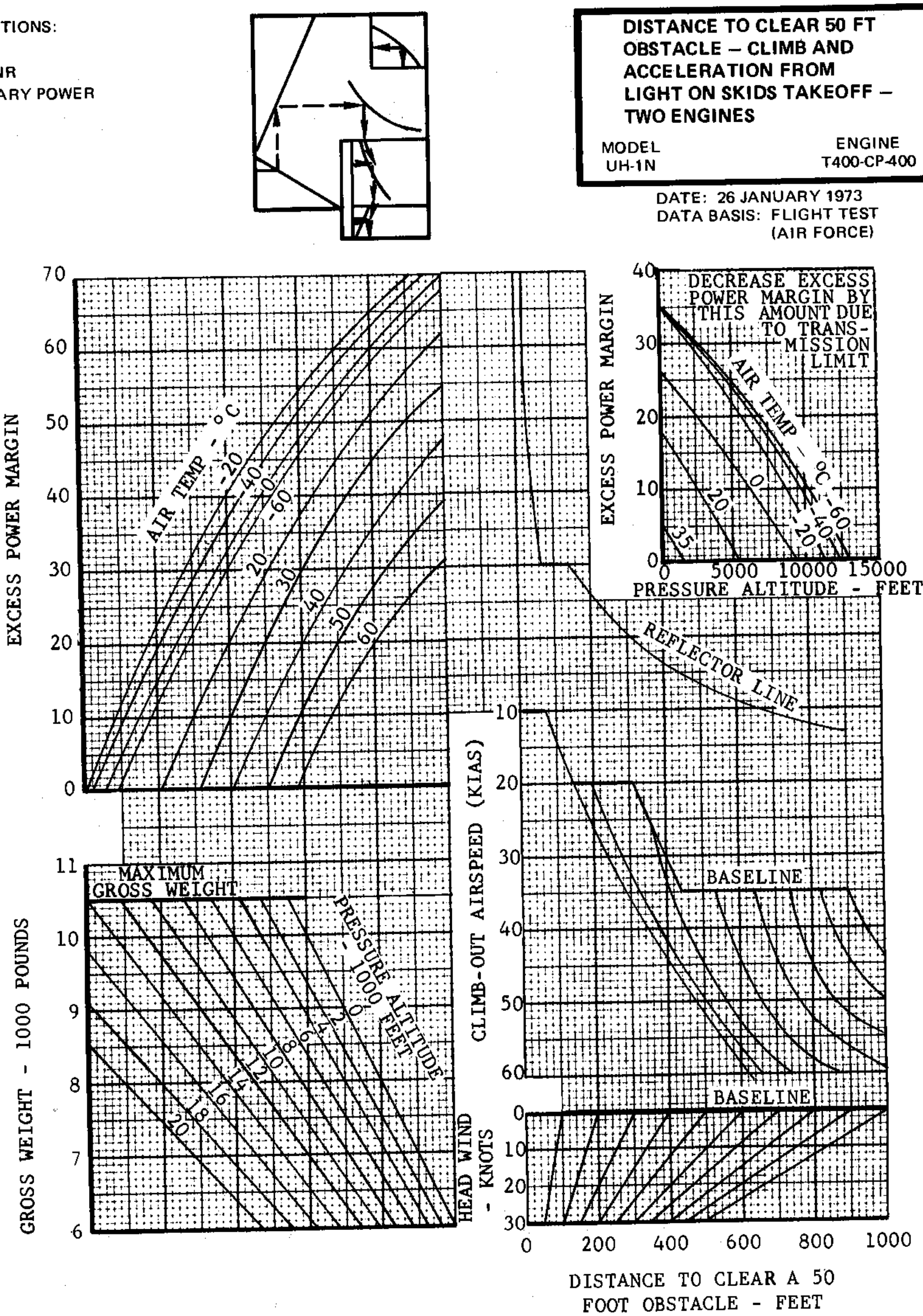


Figure A-15.

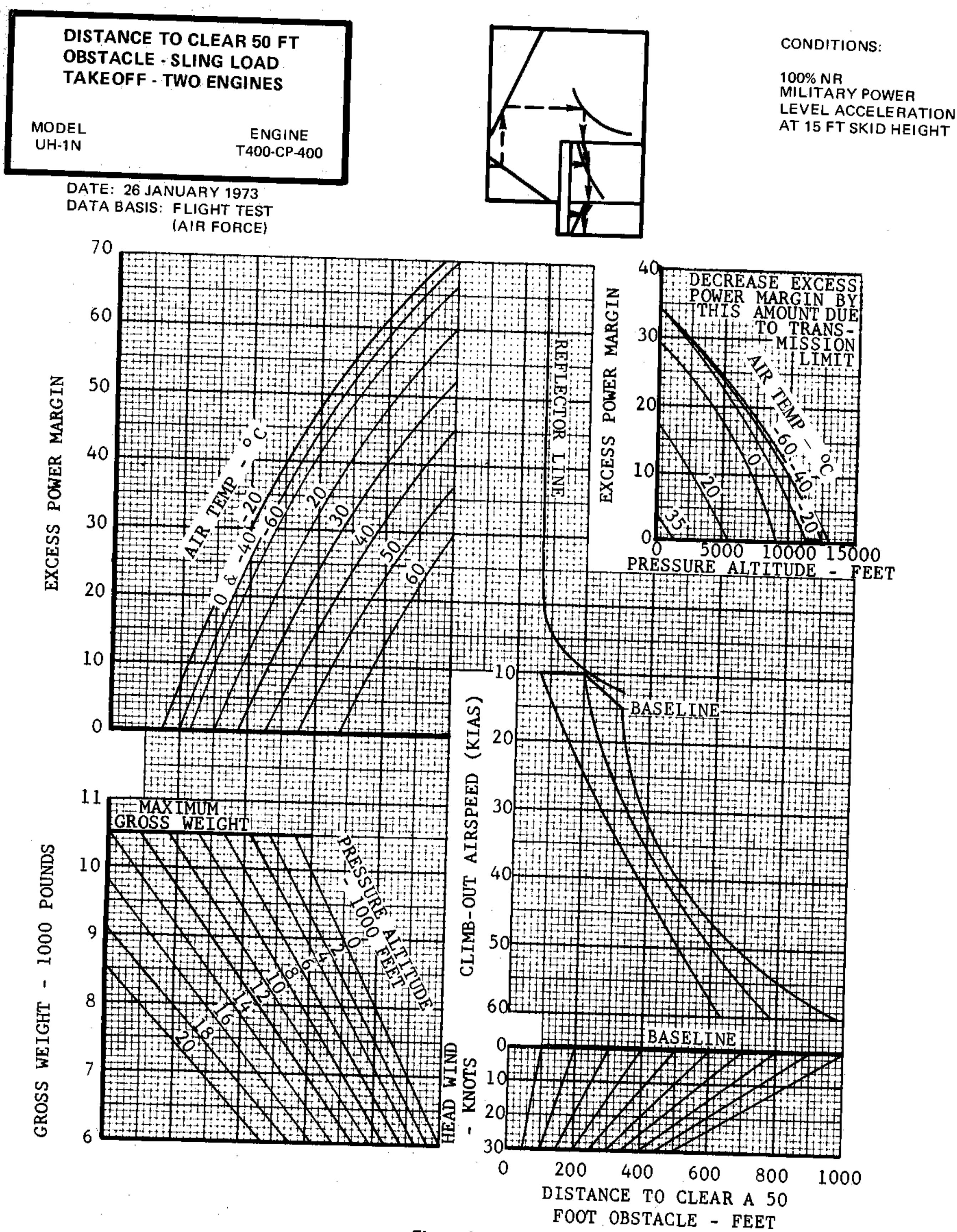

DISTANCE TO CLEAR 50 FT
OBSTACLE - SLING LOAD
TAKEOFF - TWO ENGINES
MODEL
UH-1N
ENGINE
T400-CP-400
DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST
(AIR FORCE)
CONDITIONS:
100% NR
MILITARY POWER
LEVEL ACCELERATION
AT 15 FT SKID HEIGHT
EXCESS POWER MARGIN
AIR TEMP - °C
0 & -40 -20 -60 20 30 40 50 60
REFLECTOR LINE
DECREASE EXCESS POWER MARGIN BY THIS AMOUNT DUE TO TRANSMISSION LIMIT
AIR TEMP - °C
-60 -40 -20 0 20 35
PRESSURE ALTITUDE - FEET
0 5000 10000 15000
CLIMB-OUT AIRSPEED (KIAS)
BASELINE
MAXIMUM GROSS WEIGHT
PRESSURE ALTITUDE - 1000 FEET
0 2 4 6 8 10 12 14 16 18 20
GROSS WEIGHT - 1000 POUNDS
HEAD WIND - KNOTS
BASELINE
DISTANCE TO CLEAR A 50 FOOT OBSTACLE - FEET
0 200 400 600 800 1000

Figure A-16.

CONDITIONS:

100% NR
MILITARY POWER

DISTANCE TO CLEAR 50 FT OBSTACLE - LEVEL ACCELERATION AT 4 FT SKID HEIGHT TAKEOFF - SINGLE ENGINE

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)

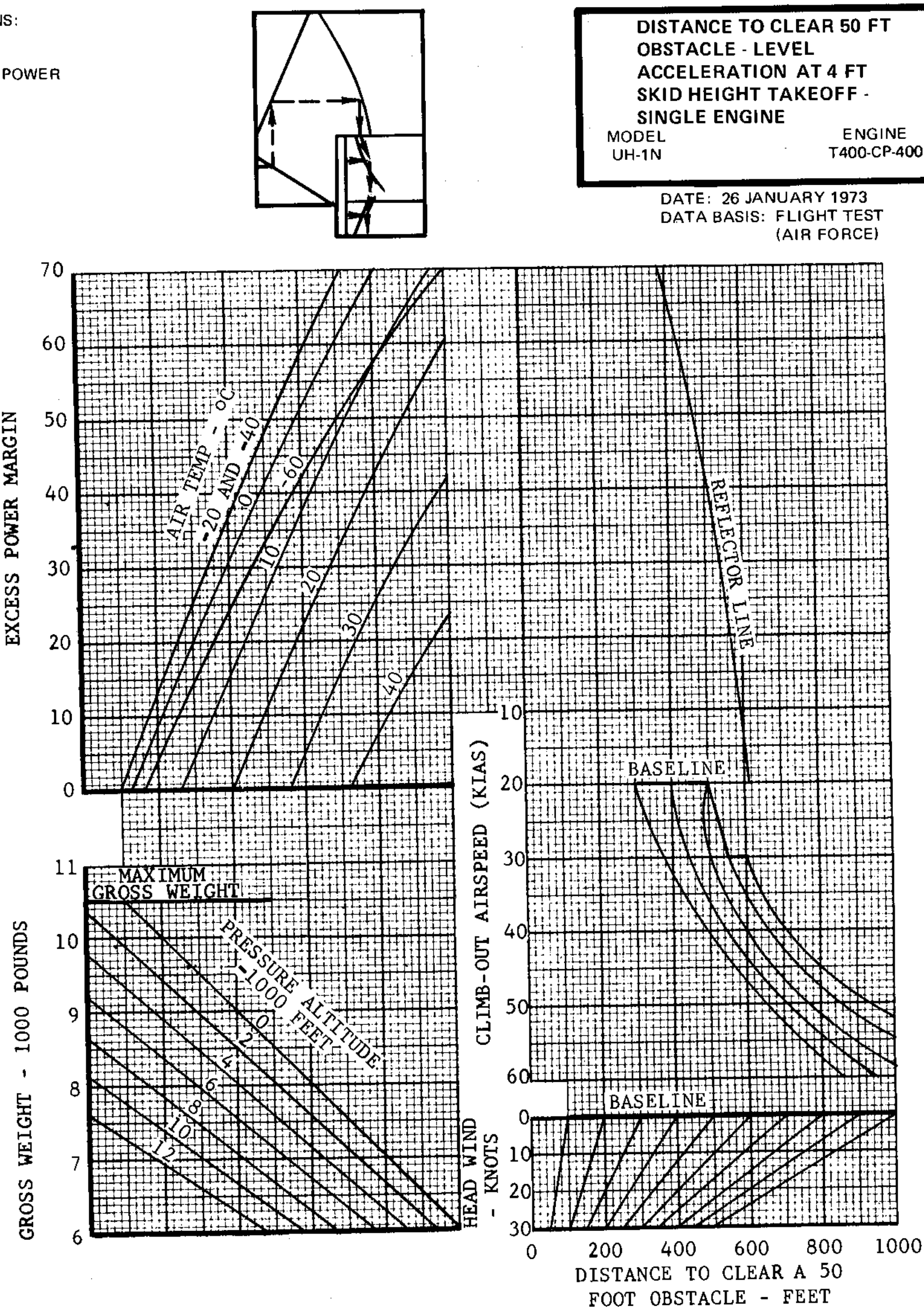


Figure A-17.

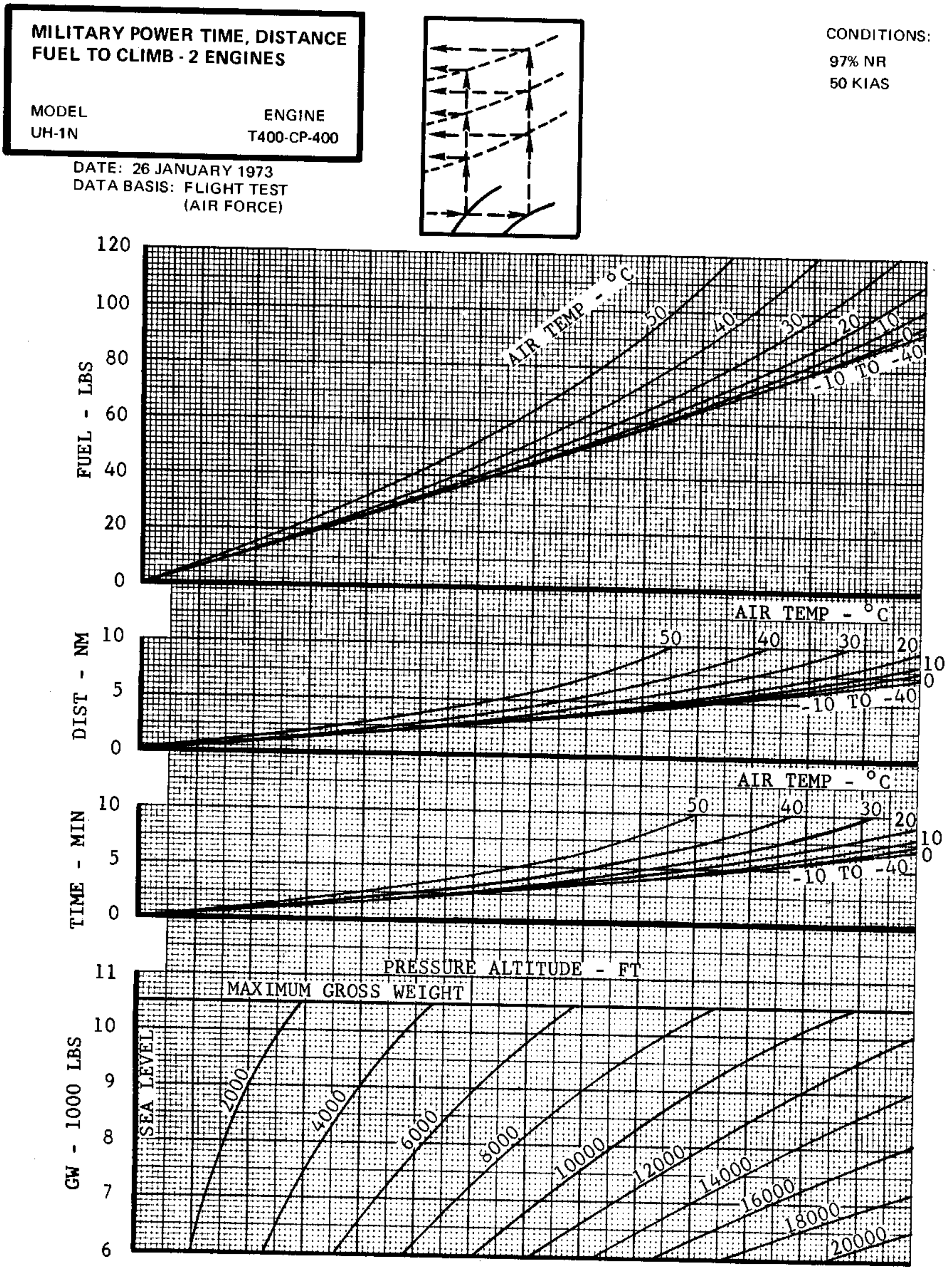
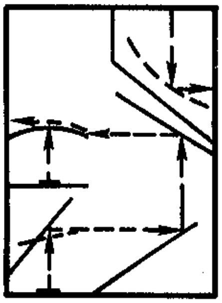

MILITARY POWER TIME, DISTANCE
FUEL TO CLIMB - 2 ENGINES
MODEL
UH-1N
ENGINE
T400-CP-400
DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST
(AIR FORCE)
CONDITIONS:
97% NR
50 KIAS
FUEL - LBS
AIR TEMP - °C
50
40
30
20
10
0
-10 TO -40
DIST - NM
TIME - MIN
PRESSURE ALTITUDE - FT
MAXIMUM GROSS WEIGHT
SEA LEVEL
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
GW - 1000 LBS

Figure A-18.

CONDITIONS:

97% NR
50 KIAS



MILITARY POWER RATE OF CLIMB

MODEL	ENGINE
UH-1N	T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)

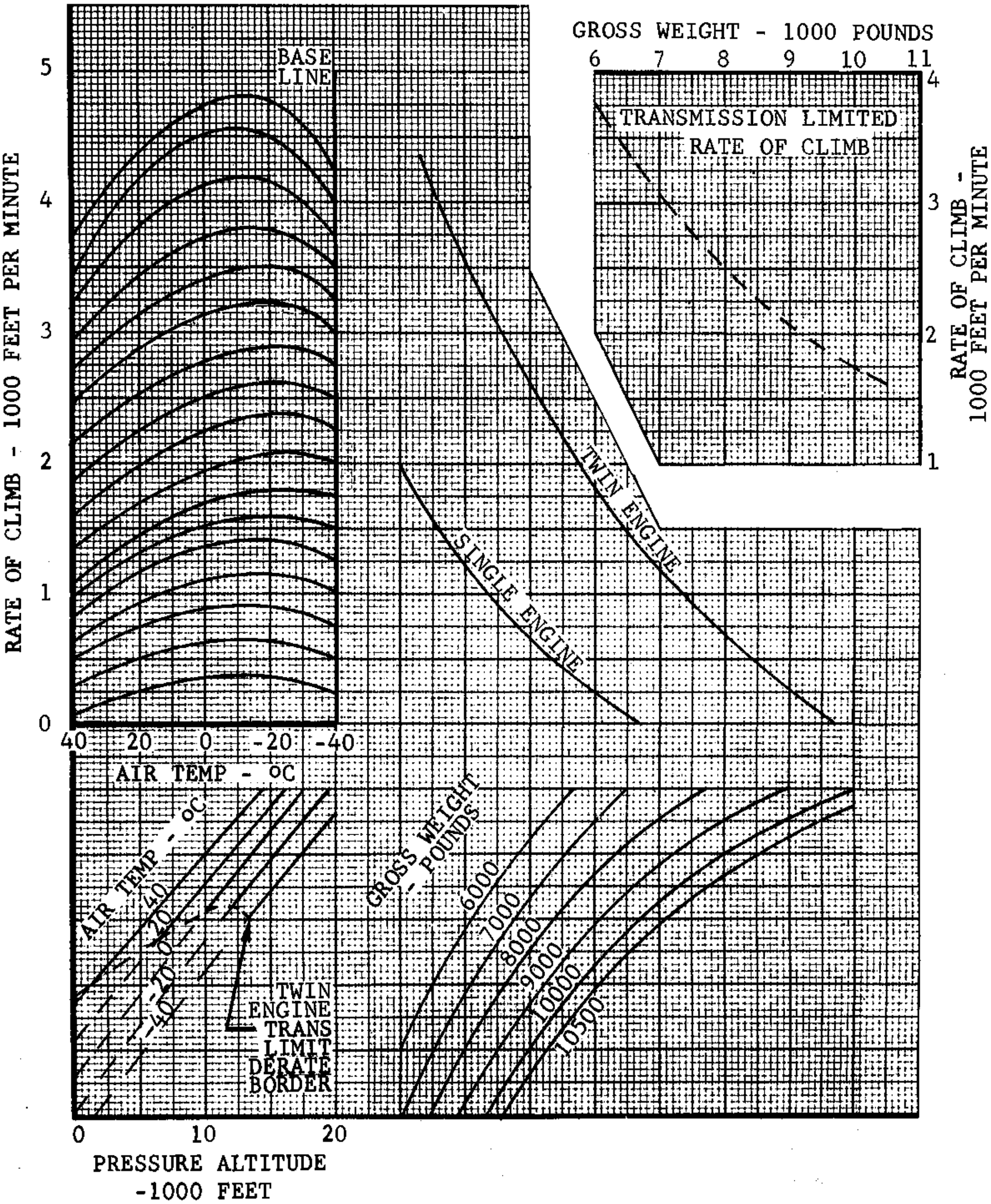


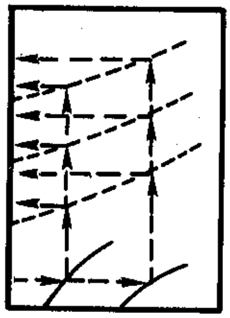
Figure A-19.

MAXIMUM CONTINUOUS POWER TIME, DISTANCE, FUEL TO CLIMB - 2 ENGINES

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)



CONDITIONS:

97% NR
50 KIAS

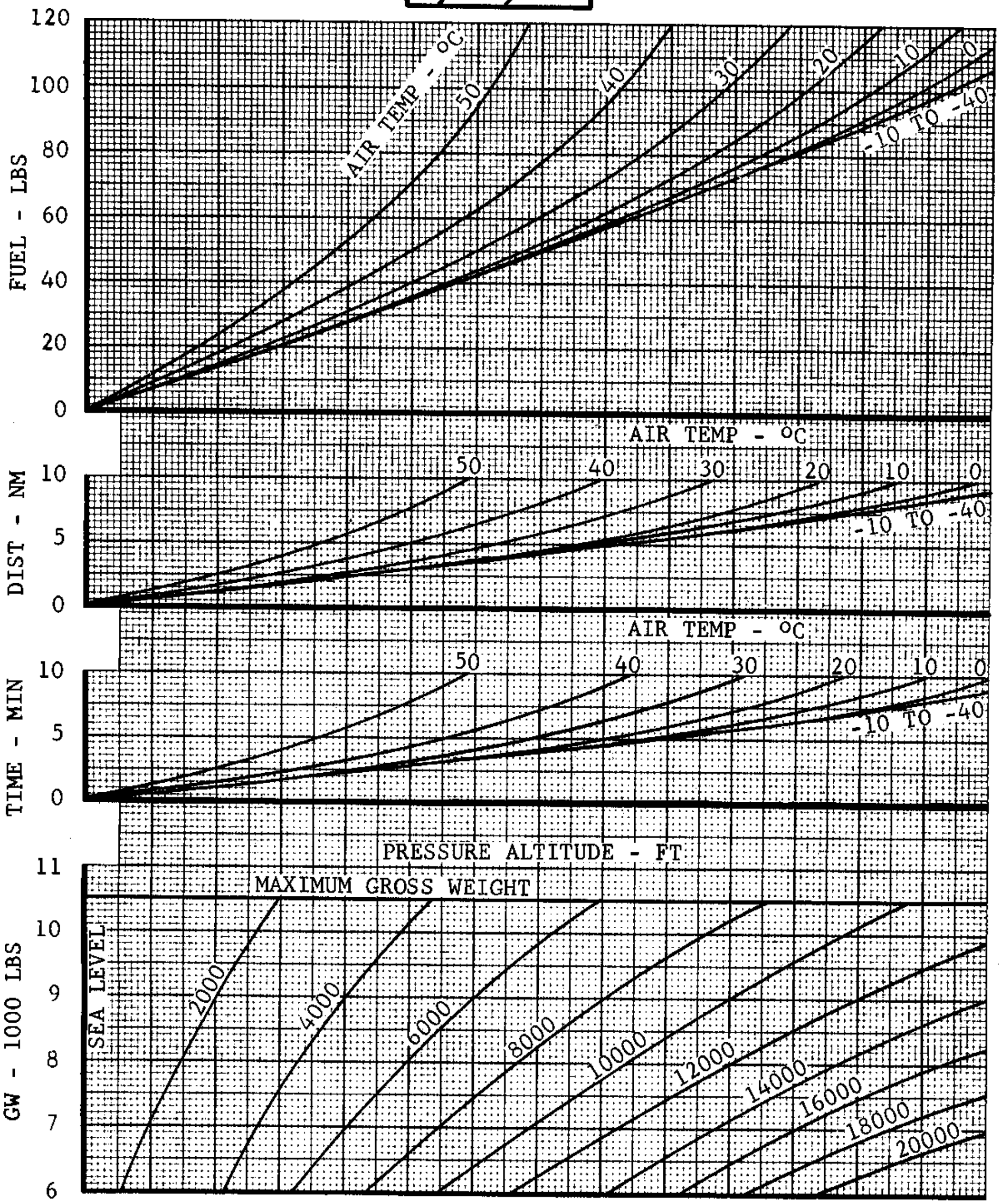


Figure A-20.

CONDITIONS:

97% NR
50 KIAS

MAXIMUM CONTINUOUS POWER
RATE OF CLIMB - 2 ENGINES

MODEL UH-1N | ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)

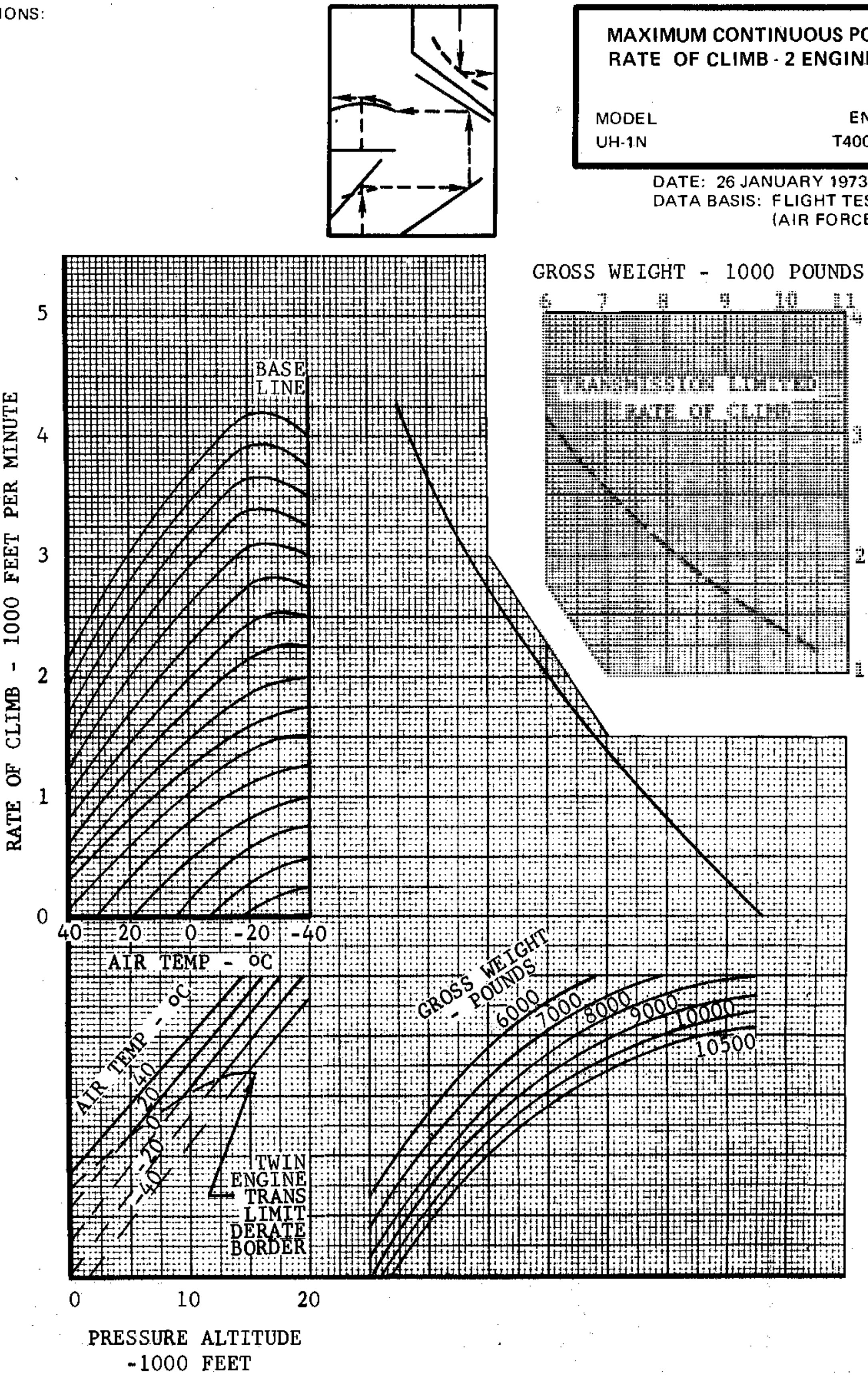


Figure A-21.

MILITARY POWER TIME, DISTANCE, FUEL TO CLIMB - SINGLE ENGINE

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)

CONDITIONS:

97% NR
50 KIAS

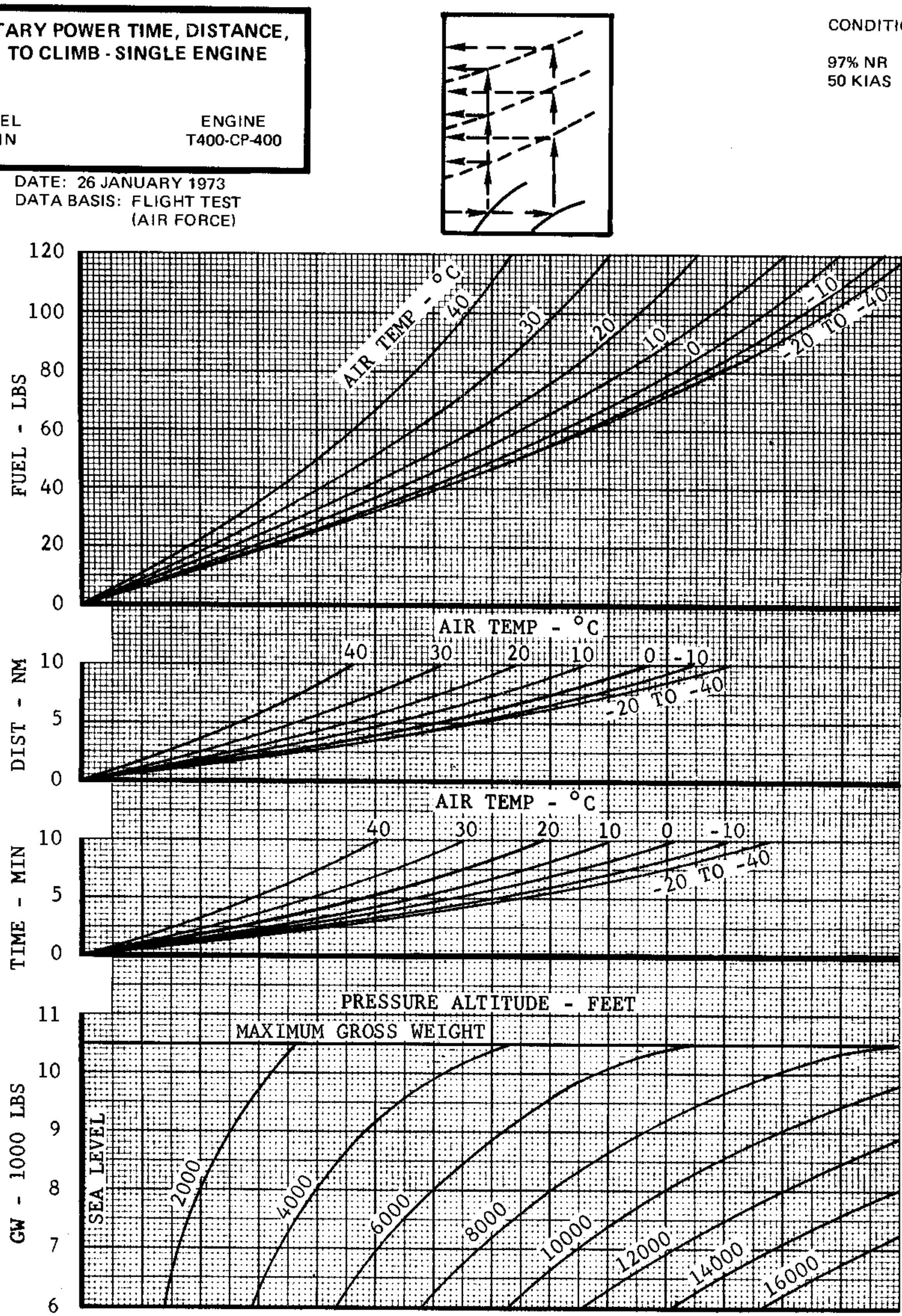
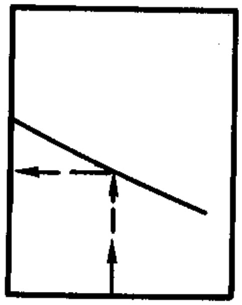


Figure A-22.

CONDITIONS:

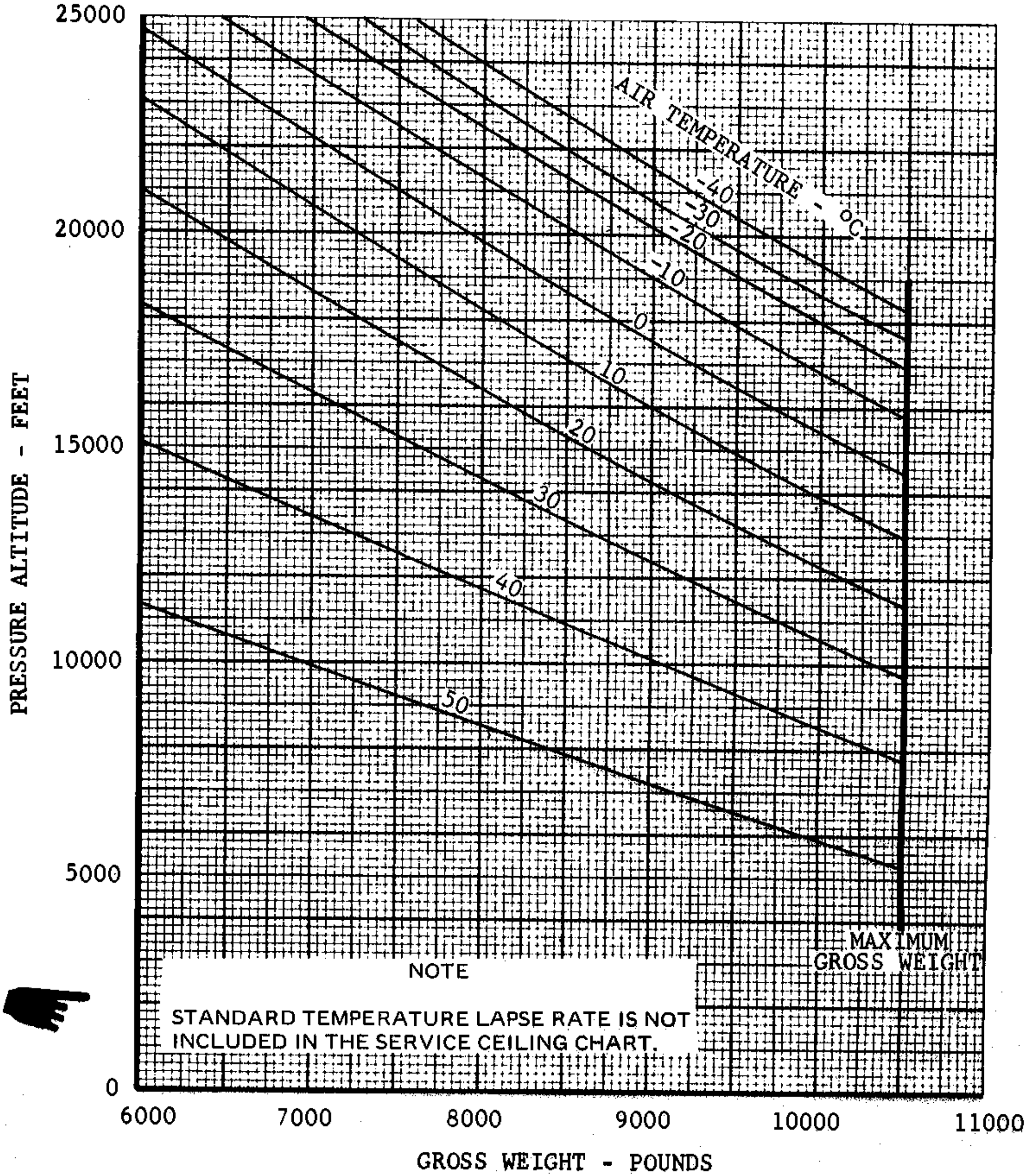
97% NR
50 KIAS



SERVICE CEILING - MAXIMUM CONTINUOUS POWER - 2 ENGINES

MODEL	ENGINE
UH-1N	T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)



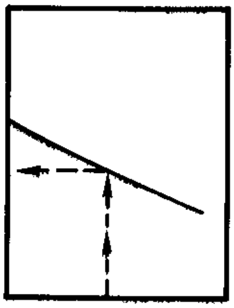
NOTE

STANDARD TEMPERATURE LAPSE RATE IS NOT INCLUDED IN THE SERVICE CEILING CHART.

Figure A-23.

CONDITIONS:

97% NR
50 KIAS



SERVICE CEILING - MILITARY POWER - SINGLE ENGINE

MODEL: UH-1N
ENGINE: T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)

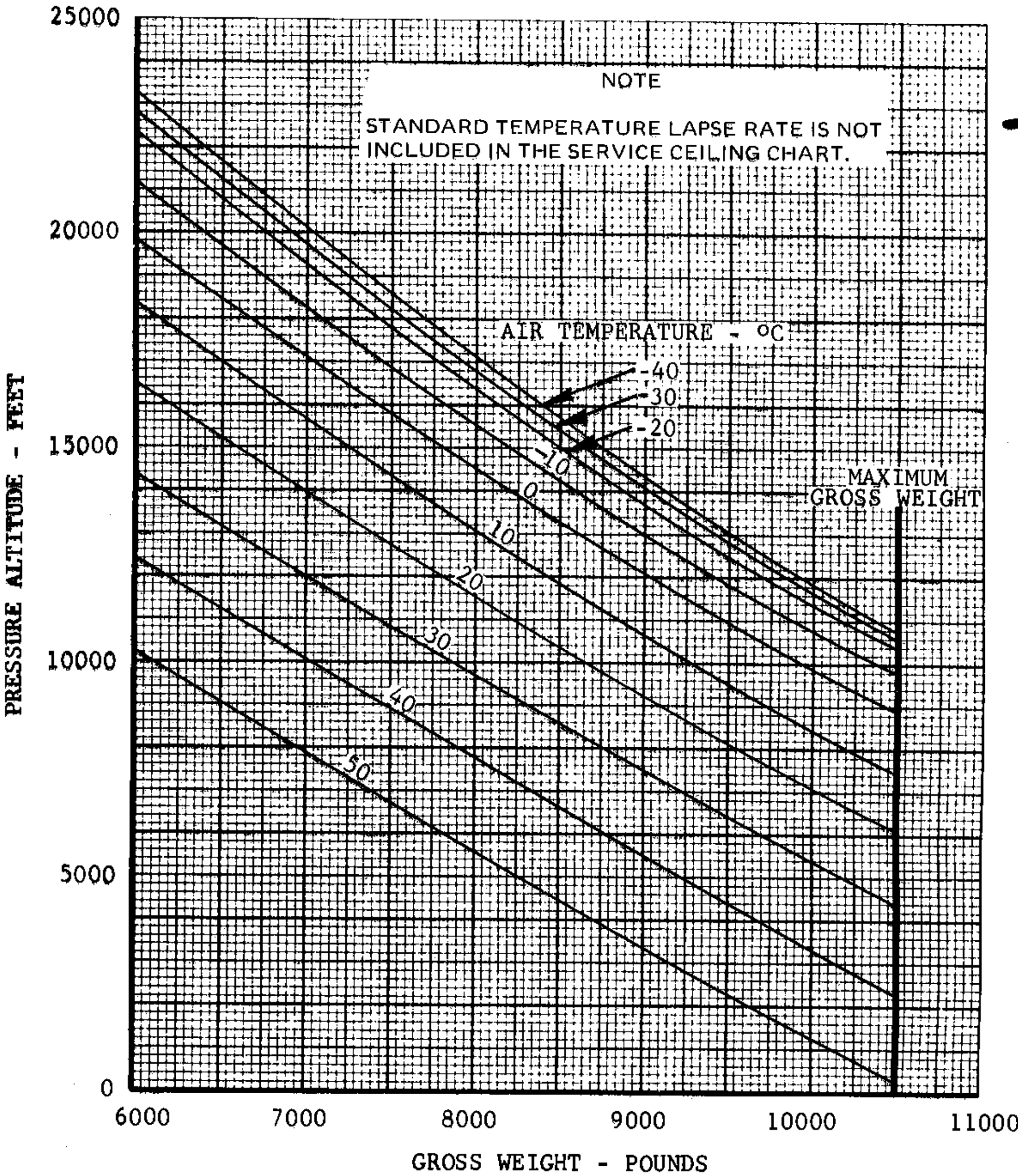


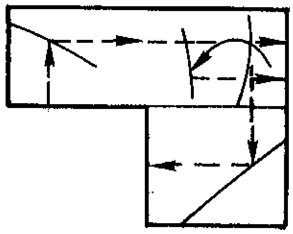
Figure A-24.

CRUISE - 2 ENGINES - AIR TEMPERATURE WARMER THAN +30°C

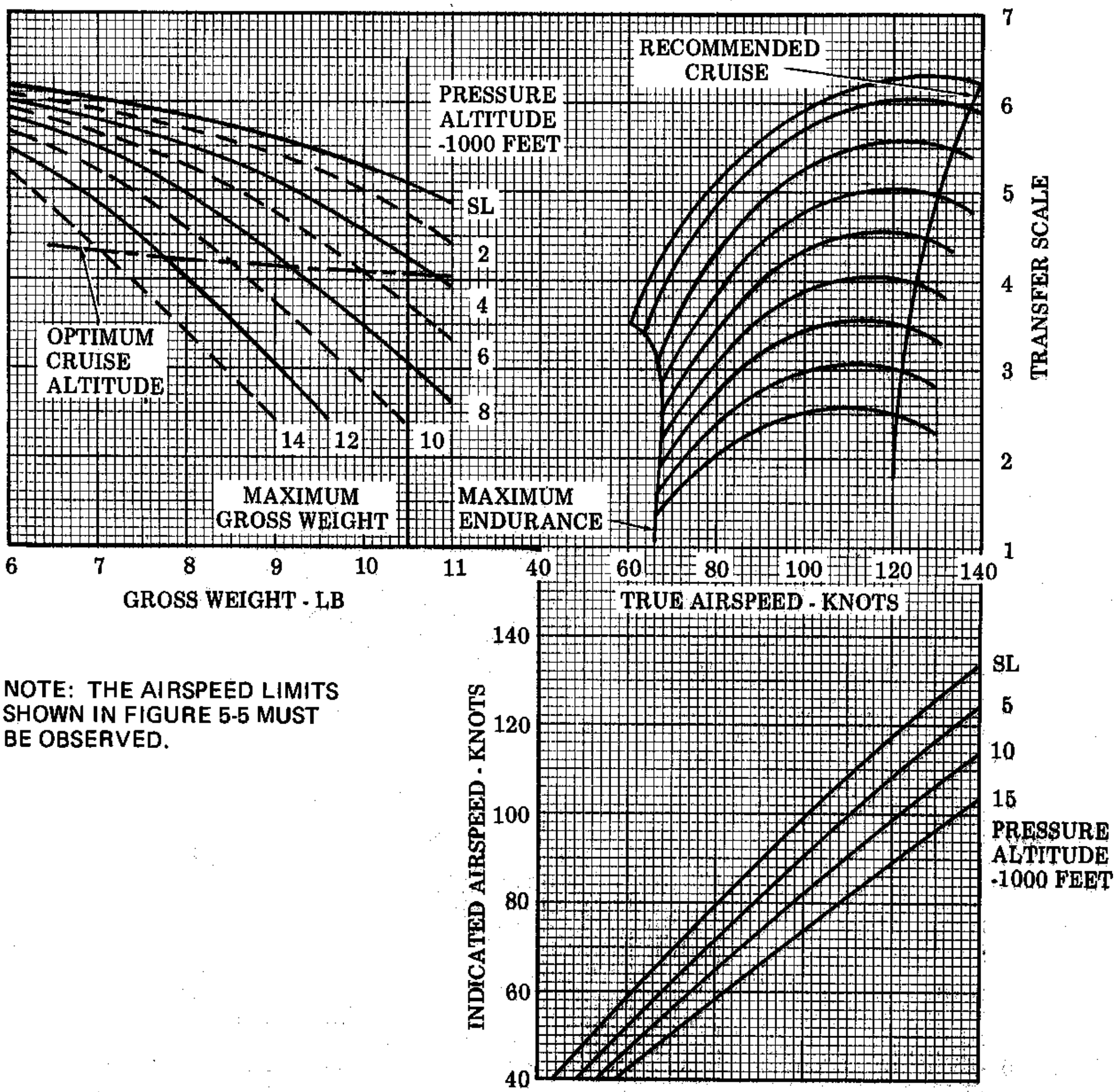
MODEL UH-1N

ENGINE T400-CP-400

DATE: 19 APRIL 1974
DATA BASIS: FLIGHT TEST (AIR FORCE)



CONDITIONS:
97% NR



NOTE: THE AIRSPEED LIMITS SHOWN IN FIGURE 5-5 MUST BE OBSERVED.

Figure A-25. (Sheet 1 of 2)

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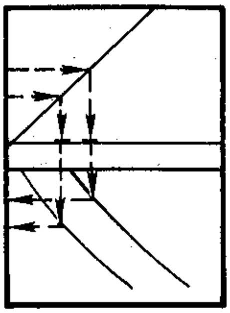
CONDITIONS:

97% NR



CRUISE - 2 ENGINES - AIR TEMPERATURE WARMER THAN +30°C

MODEL UH-1N

ENGINE T400-CP-400

19 APRIL 1974

DATA BASIS: FLIGHT TEST (AIR FORCE)

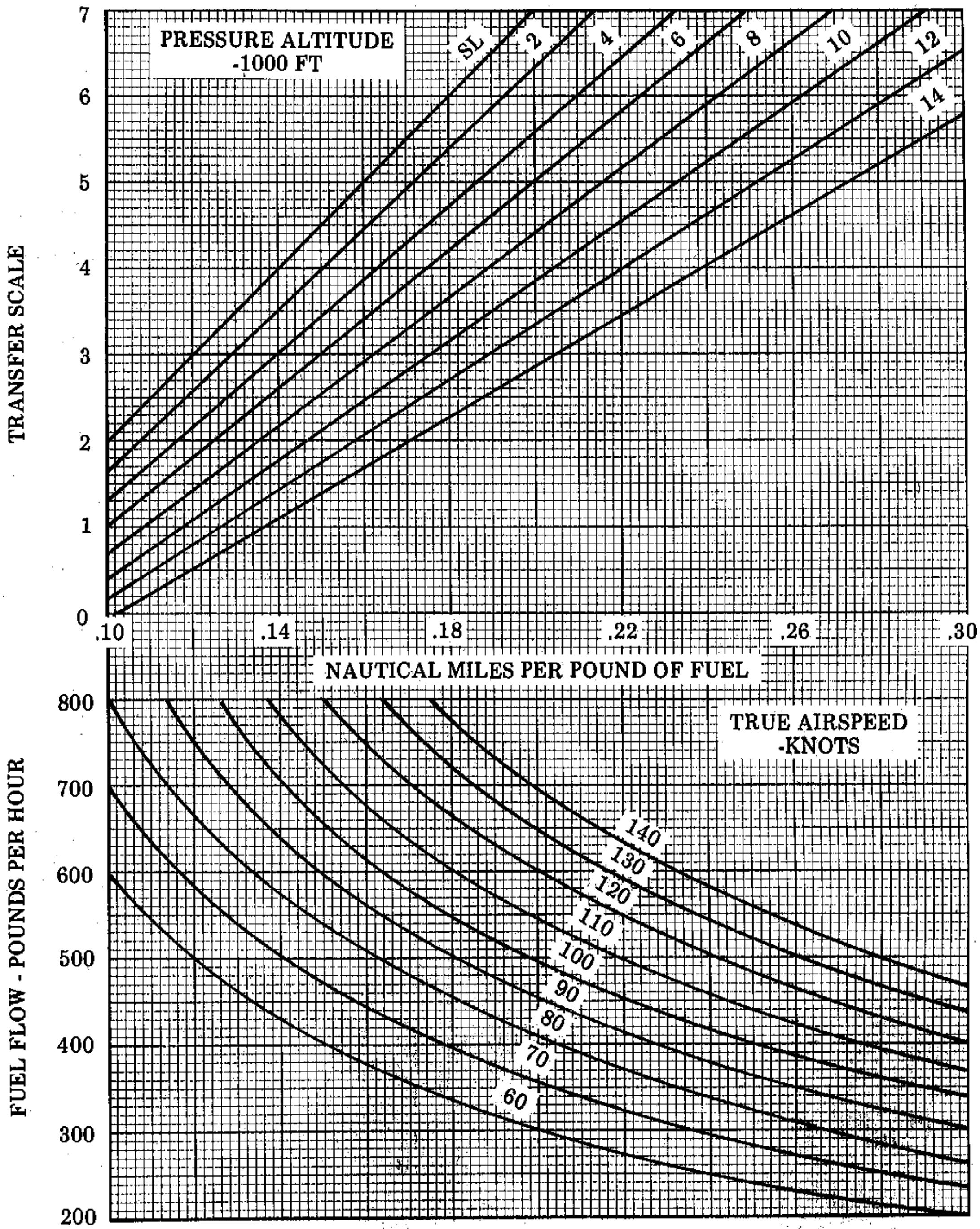
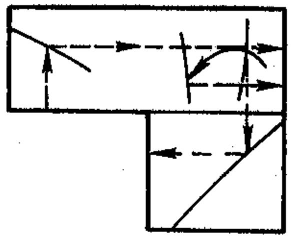


Figure A-25. (Sheet 2 of 2)

CRUISE - 2 ENGINES - AIR TEMPERATURE BETWEEN +10°C AND +30°C

MODEL UH-1N

ENGINE T400-CP-400

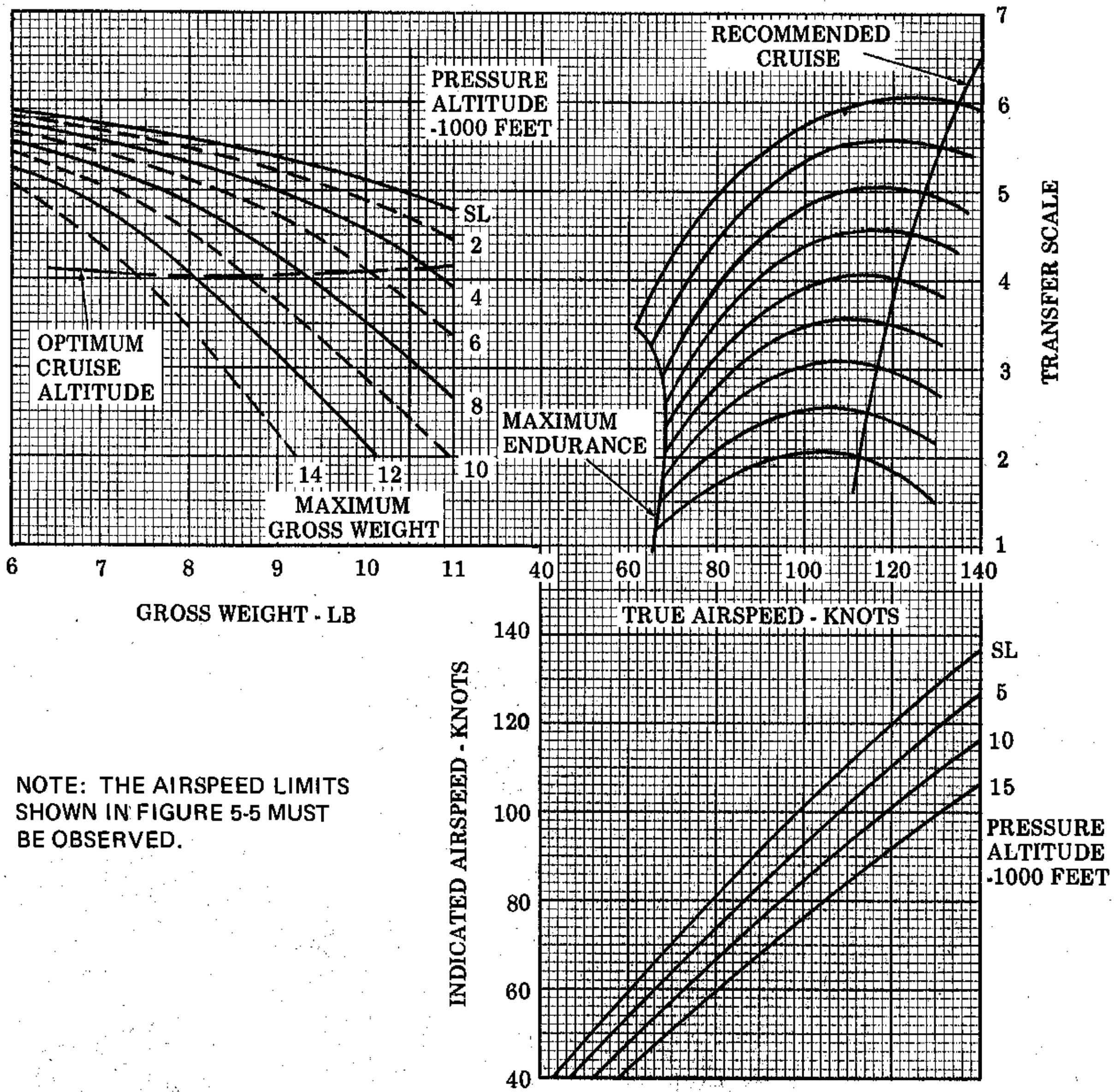


CONDITIONS:

97% NR

DATE: 19 APRIL 1974

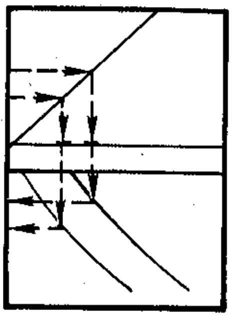
DATA BASIS: FLIGHT TEST (AIR FORCE)



NOTE: THE AIRSPEED LIMITS SHOWN IN FIGURE 5-5 MUST BE OBSERVED.

Figure A-26. (Sheet 1 of 2)

CONDITIONS:
97% NR



CRUISE - 2 ENGINES - AIR TEMPERATURE BETWEEN +10°C AND +30°C

MODEL UH-1N

ENGINE T400-CP-400

19 APRIL 1974
DATA BASIS: FLIGHT TEST (AIR FORCE)

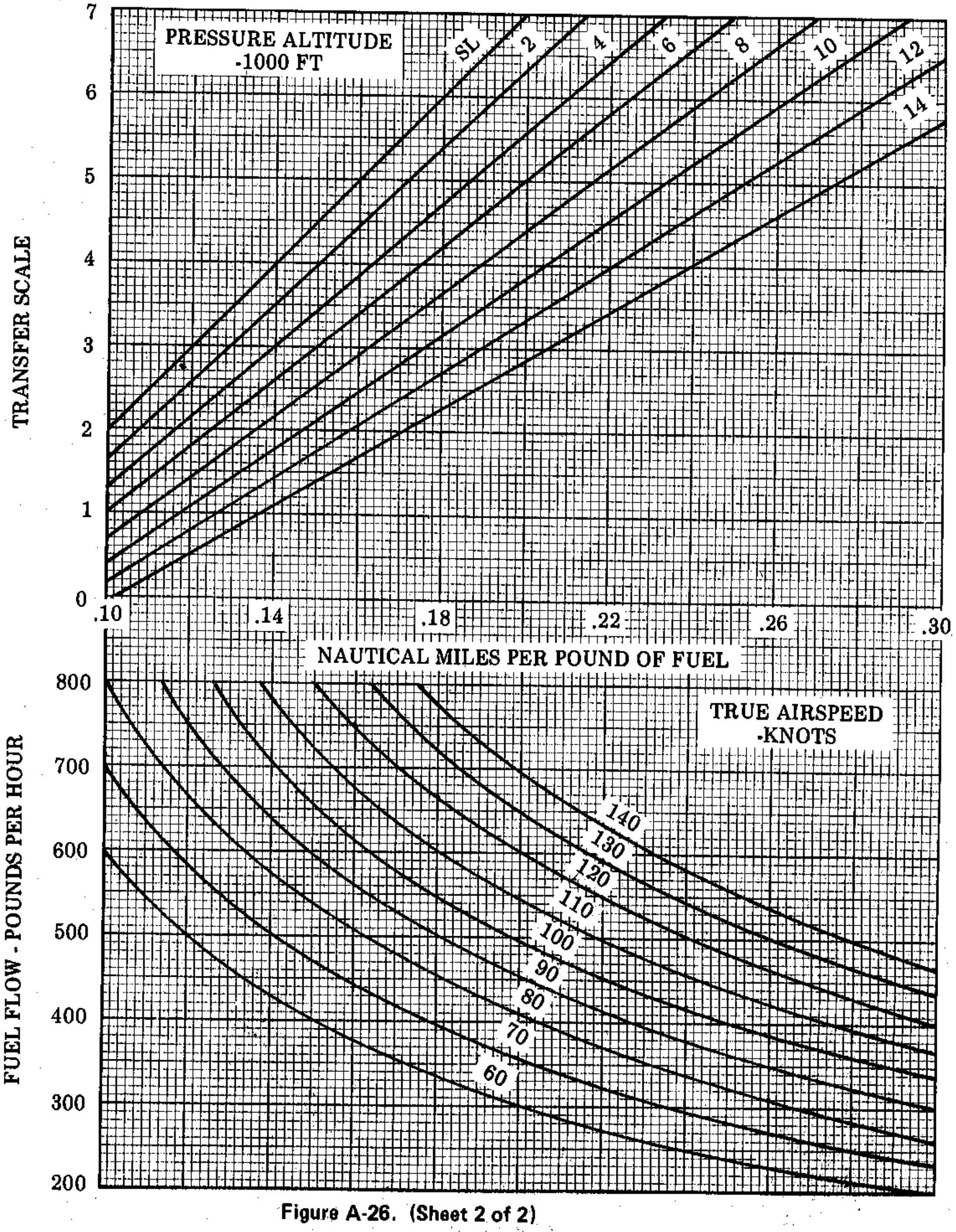
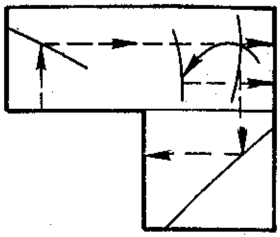


Figure A-26. (Sheet 2 of 2)

CRUISE - 2 ENGINES - AIR TEMPERATURE BETWEEN -10°C AND +10°C

MODEL UH-1N

ENGINE T400-CP-400

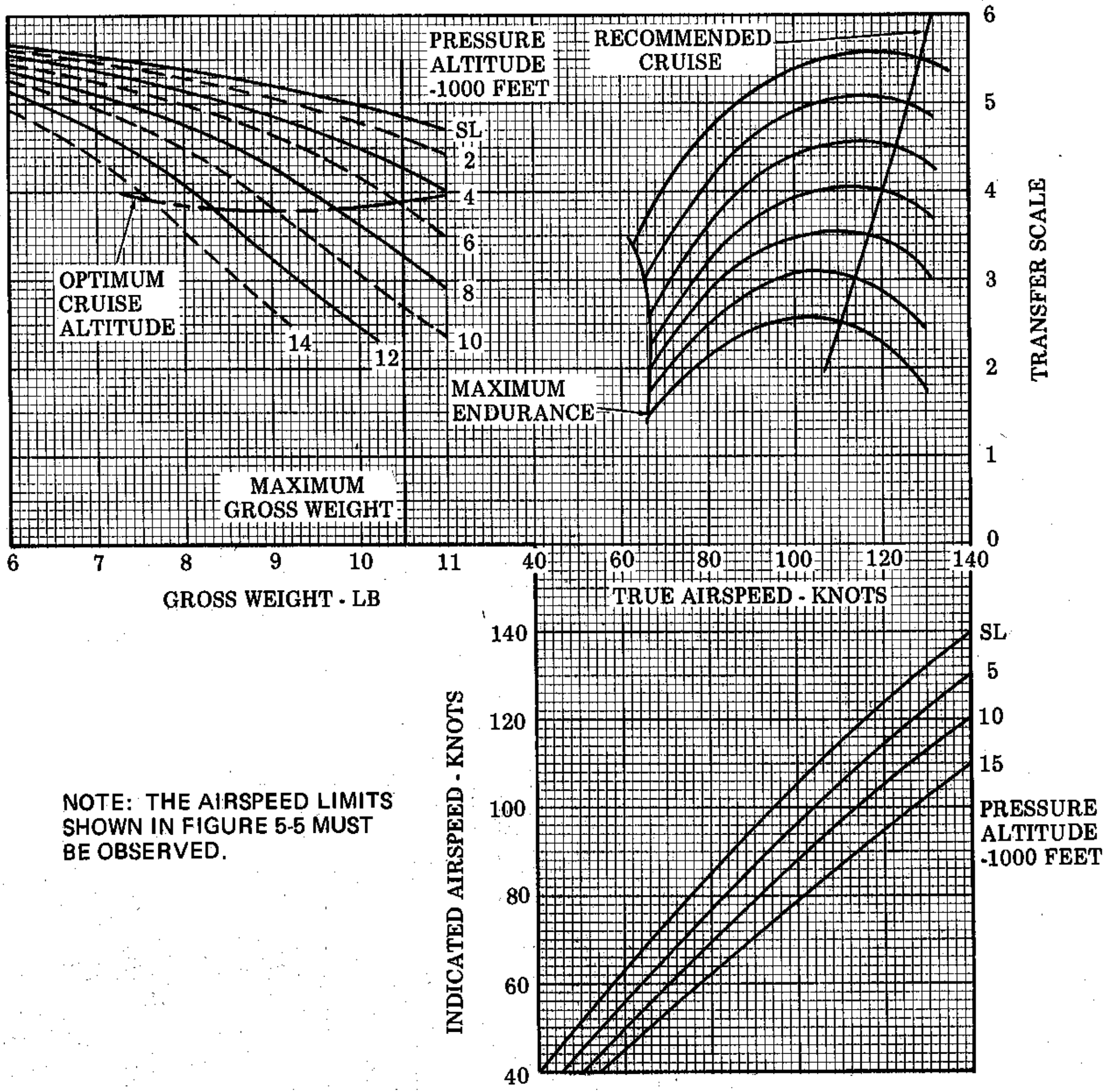


CONDITIONS:

97% NR

DATE: 19 APRIL 1974

DATA BASIS: FLIGHT TEST (AIR FORCE)

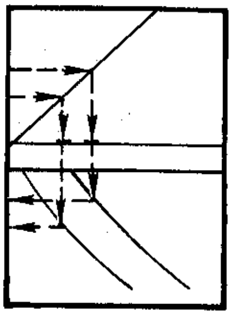


NOTE: THE AIRSPEED LIMITS SHOWN IN FIGURE 5-5 MUST BE OBSERVED.

Figure A-27. (Sheet 1 of 2)

CONDITIONS:

97% NR



CRUISE - 2 ENGINES - AIR TEMPERATURE BETWEEN -10°C AND +10°C

MODEL UH-1N

ENGINE T400-CP-400

19 APRIL 1974

DATA BASIS: FLIGHT TEST (AIR FORCE)

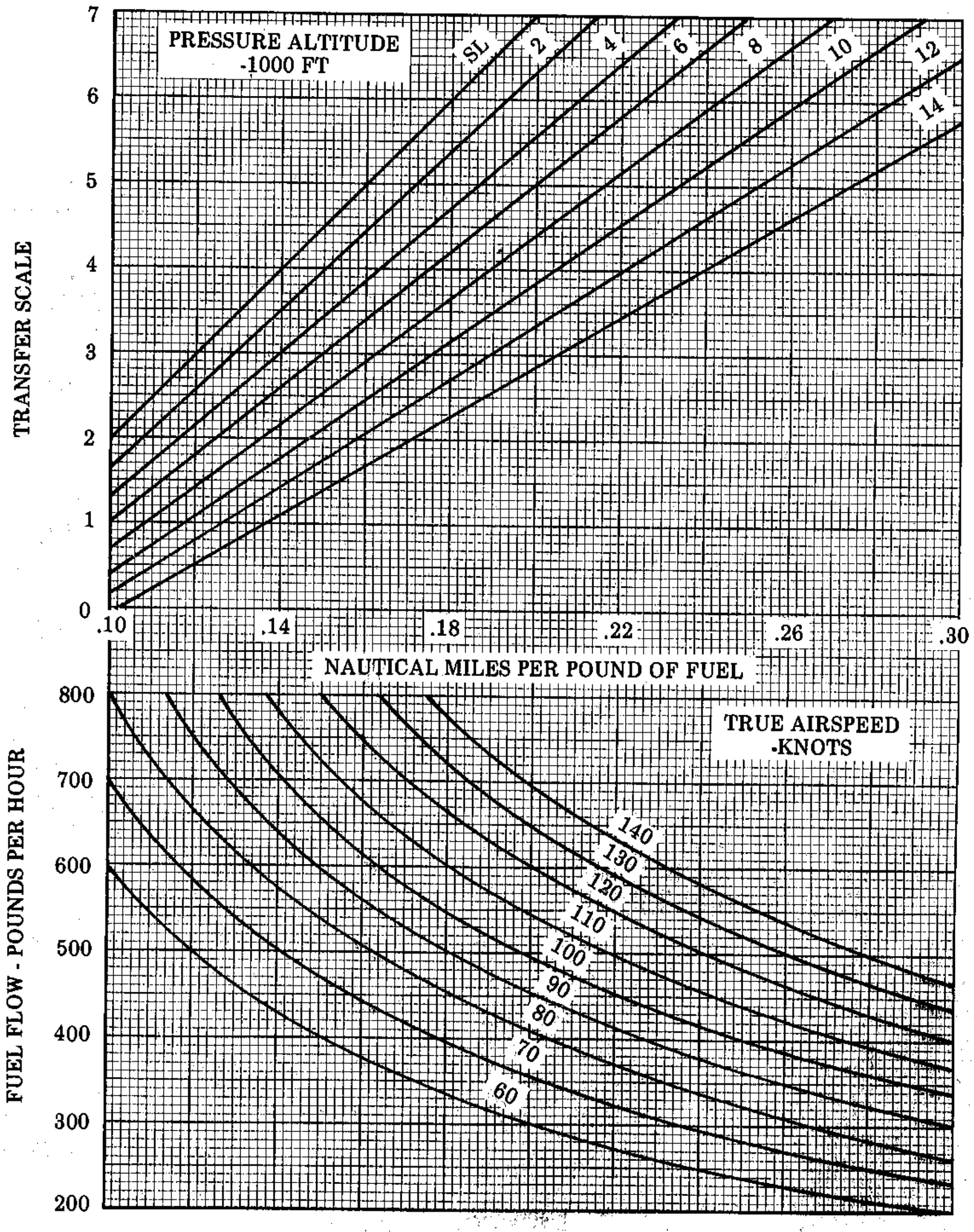
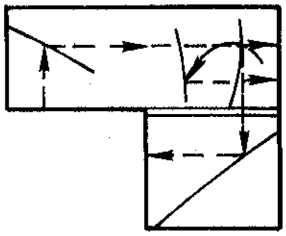


Figure A-27. (Sheet 2 of 2)

CRUISE - 2 ENGINES - AIR TEMPERATURE BETWEEN -30°C AND -10°C

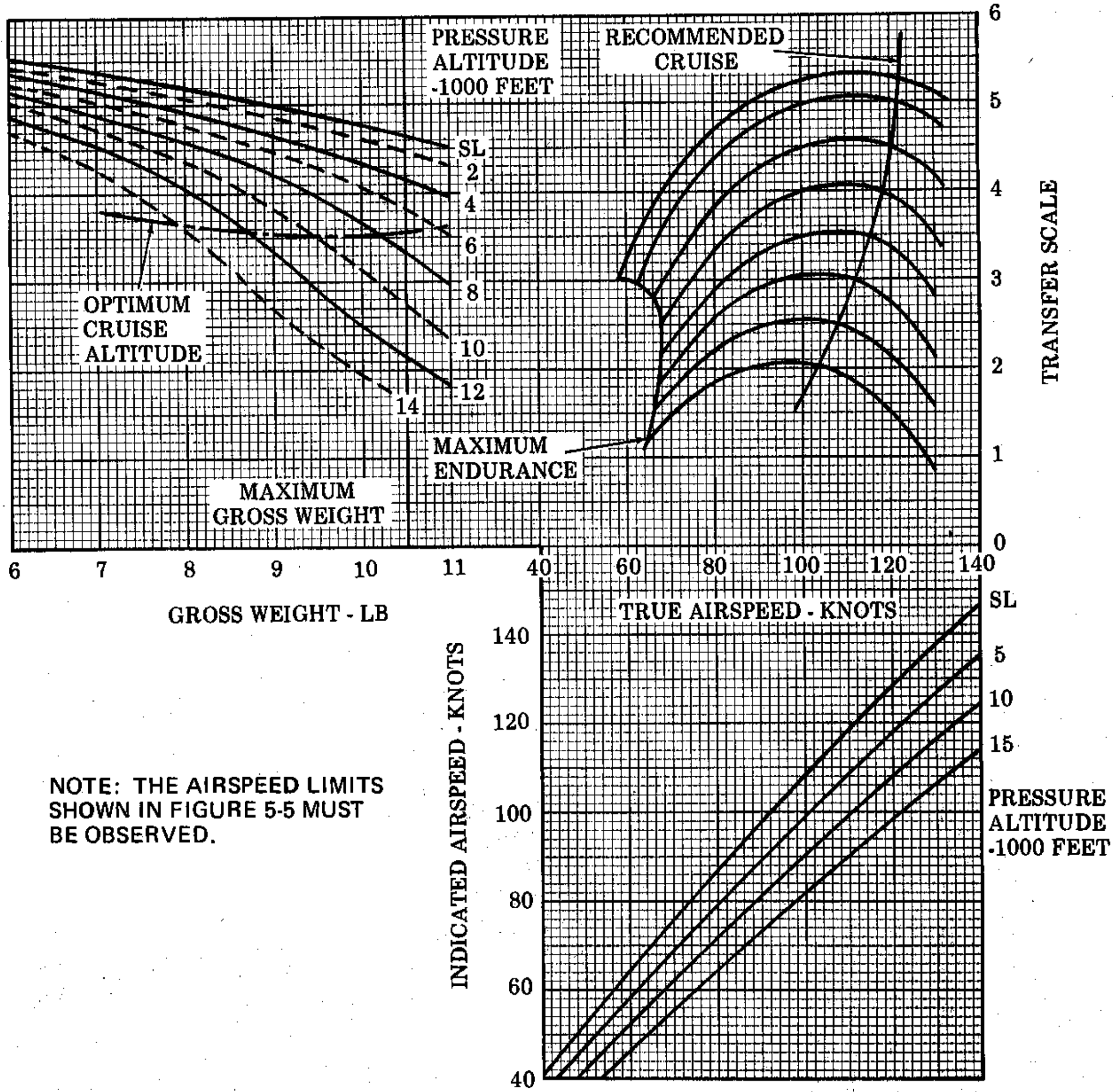
MODEL
UH-1N

ENGINE
T400-CP-400



CONDITIONS:
97% NR

DATE: 19 APRIL 1974
DATA BASIS: FLIGHT TEST
(AIR FORCE)

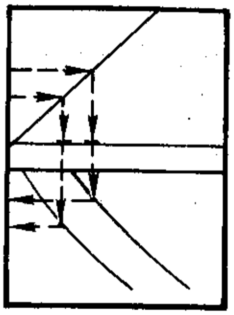


NOTE: THE AIRSPEED LIMITS SHOWN IN FIGURE 5-5 MUST BE OBSERVED.

Figure A-28. (Sheet 1 of 2)

CONDITIONS:

97% NR



CRUISE - 2 ENGINES - AIR TEMPERATURE BETWEEN -30°
AND -10°C

MODEL	ENGINE
UH-1N	T400-CP-400

19 APRIL 1974
DATA BASIS: FLIGHT TEST (AIR FORCE)

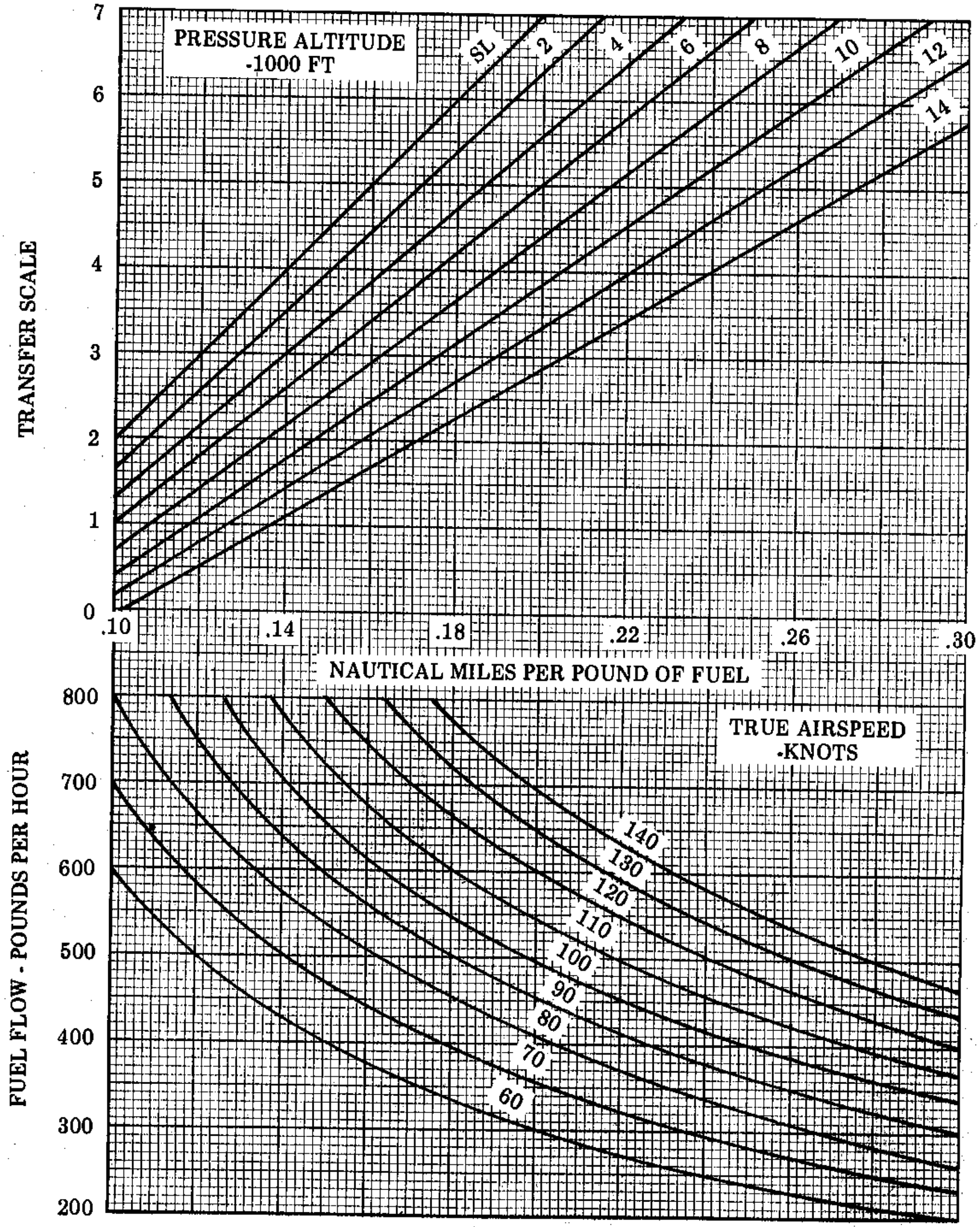


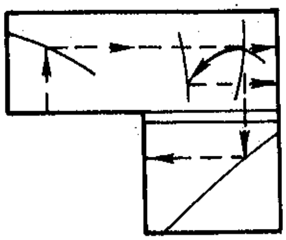
Figure A-28. (Sheet 2 of 2)

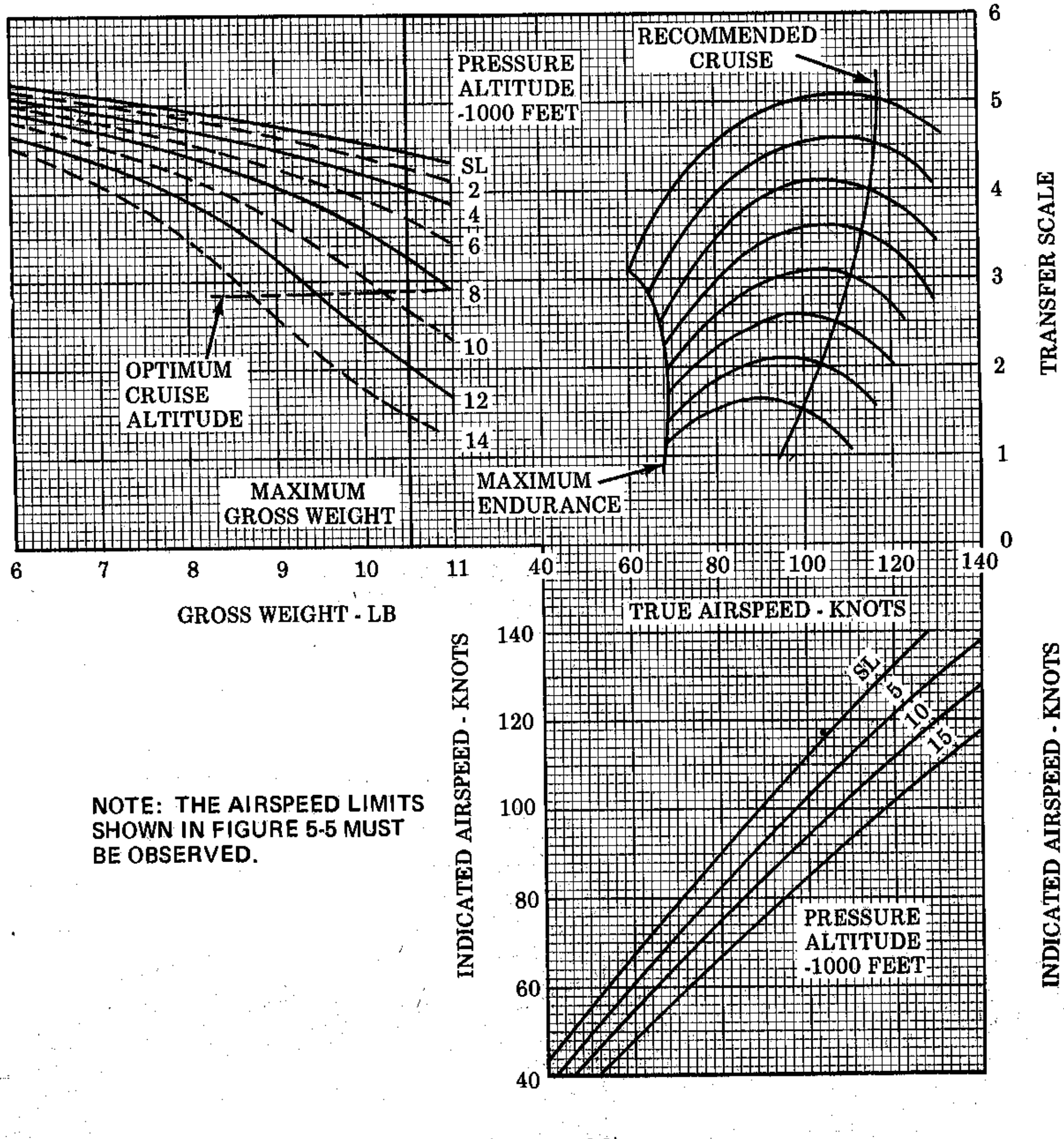
CRUISE - 2 ENGINES - AIR TEMPERATURE COLDER THAN -30°C

MODEL	ENGINE
UH-1N	T400-CP-400

DATE: 19 APRIL 1974
DATA BASIS: FLIGHT TEST (AIR FORCE)

CONDITIONS:
97% NR



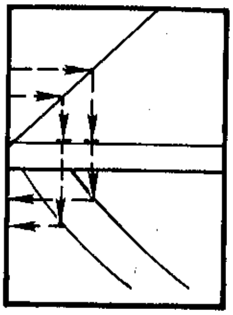


NOTE: THE AIRSPEED LIMITS SHOWN IN FIGURE 5-5 MUST BE OBSERVED.

Figure A-29. (Sheet 1 of 2)

CONDITIONS:

97% NR



CRUISE - 2 ENGINES - AIR TEMPERATURE COLDER THAN -30°C

MODEL	ENGINE
UH-1N	T400-CP-400

19 APRIL 1974

DATA BASIS: FLIGHT TEST (AIR FORCE)

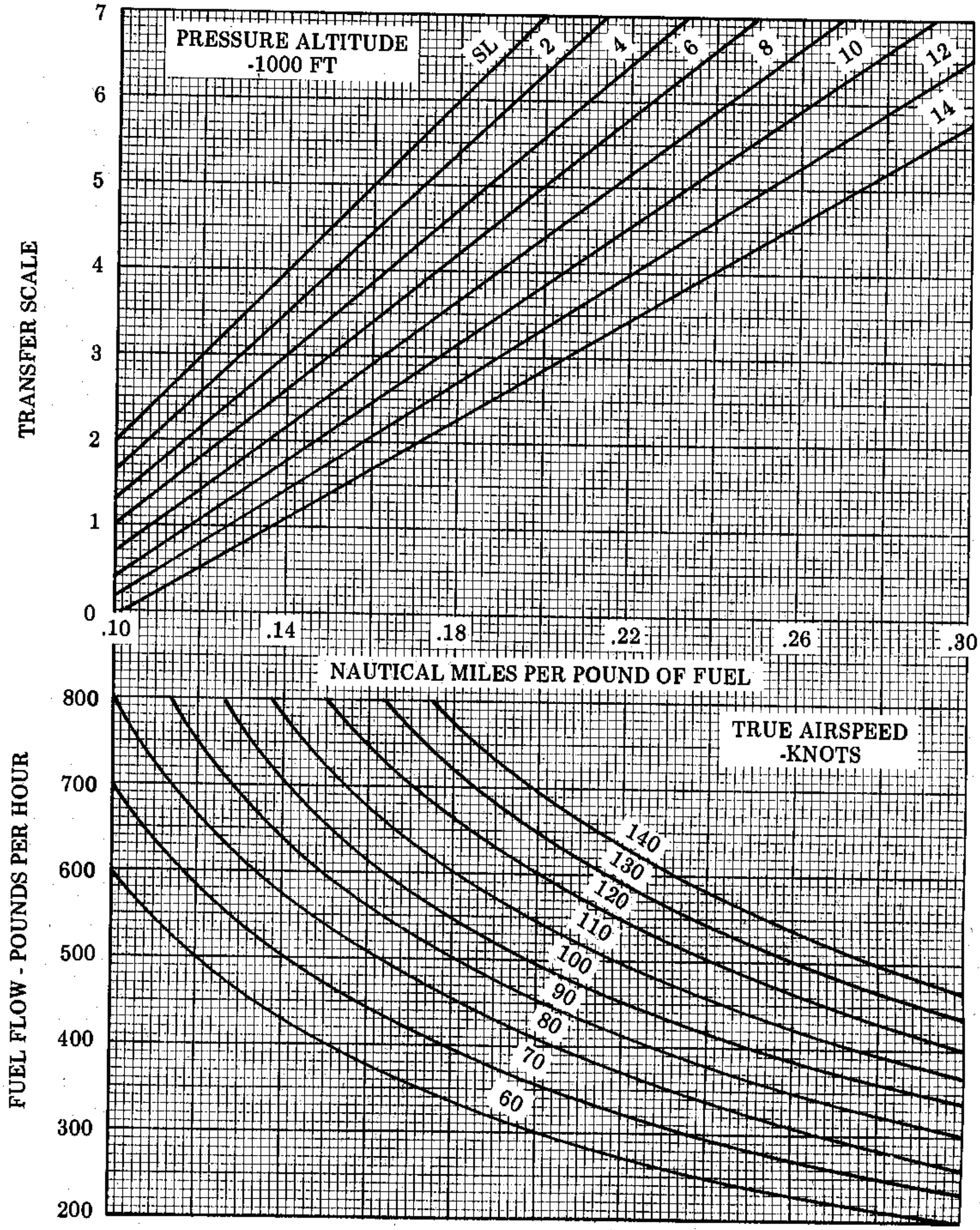


Figure A-29. (Sheet 2 of 2)

CRUISE - SINGLE ENGINE, MILITARY POWER - AIR TEMPERATURE WARMER THAN +30°C

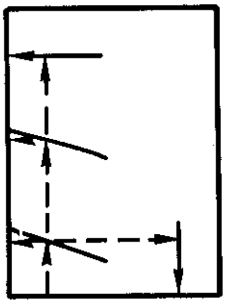
MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)

CONDITIONS:

97% NR



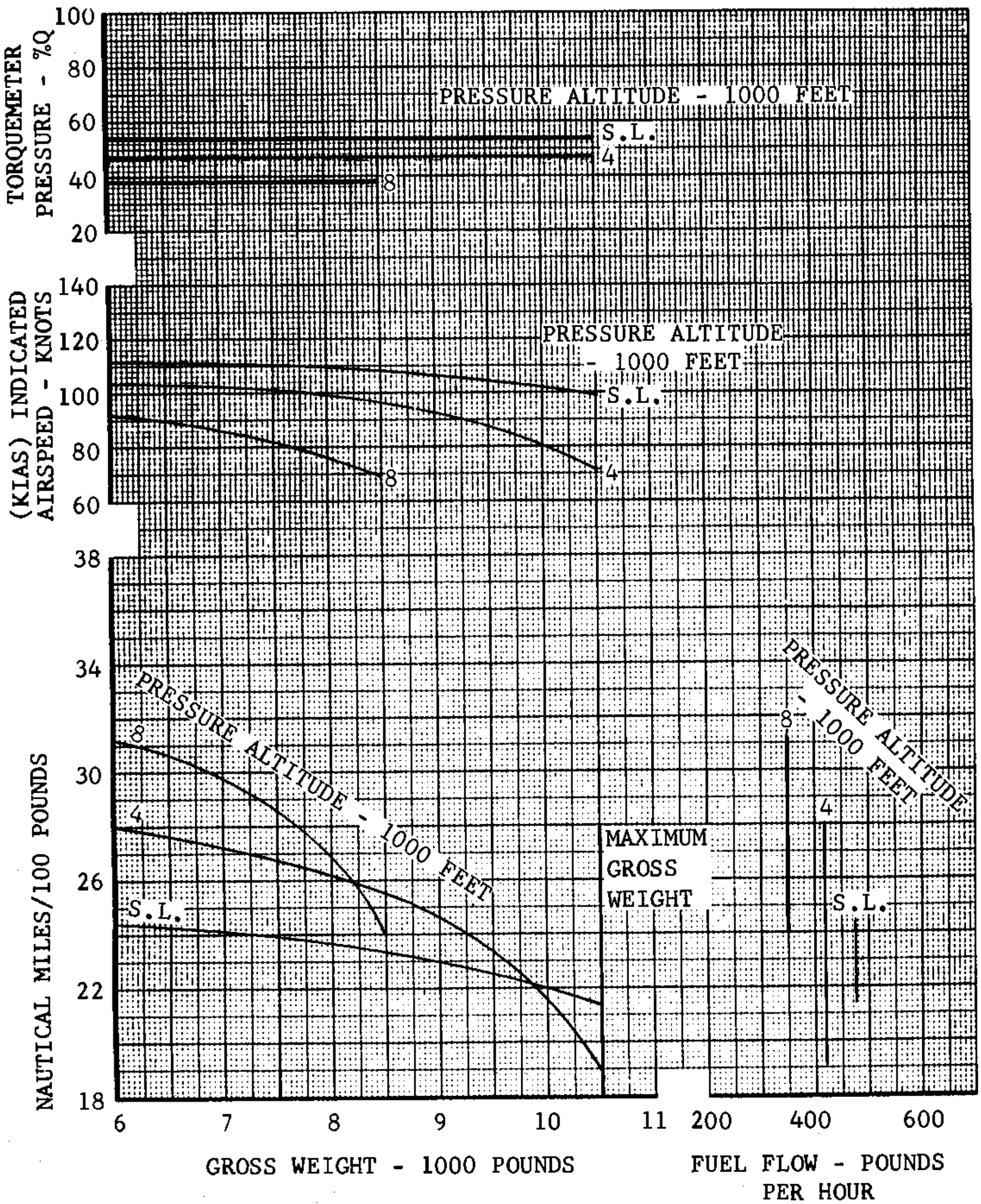
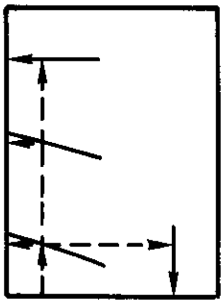


Figure A-30.

CONDITIONS:

97% NR



CRUISE- SINGLE ENGINE, MILITARY POWER - AIR TEMPERATURE BETWEEN +10°C AND +30°C

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATE BASIS: FLIGHT TEST (AIR FORCE)

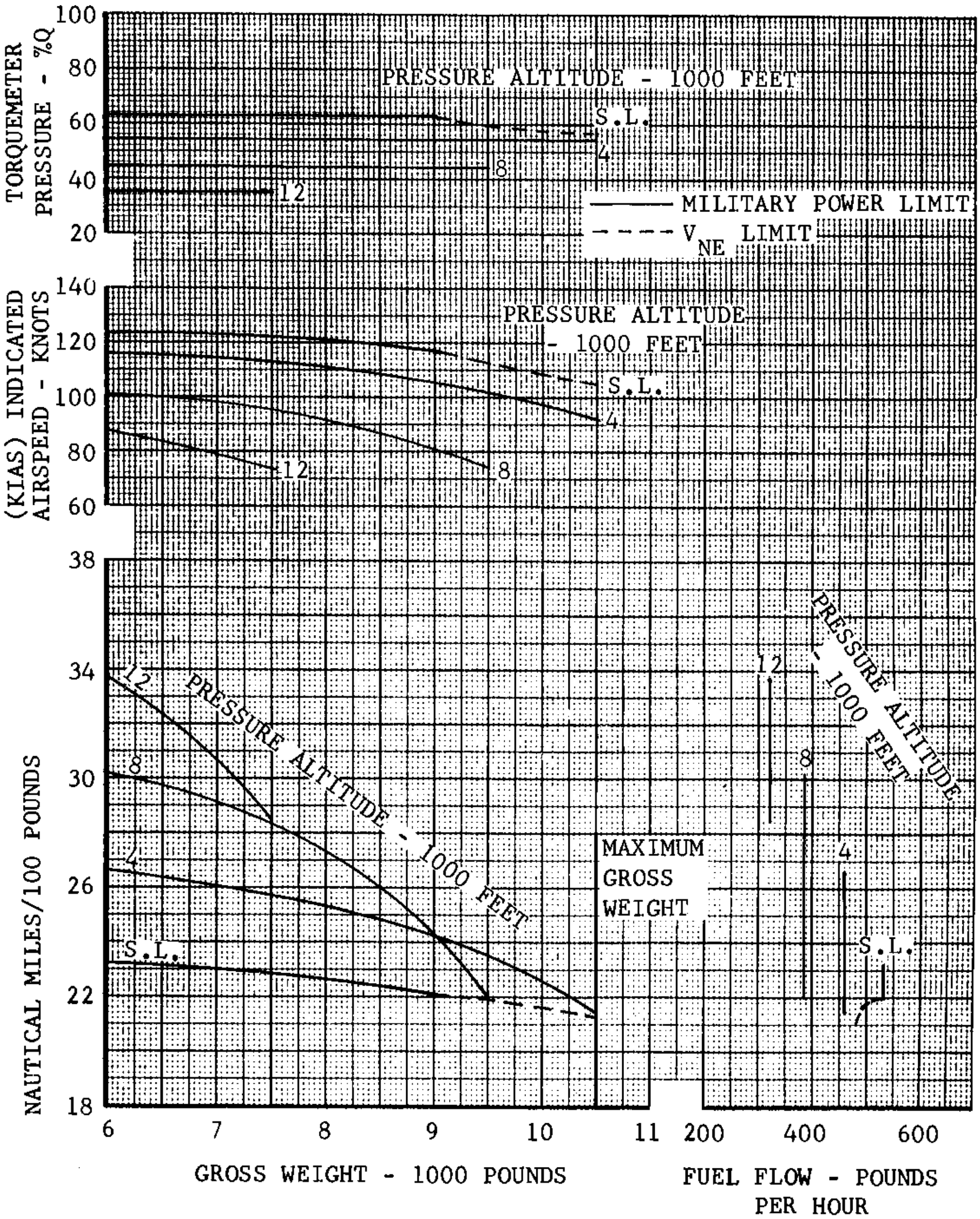


Figure A-31.

CRUISE - SINGLE ENGINE, MILITARY POWER-AIR TEMPERATURE BETWEEN -10°C AND +10°C

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973

DATA BASIS: FLIGHT TEST (AIR FORCE)

CONDITIONS:

97% NR

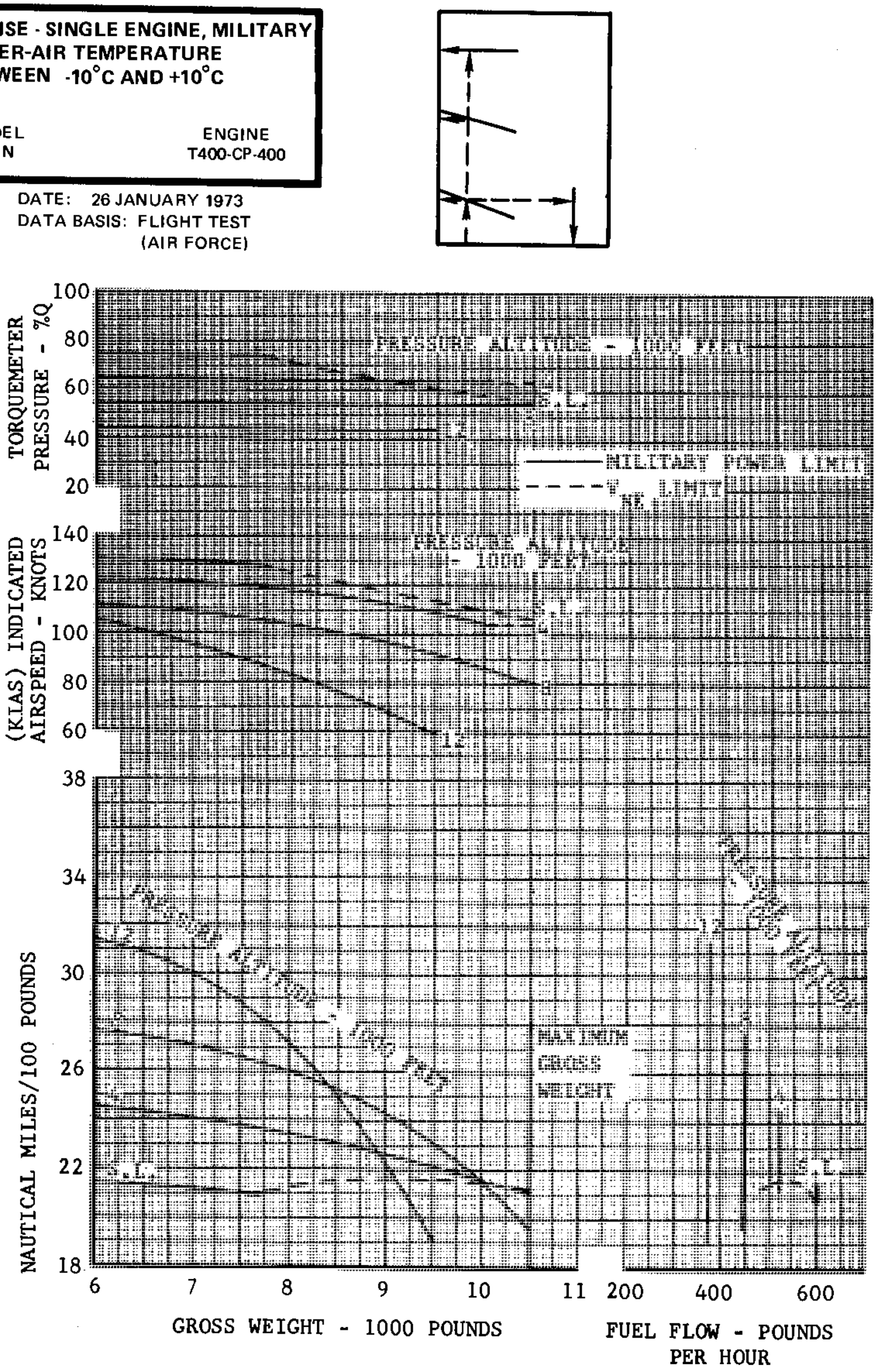


Figure A-32.

CONDITIONS:

97% NR

CRUISE- SINGLE ENGINE, MILITARY POWER - AIR TEMPERATURE BETWEEN -30°C AND -10°C

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973

DATA BASIS: FLIGHT TEST (AIR FORCE)

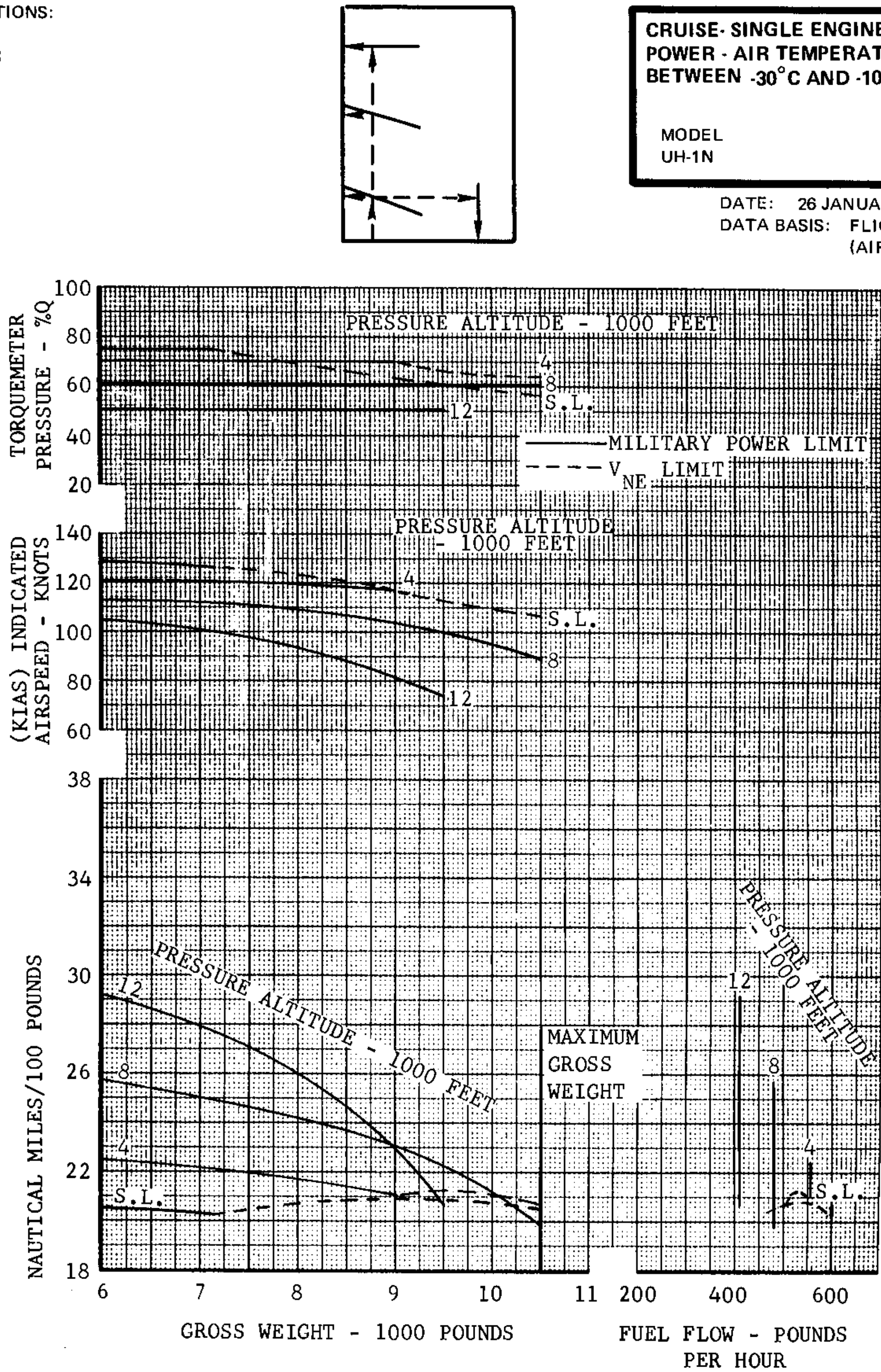


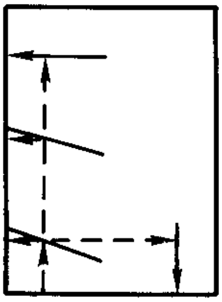
Figure A-33.

CRUISE - SINGLE ENGINE, MILITARY POWER - AIR TEMPERATURE COLDER THAN -30°C

MODEL UH-1N

ENGINE T400-CP-400

DATE: 26 JANUARY 1973
DATA BASIS: FLIGHT TEST (AIR FORCE)



CONDITIONS:

97% NR

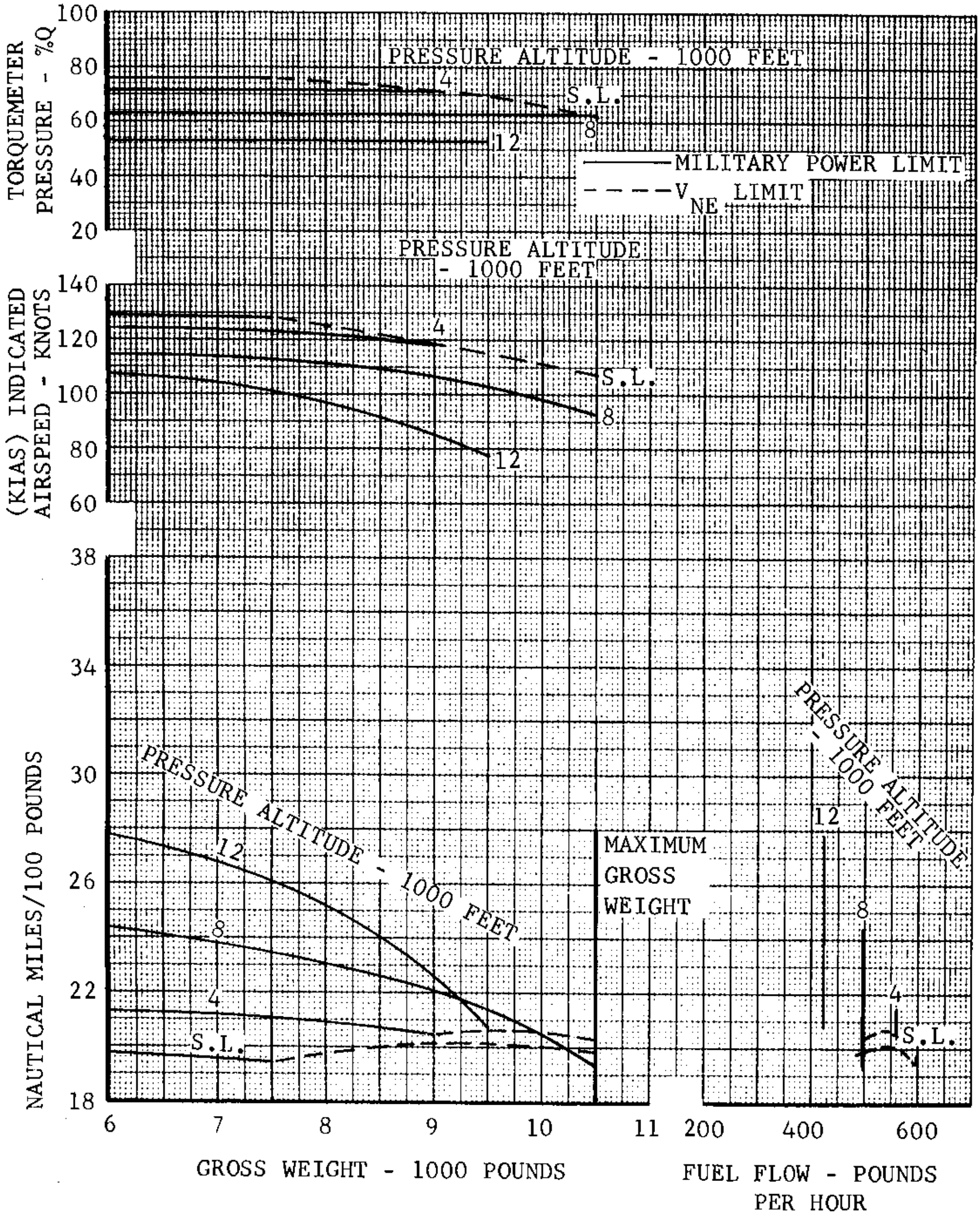


Figure A-34.