Performance

Section V

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INTRODUCTION TO PERFORMANCE

The graphs and tables presented in this section identify performance information for aid in flight planning at various parameters of aircraft weight, engine powers, altitudes and temperatures. Data you obtain will be peculiar to your aircraft since its construction and measurements differ from all others. The values (data) you generate and put into the blank charts provided should be conservative and will represent the way you fly your aircraft. In most cases it is suggested that you gather the data, plot it on a copy of the chart and when satisfied plot the final data in your manual.

NOTE

All airspeeds in this section are indicated airspeeds in knots (IAS) and assume zero instrument error. Make sure your system has been correctly calibrated and account for those errors as necessary.

Due to the Lancairs' high cruise speed, the location and quality of the static source can be critical to the systems accuracy. Most importantly indicated altitude is affected. This in turn affects calibrated airspeed, i.e. indicated airspeed corrected for errors due to both the location of the pitot and static port/s on the aircraft.

ALTIMETER CORRECTIONS

Static source errors result in **altimeter** errors **and indicated airspeed** errors. An airspeed indicator is essentially a differential pressure gauge (pitot vs static) marked with mph or knot indications. The aircraft static source is used to transmit encoded altitude and thus must be accurate when used for IFR operations.

Static source correction data should be obtained first, then the corrected altitudes flown for the airspeed system calibrated tests. Prior to calibration of the system it is best to have your altimeter (the panel gauge) calibrated. This provides a correction curve from indicated to true altitude which should be taken into account when obtaining calibrated values.

Static system calibrations are typically accomplished utilizing 1) "Tower passes", 2)A known aircraft and the "pacer" method, or 3)A "trailing cone".

Tower Pass Calibrations

"Tower passes" require numerous fly-bys, each gathering a data point at a specific flight speed and configuration. The aircraft is flown past a tower where pressure altitude in the tower, aircraft indicated altitude, aircraft distance to the tower and aircraft height above/below the tower are recorded. For example the aircraft must be flown (at least two wing spans above the ground to eliminate ground effects) along a centerline (runway or taxiway) which is a known distance from the tower. The indicated altitude of the aircraft is recorded for each level pass when the aircraft is normal (off the wing tip) to the tower and photographed from the tower using a camera (a polaroid works great). The aircraft's height above or below the tower altimeter is later determined for each data point by scaling the length of the aircraft in the picture and its distance above/below the horizon and knowing the distance from the tower camera (at the same altitude as the tower altimeter/s) to the centerline. Even the estimated distance off the centerline for each pass should be recorded to correct the tower to aircraft distance. Thus a correction of aircraft indicated altitude versus true (tower) altitude can be determined.

Extreme care should be used when flying such passes particularly the low speed and "dirty" passes. The minimum recommended fly-by speed is 80 kts, and cool smooth early morning air is best for calm air and traffic reasons. The data should be plotted and a smooth curve faired to extrapolate data to the lower speeds. A cooperative tower is required as well as a "helper" in the tower to record data and obtain the photos.

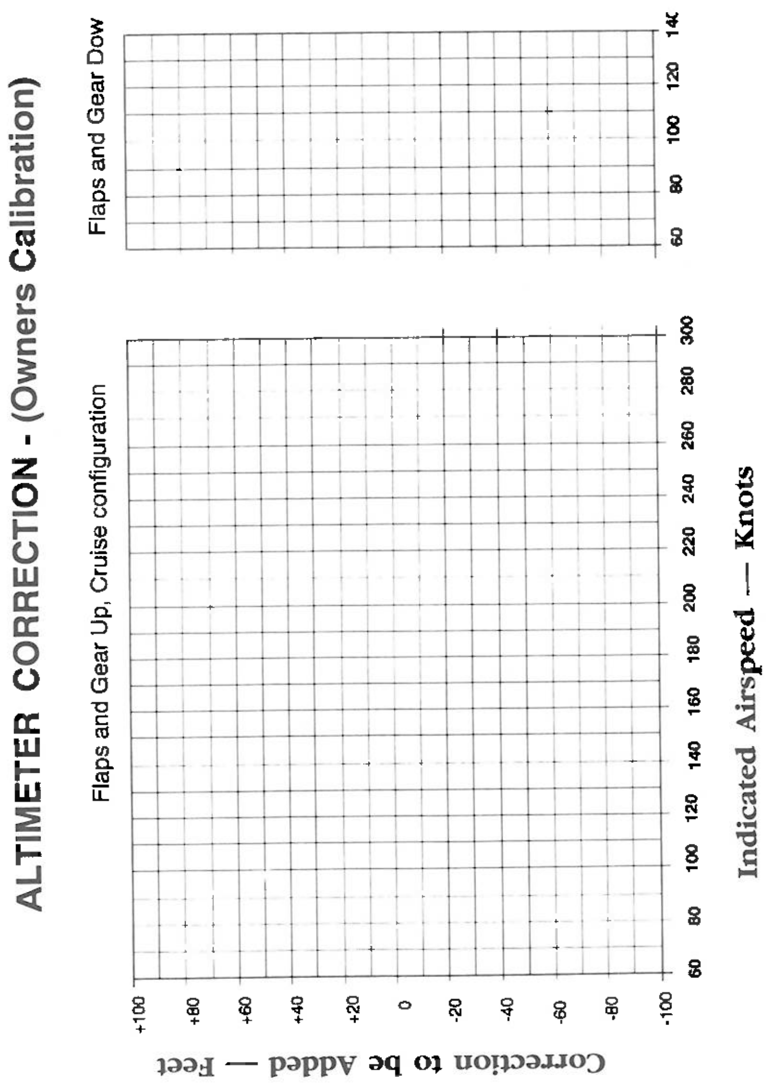
Pacer Calibrations

Pacer tests consist of flying side-by-side with another aircraft with a "known" static [generally "Wichita wagons"] recording both aircraft's speeds and altitudes at various test aircraft configurations of gear and flaps settings, and across the applicable speed range. Corrections to the test aircraft's altitude and airspeed can be determined based on the pacers **corrected** speed and altitude as shown in its Pilots Operating Handbook. Obviously both aircraft should be at the same altitude and speed for each data point and the closer the two are the more accurately any altitude differences can be detected. A minimum of four wingspans of the larger of the two planes should be maintained to eliminate the potential of one aircraft's pressure field effecting the others sensing system. Again extreme care is required as formation flying is inherently non-forgiving for inexperienced and/or non practiced pilots.

Trailing Cone Calibrations

Another method utilizing a "trailing cone" can be utilized for "solo" data gathering which will eliminate the hazards and transfer errors of a pacer calibration and the time consumed by tower passes as well as increase the measurement accuracy. These data can be gathered at several altitudes, across the full speed range, with far greater accuracy, and require no external assistance. This requires the use of a drag cone which is trailed behind the aircraft (typically from the top of the vertical fin) and at such a length that the pressure field of the aircraft has decayed. (This is on the order of 35 feet for the Lancair.) Static ports are located in the tubing forward of the cone 10 to 12 cone diameters. Since the "Cone" provides true outside pressure altitude, a differential pressure gauge between the Cone and the aircraft's system will display the error. This eliminates the error associated with the comparison of two absolute measurements but requires the use of tables of pressures versus altitudes in the range of inches of water for the altitudes flown. The result is however an extremely accurate calibration of your static source such that you will know that your corrected 8000 feet in IMC conditions is really 8000 feet, and you'll know the effects of gear and flaps on indicated altitude also. The Trailing Cone is used world wide for static source location development and certification purposes.

Once these data are gathered by whichever means, they can be plotted on the following chart and then represent the calibration for your aircraft specifically. These corrected altitudes should then be flown for all subsequent airspeed system tests.



Altimeter Correction Chart

AIRSPEED SYSTEM CALIBRATION

Airspeed pitot and static system calibrations can be obtained while flying against the pacer aircraft. Pitot systems can also be calibrated by flying between two known locations (fixes), in opposite directions carefully measuring the time and air temperature then working back from true airspeed to a calibrated value. (The altimeter system should be calibrated prior to this test.) Ideally the wind should be calm, along the flight path, and the test run at relatively low altitude to minimize the timing errors due to fix passage factors. LORAN and/ or DME can also be used effectively when the DME station slant range is minimal. A test leg from 50 to 75 miles from the station and return would be acceptable.

These calibration data can be plotted as lines (faired thru the data scatter) on the accompanying charts and tagged as to flap position (up, approach and full, typically) and gear position, or presented in tabular form for each configuration. The data should be taken from the lowest practical speed to maximum in approximately 20 kt increments. If the chart method is used, it would be prudent to plot the data, fair a smooth line thru that data, then plot the faired line data to reduce data acquisition scatter. Thus data obtained at 154 kts for example could be "corrected" and tabulated at 150 or 160 kts.

A sample chart is shown as well as a blank suitable for your use. It is suggested that you initially plot your data on the sample chart and when satisfied with that transfer it to your own blank.

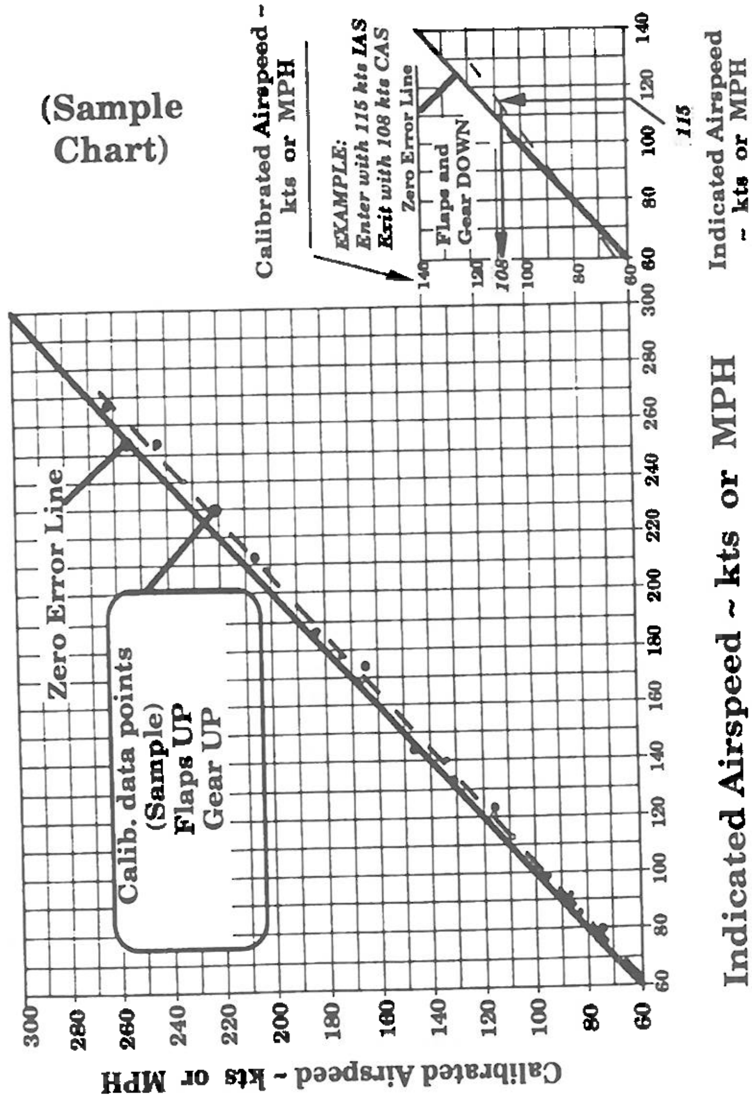
Example Data

Cruise Configuration		
For actual Kts / mph	Add	Indicated kts/mph
80	+5	85
90	+5	95
100	+4	104
110	+2	112
120	0	120
130	-1	129
etc.		etc.

Landing Configuration		
For actual Kts / mph	Add	Indicated kts/mph
70	-5	65
80	-5	75
90	-4	86
100	-2	98
110	0	110
120	+3	123
etc.		etc.

Airspeed Calibration Data Samples

Airspeed Calibration



(Sample Calibration Chart)

AIRSPEED
CALIBRATION

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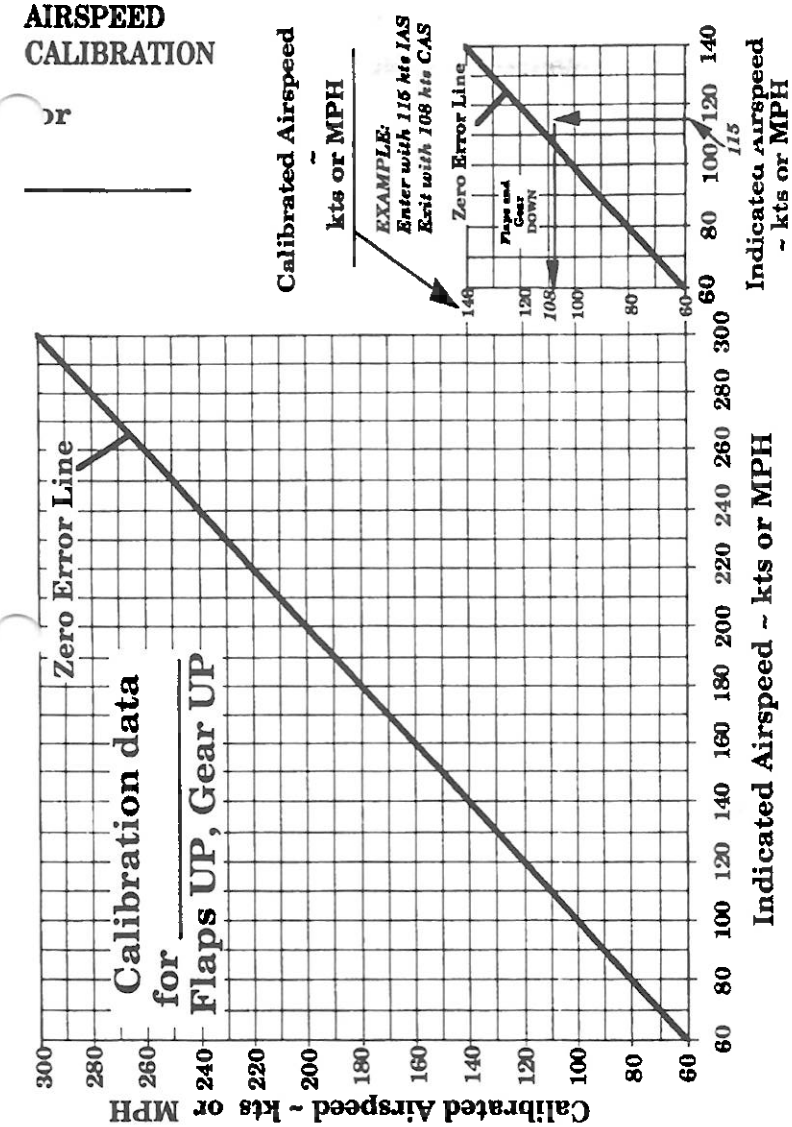


Airspeed Calibration for ______________

(U.S. Example, N 9869R)

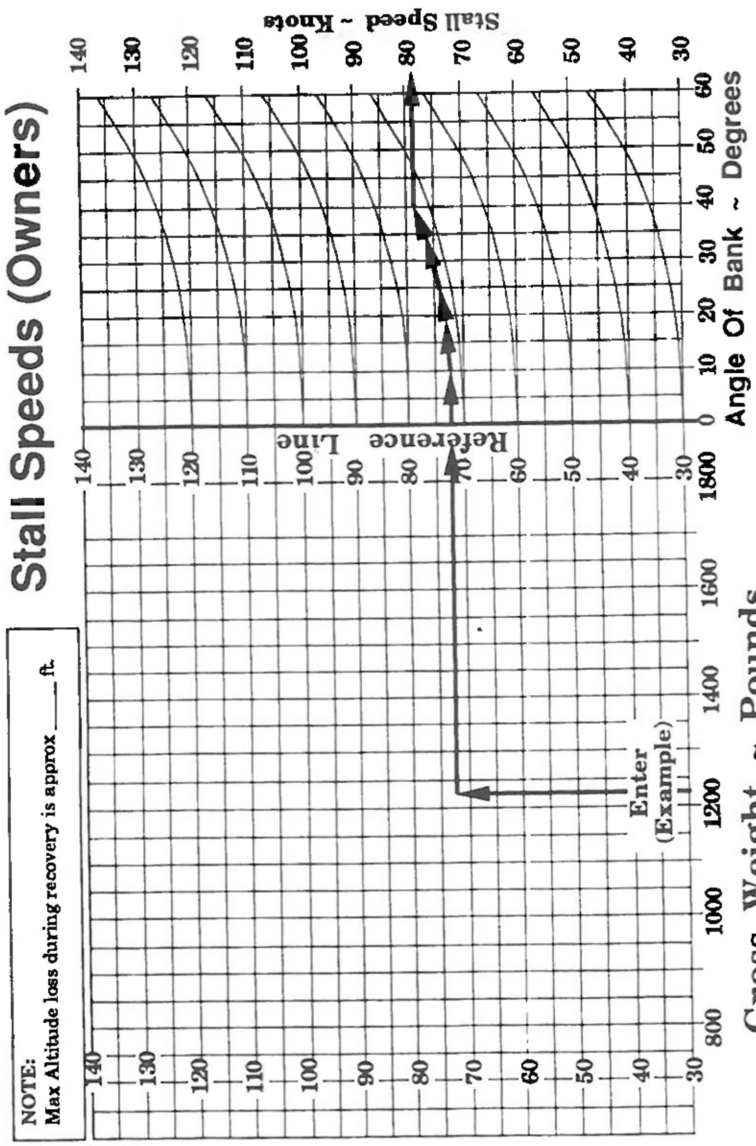
STALL SPEEDS

Aircraft stall speeds are a function of gross weight, flap position, and engine power setting for unaccelerated stalls. In addition, turning flight adds effective weight as a function of bank angle (i.e. 60° bank equals twice the effective gross weight). Stalls should be conducted from minimum to maximum weights, three flap positions, and appropriate power settings (idle and T.O.).

These tests should be conducted at altitudes such that should a spin inadvertently occur there is sufficient altitude for recovery. Three thousand feet AGL is recommended. As the aircraft is decelerated slowly, altitude should be maintained and notes made as to what speed the stall warnings are initially felt and when the aircraft fully stalls. Sufficient stalls should be conducted to define the repeatability at any one condition, and at three or four weights such that a line can be drawn thru the speed points to form a line for cruise and landing configuration.

Stalls should cover both the cruise configuration and the landing configuration with the gear and flaps in the full down position. Intermediate flaps would be the final data to obtain. **Be sure to note the altitude lost on each stall** so that the Note can be filled in on your "Stall Speeds (Owners)" chart.

Once your stall speed lines are defined, the values can be corrected for bank angle by using the chart for bank angle effects. The chart is used by entering at the gross weight, moving vertically up the chart until intersecting the appropriate line, then horizontally right to the reference line, then following the line until reaching the degree of bank desired then horizontally again to the right scale.



Stall Speed Chart for ________

TAKEOFF DISTANCES

Takeoff distances are a function of pressure altitude, gross weight, wind component and outside air temperature. Runway slope and surface type (grass, slush, etc.) can lengthen your required takeoff distance significantly, takeoff flaps reduce the number slightly. Takeoff distance is broken into two segments, ground roll and distance to clear a 50 foot obstacle. Significant differences can result from both aircraft and pilot technique so it is recommended that you fly your aircraft and determine these "numbers" specifically. If your test runway has any significant slope, obtain some data in both directions to determine the effect of that factor. The latter is best checked at heavy weights.

These data can be obtained as described below. They should be obtained after the static source, the airspeed and the stall speed tests have been accomplished. **Be sure to make any corrections to your indicated speeds when you define your "Vr" and "Vy" for these tests (65 and 75 kts CIAS respectively).**

Pick a time when airport traffic is minimal the wind is calm and a "brakes release" point. Coordinate with the "tower" personnel and obtain the necessary support personnel. Station them down the runway (with distance markers on it) such that one can pick off the lift-off point along the runway and the other estimate your distance at the 50 foot altitude. (This will take some practice to judge, and a copilot calling "Mark" based on your indicated altitude can help the ground spotter pick your "50ft" distance. Estimate your gross weight for each takeoff and make multiple runs to define the scatter. It is suggested that you plot each point on a chart to show the data scatter, then enter the data on the chart.

Associated Conditions:
T.O. Pwr - Set before brakes release
Flaps - UP, (Takeoff)
Gear - Retracted after Lift Off
Runway - Paved

Notes:
• Decrease distance 4% for each 5 Kts headwind
• Increase distance by 6% for each 2.5 Kts tailwind

Weight LBS	Takeoff Speed Knots ~ CIAS Lift off	50Ft	Pressure Altitude Ft	0°C, (32°F) Ground Roll	Clear 50 Ft
1200	65	75	SL 2000 4000 6000		
1400	65	75	SL 2000 4000 6000		
1600	65	75	SL 2000 4000 6000		

Weight LBS	Takeoff Speed Knots ~ IAS Lift off	50Ft	Pressure Altitude Ft	20°C, (68°F) Ground Roll	Clear 50 Ft
1200	65	75	SL 2000 4000 6000		
1400	65	75	SL 2000 4000 6000		
1600	65	75	SL 2000 4000 6000		

Weight LBS	Takeoff Speed Knots ~ IAS Lift off	50Ft	Pressure Altitude Ft	40°C, (104°F) Ground Roll	Clear 50 Ft
1200	65	75	SL 2000 4000 6000		
1400	65	75	SL 2000 4000 6000		
1600	65	75	SL 2000 4000 6000		

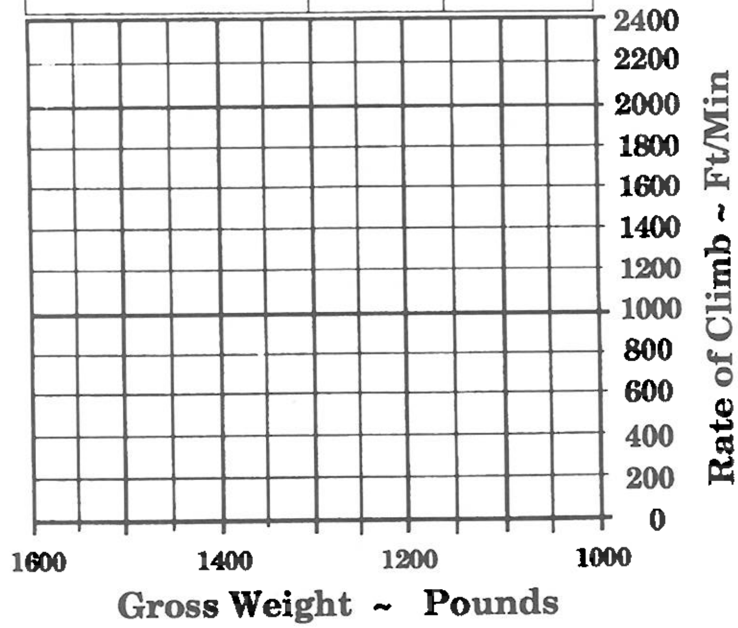
Take-off Distance Data for _______

RATE OF CLIMB

Your Rate of Climb is a function of gross weight, pressure altitude and outside air temperature. It assumes full power, (leaned at higher altitudes), climb at 125 kts IAS, with flaps and gear up. These data can be obtained during normal cross-country flights with a little preplanning to record the data. It is suggested that data of OAT, rate of climb, and gross weight be recorded whenever possible, then when sufficient data has been generated over a temperature and weight range the data can be added to the chart below.

Rate of Climb

ASSOCIATED CONDITIONS:	Gross Weight	Cruise Climb Airspeed
1. Power- Maximum throttle 2. Flaps & Gear- UP 3. Mixture- Lean to Max EGT	All	125 KTS



Rate of Climb for _______

CRUISE SPEEDS

—with the climb chart data, your actual cruise speed data can be . ɔrded during normal cross country flights. Your engine's power setting (rpm, altitude and manifold pressure) for the flight must be converted to HP for your actual cruise power setting. The engine manual for your engine model will contain such horsepower availability data. You should also find a chart such as the "Part Throttle Fuel Consumption" chart from which you can establish your fuel burn rate. The faint dotted lines (as shown on the sample, next page) may be added, faired thru your data.

OTHER CHARTS

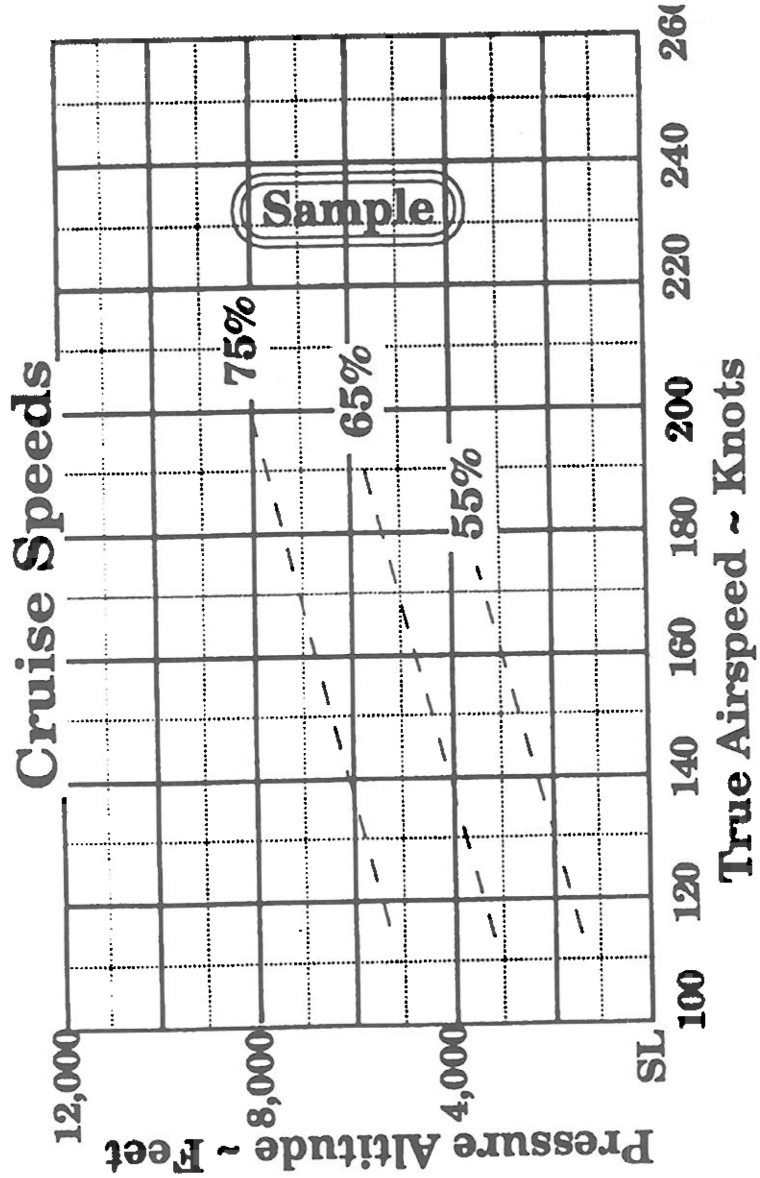
Several other charts of a general nature are included for your use. The aforementioned "Part Throttle Fuel Consumption" chart for one common engine is shown. If this is not your engine, your engine's manual will have a similar chart, and it is recommended that you include such a chart (photo reduced to fit) in your POH.

. :hart of the International Standard Atmosphere as well as a Fahrenheit to Celsius conversion chart are included for your reference and convenience.

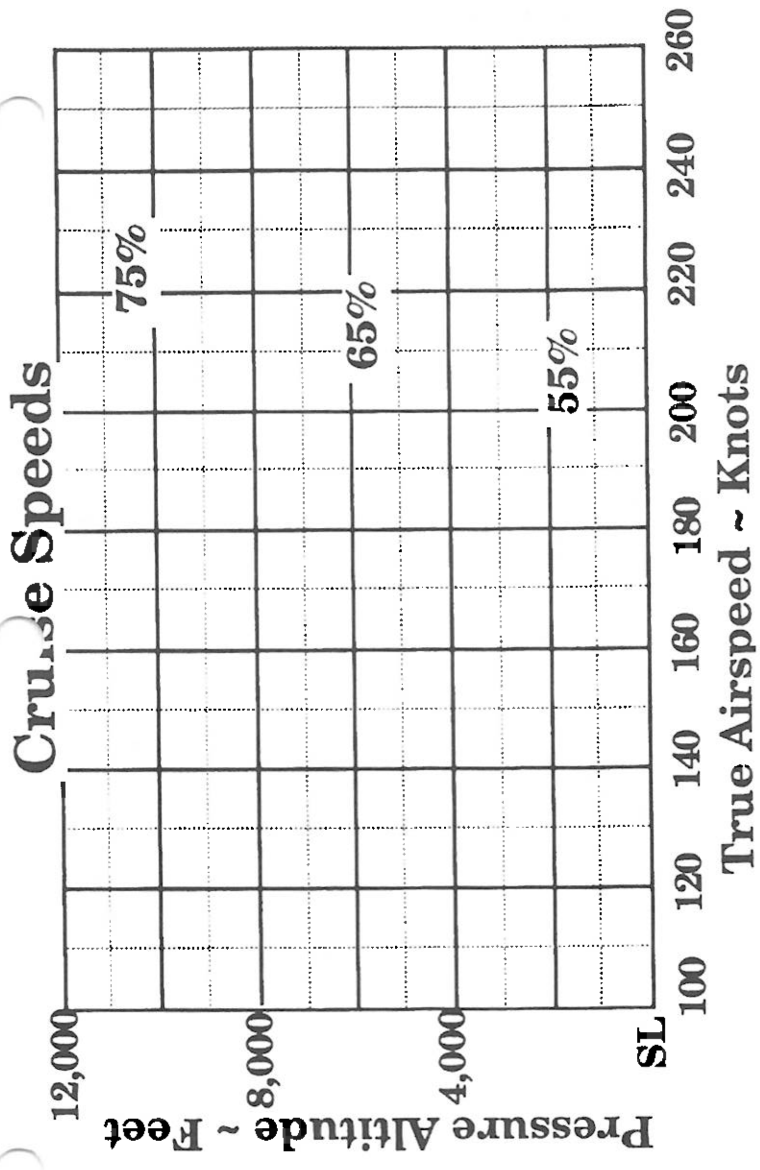
SUMMARY

While all this performance data may at first seem to be excessive, when completed as outlined, you can take pride in having truly explored the capabilities of your particular machine as well as your piloting technique. When completed you will have a truly professional document to match your outstanding Lancair aircraft.

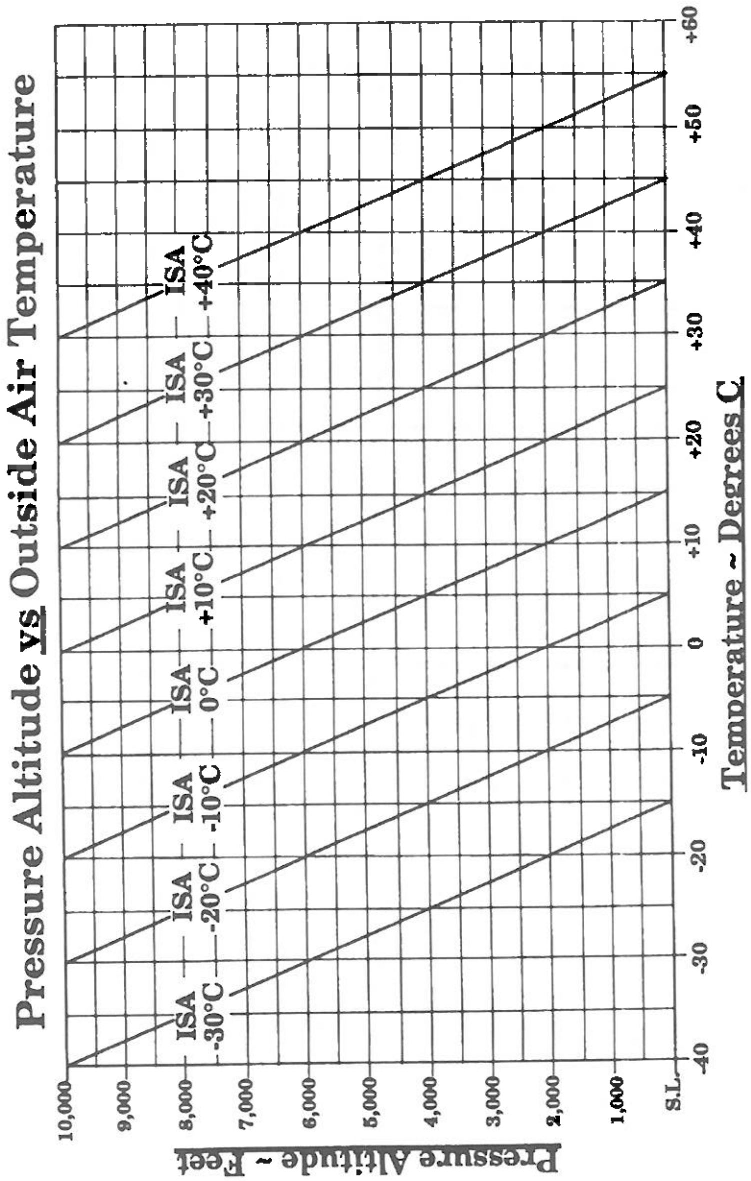
SAFE & HAPPY TESTING !



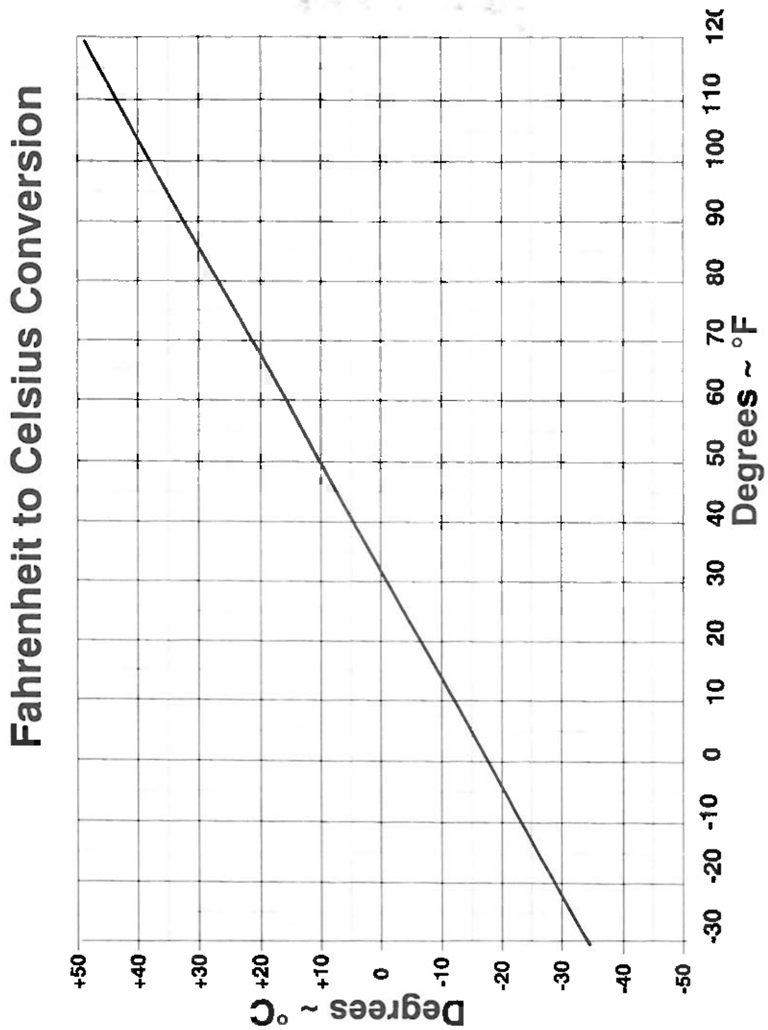
Sample Cruise Speed Data



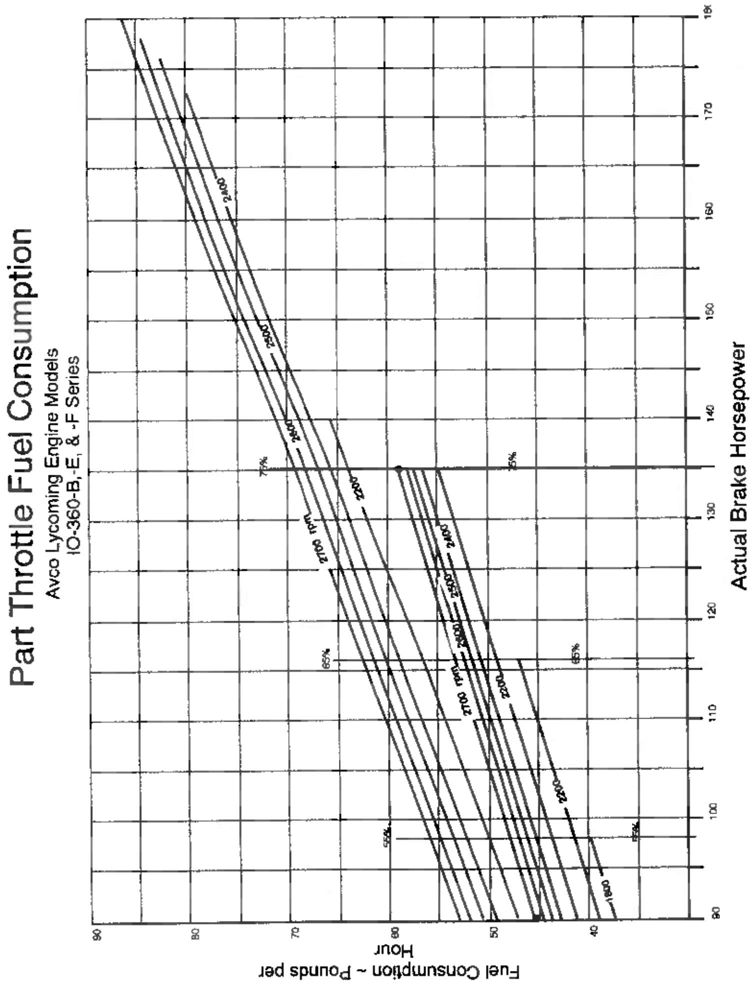
Cruise Speed Data **for** ____________



International Standard Atmosphere (ISA)



Temperature Conversions



Typical Engine Chart

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