PILOT OPERATING HANDBOOK

&

FLIGHT MANUAL

Columbia 400 / Cessna Corvalis TT
with Garmin G1000 Integrated Flight Display

by

JGX-Designs

Designed Exclusively for
X-Plane by Laminar Research

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Austin Meyer
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The Columbia 400 / Cessna Corvalis TT

The Columbia 400 is a single-engine, fixed-gear, low-wing general aviation aircraft built from composite materials.

The Columbia 400 was designed by the legendary Lance Neibauer and originally certified by the Federal Aviation Administration under FAR 23, on April 8, 2004 as the Model LC41-550FG (for *Lancair Certified, Model 41, Continental 550 engine, Fixed Gear*) and marketed under the designation Columbia 400. Columba Aircraft was located at Bend Airport in Bend, Oregon, USA.

Columbia Aircraft was purchased by Cessna in late 2007. In April 2009 Cessna announced that it would close the Bend, Oregon factory where the Cessna 400 was produced and move production to Independence, Kansas, USA. Initially sold simply as the Cessna 400, the aircraft was given the marketing name *Corvalis TT* for *twin turbocharged* by Cessna on January 14, 2009. EASA certification was added in February 2009.

The Cessna Corvalis TT is the fastest FAA-certified fixed-gear, single-engine piston aircraft in production today, reaching a speed of 235 knots true air speed at 25,000 feet. The aircraft is powered by a turbocharged Continental engine producing 310 horsepower at 2600 rpm and features a Garmin G1000 glass cockpit

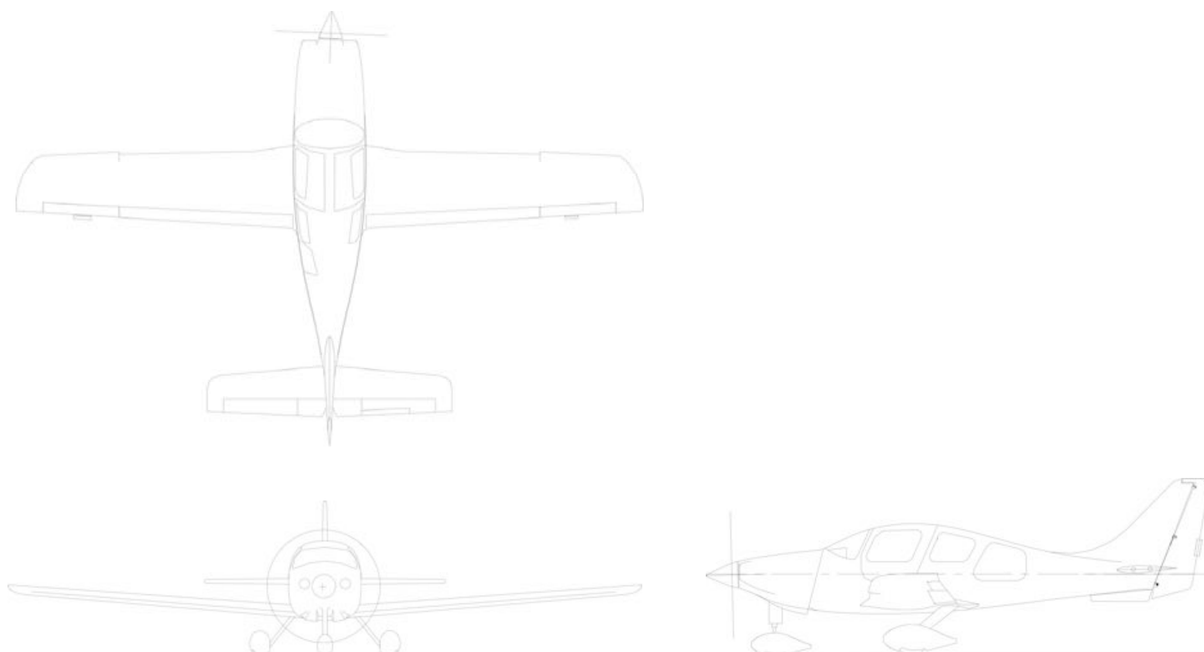
The Cessna Corvalis is certified in the Utility Category, with a positive limit maneuvering load factor of 4.4, whereas most comparable aircraft (such as the Cessna 182 and Cirrus SR22) are certified in the Normal Category with a load factor of 3.8. The Corvalis has a certified airframe maximum life of 25,200 flight hours.

THREE-VIEW DRAWING OF THE AIRPLANE

Specifications

Wing Area	141.2 Square Feet
Wing Span	35.8 Feet
Length	25.2 Feet
Empty Weight (+/-)	2500 Pounds
Gross Weight	3600 Pounds
Stall Speed	59 KIAS 60 KIAS
Maneuvering Speed	158 KIAS 182 KCAS
Cruising Speed	181 KIAS 185 KCAS
Never Exceed Speed	230 KIAS 235 KCAS
Engine	310 HP Cointinental TSIO-550-C
Propeller	78 in. Constant Speed
Governor	McCauley

*Note: Wingspan is 36 Feet +/- with position lights.



Section 1 – General

INTRODUCTION

This handbook is written in sections and covers the operations and systems of the Columbia 400/Cessna Corvalis TT with the Garmin G1000 Flight Deck. For simplicity we will refer to the aircraft as C400. We have attempted to simulate most of the systems of the C400 and G1000. However, due to limitations within X-Plane itself and the extreme complexity of the G1000, this is NOT a 100% simulation of EVERY system and feature. A separate document named C400_G1000_Features is available, which is an attempt to list the G1000 Systems, including if and how they have been implemented. Additional details of the systems and how they operate (or deviate from the G1000) are outlined within the specific chapters of this document

Section 1 of this handbook contains generalized descriptive data about the airplane including dimensions, fuel and oil capacities, and certified weights. There are also definitions and explanations of symbols, abbreviations, and commonly used terminology for this airplane.

DESCRIPTIVE DATA

ENGINE
Number of Engines: 1
Engine Manufacturer: Teledyne Continental
Engine Model Number: TISO-550-C
Engine Type: Twin-turbocharged, direct drive, air-cooled, horizontally opposed, fuel-injected, six-cylinder engine with 552 cubic inch displacement.
Takeoff Power: 310 BHP at 2600 RPM, 35.5 in of Hg
Maximum Continuous Power: 262 BHP (85%) at 2500 RPM, and 33.5 in of Hg
Maximum Climb Power: 310 BHP at 2600 RPM
Maximum Cruise Power: 262 BHP at 2550 RPM

PROPELLER
Propeller Manufacturer: Hartzell
Propeller Hub and Blade Model Number: HC-H3YF-1RF and F7693DF
Number of Blades: 3
Propeller Diameter: 77 inches (196cm) minimum, 78 inches (198 cm) maximum
Propeller Type: Constant speed and hydraulically actuated, with a low pitch setting of 16.5° +/- 0.2° and a high pitch setting of 42.0° +/- 1.0° (30 inch station)

FUEL
The following fuel grades, including the respective colors, are approved for this airplane.
100LL Grade Aviation Fuel (Blue)
100 Grade Aviation Fuel (Green)

Total Fuel Capacity - 106 Gallons US
Total Capacity Each Tank: 53 Gallons US
Total Usable Fuel: 49 Gallons US/tank, 98 Gallons US Total

OIL
Specification or Oil Grade (the first 25 engine hours) – Non-dispersant mineral oil conforming to SAE J1966 shall be used during the first 25 hours of flight operations. However, if the engine is flown less than once a week, a straight mineral oil with corrosion preventative MIL-C-6529 for the first 25 hours is recommended.

Specification or Oil Grade (after 25 engine hours) – Teledyne Continental Motors Specification MHS-24. An ashless dispersant oil shall be used after 25 hours.

Viscosity Recommended for Various Average Air Temperature Ranges
Below 40°F (4°C) – SAE 30, 10W30, 15W50, OR 20W50
ABOVE 40°F (4°C) – SAE 50, 15W50, OR 20W50

Total Oil Capacity
Sump: 8 Quarts
Total: 10 Quarts
Drain and Refill Quantity: 8 Quarts
Oil Quantity Operating Range: 6 to 8 Quarts

MAXIMUM CERTIFICATED WEIGHTS
Ramp Weight: 3600 pounds
Takeoff Weight: 3600 pounds
Landing Weight: 3420 pounds
Baggage Weight: 120 pounds

TYPICAL AIRPLANE WEIGHTS

The empty weight of a typical airplane offered with four-place seating, standard interior, avionics, accessories, and equipment has a standard empty weight of about 2500 pounds.

Maximum Useful Load: 1100 pounds

CABIN AND ENTRY DIMENSIONS

Maximum Cabin Width: 48.17 inches
Maximum Cabin Length: (Firewall to aft limit of baggage compartment): 139.6 inches
Maximum Cabin Height: 49 inches
Minimum Entry Width: 33 inches
Minimum Entry Height:: 33 inches
Maximum Entry Clearance: 46 inches

SPACE AND ENTRY DIMENSIONS OF BAGGAGE COMPARTMENT

Maximum Baggage Compartment Width: 38.5 inches
Maximum Baggage Compartment Length: 52 inches
Maximum Baggage Compartment Height: 34.5 Inches
Maximum Baggage Entry Width: 28 Inches

SPECIFIC LOADINGS

Wing Loading: 25.5 pounds/square foot
Power Loading: 11.61 pounds/square foot

ABBREVIATIONS, TERMINOLOGY, AND SYMBOLS

AIRSPEED TERMINOLOGY

CAS	*Calibrated Airspeed* means the indicated airspeed of an aircraft, corrected for position and instrument error, Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.
KCAS	Calibrated Airspeed expressed in knots.
GS	*Ground Speed* is the speed of an airplane relative to the ground
IAS	*Indicated Airspeed* is the speed of an aircraft as shown on the airspeed indicator when corrected for instrument error. IAS values published in this handbook assume zero instrument error.
KIAS	Indicated Airspeed expressed in knots.
TAS	*True Airspeed* is the speed of an airplane relative to undisturbed air, which is the CAS, corrected for altitude, temperature, and compressibility.
V_H	This term refers to the maximum speed in level flight with maximum continuous power.
V_O	*The maximum operating maneuvering speed* of the airplane. Do not apply full or abrupt control movements above this speed. If a maneuver is entered gradually at VO with maximum weight and full forward CG, the airplane will stall at limit load. However, limit load can be exceeded at VO if abrupt control movements are used or the CG is farther aft.
V_{FE}	*Maximum Flap Extended Speed* is the highest speed permissible with wing flaps in a prescribed extended position.
V_{NE}	*Never Exceed Speed* is the speed limit that may not be exceeded at any time.
V_{NO}	*Maximum Structural Cruising Speed* is the speed that must not be exceeded except in smooth air and then only with caution.
V_S	*Stalling Speed* or the maximum steady flight speed at which the airplane is controllable.
V_{SO}	*Stalling Speed* or the minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_X	*Best Angle-of-Climb Speed* is the airspeed that delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_Y	*Best Rate-of-Climb Speed* is the airspeed that delivers the greatest gain in altitude in the shortest possible time.

ENGINE POWER & CONTROLS TERMINOLOGY

BHP	*Brake Horsepower* is the power developed by the engine.
MP	*Manifold Pressure* is the pressure measured in the intake system of the engine and is depicted in inches of Hg.
MCP	*Maximum Continuous Power* is the maximum power for abnormal or emergency operations.
Maximum Cruise Power	The maximum power recommended for cruise.
MNOP	*Maximum Normal Operating Power* is the maximum power for all normal operations (except takeoff). This power, in most situations, is the same as Maximum Continuous Power,.
Mixture Control	The *Mixture Control* provides a mechanical linkage with the fuel control unit of fuel injection engines, to control the size of the fuel feed aperture, and thus, the air/fuel mixture. It is also a primary means to shut down the engine.
Propeller Control	The lever used to select a propeller speed.
Propeller Governor	The device that regulates the RPM of the engine and propeller by increasing or decreasing the propeller pitch, through a pitch change mechanism in the Propeller hub.

Section 2 – Limitations

INTRODUCTION

Section 2 contains the operating limitations and instrument markings of the airplane

The airspeed limitations below are based on the maximum gross takeoff weight of 3600 pounds. The maximum operating maneuvering speeds (V_O) and applicable weight limitations are shown in figure 2-1.

	SPEED	KCAS	KIAS	REMARKS
V_O	Max. Operating Maneuvering Speed 2600 pounds gross weight 2600 pounds gross weight @ FL250 3600 Pounds Gross Weight 3600 Pounds Gross Weight @ FL250 *Decrease 3 knots for each 1000 ft. above 12.000 feet (Press. Alt.)	138* 96 162* 123	135* 93 158* 120	Do not apply full power or abrupt control movements above this speed
V_{FE}	Maximum Flap Extended Speed (Down or 40° Flap Setting) *Decrease 2.4 knots for each 1000 ft. above 12,000 feet (Press. Alt.)	120*	117*	Do not exceed this speed with full flaps. Takeoff flaps can be extended at 130 KCAS (127 KIAS). Do not use flaps above 14,000 ft.
V_{NO}	Max. Structural Cruising Speed Max. Structural Cruising Speed @ FL250 *Decrease 3.5 knots for each 1000 ft. above 12,000 feet (Press. Alt.)	185* 140	181* 137	Do not exceed this speed except in smooth air and then only with caution
V_{NE}	Never Exceed Speed Never Exceed Speed @ Fl250 *Decrease 4.4 knots for each 1000 ft. above 12,000 feet (Press. Alt.)	235* 178	230* 174	Do not exceed this speed in any operation.

Figure 2-1

AIRSPEED INDICATOR MARKINGS

The airspeed is shown on both the PFD and backup airspeed indicator. The airspeed on the PFD is indicated with and airspeed tape and colored bands. The backup airspeed indicator has four colored arcs on the outer circumference. The meaning of each band and arc is tabulated in Figure 2-2.

MARKING	KIAS VALUE OR RANGE	SIGNIFICANCE
White Band/Arc	60 – 117*	Full Flap Operating Range - Lower limit is maximum weight stalling speed in the landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Band/Arc	73 – 181*	Normal Operating Range - Lower limit is maximum weight stalling speed with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Band/Arc	181 – 230*	Operations must be conducted with caution and only in smooth air.
Red Line	230*	Maximum speed for all operations.

Figure 2-2

POWERPLANT LIMITATIONS
Number of Engines: One (1)
Engine Manufacturer: Teledyne Continental
Engine Model Number: TSIO-550-C
Recommended Time Between Overhaul: 2000 Hours (Time in Service)
Maximum Power: 310 BHP at 2600 RPM
Maximum Manifold Pressure: 35.5 inches of Hg
Minimum Power Setting Above 18,000 ft.: 15 inches of Hg and 2200 RPM
Maximum Recommended Cruise: 262 BHP (85%)
Maximum Cylinder Head Temperature: 460˚F
Maximum Turbine Inlet Temperature: 1750˚F/1850˚F for 30 seconds

POWERPLANT FUEL AND OIL DATA
Oil Grades Recommended for Various Average Air Temperature Ranges
Below 40˚F (4˚C) – SAE 30, 10W30, 15W50, OR 20W50
ABOVE 40˚F (4˚C) – SAE 50, 15W50, OR 20W50

Oil Temperature
Maximum Allowable: 240˚F
Recommended takeoff minimum: 100˚F
Recommended flight operations: 170˚F to 220˚F

Oil Pressure
Normal Operations: 30-60 psi
Idle, minimum: 10 psi
Maximum allowable (cold oil): 100 psi

Approved Fuel Grades
100LL Grade Aviation Fuel (Blue)
100 Grade Aviation Fuel (Green)

Fuel Flow
Normal Operations": 13 to 25 GPH
Idle, minimum: 2 to 3 GPH
Maximum allowable: 38.5 GPH

Vapor Suppression
Required Usage:

- The Vapor Suppression rocker switch is required to be on above 18,000 ft.
- The Vapor Suppression rocker switch must be turned ON if TIT is rising above 1460˚F at full power with the mixture full rich (at any altitude). Vapor suppression may be turned off below 18,000 ft. if power has been reduced below 85% and engine temperatures have stabilized.

POWERPLANT INSTRUMENT MARKINGS

The following table, Figure 2-3, shows applicable color-coded ranges for the various powerplant gauges displayed on the MFD.

INSTRUMENT	RED LINE Minimum Limit	YELLOW RANGE Warning	WHITE RANGE Limited Time Operations	GREEN RANGE Normal Operating	RED LINE Limit
Tachometer	Minimum for idle 600 RPM	N/A	2500 - 2600 RPM	2000 - 2500 RPM	2600 RPM
Manifold Pressure	N/A	N/A	33.5 - 35.5 In. of Hg	15 - 33.5 In. of Hg (No Placard)	35.5 In of Hg
Oil Temperature	Minimum for Takeoff 100˚F*	220˚F - 240˚F	100˚F - 170˚F	170˚F - 220˚F	240˚F
Oil Pressure	Minimum for idle 10 psi	N/A	10 - 30 psi and 60 - 100 psi	30 - 60 psi	100 psi
Fuel Quantity	A red line at "zero" indicates the remaining two gallons in each tank cannot be used safely in flight.	N/A	N/A	N/A	N/A
Fuel Flow				10 - 25 GPH	40 GPH
Cylinder Head Temperature	N/A	100˚F - 240˚F 420˚F - 460˚F	N/A	240 - 420˚F	460˚F
Turbine Inlet Temperature	N/A	1650˚F - 1750˚F	N/A	1000˚F - 1650˚F	1750˚F (1850˚F for 30 sec. limit)*

* These temperatures or pressures are not marked on the gauge. However, it is important information that the pilot must be aware of.

Figure 2-3

PROPELLER DATA AND LIMITATIONS

Number of Propellers: 1
Propeller Manufacturer: Hartzell
Propeller Hub and Blade Model Numbers: HC-H3YF-1RF AND F7693DF

Propeller Diameters
Minimum: 77 in.
Maximum: 78 in.

Propeller Blade Angle at 30 in. Station
Low: 16.5˚ +/- 0.2˚
High: 42.0˚ +/- 1.0˚

WEIGHT LIMITS	**Utility Category**
Maximum Ramp Weight	3600 lbs.
Maximum Empty Weight:	2708 lbs.
Maximum Takeoff Weight:	3600 lbs.
Maximum Landing Weight:	3420 lbs.
Maximum Baggage Weight:*	120 lbs.

*The baggage compartment has two areas, the main area and the hat rack area. The combined weight in these areas cannot exceed 120 lbs. The main area is centered at station 166.6 with maximum weight allowance of 120 lbs. The hat rack area, which is centered at station 199.8, has a maximum weight allowance of 20 lbs. When loading baggage in the main baggage compartment, Zone A (the forward portion of the main baggage area) must always be loaded first.

MANEUVER LIMITS

Utility Category – This airplane is certified in the utility category. Only the acrobatic maneuvers shown in Figure 2-6 are approved.

APPROVED ACROBATIC MANEUVERS

MANEUVER	ENTRY SPEED
Chandelles	150 KIAS
Lazy Eights	150 KIAS
Steep Turns	150 KIAS
Stalls	Slow Deceleration*

*Ensure that maximum fuel imbalance does not exceed 10 gallons.

While there are no limitations to the performance of the acrobatic maneuvers listed in figure 2-6, it is recommended that the pilot not exceed 60° of bank since this will improve the service life of the gyros. Also, it is important to remember that the airplane accelerates quite rapidly in a nose down attitude, such as when performing a lazy eight.

SPINS

The intentional spinning of the aircraft is prohibited. Flight tests have shown that the aircraft will recover from a one turn spin in less than one additional turn after the application of recovery controls for all points in the weight and balance envelope, up to the maximum certified altitude. The recommended recovery inputs are: power idle, rudder full against the spin, elevator full forward and aileron full against the spin. If the flaps are extended, they should be retracted after the spin rotation is stopped to avoid exceeding the flap speed limit during pull out. When rotation stops, the aircraft will be in a steep nose down attitude. Airspeeds up to 160 KIAS are possible during a 3g pull out. Above 120 KIAS it may be possible to pull more than 3.7 g's in light weight conditions. Care should be taken, under such conditions, to avoid overstressing the airframe. A steady state spin may be encountered if pro-spin control inputs are held for 1-1/2 turns or more. Steady state spins entered above 20,000 feet at heavy weight and aft CG conditions will take the most turns to recover. If a steady state spin is entered, making and holding the recommended recovery inputs will produce the fastest recovery.

The intentional spinning of the aircraft is prohibited.

WARNING

If a spin is entered with the flaps extended, they should be retracted after the spin rotation is stopped to avoid exceeding the flap speed limit during recovery.

WARNING

If a steady state spin is entered, holding the recommended recovery inputs of power idle, rudder full against the spin, elevator full forward, and aileron full against the spin will produce the fastest recovery. When recovering from a steady state spin, the aircraft may exceed the typical one turn recovery time, and additional turns may be experienced until the aircraft recovers from the spin.

FLIGHT LOAD FACTOR LIMITS
Utility Category - Maximum flight load factors for all weights are:

Flaps Position	Max Load Factor
Up (Cruise Position)	+4.4g and -1.76g
Down (Landing Position)	+2.0g and -0.0g

KINDS OF OPERATION LIMITS AND PILOT REQUIREMENTS
The airplane has the necessary equipment available and is certified for daytime and nighttime VFR and IFR operations with only one pilot. The operational minimum equipment and instrumentation for the kinds of operation are detailed in Part 91 of the FARs.

ICING CONDITIONS
Flight into known icing is prohibited.

FUEL LIMITATIONS
Total Capacity: 106 Gallons
Total Capacity Each Tank: 53 Gallons
Maximum Fuel Imbalance: 10 Gallons between left and right fuel tanks
Total Usable Fuel:
Standard: 43 Gallons US/tank, 86 Gallons US
Long Range: 51 Gallons US, 102 Gallons Total

OTHER LIMITATIONS
Altitude – The maximum flight altitude is 25,000 MSL with an FAA approved oxygen installation and 14,000 MSL without oxygen installed.

Flap Limitations
Flaps may not be extended at altitudes above 14,000 fee PA.
Approved Takeoff Range: 12°
Approved Landing Range: 12° and 40°

Passenger Seating Capacity - The maximum passenger seating configuration is four persons (one pilot and three passengers).

Leading Edge Devices - All leading edge devices (stall strips, leading edge tape, flat triangular leading edge tape, and zig zag tape) must be installed and in good condition for flight.

Section 3 – Normal Procedures

INTRODUCTION

Section 3 contains checklists for normal procedures. Checklists that are usable under flight conditions are provided elsewhere in the documentation folder. The first section of Section 3 contains various checklists appropriate for normal operations.

INDICATED AIRSPEEDS FOR NORMAL OPERATION

The speeds tabulated below, Figure 3-1, provide a general overview for normal operations and are based on a maximum certificated gross weight of 3600 pounds. At weights less than maximum certificated gross weight, the indicated airspeeds are different.

Takeoff	**Flaps Setting**	**Airspeed**
Normal Climb Out	Up Position	110 KIAS
Short Field Takeoff to 50 feet	Takeoff Position	80 KIAS
Climb to Altitude	**Flaps Setting**	**Airspeed**
Normal (Best Engine Cooling)	Up Position	110 KIAS
Best Rate of Climb at Sea Level	Up Position	110 KIAS
Best Rate of Climb at 10,000 Feet	Up Position	110 KIAS
Best Angle of Climb at Sea Level	Up Position	82 KIAS
Best Angle of Climb at 10,000 Feet	Up Position	86 KIAS
Approach to Landing	**Flaps Setting**	**Airspeed**
Normal Approach	Up Position	105-110 KIAS
Normal Approach	Down Position	85-90 KIAS
Short Field Landing	Down Position	80 KIAS
Balked Landing (Go Around)	**Flaps Setting**	**Airspeed**
Apply Maximum Power	Takeoff Position	90 KIAS
Apply Maximum Power	Landing Position	82 KIAS
Maximum Recommended Turbulent Air Penetration Speed	**Flaps Setting**	**Airspeed**
3600 lbs.	Up Position	162 KIAS
2600 lbs.	Up Position	138 KIAS
Maximum Demonstrated Crosswind Velocity*	**Flaps Setting**	**Airspeed**
Takeoff	Takeoff Position	23 Knots
Landing	Landing Position	23 Knots

*The maximum demonstrated crosswind velocity assumes normal pilot technique and a wind with a fairly constant velocity and direction. The maximum demonstrated crosswind component of 23 knots is not considered limiting.

Figure 3-1

NORMAL PROCEDURES CHECKLISTS

PREFLIGHT INSPECTION

Figure 3-2 depicts the major inspection points, and the arrows show the sequence for inspecting each point.. The inspection sequence in Figure 3-2 runs in a clockwise direction, however, it does not matter in which direction the pilot performs the preflight inspection so long as it is systematic. The inspection should be initiated in the cockpit from the pilot's side of the airplane.

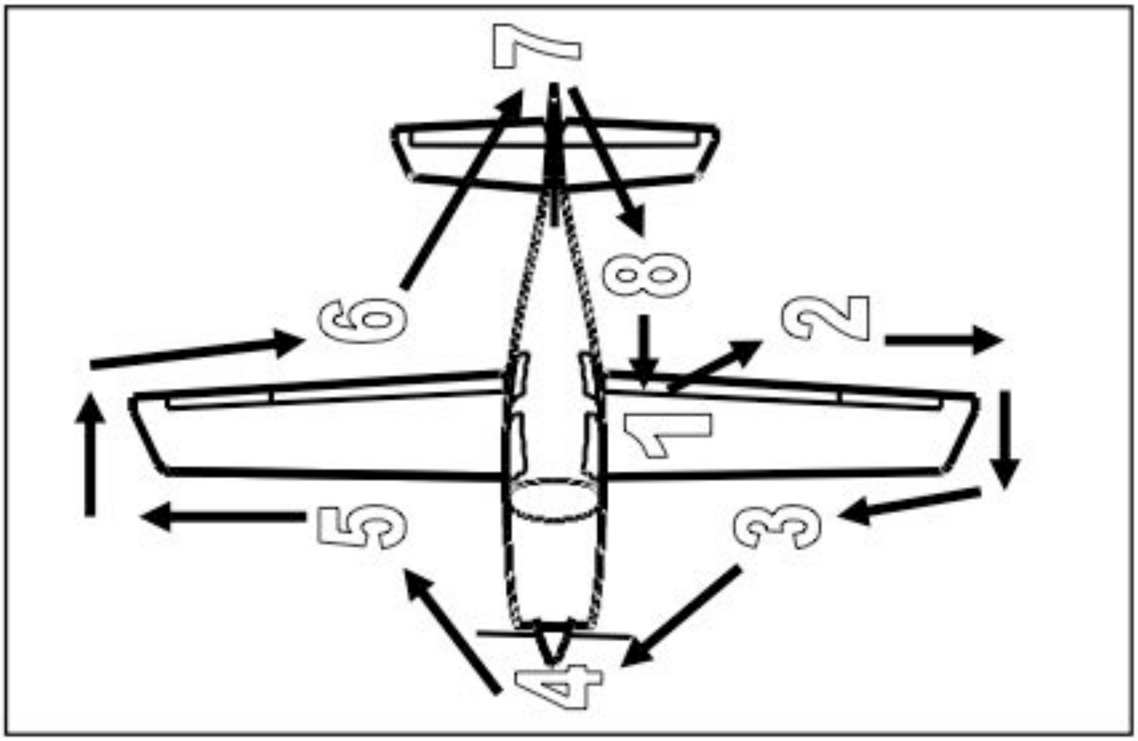


Figure 3-2

Area 1 (The Cabin)

1. Pitot Tube Cover – REMOVE AND STORE
2. Required Aircraft Documents – AVAILABLE IN THE AIRPLANE
3. Ignition Switch – OFF
4. Mixture – IDLE CUTOFF
5. Avionics Master Switch – OFF
6. Crosstie Switch – OFF
7. Left Battery Switch – ON (Press the right side of the split rocker switch.)
8. Right Batter Switch – ON (Press the right side of the split rocker switch.)
9. A/P Trim System Switch in Overhead - CHECK (ON)
10. Flaps – TAKEOFF THEN LANDING POSITION
11. Trim Tabs – Neutral

12. Fuel Quantity Indicators – CHECK FUEL QUANTITY
13. Fuel Annunciation – NOT DISPLAYED
14. Oxygen System – CHECK IF REQUIRED
    a. Avionics Switch – ON
    b. Oxygen System - ON, CHECH QUANTITY, ENSURE SYSTEM RETAINS PRESSURE, VERIFY PROPER OXYGEN FLOW AT ALL BREATHIGN DEVICES.
    c. Oxygen System – OFF
15. Pitot Heat, Propeller Heat, and Exterior Lights – ON AS REQUIRED, CHECK OPERATION (see note and warning that follows).
16. Induction Heated Air – CYCLE THEN OFF
17. Stall Warning Vane - CHECK WARNING HORN
18. Pitot Heat, Propeller Heat, Exterior Lights – OFF
19. Left and Right Battery Switches – OFF
20. Circuit Breakers – CHECK IN

NOTE

The heated pitot housing should be warm to the touch in a minute or so, and it should not be operated for more than one to two minutes when the airplane is in the static condition. For this reason the operational check must be performed out of sequence.

The pitot heat system includes a relay which will keep it from getting too hot on the ground. Full pitot heat is only available during flight.

WARNING

The pitot tube can get hot within one minute, and care must be used when touching the housing. The technique used for testing the hotness of an iron should be employed.

Area 2 (Left Wing Flap, Trailing Edge, and Wing Tip)

1. Flap – CHECK (Proper extension and security of hardware.)
2. Left Wing Tie-Down – REMOVE
3. Aileron – CHECK (Movement, condition, and security of hardware.)
4. Aileron Servo Tab – CHECK FOR PROPER OPERATION
5. Static Wicks (2) – CHECK FOR INSTALLATION AND CONDITION
6. Wing Tip – CHECK (look for damage, check for security of position and anti-collision lights.)

Area 3 (Left Wing Leading Edge, Fuel Tank, and Left Tire)

1. Leading Edge, Leading Edge Tape, Triangular Shaped Leading Edge Tape, abd Stall Strips – CHECK (Look for damage.)
2. Fuel Vent – CHECK FOR OBSTRUCTIONS
3. Landing Light – CHECK (Look for lens cracks and check security.)
4. Fuel Quantity – CHECK VISUALLY AND SECURE FILLER CAP
5. Stall Warning Vane CHECK FOR FREER MOVEMENT AND ENSURE NOT BENT
6. Wing Fuel Drain – CHECK FOR CONTAMINATION (Preceding first flight of the day or after refueling.)
7. Left Main Strut and Tire – CHECK (Remove wheel chocks, check tire for proper inflation, check gear strut for evidence of damage, bushing in place.
8. Main Fuel Drain – CHECK FOR CONTAMINATION (Preceding first flight of the day or after refueling.)
9. Gascolator Access Door and Inspection Panels – CHECK (Security of hardware.)

Area 4 (Nose Section)

1. Left Windscreen, Cowl, and Exhaust – CHECK (Condition and security of hardware.)
2. Engine Oil – CHECK LEVEL (Maintain between 6 and 8 quarts, and fill to 8 quarts for extended flights.)
3. Engine Oil Filler Cap and Accessory Door – CAP AND ACCESSORY DOOR SECURE
4. Propeller and Spinner – CHECK (Look for nicks, security, and evidence of oil leakage.)
5. Alternator Belt – CHECK (Condition and tension.)
6. Nose Wheel Strut – CHECK INFLATION (Approximately 3 to 4 inch of chrome strut must be visible.)
7. Nose Tire – CHECK (Remove wheel chocks, check for proper inflation.)
8. Right Windscreen, Cowl, Cabin Air Inlet, and Exhaust – CHECK (Condition , air inlet duct connected, no obstructions, and security of hardware.)

Area 5 (Right Wing Leading Edge, Fuel Tank, and Right Tire)

1. Wing Fuel Drain – CHECK FOR CONTAMINATION (Preceding first flight of the day or after refueling.)
2. Right Main Strut and Tire – CHECK (Remove wheel chocks, check tire for proper inflation, check gear strut for evidence of damage, bushing in place.
3. Leading Edge, Leading Edge Tape, Triangular Shaped Leading Edge Tape, abd Stall Strips – CHECK (Look for damage.)
4. Fuel Quantity – CHECK VISUALLY AND SECURE FILLER CAP
5. Fuel Vent – CHECK FOR OBSTRUCTIONS

6. Pitot Tube – CHECK FOR OBSTRUCTIONS.

Area 6 (Right Wing Tip, Trailing Edge, Wing Flap, and Right Fuselage Area)

1. Wing Tip – CHECK (Look for damage; check security of position and anti-collision lights.
2. Aileron - CHECK (Movement, condition, abd security of hardware.)
3. Aileron Trim Tab – CHECK FOR NEUTRAL POSITION.
4. Static Wicks (2) – CHECK FOR INSTALLATION AND CONDITION
5. Right Wing Tie-Down REMOVE
6. Flap - CHECK (Visually check for proper extension and security of hardware.)
7. Antennas Bottom of Fuselage – CHECK FOR SECUROTY
8. Static Port - CHECK FOR BLOCKAGE

Area 7 (Tail Section)

1. Leading Edge of Horizontal and Vertical Surfaces – CHECK (Look for damage.)
2. Leading Edge Tape and Zig Zag Tape – CHECK (Attached and in good condition.)
3. Antennas Vertical Stabilizer – CHECK FOR SECURITY
4. Rudder/Elevator Hardware - CHECK (General condition and security.)
5. Rudder Surface – CHECK (Freedom of movement.)
6. Fixed Elevator Surfaces – CHECK SECURE, CHECK CLEARANCE TO RUDDER AT FULL DEFLECTION
7. Elevator Surface – CHECK (Freedom of movement.)
8. Elevator Trim Tab – CHECK FOR NEUTRAL POSITION
9. Ventral Fin – CHECK FOR SECURITY AND LOWER EDGE DAMAGE
10. Static Wicks (5) - CHECK FOR INSTALLATION AND CONDITION
11. Tail Tie-Down – REMOVE

Area 8 (Aft Fuselage and Cabin)

1. Baggage Door – CHECK CLOSED AND LOCKED
2. Fire Extinguisher – CHECK FOR PRESENCE AND SECURITY
3. Crash Ax/Hatchet – CHECK FOR PRESENCE AND SECURITY

BEFORE STARTING ENGINE

1. Preflight Inspection – COMPLETE
2. Fresh Air Vents – CLOSED FOR ENGINE START
3. Seat Belts and Shoulder Harness – SECURE (Stow all unused seat belts.)

4. Fuel Selector – SET TO LEFT OR RIGHT TANK
5. Avionics Master Switch – OFF
6. Cross-tie Switch – VERIFY OFF
7. Brakes – TESTED AND SET
8. Circuit Breakers – CHECK IN
9. Oxygen Masks and Cannulas – CHECK (Kinks in hose, rips, or tears.)
10. Passenger Briefing Card – ADVISE PASSENGERS TO REVIEW.

CAUTION

There is a significant amount of electric current required to start the engine. For this reason, the avionics master switch must be set to the OFF position during starting to prevent possible serious damage to the avionics equipment.

STARTING COLD ENGINE

1. Mixture – RICH
2. Propeller – HIGH RPM
3. Vapor Suppression – OFF
4. Induction Heated Air – OFF
5. Throttle – CLOSED, THEN OPEN APPROXIMATELY ONE INCH
6. Left and Right Battery Switches – ON
7. Anti-Collision/Position Lights – ON AS REQUIRED
8. Primer Switch – PUSH IN (approximately 5 seconds)
9. Throttle – CLOSED, THEN OPEN 1/8 INCH TO ¼ INCH
10. Check Propeller Area – CLEAR (Ensure people/equipment are not in the propeller area.)
11. Ignition Switch – START
12. Throttle – ADJUST IDLE (900 to 1000 RPM)
13. Oil Pressure – CHECK (Ensure oil pressure gauge reads between 30 to 60 psi.)

CAUTION

If no oil pressure is noted within 30 seconds, shut down the engine and investigate the cause. Operating the engine without oil pressure may result in engine malfunction and stoppage.

STARTING HOT ENGINE

1. Mixture – IDLE CUTOFF
2. Propeller – HIGH RPM

3. Throttle – CLOSED
4. Induction Heated Air – OFF
5. Left and Right Battery Switches – ON
6. Anti-Collision/Position Lights– ON AS REQUIRED
7. Vapor Suppression – ON FOR 30 SECONDS TO 60 SECONDS, THEN OFF
8. Mixture – RICH
9. Primer Switch – PUSH IN (Approximately 3 seconds.)
10. Throttle – CLOSED, THEN OPEN APPROXIMATELY ¼ INCH
11. Check Propeller Area – CLEAR (Ensure people/equipment are not in the propeller area.)
12. Ignition Start – START

NOTE

It may be necessary to leave the vapor suppression on during starting and turn it off approximately one minute after engine start.

NOTE

If the engine is only moderately warm it may be necessary to push the primer switch for a few seconds before starting.

13. Throttle – IDLE (900 to 1000 RPM)
14. Oil Pressure – CHECK (Ensure the oil pressure gauge reads between 30 to 60 psi.)
15. Left and Right Alternator Switches – ON

AFTER ENGINE START

1. Avionics Master Switch - ON
2. Engine Indication Systems – CHECK
3. Ammeters – CHECK (Ensure alternator annunciation message is not displayed and the ammeters are indicating the left and right alternators are charging.)
4. MFD Fuel Remaining – INITIALIZE
5. Radios and Required Avionics – SET AS REQUIRED
    a. COM Radios– SET
    b. NAV Radios – SET
    c. PFD and Backup Altimeters – SET
    d. FMS Flight Plan – LOADED
    e. Altitude and Heading Bugs – SET
    f. Transponder – SET
6. Oxygen Quantity – NOTE

7. Rudder Hold – ON, VERIFY OVERRIDE BY FORCE TO PEDAL, THEN OFF

CROSSTIE OPERATION

1. Air Conditioning – OFF
2. Left Master Switch – OFF (Ensure the essential and avionics buses are energized.)
3. L BUS OFF Annunciation – DISPLAYED
4. Crosstie Switch – ON (Ensure the right ammeter is showing charge and load increase for the left and right buses.)
5. L BUS OFF Annunciation - CLEARS
6. Crosstie Switch – OFF
7. Left Master Switch – ON
8. Right Master Switch – OFF (Ensure the essential and avionics buses are energized).)
9. R BUS OFF Annunciation – DISPLAYED
10. Crosstie Switch – ON (Ensure the left ammeter is showing charge and load increase for the left and right buses.)
11. R BUS OFF Annunciation - CLEARS
12. Crosstie Switch – OFF
13. Right Master Switch – ON
14. Air Conditioning - USE AS DESIRED

SPEEDBRAKE™ GROUND OPERATIONS

1. SpeedBrake™ Switch – ON/UP POSITION
2. SPEED BRAKES Annunciation – DISPLAYED
3. SpeedBrake™ Switch – OFF/DOWN POSITION (Ensure both SpeedBrakes™ are retracted.)
4. SPEED BRAKES Annunciation – CLEARS

NOTE

The SpeedBrake™ system should be functionally checked for proper operation prior to flight. The independent electrical clutches need to be synchronized by SpeedBrake™ activation before flight and/or after SppedBrake™ circuit breaker pull. If the SpeedBrakes™ remain slightly extended, this indicates SpeedBrake™ failure and the SpeedBrake™ circuit breaker should be pulled.

AUTOPILOT AUTOTRIM OPERATION

1. Autopilot – ENGAGE

2. Control Stick – APPLY FORWARD PRESSURE (Ensure trim runs Nose Up after 3 seconds.)
3. Control Stick – APPLY AFT PRESSURE (Ensure trim runs Nose Down after 3 seconds.)
4. ELECTRIC TRIM SWITCH – MOVE UP AND DOWN, ENSURE AUTOPILOT DOSCINNECTS (Trim should operate in the commanded direction.)
5. Autopilot – ENGAGE
6. HDG Bug – SYNC
7. Autopilot – SELECT HDG MODE
8. HDG Bug – VERIFY CONTROL STICK MOVEMENT
9. Degrees Autopilot Disconnect/Trim Interrupt Switch on Control Stick – ENSURE AUTOPILOT DISCONNECTS
10. Trim – TRIM FOR TAKEOFF (Ensure all controls for freedom of motion and ensure the autopilot is disconnected.)

WARNING

If the autotrim fails any portion of the above check procedures, do not attempt to use the autopilot until after the fault is corrected.

GROUND OPERATION OF AIR CONDITIONING

1. Control Head – SELECT MODE AND TEMPERATURE DESIRED
2. Engine RPM – KEEP RPM AT OR ABOVE 1000 RPM
3. Ammeters – MONITOR BATTERIES (Decrease electrical load if discharge is displayed.)

BEFORE TAXI

1. Engine Instruments – CHECK (Within proper ranges.)
2. Fuel Gauges – CHECK PROPER INDICATION
3. Ammeters - CHARGING
4. Wing Flaps – TAKEOFF, THEN UP (Cruise position.)
5. Radio Clearance – AS REQUIRED
6. Taxi Light - AS REQUIRED
7. Brakes – RELEASE

TAXIING

1. Brakes – CHECK FOR PROPER OPERATION

2. PFD and Backup Flight instruments – CHECK FOR PROPER OPERATION
3. Turn Coordinator (PFD) – CHECK FOR PROPER OPERATION
4. Directional Gyro (PFD) – CHECK FOR PROPER OPERATION

BEFORE TAFEOFF (Runup)

1. Runup Position – MAXIMU HEADWIND COMPONENT
2. Parking Brake/Foot Brakes – SET or HOLD
3. Flight Controls – FREE AND CORRECT
4. Crosstie Switch – VERIFY OFF
5. Autopilot (A/P) Trim System in Overhead – VERIFY ON
6. Autopilot – VERIFY DISENGAGED
7. Trim Tabs – SET FOT TAKEOFF
8. PFD and Backup Flight Instruments – CROSSCHECK AND SET
9. Fuel Selector – SET OUT OF DETENT (Ensure that 2 seconds after the annunciation displays the aural warning is played.)
10. Alerts Softkey on PFD - PRESS (Ensure aural warning stops.)
11. Fuel Selector – SET TO FULLER TANK
12. Cabin Doors – CLOSED AND LATCHED (Verify that red annunciation message is not displayed.)
13. Passenger Side Door Lock – IN THE UNLOCKED POSITION
14. Engine Runup – OIL TEMPERATURE CHECK (Above 100˚F)
15. Throttle – 1700 RPM
16. Ignition Switch – L POSITION (25 RPM drop minimum, 150 RPM drop maximum, EGTs should rise.)
17. Ignition Switch – R POSITION (25 RPM drop minimum, 150 RPM drop maximum, EGTs should rise.)
18. Ignition Switch – R/L POSITION (EGTs should drop.)
19. Propeller – CHECK OPERATION (Cycle two or three times with a 300 to 500 RPM drop.)
20. Engine Instruments and Ammeter – CHECK (Within proper ranges.)
21. Batteries – VERIFY CHARGE CONDITION BEFORE TAKEOFF (At 1700 RPM, the battery charge rate should be less than 10 amps for each battery.)
22. Throttle – VERIFY IDLE, THEN 900 TO 100 RPM.
23. Illuminated Switch Bulb Test – ALL LAMPS ILLUMINATED
24. Radios – SET, CROSSCHECK NAV INDICATORS
25. Flight Director – AS REQUIRED

26. Transponder – VERIFY CODE
27. Wing Flaps – TAKEOFF POSITION
28. Rudder Hold System – Disengaged
29. SpeedBrake™ Switch – VERIFY OFF/DOWN POSITION
30. Doors – LATCHED AND DETENTED
31. PFD Annunciator Window – ALL MESSAGES ADDRESSED
32. Door Seals – ON
33. Backup Fuel Pump - ARMED
34. Oxygen System – ON
35. Mask or Cannula – DON
36. Flowmeters – CHECK AND ADJUST TO PLANNED CRUISE ALTITUDE (Ensure that the internal metering ball moves freely and oxygen is flowing to the delivery devices.)
37. Time - NOTE
38. Brakes - RELEASE

WARNING

The absence of RPM drop when checking magnetos may indicate a malfunction in the ignition circuit resulting in a hot magneto, ie., one that is not grounding properly. Should the propeller be moved by hand (as during preflight inspection) the engine might start and cause death or injury. This type of malfunction must be corrected before operating the engine.

CAUTION

Do not underestimate the importance of pre-takeoff magneto checks. When operating om single ignition, some RPM drop should always occur. Normal indications are 25 to 75 RPM and a slight engine roughness as each magneto is switched off. A drop in excess of 150 RPM may indicate a faulty magneto or fouled spark plugs.

NOTE

When checking the oxygen flowmeter, the reading is taken at the midpoint of the ball. Ensure the flowmeter is held vertically when adjusting flow rate or reading.

NORMAL TAKEOFF

1. Landing/Taxi Lights – AS REQUIRED
2. Wing Flaps – TAKEOFF POSITION
3. Mixture – FULL RICH
4. Backup Fuel Pump – ARMED
5. Pitot Heat and Propeller Heat – AS REQUIRED

6. Throttle – ADVANCE SLOWLY TO FULL POWER (2600 RPM) (Watch Manifold Pressure for indication of overboost.)
7. Elevator Control – LIFT NOSE AT 75 KIAS
8. Climb Speed – ACCELERATE TO BEST RATE OF CLIMB SPEED OF 110 KIAS
9. Wing Flaps – RETACT (At 400 feet AGL and at or above 95 KIAS.)

SHORT FIELD TAKEOFF

1. Landing/Taxi Lights – AS REQUIRED
2. Wing Flaps – TAKEOFF POSITION
3. Brakes - APPLY
4. Mixture – FULL RICH
5. Backup Fuel Pump – ARMED
6. Throttle – ADVANCE SLOWLY TO FULL POWER (2600 RPM)
7. Brakes – RELEASE
8. Elevator Control – MAINTAIN LEVEL NOSE ATTITUDE
9. Rotate Speed – 64 to 75 KIAS (Speed per Figure 5-11, 5° nose up pitch attitude.)
10. Climb Speed – 74 to 84 KIAS (Speed per Figure 5-11. Until clear of obstacles.)
11. Wing Flaps – RETRACT (At 400 feet AGL and at or above 95 KIAS.)

NOTE

If usable runway length is adequate, it is preferable to use a rolling start to begin the takeoff roll as opposed to a standing start at full power. Otherwise, position the airplane to use all of the runway available.

CROSSWIND OPERATIONS

Crosswind takeoffs and landings require a special technique but not specific procedures and, as such, do not require a dedicated checklist.

NOTE

If the cross control method is used during a crosswind approach, the resulting sideslip causes the airspeed to read up to 5knots higher or lower, depending on the direction of the sideslip.

NORMAL CLIMB

1. Airspeed - ACCELERATE TO BEST RATE OF CLIMB SPEED OF 110 KIAS
2. Power Settings – ADJUST AS NECESSARY
3. Fuel Selector – SET TO RIGHT OR LEFT TANK (As appropriate.)
4. Mixture – FULL RICH ABOVE 85% POWER

5. Backup Fuel Pump – ARMED
6. Vapor Suppression – ON (Above 18,000 ft.)
7. Rudder Hold System – SET RUDDER TO DESIRED POSITION AND ENGAGE RUDDER HOLD SYSTEM
8. Landing/Taxi Lights – AS REQUIRED

MAXIMUM PERFORMANCE CLIMB

1. Airspeed – 110 KIAS (All altitudes)
2. Power Settings – 2600 RPM AND FULL THROTTLE
3. Fuel Selector – SET TO RIGHT OR LEFT TANK (As appropriate.)
4. Mixture – FULL RICH
5. Backup Fuel Pump – ARMED
6. Vapor Suppression – ON (Above 18,000 ft.)
7. Rudder Hold System – SET RUDDER TO DESIRED POSITION AND ENGAGE RUDDER HOLD SYSTEM

CRUISE

1. Rudder Hold System – AS REQUIRED
2. Throttle – SET AS APPROPRIATE TO ACHIEVE 85% POWER OR LESS
3. Propeller – SET AS APPROPRIATE TO ACHIEVE 85 % POWER OR LESS
4. Mixture – LEAN AS REQUIRED
5. Backup Fuel Pump – OFF
6. Changing Fuel Tanks – PERFORM STEPS 6a and 6b
    a. Vapor Suppression – SET TO ON DURING FUEL TANK CHANGEOVERS
    b. Fuel Selector – CHANGE AS REQUIRED (The maximum permitted fuel imbalance is 10 gallons)
7. Landing/Taxi Lights – AS REQUIRED
8. Oxygen Quantity – CHECK PERIODICALLY (Approximately every 20 minutes)
9. Oxygen Outlet Pressure – CHECK PERIODICALLY (Approximately every 20 minutes)
10. Flowmeter or Flow Indicator – CHECK PERIODICALLY FOR OXYGEN FLOW (Approximately every 10 minutes)
11. Altitude Change – ADJUST FLOW DEVICES TO NEW ALTITUDE
12. Physiological Requirement – ADJUST FLOW DEVICE TO HIGHER ALTITUDE

NOTE

Do not pull the throttle back to idle without leaning the mixture appropriately above 18,000 ft. (Critical altitude, the engine does not produce full manifold pressure above the critical altitude). The reduced air density is causing an over-rich condition at idle, which floods the engine and can make it quit. If it does quit, it is possible to restart the engine at any altitude by leaning the mixture. Above 18,000 ft. the minimum manifold pressure is 15 in. Hg; minimum RPM is 2,200.

NOTE

The vapor suppression must be turned on before changing the selected tank. After proper engine operations are established, the pump is turned off (except above 18,000 ft. when the pump stays on.)

When changing power, the sequence control usage is important. Monitor the TIT gauge to avoid exceeding 1750°F limit. To increase power, first increase the mixture (not necessarily to full rich), then increase RPM with the propeller control and then increase manifold pressure with the throttle control. To decrease power, decrease manifold pressure first with the throttle control and then decrease RPM with the propeller control. When engine temperatures have stabilized, lean mixture to desired TIT.

WARNING

Continuous overboost operation may damage the engine and require engine inspection.

DESCENT

1. Fuel Selector – RIGHT OR LEFT TANK (As appropriate.)
2. Power Settings – AS REQUIRED
3. Mixture – AS REQUIRED
4. Backup Fuel Pump – OFF
5. Vapor Suppression – OFF (Below 18,000 ft.)
6. PFD and Backup Altimeters – SET
7. Altitude Bug – SET
8. Landing/Taxi Lights – AS REQUIRED

EXPEDITED DESCENT

1. Power Setting – 2400 RPM and approximately 25 INCHES OF MANIFOLD PRESSURE
2. SpeedBrake™ Switch – ON/UP POSITION

3. Airspeed – 165 KIAS
4. SpeedBrake™ Switch – OFF/DOWN POSITION (To retract SpeedBrakes™)

APPROACH

1. Approach – LOADED INTO FLIGHTPLAN
2. PFD BaroMin – Set
3. GPS Raim/Map Integrity - VERIFY
4. PFD OBS/SUSP Softkey – REVIEW and BRIEF USAGE DURING APPROACH
5. PFD CDI Button – SELECT NAV SOURCE
6. Nav Aids – TUNED AND IDENTIFIED
7. Approach Course – SET
8. PFD and Backup Altimeters – SET
9. Mixture – FULL RICH

NOTE

Passing FAF, new course may be needed.

BEFGORE LANDING

1. Seat Belts and Shoulder Harnesses – SECURE (Both pilot and passengers)
2. Mixture – FULL RICH
3. Fuel Selector – RIGHT OR LEFT TANK (As appropriate.)
4. Backup Fuel Pump – OFF
5. Propeller – HIGH RPM
6. Rudder Hold System – DISENGAGED
7. Autopilot – DISENGAGED (If applicable)

NORMAL LANDING

1. Approach Airspeed – AS REQUIRED FOR CONFIGURATION
   a. Flaps (Cruise Position) 95 to 100 KIAS
   b. Flaps (Takeoff Position 90 to 95 KIAS
   c. Flaps (Landing Position) 85 to 90 KIAS
2. Trim Tabs – ADJUST AS REQUIRED
3. Touchdown – MAIN WHEELS FIRST
4. Landing Roll – GENTLY LOWER NOSE WHEEL
5. Braking – AS REQUIRED

SHORT FIELD LANDING (Complete "BEFORE LANDING" Checklist first.)

1. Wing Flaps – LANDING POSITION
2. Initial Approach Airspeed – 90 KIAS
3. Minimum Approach Speed – 73 to 82 KIAS
4. Trim Tabs – ADJUST AS REQUIRED
5. Power – REDUCE AT THE FLARE POINT
6. Touchdown – MAIN WHEELS FIRST
7. Landing Roll – LOWER NOSE WHEEL SMOOTHLY AND QUICKLY
8. Braking and Flaps – APPLY HEAVY BRAKING AND RETRACT FLAPS (Up position.)

BALKED LANDING (Go Around)

1. Throttle – FULL (At 2600 RPM.)
2. SpeedBrakes™ Switch – OFF/DOWN POSITION
3. Wing Flaps – TAKEOFF POSITION
4. Airspeed – 82 KIAS
5. Climb – POSITIVE (Establish Positive Rate of Climb.)
6. Backup Fuel Pump – ARM.
7. Wing Flaps – RETRACT (At 400 feet AGL and at or above 95 KIAS.)

AFTER LANDING

1. Wing Flaps – UP (Cruise Position.)
2. SpeedBrakes™ Switch – OFF/DOWN POSITION
3. Door Seal, Pitot Heat, and Propeller Heat – OFF
4. Transponder – VERIFY STANDBY/GROUND MODE
5. Landing/Taxi Lights – AS REQUIRED
6. Time – Note

SHUTDOWN

1. Parking Brake – SET
2. Throttle – IDLE (900 RPM)
3. Oxygen System – OFF
4. ELT – CHECK NOT ACTIVATED
5. Trim Tabs – SET TO NEUTRAL
6. Time – COOLDOWN COMPLETE
7. Avionics Master Switch – OFF (Ensure shutdown.)

8. Electrical/Environmental Equipment – OFF
9. Mixture – IDLE CUTOFF
10. Left and Right Master Switches – OFF
11. Ignition Switch – OFF (After engine stops.)
12. Anti-Collision/Position Lights – OFF

CAUTION

Allow the engine to idle at 900 RPM for 5 minutes before shutdown in order to cool the turbochargers. Taxi time can be counted as cooling time.

AMPLIFIED PROCEDURES

Normal Takeoff – In all takeoff situations, the primary consideration is to ascertain that the engine is developing full takeoff power. This is normally checked in the initial phase of the takeoff run. The engine should operate smoothly and provide normal acceleration. The engine RPM should read 2600 RPM and the manifold pressure should be near anticipated output. Ensure that the engine is not over-boosting (manifold pressure is at or below 35.5 in. of Hg).

Avoid the tendency to ride the breaks by making light steering corrections as required and then allowing the feet to slide off the brakes and the heels to touch the floor. For normal takeoffs (not short field) on surfaces with loose gravel and the like, the rate of throttle advancement should be slightly less than normal. While this extends the length of the takeoff run somewhat, the technique permits the airplane to obtain momentum at lower ROM settings, which reduces the potential for propeller damage. Using this technique ensures that the propeller blows loose gravel and rocks aft of the propeller blade. Rapid throttle advancement is more likely to draw gravel and rocks into the propeller blade.

Short Field Takeoff – The three major items of importance in a short field takeoff are developing takeoff power, maximum acceleration, and utilization of the entire runway available. Be sure the mixture is properly set for takeoff if operating from a high altitude airport. During the takeoff run, do not raise the nose wheel too soon since this will impede acceleration. Finally, use the entire runway that is available; that is, initiate the takeoff run at the furthest downwind point available. Use a rolling start if possible, provided there is adequate usable runway. If a rolling start is practicable, any necessary mixture adjustment should be made just before initiating the takeoff run.

The flaps are set to the takeoff position. After liftoff, maintain the speed per Figure 4-11 until the airplane is clear of all obstacles. Once past all obstacles, accelerate to the best rate of climb speed (110 KIAS), and raise the flaps. If no obstacles are present, accelerate the airplane to the best rate of climb speed, and raise the flaps when at a safe height above the ground.

Crosswind Takeoff – Crosswind takeoffs should be made with takeoff flaps. When the take off run is initiated, the aileron is fully deflected into the wind. As the airplane accelerates and control response becomes more positive, the aileron deflection should be reduced as necessary. Accelerate the airplane to approximately 75 knots, and then quickly lift the airplane off the ground. When airborne, turn the airplane into the wind as required to maintain alignment over the runway and in the climb out corridor. Maintain the best angle of climb speed (82 to 86 KIAS) until the airplane is clear of all obstacles. Once past all obstacles, accelerate to the best rate of climb speed (110 KIAS); at or above 400 feet AGL, raise the flaps. The maximum demonstrated crosswind component for takeoff is 23 knots.

Best Rate of Climb Speeds – The normal climb speed of the airplane, 110 KIAS, produces the most altitude gain in a given time period while allowing for proper engine cooling and good forward visibility. The best rate of climb airspeed is used in situations which require the most altitude gain in a given time period, such as after takeoff when an initial 2,000 feet or so height above the ground is desirable as a safety buffer. In another situation, ATC might require the fastest altitude change possible. The mixture should always be full rich in climbs.

Cruise Climb – Climbing at speeds above 115 KIAS is preferable, particularly when climbing to higher altitudes, ie., those that require more than 6,000 feet of altitude change. A 500 FPM rate of climb at cruise power provides better forward visibility and engine cooling. The engine should not be leaned during climb.

Best Angle of Climb Speeds – The best angle of climb speed (Vx) for the airplane is 82 KIAS at sea level to 86 KIAS at 10,000 feet, with flaps in the up position. The best angle of climb airspeed produces the maximum altitude change in a given distance and is used in a situation where clearance of obstructions is required. When using the best angle of climb airspeed, the rate at which the airplane approaches an obstruction is reduced, which allows more space in which to climb. For example, if a pilot is approaching the end of a canyon and must gain altitude, the appropriate Vx speed should be used. Variations in the Vx speeds from sea level to 10,000 feet are more or less linear, assuming ISA conditions.

Power Setings – Use maximum continuous power until the airplane reaches a safe altitude above the ground. Ensure the propeller RPM does not exceed the red line limitation. It is recommended to use full throttle and 2600 RPM in climb because this setting provides the engine with extra fuel for cooling at the slower airspeeds. When changing power, the sequence control usage is important. To decrease power, decrease manifold pressure first with the throttle control and then decrease RPM with the propeller control. The engine's turbochargers keep manifold pressure constant from MSL to approximately 18,000 feet.

NOTE

During normal climb operations above 18,000 FEET, a minimum engine condition of 2,200 RPM and 15 in. Hg of manifold pressure are required to insure proper turbocharger operation is maintained. If engine operation below 15 in. Hg of manifold pressure is necessary, the fuel mixture must be properly leaned or engine stoppage will result.

Vapor Suppression – The vapor suppression switch must be turned on in the following situations:

- Operation above 18,000 feet.
- If TIT is rising above 1460˚F at full power with the mixture full rich (at any altitude).

Once engine temperatures have stabilized and if the aircraft is below 18,000 feet, the vapor suppression switch may be turned off.

The vapor suppression switch should also be turned on any time the engine is not running smooth or it is suspected there is vapor in the lines. Vapor in the line is most likely to happen in hot weather or high altitudes.

NORMAL OPERATIONS ABOVE 18,000 FEET

During normal climb, cruise and descent operations above 18,000 feet, a minimum engine condition of 2200 RPM and 15 in. Hg of manifold pressure are required to insure proper turbocharger operation is maintained. If engine operation below 15 in. Hg of manifold pressure is necessary, the fuel mixture must be properly leaned or engine stoppage will result.

CRUISE

Flight Planning – Several considerations are necessary in selecting a cruise airspeed, power setting, and altitude. The primary issued are time, range, and fuel consumption. High cruise speeds shorten the time en route, but at the expense of decreased range and increased fuel consumption.

Cruising at higher altitudes increases airspeed and improves fuel consumption, but the time and fuel used to reach the higher altitude must be considered. Clearly, numerous factors are weighted to determine what altitude, airspeed, and power settings are optimal for a particular flight.

In general, the airplane cruises at 50% to 75% of available power. The maximum recommended cruise power setting is 85%. The minimum cruise power setting is 40%, but higher power settings may be required in colder weather to maintain minimum engine temperatures.

Mixture Settings – In cruise flight and cruise climb, care is needed to ensure that engine instrument indications are maintained within normal operating ranges. After reaching the desired altitude and engine temperatures stabilize (usually within five minutes), the mixture must be adjusted. The engine driven fuel pump references deck pressure and adjusts mixture automatically for deck pressure and altitude effects. The pilot is responsible to lean the mixture in cruise for lower fuel flow.

Control by Turbine Inlet Temperature (TIT) – When leaning the mixture using TIT, the pilot should use the TIT gauge on the MFD. At power settings below 85%, starting at full rich mixture, lean slowly while observing the TIT. When changing the mixture to lean of peak, it is acceptable to have TIT indications temporarily in the yellow range, but indications must return to the normal range upon leaning completion. Best power is obtained at 1625˚F. Above 65% power, the engine must be operated rich of peak to avoid exceeding the TIT limit. Below 65% power the engine can be leaned past peak and be operated 50˚F lean of peak TIT. Lean of peak operation improves the efficiency of the airplane and provides about 30˚F lower CHT at the same RPM/MAP combination. Fuel flow can be used as a reference to judge the resulting power setting, but should not be used for leaning.

DESCENT

The primary consideration during the descent phase of the flight is to maintain the engine temperatures within normal indications.   The descent from altitude is best performed through gradual power reductions and gradual enrichment of the mixture. Avoid long descents at low manifold pressure as the engine can cool excessively and may mot accelerate properly when power is reapplied. If long, rapid descents are made, the speed brakes should be deployed rather than reducing power significantly.

The fuel pump switch should only be in the "armed" position for takeoff and climb. It should be off for descent and landing; during very low power operation and improper fuel system setup it may be possible that the fuel pressure will drop below the 5.5 psi limit at which time the fuel pump will come on. If this happens, the engine will flood and quit.

If power must be reduced for long periods, set the propeller to the minimum low RPM setting, and adjust manifold pressure as required to maintain the desired descent. If the outside air temperature is extremely cold, it may be necessary to add drag to the airplane by lowering the flaps so that additional power is needed to maintain the descent airspeed. Do not permit the cylinder head temperature to drop below 240˚F for more than five minutes.

APPROACH

On the downwind leg, adjust power to maintain 110 KIAS to 120 KIAS with the flaps retracted. When opposite the landing point, reduce power, set the flaps to the takeoff position, and reduce speed to about 90 KIAS. On the base leg, set flaps to the landing position, and reduce speed to 85 to 90 KIAS. Be prepared to counteract the ballooning tendency which occurs when full flaps are applied. On final approach, maintain airspeed of 80 to 85 KIAS depending on crosswind condition and/or landing weight. Reduce the indicated airspeed to 80 knots as the touchdown point is approached.

Glideslope Flight Procedure with Autopilot

Approach the glideslope intercept point (usually the OM) with the flaps set to the takeoff position at 100 to 115 KIAS (recommended approach speed in turbulence is 110 KIAS or greater) and with the aircraft stabilized in altitude hold mode. At the glideslope intercept, adjust power for the desired airspeed. For best tracking results make power adjustments in small, smooth increments to maintain desired airspeed, At 200 feet AGL disconnect the autopilot and continue to manually fly the aircraft to the missed approach point or the decision height. If a missed approach is required, the autopilot may be re-engaged after the aircraft has been reconfigured for and established in a stabilized climb above 400 feet AGL.

When making ILS approaches, the pilot should plant to intercept the approach between 100 to 115 knots. Once established and the glideslope intercept is achieved, the flaps should be placed in the takeoff position and the aircraft slowed to 100 knots. At the FAF (final approach fix), full flaps should be applied and the aircraft slowed to 90 knots. This technique will typically require a power setting in excess of 1900 RPM. Power settings resulting in approximately 1800-1850 RPM should be avoided as this propeller speed may intermodulate with the g;ideslope reception resulting in continuous minor control stick motion during coupled approaches and continuous minor glideslope deviation indications during coupled and non-coupled, or hand-flown, ILS approaches.

LANDINGS

Normal Landings – Landings under normal conditions are performed with the flaps set to the landing position. The landing approach speed is 85 to 90 KIAS depending on gross weight and wind conditions. The approach can be made with or without power; however, power should be reduced to idle before touchdown. The use of forward and sideslips are permitted if required to dissipate excess altitude. Remember that the slipping maneuver will increase the stall speed of the airplane, and a margin for safety should be added to the approach speed.

The landing attitude is slightly nose up so that the main gear touches the ground first. After touchdown, the back-pressure on the elevator should be released slowly so the nose gear gently touches the ground. Brakes should be applied gently and evenly to both pedals. Avoid skidding the tires or holding back pressure for sustained periods.

Short Field Landings – In a short field landing, the important issues are to land just past the beginning of the runway at minimum speed. The initial approach should be made at 86 to 90 KIAS and reduced to 80 KIAS when full flaps are applied. A low-power descent, from a slightly longer than normal final approach, is preferred. It provides more time to set up and establish the proper descent path. If there is an obstacle, cross over it at the speed indicated in the landing schedule in Figure XX. Maintain a power on approach until just prior to touochdown. Do not extend the landing flare; rather, allow the airplane to land in a slight nose up attitude on the main landing gear first. Lower the nose wheel smoothly and quickly, and apply heavy braking. However, do not skid the tires. Braking response is improved if the flaps are retracted after touchdown.

Crosswind Landings – When landing in a strong crosswind, use slightly higher than normal approach speed, and avoid the use of landing flaps unless required because of runway length. If practicable, use and 85 to 90 KIAS approach speed with the flaps in the takeoff position. A power descent, from a slightly longer than normal final approach, is preferred. It provides more time to set up and establish the proper crosswind compensation. Maintain runway alignment wither with a crab into the wind, a gentle forward flip (upwind wing down), or a combination of both. Touch down on the upwind main gear first by holding aileron into the wind. As the airplane decelerates, increase the aileron deflection. Apply braking as required. Raising the flaps after landing will reduce the lateral movement cause by the wind and also improves braking. The maximum demonstrated crosswind component for landing is 23 knots.

Sideslipping the airplane will cause the airspeed to read up to 5 knots higher or lower, depending on the direction of the sideslip. This occurs because the static air source for the airplane is only on one side of the fuselage.

Balked Landings – In a balked landing or a go-around, the primary concerns are to maximize power, minimize drag, and establish a climb. Initiate a go-around by the immediate but smooth full application of power. If the flaps are in the landing position, reduce then to the takeoff position once a positive rate of climb is established at 80 KIAS. Increase speed to Vy. When the airplane is a safe distance above the surface and at 106 KIAS or higher, arm the backup fuel pump and retract the flaps to the up position.

Section 4 - Performance

INTRODUCTION

The performance charts and graphs on the following pages are designed to assist the pilot in determining specific performance characteristics in all phases of flight operation. These phases include takeoff, climb, cruise, descent, and landing. The data in these charts were determined through actual flight tests of the airplane. At the time of the tests, the airplane and engine were in good condition and normal piloting skills were employed.

There may be slight variations between actual results and those specified in the tables and graphs. The condition of the airplane, as well as runway condition, air turbulence, and pilot techniques, will influence actual results. Fuel consumption assumes proper leaning of the mixture and control of the power settings. The combined effect of these variables may produce differences as great as 10%. The pilot must apply an appropriate margin of safety in terms of estimated fuel consumption and other performance aspects, such as takeoff and landing Fuel endurance data include a 45-minute reserve at the specified cruise power setting. When it is appropriate, the use of a table or graph is explained or an example is shown on the graph.

When using the tables that follow, some interpolation may be required. If circumstances do not permit interpolation, then use tabulations that are more conservative. The climb and descent charts are based on sea level, and some subtraction is required for altitudes above sea level.

AIRSPEED CALIBRATION

KIAS	ERROR	KCAS
Less than 70	+1	Less than 71
71 to 112+2	+2	73 to 114
113 to 154	+3	116 to 157
155 to 200	+4	159 to 204
Greater than 200	+5	Greater than 205

Figure 4-1

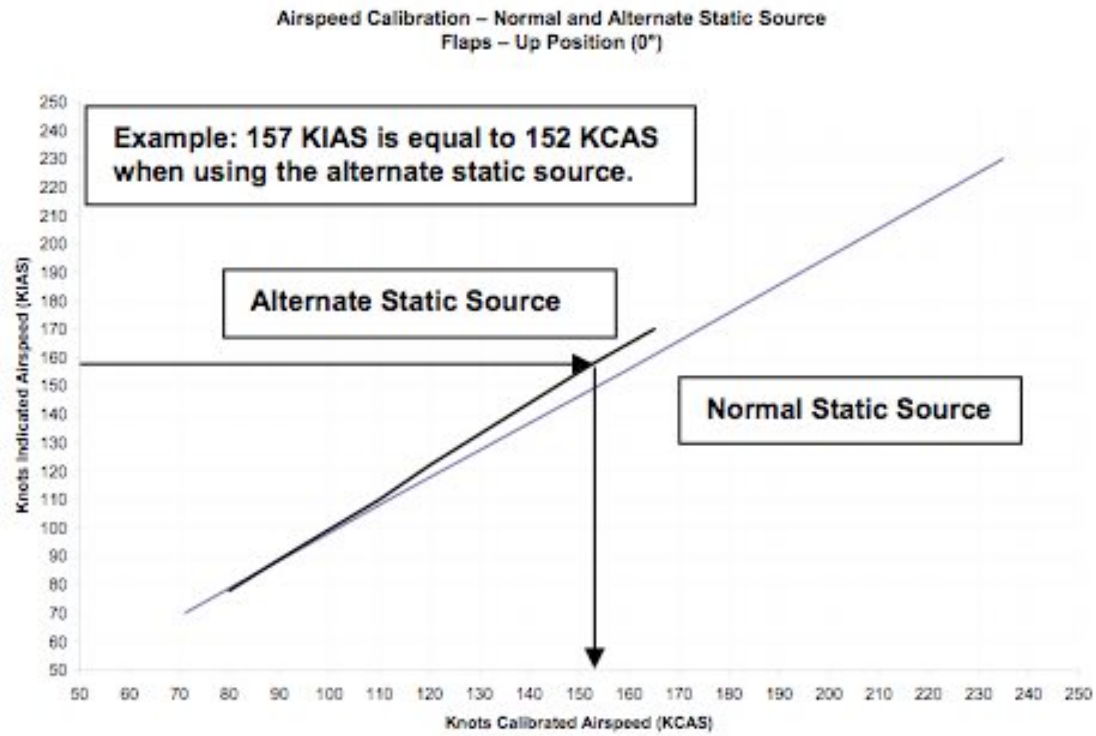


Figure 4-2

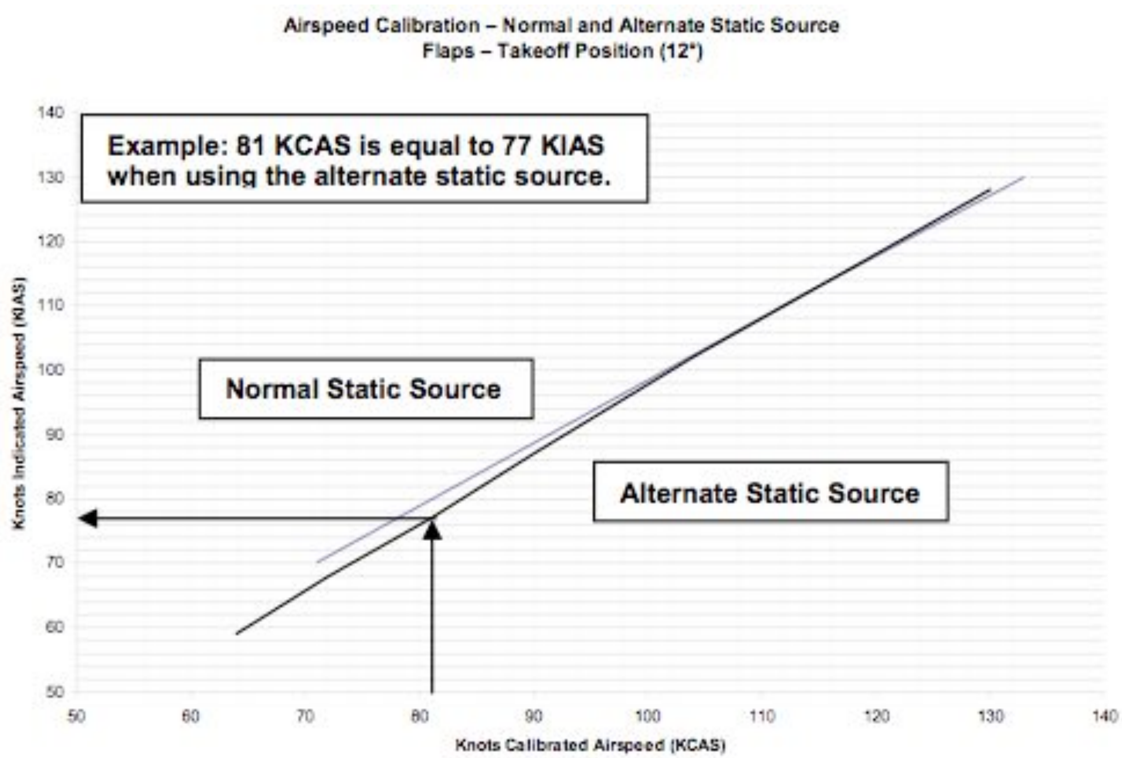


Figure 4-3

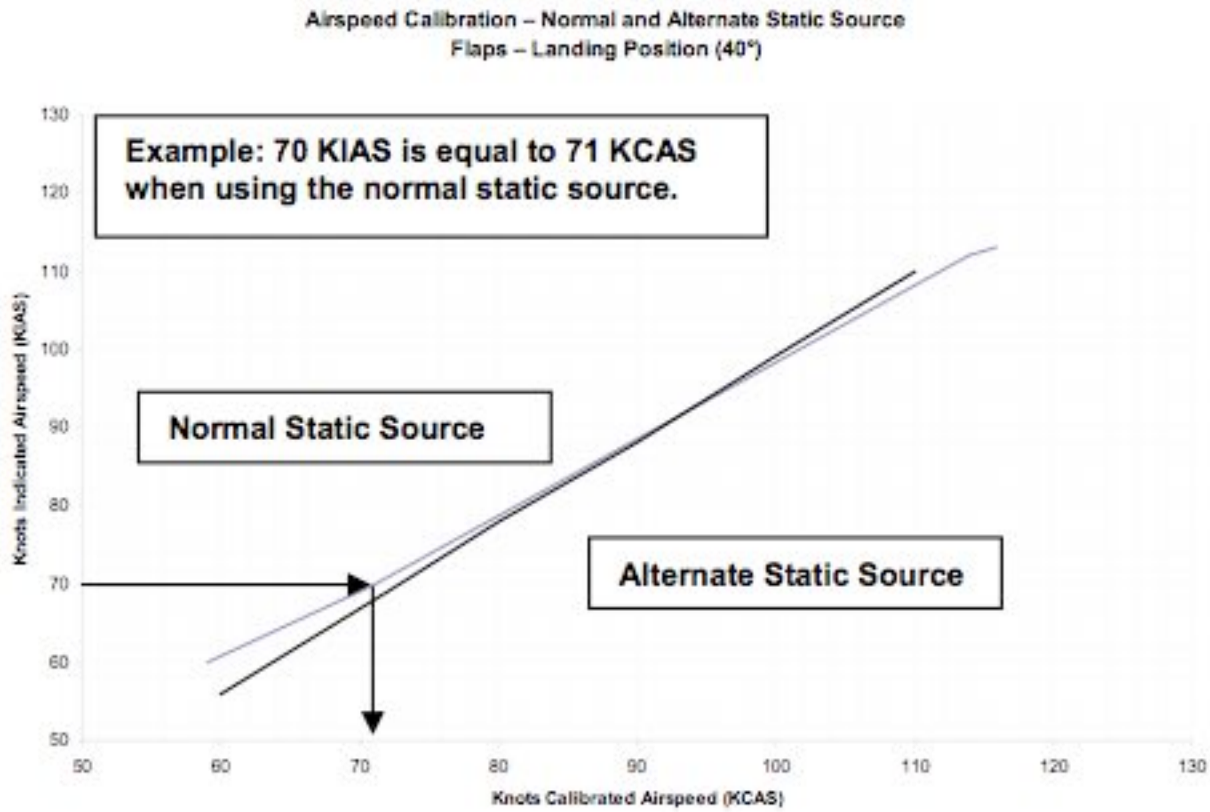


Figure 4-4

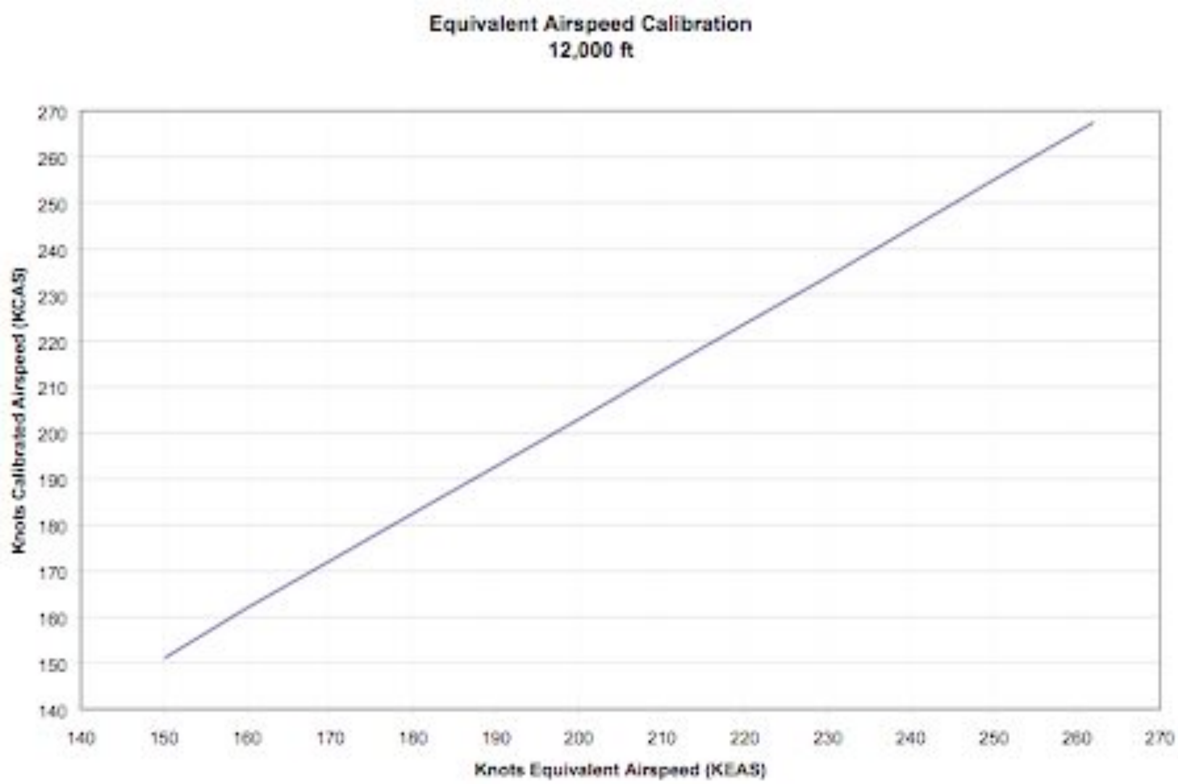


Figure 4-5

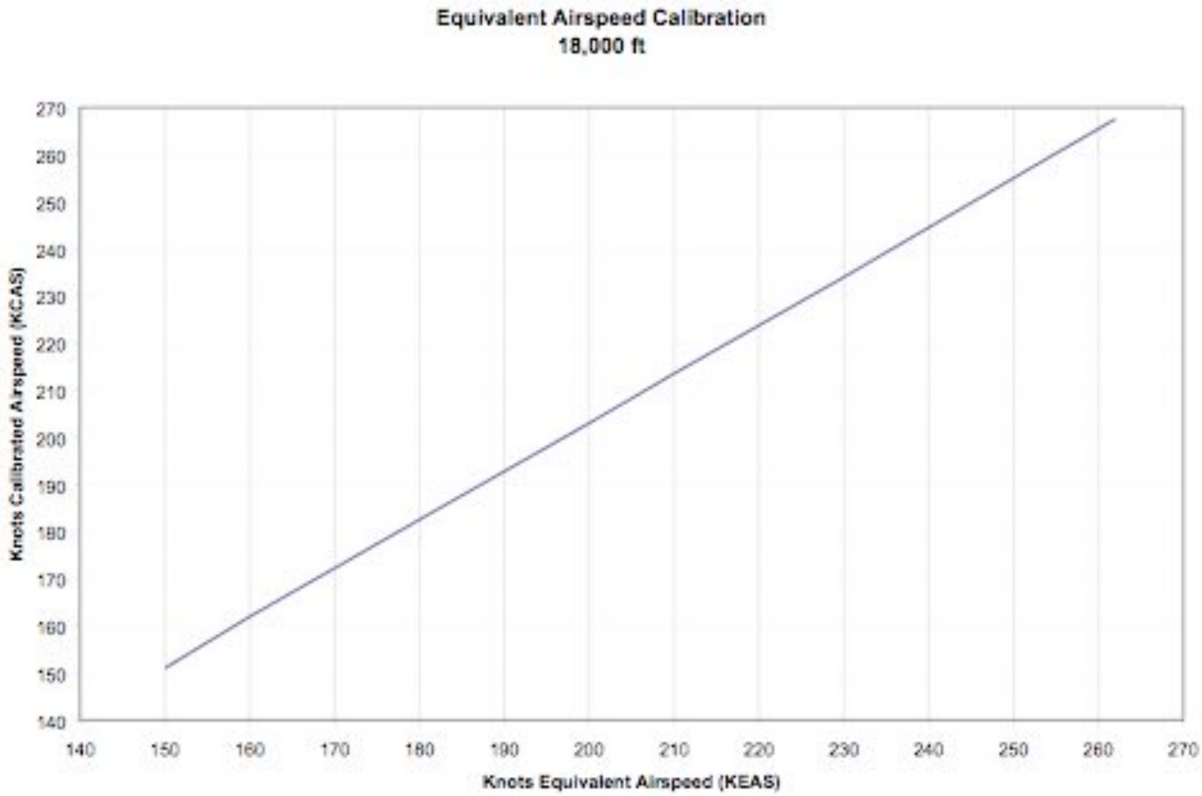
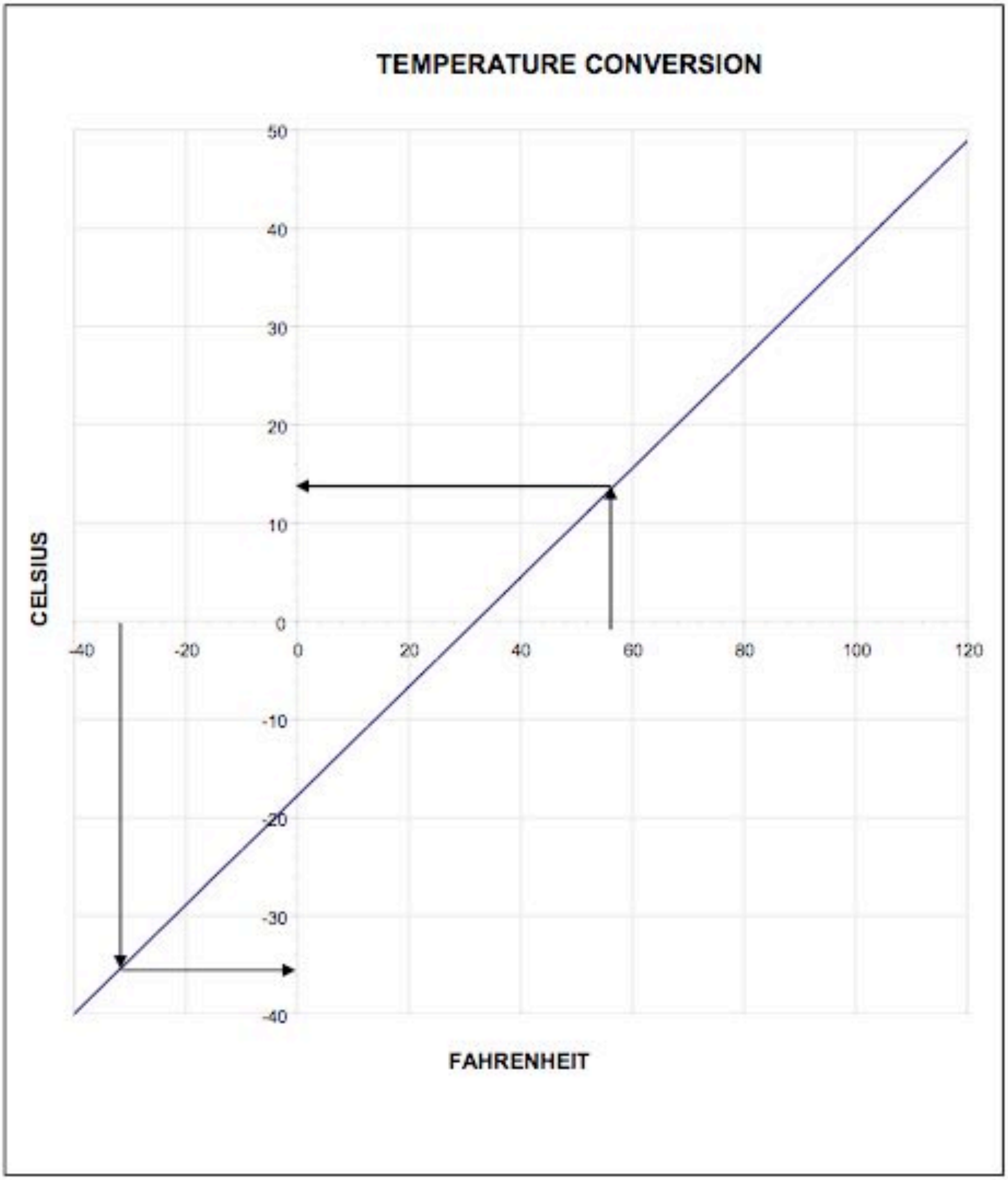

Equivalent Airspeed Calibration
18,000 ft
Knots Calibrated Airspeed (KCAS)
270
260
250
240
230
220
210
200
190
180
170
160
150
140
140
150
160
170
180
190
200
210
220
230
240
250
260
270
Knots Equivalent Airspeed (KEAS)

Figure 4-6

Figure 4-7


TEMPERATURE CONVERSION
CELSIUS
FAHRENHEIT
50
40
30
20
10
0
-10
-20
-30
-40
-40
-20
0
20
40
60
80
100
120

STALL SPEEDS

Figure 4-8 shows the stalling speed of the airplane for various flap settings and angles of bank. To provide a factor of safety, the tabulated speeds are established using maximum gross weight and the most forward center of gravity (CG), ie. 3600 pounds with the CG located 108.8 inches from the datum. This configuration will produce a higher stalling speed when compared with the speed that would result from a more rearward CG or a lesser gross weight at the same CG. While an aft CG lowers the stalling speed of the airplane, the benign stalling characteristics attendant with a forward CG are noticeably diminished. The maximum altitude loss during power off stalls is about 500 feet. Nose down attitude change during stall recovery is generally less than 5˚ but may be up to 15˚. **Example**: Using the table below, stall speeds of 64 KIAS and 65 KCAS are indicated for 30˚ of bank with the landing flaps.

STALLING SPEEDS

CONDITIONS		**ANGLE OF BANK (Most Forward Center of Gravity - Power Off - Coordinated Flight)**															
Weight		0˚				30˚				45˚				60˚			
	Flap Setting	KIAS *		KCAS *		KIAS *		KCAS *		KIAS *		KCAS *		KIAS *		KCAS *	
3600 lbs.	Flaps - Cruise	72	73	73	74	76	77	78	79	85	85	87	87	101	102	103	104
	Flaps - Takeoff	65	67	66	68	70	72	71	73	77	79	79	81	92	95	94	97
	Flaps - Landing	59	60	60	61	64	65	65	66	70	71	72	73	83	84	85	86

* The second stall speed is with Flat Triangular leading edge tape applied to the wings.

Figure 4-8

SPEEDBRAKES™

When SpeedBrakes™ are installed it is important to be aware of the following performance changes that may result when the speed brakes are deployed.

1. During takeoff with the SpeedBrakes™ inadvertently deployed, expect an extended takeoff roll and reduction in rate of climb until the SpeedBrakes™ are retracted.
2. During cruise flight with the SpeedBrakes™ deployed, expect the cruise speed and range to be reduced 20%.
3. In the unlikely event of one of the SpeedBrake™ cartridges deploying while the other remains retracted, a maximum of ¼ to 1/3 of corrective aileron travel, and up to 20 lbs. of additional rudder pressure are required for coordinated flight from stall through VNE. Indication of this condition will be noted by an annunciation message with the SpeedBrakes™ switch ON.
4. Deployed SpeedBrakes™ have minor to no effect on stall speed and stall characteristics.

Degrees Wind Off Runway Centerline	10° Component in knots of		20° Component in knots of		30° Component in knots of		40° Component in knots of		50° Component in knots of		60° Component in knots of		70° Component in knots of		80° Component in knots of	
WIND VELOCITY KNOTS	Crosswind	Headwind or Tailwind	Crosswind	Headwind or Tailwind	Crosswind	Headwind or Tailwind	Crosswind	Headwind or Tailwind	Crosswind	Headwind or Tailwind	Crosswind	Headwind or Tailwind	Crosswind	Headwind or Tailwind	Crosswind	Headwind or Tailwind
5	1	5	2	5	2	4	3	4	4	3	4	3	5	2	5	1
10	2	10	3	9	5	9	6	8	8	6	9	5	9	3	10	2
15	3	15	5	14	7	13	10	11	11	10	13	8	14	5	15	3
20	3	20	7	19	10	17	13	15	15	13	17	10	19	7	20	3
25	4	25	9	23	12	22	16	19	19	16	22	13	23	9	25	4
30	5	30	10	28	15	26	19	23	23	19	26	15	28	10	30	5
35	6	34	12	33	17	30	22	27	27	22	30	18	33	12	34	6
40	7	39	14	38	20	35	26	31	31	26	35	20	38	14	39	7

This table is used to determine the headwind, crosswind, or tailwind component. For example, a 15-knot wind, 55° off the runway centerline, has a headwind component of 9 knots and a crosswind component of 12 knots. For tailwind components, apply the number of degrees the tailwind is off the centerline and read the tailwind component in the headwind/tailwind column. A 20-knot tailwind, 60° off the downwind runway centerline, has a tailwind component of 10 knots and a crosswind of 17 knots.

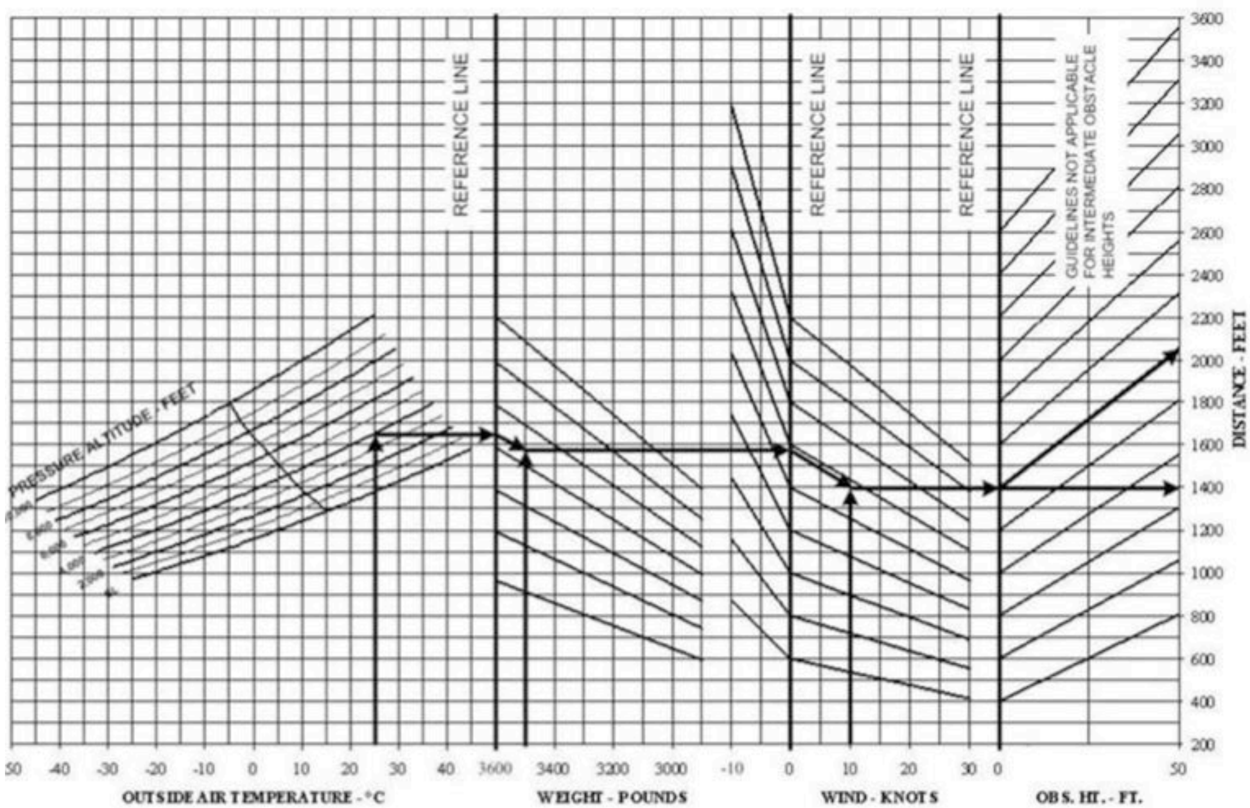
CROSSWIND, HEADWIND, AND TAILWIND COMPONENT

Figure 4-9

SHORT FIELD TAKEOFF DISTANCE (12° – TAKEOFF FLAPS)

ASSOCIATED CONDITIONS		EXAMPLE	
Power	Takeoff Power Set Before Brake Release	OAT	25°C
Flaps	12° (Takeoff position)	Pressure Altitude (PA)	4000 ft
Runway	Paved, Level, Dry Surface	Takeoff Weight	3500 lbs
Takeoff Speed	See Speed Schedule in Figure 5 - 11.	Headwind Component	10 Knots
		Ground Roll = 1400 ft (427 m) **50 ft Obstacle = 2050 ft (625 m)**	

Runway Slope Correction: Add 1% to ground roll for every 0.1° (0.2%) of uphill slope. For operation on a known level, smooth, mowed grass runway, which is either wet or dry but does not include standing water, the ground roll distance obtained from this takeoff performance chart must be multiplied by a factor of 1.3 to obtain the correct field length. In the above example, the ground roll distance would be 1.3 x 1400 ft = 1820 ft (555 m). The total distance to clear a 50-ft obstacle would be 2470 ft (753 m) in this instance.



SHORT FIELD TAKEOFF SPEED SCHEDULE

The following chart should be used in conjunction with the takeoff distance chart in Figure 4-10 to determine the proper takeoff speed based on aircraft weight.

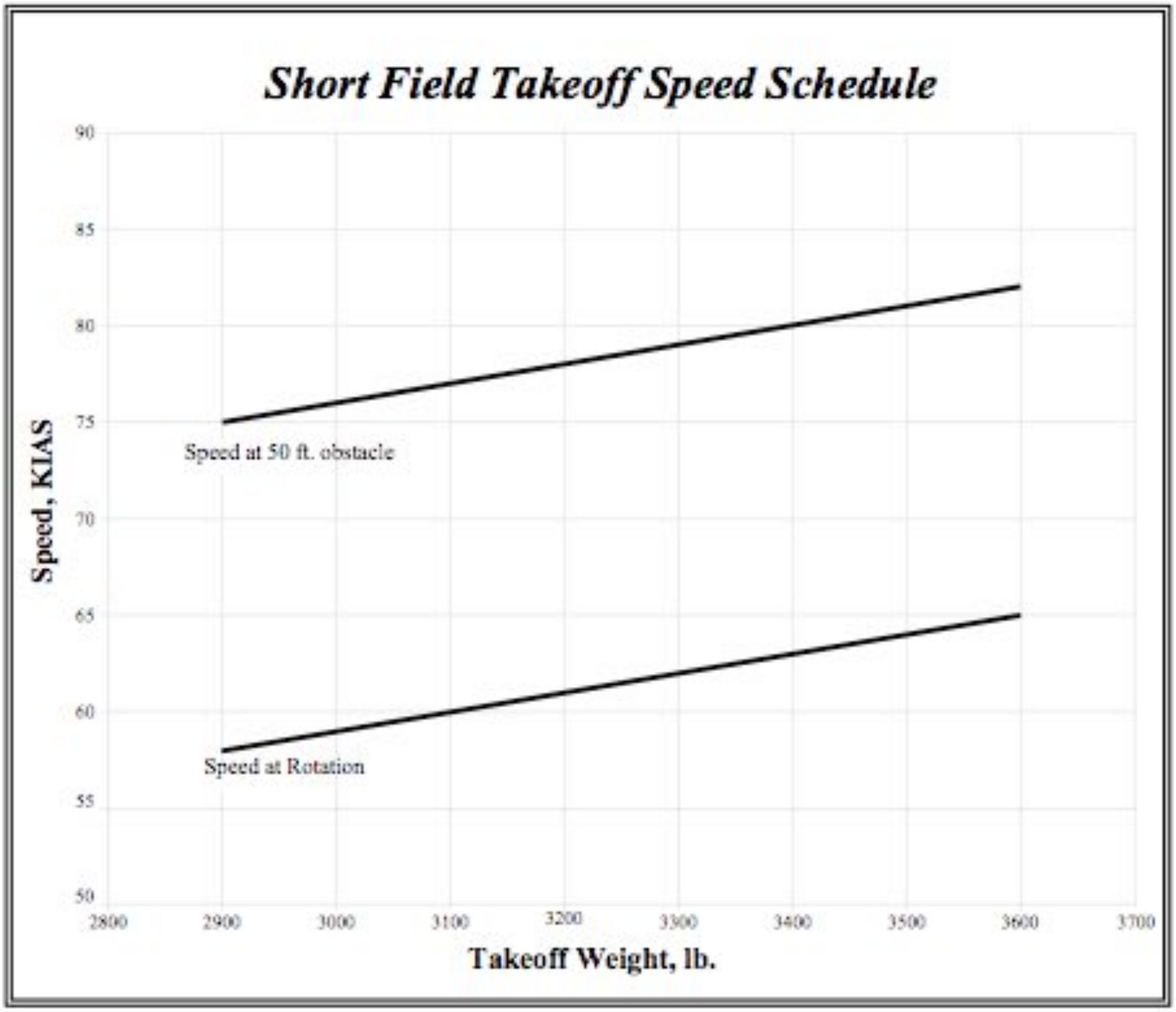


Figure 4-11

Pressure Altitude (Feet)	RATE OF CLIMB (FT/MIN) 3000 lb. 106 KIAS			RATE OF CLIMB (FT/MIN) 3300 lb. 108 KIAS			RATE OF CLIMB (FT/MIN) 3600 lb. 110 KIAS		
	ISA -20 C	ISA	ISA +30 C	ISA -20 C	ISA	ISA +30 C	ISA -20 C	ISA	ISA +30 C
0	1805	1520	1115	1665	1400	1030	1530	1285	940
1000	1805	1520	1115	1670	1400	1030	1530	1285	940
2000	1810	1520	1120	1670	1400	1035	1535	1285	945
3000	1810	1520	1120	1670	1400	1035	1535	1285	945
4000	1810	1520	1115	1670	1400	1032	1535	1285	945
5000	1815	1520	1115	1675	1400	1030	1535	1285	940
6000	1815	1520	1110	1675	1400	1028	1537	1285	940
7000	1815	1520	1110	1675	1400	1026	1540	1285	940
8000	1820	1520	1105	1680	1400	1025	1540	1285	935
9000	1820	1520	1105	1680	1400	1025	1540	1285	935
10000	1820	1520	1105	1680	1400	1020	1540	1285	935
11000	1825	1520	1100	1685	1400	1020	1545	1285	930
12000	1825	1520	1100	1685	1402	1017	1545	1285	930
13000	1825	1520	1095	1675	1391	1005	1535	1275	920
14000	1830	1520	1095	1665	1380	995	1525	1265	910
15000	1830	1520	1095	1655	1370	980	1515	1255	900
16000	1790	1479	1055	1625	1345	955	1495	1230	875
17000	1750	1440	1020	1600	1320	935	1470	1210	855
18000	1710	1400	985	1575	1295	910	1445	1185	830
19000	1655	1350	935	1525	1245	865	1400	1140	790
20000	1600	1300	890	1475	1200	820	1355	1100	750
21000	1550	1250	840	1430	1155	780	1310	1055	710
22000	1475	1180	780	1360	1090	720	1245	995	655
23000	1400	1110	715	1290	1025	660	1180	935	600
24000	1305	1025	635	1200	940	585	1100	860	530
25000	12120	935	555	1115	860	510	1020	785	465

MAXIMUM RATE OF CLIMB (With Flat Triangular Leading Edge Tape On The Wings)

Figure 4-13

Pressure Altitude	Climb Speed KIAS	Rate of Climb FPM	Time Min	Fuel Used Gallons	Distance NM
0	110	1285	0.0	0.0	0
1000	110	1285	0.8	0.5	1
2000	110	1285	1.6	1.0	3
3000	110	1285	2.3	1.5	4
4000	110	1285	3.1	2.0	6
5000	110	1285	3.9	2.5	7
6000	110	1285	4.7	3.0	9
7000	110	1285	5.4	3.5	11
8000	110	1285	6.2	4.0	12
9000	110	1285	7.0	4.6	14
10000	110	1285	7.8	5.1	16
11000	110	1285	8.6	5.6	17
12000	110	1285	9.3	6.1	19
13000	110	1275	10.1	6.6	21
14000	110	1265	10.9	7.1	22
15000	110	1255	11.7	7.6	24
16000	110	1230	12.5	8.1	26
17000	110	1210	13.3	8.7	28
18000	110	1185	14.2	9.2	30
19000	110	1140	15.1	9.8	32
20000	110	1100	16.0	10.4	35
21000	110	1055	16.9	11.0	37
22000	110	995	17.9	11.7	40
23000	110	935	19.0	12.4	43
24000	110	860	20.2	13.1	46
25000	110	785	21.4	13.9	49

TIME, FUEL, AND DISTANCE TO CLIMB (With Flat Triangular leading Edge Tape)

Associated Conditions

Power..2600 RPM
Flaps..Cruise
Mixture..At recommended leaning schedule
Temp..Standard Day (ISA)
Wind..Zero Wind
Time..Include 45 seconds for takeoff and acceleration to V_Y

Figure 4-15

CRUISE PERFORMANCE OVERVIEW

The tables on pages XXX through XXX contain cruise data to assist in the flight planning process. This information is tabulated for Sea Level, 6000 feet, 12000, feet, 18000 feet, and 25000 feet. Interpolation is required for all other altitudes.

The tables assume proper leaning at the various horsepowers. Between 65% and 85% of brake horsepower, the mixtures should be leaned through use of the turbine inlet temperature (TIT) gauge.

KTAS values in the tables are valid without the nose wheel pant installed. If the nose wheel pant is installed add 4 knots to the KTAS values.

The maximum recommended cruise setting is 85% of brake horsepower. The mixture must not be leaned above settings that produce more than 85% of brake horsepower. During cruise power settings above 65%, ambient temperature conditions need to be considered. In hot weather and high altitudes, it may be necessary to set the fuel to a lower TIT to maintain cylinder head temperatures within the recommended range for cruise.

The cruise performance is not affected by the flat triangular leading edge tape.

CRUISE PERFORMANCE SEA LEVEL PRESSURE ALTITUDE

INITIAL SETTINGS			-5° C (20° C BELOW STANDARD TEMP)				15° C (STANDARD TEMPERATURE)				45° C (30° C ABOVE STANDARD TEMP)			
			%		FUEL FLOW		%		FUEL FLOW		%		FUEL FLOW	
RPM	MAP	MAP	BHP	KTAS	GAL/HR (L/HR)		BHP	KTAS	GAL/HR (L/HR)		BHP	KTAS	GAL/HR (L/HR)	
	BEST POWER	-50 LOP			BEST POWER	-50 LOP			BEST POWER	-50 LOP			BEST POWER	-50 LOP
2500	31.5		91	182	26 (97)		85	182	23 (87)		76	180	20 (75)	
2500	30.0		86	179	24 (90)	19 (72)	80	178	21 (81)	18 (66)	71	176	18 (69)	16 (60)
2500	29.0	32.0	83	177	23 (85)	18 (68)	77	176	20 (77)	17 (64)	68	173	17 (66)	15 (58)
2500	27.0	29.5	77	172	20 (77)	17 (64)	71	170	18 (69)	16 (60)	62	167	16 (60)	14 (54)
2500	25.0	27.5	71	166	18 (69)	16 (60)	65	164	16 (62)	15 (56)	56	160	14 (54)	13 (49)
2500	24.0	26.0	68	163	17 (65)	15 (58)	62	161	16 (59)	14 (53)	53	156	13 (51)	12 (47)
2500	22.0	23.5	61	157	15 (58)	14 (53)	55	154	14 (53)	13 (48)	46	148	12 (45)	11 (41)
2500	20.0	21.0	54	150	14 (52)	13 (48)	48	146	12 (47)	11 (43)	39	140	10 (40)	9 (36)
2400	33.0		90	182	26 (97)		84	182	23 (87)		75	179	20 (74)	
2400	31.0		85	178	23 (88)		79	177	21 (79)		70	174	18 (68)	
2400	30.0		82	176	22 (84)	18 (68)	76	175	20 (75)	17 (64)	67	172	17 (65)	15 (57)
2400	28.0	30.5	77	171	20 (76)	17 (64)	71	170	18 (68)	16 (60)	62	166	16 (59)	14 (53)
2400	26.0	28.5	70	166	18 (68)	16 (60)	64	164	16 (62)	15 (55)	55	159	14 (53)	13 (49)
2400	25.0	27.0	67	163	17 (65)	15 (57)	61	161	15 (59)	14 (53)	52	156	13 (51)	12 (46)
2400	23.0	25.0	61	157	15 (58)	14 (53)	55	154	14 (53)	13 (48)	46	148	12 (45)	11 (41)
2400	20.0	21.0	51	146	13 (49)	12 (45)	45	143	12 (44)	11 (41)	36	136	10 (37)	9 (33)
2300	34.0		88	180	25 (93)		82	180	22 (83)		73	177	19 (71)	
2300	33.0		86	178	23 (89)		80	178	21 (80)		71	175	18 (68)	
2300	31.0		81	174	21 (81)	18 (67)	75	173	19 (73)	17 (63)	66	170	17 (63)	15 (56)
2300	29.0	31.5	75	170	20 (74)	17 (63)	69	168	18 (67)	16 (59)	60	165	15 (58)	14 (52)
2300	27.0	29.5	70	165	18 (67)	16 (59)	64	163	16 (61)	14 (55)	55	158	14 (53)	13 (48)
2300	26.0	28.5	67	162	17 (64)	15 (57)	61	160	15 (58)	14 (53)	52	155	13 (50)	12 (46)
2300	24.0	26.5	61	157	15 (58)	14 (53)	55	154	14 (53)	13 (48)	46	148	12 (45)	11 (41)
2300	21.0	23.5	51	147	13 (50)	12 (46)	45	143	12 (45)	11 (41)	36	136	10 (38)	9 (34)

3600 lbs. (1633 kg) Gross Weight. Flaps Up. Recommended Mixture Setting. Data in these charts are based on this leaning schedule discussed on page 4-25. Best Power or Lean of Peak. * As a rule, always round to the more conservative number when using the performance tables in this handbook.

EXAMPLE PROBLEM AND SOLUTION

Conditions: Cruise Altitude = 1000 ft.; Temperature = 13° C; Manifold Pressure = 25 in. Hg.; RPM = 2500, Best Power	Determine: % of BHP; Fuel Consumption (GPH); True Airspeed	Solution: % of BHP = 65%; Fuel Consumption = 16 GPH (62 LPH); True Airspeed = 165 Knots*

CRUISE PERFORMANCE 6000 FT PRESSURE ALTITUDE

INITIAL SETTINGS			-17° C (20° C BELOW STANDARD TEMP)				3° C (STANDARD TEMPERATURE)				33° C (30° C ABOVE STANDARD TEMP)			
RPM	MAP	MAP	% BHP	KTAS	FUEL FLOW GAL/HR (L/HR)		% BHP	KTAS	FUEL FLOW GAL/HR (L/HR)		% BHP	KTAS	FUEL FLOW GAL/HR (L/HR)	
	BEST POWER	-50 LOP			BEST POWER	-50 LOP			BEST POWER	-50 LOP			BEST POWER	-50 LOP
2500	31.5		91	193	26 (97)		85	192	23 (87)		76	190	20 (75)	
2500	30.0		86	189	24 (90)	19 (70)	80	188	21 (81)	18 (66)	71	186	18 (69)	16 (60)
2500	29.0	32.0	83	187	23 (85)	18 (68)	77	186	20 (77)	17 (64)	68	183	17 (66)	15 (58)
2500	27.0	29.5	77	181	20 (77)	17(64)	71	180	18 (69)	16 (60)	62	176	16 (60)	14 (54)
2500	25.0	27.5	71	175	18 (69)	16 (60)	65	173	16 (62)	15 (56)	56	169	14 (54)	13 (49)
2500	24.0	26.0	68	172	17 (65)	15 (58	62	170	16 (59)	14 (53)	53	165	13 (51)	12 (47)
2500	22.0	23.5	61	165	15 (58)	14 (53)	55	163	14 (53)	13 (48)	46	157	12 (45)	11 (41)
2500	20.0	21.0	54	158	14 (52)	13 (48)	48	155	12 (47)	11 (43)	39	149	10 (40)	9 (36)
2400	33.0		90	192	26 (97)		84	192	23 (87)		75	190	20 (74)	
2400	31.0		85	188	23 (88)		79	187	21 (79)		70	184	18 (68)	
2400	30.0		82	186	22 (84)	18 (68)	76	185	20 (75)	17 (64)	67	182	17 (65)	15 (57)
2400	28.0	30.5	77	181	20 (76)	17 (64)	71	179	18 (68)	16 (60)	62	175	16 (59)	14 (53)
2400	26.0	28.5	70	175	18 (68)	16 (60)	64	173	16 (62)	15 (55)	55	169	14 (53)	13 (49)
2400	25.0	27.0	67	172	17 (65)	15 (57)	61	170	15 (59)	14 (53)	52	165	13 (51)	12 (46)
2400	23.0	25.0	61	165	15 (58)	14 (53)	55	163	14 (53)	13 (48)	46	157	12 (45)	11 (41)
2400	20.0	21.0	51	154	13 (49)	12 (45)	45	151	12 (44)	11 (41)	36	144	10 (37)	9 (33)
2300	34.0		88	191	25 (93)		82	190	22 (83)		73	187	19 (71)	
2300	33.0		86	189	23 (89)		80	188	21 (80)		71	185	18 (68)	
2300	31.0		81	184	21 (81)	18 (67)	75	183	19 (73)	17 (63)	66	180	17 (63)	15 (56)
2300	29.0	31.5	75	180	20 (74)	17 (63)	69	178	18 (67)	16 (59)	60	174	15 (58)	14 (52)
2300	27.0	29.5	70	174	18 (67)	16 (59)	64	172	16 (61)	14 (55)	55	168	14 (53)	13 (48)
2300	26.0	28.5	67	171	17 (64)	15 (57)	61	169	15 (58)	14 (53)	52	164	13 (50)	12 (46)
2300	24.0	26.5	61	165	15 (58)	14 (53)	55	163	14 (53)	13 (48)	46	157	12 (45)	11 (41)
2300	21.0	23.5	51	155	13 (50)	12 (46)	45	151	12 (45)	11 (41)	36	145	10 (38)	9 (34)

3600 lbs. (1633 kg) Gross Weight. Flaps Up. Recommended Mixture Setting. Data in these charts are based on this leaning schedule discussed on page 4-25. Best Power or Lean of Peak.

EXAMPLE PROBLEM AND SOLUTION

Conditions: Cruise Altitude = 6000 ft.; Temperature = 33° C; Manifold Pressure = 23 in. Hg.; RPM = 2500, Best Power	Determine: % of BHP; Fuel Consumption (GPH); True Airspeed	Solution: % of BHP = 49%; Fuel Consumption = 13 GPH (48 LPH); True Airspeed = 161 Knots.

CRUISE PERFORMANCE 12000 FT PRESSURE ALTITUDE

INITIAL SETTINGS			-29° C (20° C BELOW STANDARD TEMP)				-9° C (STANDARD TEMPERATURE)				21° C (30° C ABOVE STANDARD TEMP)			
RPM	MAP	MAP	% BHP	KTAS	FUEL FLOW GAL/HR (L/HR)		% BHP	KTAS	FUEL FLOW GAL/HR (L/HR)		% BHP	KTAS	FUEL FLOW GAL/HR (L/HR)	
	BEST POWER	-50 LOP			BEST POWER	-50 LOP			BEST POWER	-50 LOP			BEST POWER	-50 LOP
2500	31.5		91	209	27 (101)		85	207	24 (90)		76	204	20 (77)	
2500	30.0		86	204	25 (93)	19 (70)	80	203	22 (83)	18 (66)	71	199	19 (71)	16 (60)
2500	29.0	32.0	83	201	23 (88)	18 (68)	77	199	21 (79)	17 (64)	68	196	18 (68)	15 (58)
2500	27.0	29.5	77	195	21 (79)	17 (64)	71	193	19 (71)	16 (60)	62	189	16 (61)	14 (54)
2500	25.0	27.5	71	188	19 (71)	16 (60)	65	186	17 (64)	15 (56)	56	181	14 (55)	13 (49)
2500	24.0	26.0	68	184	18 (67)	15 (58)	62	182	16 (60)	14 (53)	53	178	14 (52)	12 (47)
2500	22.0	23.5	61	177	16 (60)	14 (53)	55	174	14 (54)	13 (48)	46	170	12 (46)	11 (41)
2500	20.0	21.0	54	169	14 (53)	13 (48)	48	166	13 (48)	11 (43)	39	161	11 (40)	9 (36)
2400	33.0		90	209	26 (100)		84	207	24 (90)		75	204	20 (77)	
2400	31.0		85	203	24 (91)		79	201	22 (82)		70	198	18 (70)	
2400	30.0		82	200	23 (86)	18 (68)	76	198	21 (78)	17 (64)	67	195	18 (66)	15 (57)
2400	28.0	30.5	77	194	21 (78)	17 (64)	71	192	19 (70)	16 (60)	62	188	16 (60)	14 (53)
2400	26.0	28.5	70	187	19 (70)	16 (60)	64	185	17 (63)	15 (55)	55	181	14 (54)	13 (49)
2400	25.0	27.0	67	184	18 (67)	15 (57)	61	182	16 (60)	14 (53)	52	177	14 (52)	12 (46)
2400	23.0	25.0	61	177	16 (60)	14 (53)	55	174	14 (54)	13 (48)	46	170	12 (46)	11 (41)
2400	20.0	21.0	51	165	13 (50)	12 (45)	45	162	12 (45)	11 (40)	36	157	10 (38)	9 (33)
2300	34.0		88	206	25 (96)		82	204	23 (86)		73	201	19 (73)	
2300	33.0		86	204	24 (92)		80	202	22 (82)		71	198	19 (70)	
2300	31.0		81	198	22 (84)	18 (67)	75	196	20 (75)	17 (63)	66	193	17 (65)	15 (56)
2300	29.0	31.5	75	193	20 (76)	17 (63)	69	191	18 (69)	16 (59)	60	187	16 (59)	14 (52)
2300	27.0	29.5	70	187	18 (69)	16 (59)	64	184	17 (63)	14 (55)	55	180	14 (54)	13 (48)
2300	26.0	28.5	67	183	17 (66)	15 (57)	61	181	16 (60)	14 (53)	52	177	13 (51)	12 (46)
2300	24.0	26.5	61	177	16 (60)	14 (53)	55	174	14 (54)	13 (48)	46	169	12 (46)	11 (41)
2300	21.0	23.5	51	166	13 (51)	12 (46)	45	163	12 (45)	11 (41)	36	158	10 (38)	9 (34)

3600 lbs. (1633 kg) Gross Weight. Flaps Up. Recommended Mixture Setting. Data in these charts are based on this leaning schedule discussed on page 4-25. Best Power or Lean of Peak.

EXAMPLE PROBLEM AND SOLUTION

Conditions: Cruise Altitude = 12000 ft.; Temperature = -9° C; Manifold Pressure = 26 in. Hg.; RPM = 2300	Determine: % of BHP; Fuel Consumption (GPH); True Airspeed	Solution: % of BHP = 61%; Fuel Consumption = 16 GPH (60 LPH); True Airspeed = 181 Knots.

CRUISE PERFORMANCE 18000 FT PRESSURE ALTITUDE

INITIAL SETTINGS			-41° C (20° C BELOW STANDARD TEMP)				-21° C (STANDARD TEMPERATURE)				9° C (30° C ABOVE STANDARD TEMP)			
RPM	MAP	MAP	% BHP	KTAS	FUEL FLOW GAL/HR (L/HR)		% BHP	KTAS	FUEL FLOW GAL/HR (L/HR)		% BHP	KTAS	FUEL FLOW GAL/HR (L/HR)	
	BEST POWER	-50 LOP			BEST POWER	-50 LOP			BEST POWER	-50 LOP			BEST POWER	-50 LOP
2500	31.5		91	217	27 (103)		85	219	25 (93)		76	220	21 (80)	
2500	30.0		86	214	25 (96)	19 (70)	80	216	23 (86)	18 (66)	71	216	20 (74)	16 (60)
2500	29.0	32.0	83	212	24 (91)	18 (68)	77	213	22 (82)	17 (64)	68	213	19 (71)	15 (58)
2500	27.0	29.5	77	207	22 (82)	17 (64)	71	208	20 (74)	16 (60)	62	207	17 (64)	14 (54)
2500	25.0	27.5	71	201	19 (74)	16 (60)	65	202	18 (67)	15 (56)	56	200	15 (58)	13 (49)
2500	24.0	26.0	68	198	18 (70)	15 (58)	62	198	17 (64)	14 (53)	53	196	15 (55)	12 (47)
2500	22.0	23.5	61	192	17 (63)	14 (53)	55	191	15 (57)	13 (48)	46	189	13 (49)	11 (41)
2500	20.0	21.0	54	185	15 (56)	13 (48)	48	184	14 (51)	11 (43)	39	180	12 (44)	9 (36)
2400	33.0		90	217	27 (103)		84	219	24 (92)		75	220	21 (79)	
2400	31.0		85	213	25 (93)		79	214	22 (84)		70	215	19 (73)	
2400	30.0		82	211	24 (89)	18 (68)	76	212	21 (80)	17 (64)	67	212	18 (69)	15 (57)
2400	28.0	30.5	77	206	21 (81)	17 (64)	71	207	19 (73)	16 (60)	62	206	17 (63)	14 (53)
2400	26.0	28.5	70	201	19 (73)	16 (60)	64	201	18 (66)	15 (55)	55	199	15 (58)	13 (49)
2400	25.0	27.0	67	198	18 (70)	15 (57)	61	198	17 (63)	14 (53)	52	196	15 (55)	12 (46)
2400	23.0	25.0	61	192	17 (63)	14 (53)	55	191	15 (57)	13 (48)	46	189	13 (49)	11 (41)
2400	20.0	21.0	51	182	14 (54)	12 (45)	45	180	13 (49)	11 (41)	36	176	11 (41)	9 (33)
2300	34.0		88	215	26 (98)		82	217	23 (89)		73	217	20 (76)	
2300	33.0		86	214	25 (94)		80	215	22 (85)		71	215	19 (73)	
2300	31.0		81	210	23 (87)	18 (67)	75	211	21 (78)	17 (63)	66	210	18 (68)	15 (56)
2300	29.0	31.5	75	205	21 (79)	17 (63)	69	206	19 (72)	16 (59)	60	205	16 (62)	14 (52)
2300	27.0	29.5	70	200	19 (72)	16 (59)	64	200	17 (66)	14 (55)	55	199	15 (57)	13 (48)
2300	26.0	28.5	67	198	18 (69)	15 (57)	61	197	17 (63)	14 (53)	52	195	14 (54)	12 (46)
2300	24.0	26.5	61	192	17 (63)	14 (53)	55	191	15 (57)	13 (48)	46	188	13 (49)	11 (41)
2300	21.0	23.5	51	182	14 (54)	12 (46)	45	180	13 (49)	11 (41)	36	177	11 (41)	9 (34)

3600 lbs. (1633 kg) Gross Weight. Flaps Up. Recommended Mixture Setting. Data in these charts are based on this leaning schedule discussed on page 4-25. Best Power or Lean of Peak.

CRUISE PERFORMANCE 25000 FT PRESSURE ALTITUDE

INITIAL SETTINGS			-55° C (20° C BELOW STANDARD TEMP)				-35° C (STANDARD TEMPERATURE)				-5° C (30° C ABOVE STANDARD TEMP)			
RPM	MAP	MAP	% BHP	KTAS	FUEL FLOW GAL/HR (L/HR)		% BHP	KTAS	FUEL FLOW GAL/HR (L/HR)		% BHP	KTAS	FUEL FLOW GAL/HR (L/HR)	
	BEST POWER	-50 LOP			BEST POWER	-50 LOP			BEST POWER	-50 LOP			BEST POWER	-50 LOP
2500	31.5		91	231	27 (103)		85	235	25 (93)		76	238	21 (80)	
2500	30.0		86	228	25 (96)	19 (70)	80	232	23 (86)	18 (66)	71	234	20 (74)	16 (60)
2500	29.0	32.0	83	226	24 (91)	18 (68)	77	229	22 (82)	17 (64)	68	231	19 (71)	15 (58)
2500	27.0	29.5	77	222	22 (82)	17 (64)	71	224	20 (74)	16 (60)	62	225	17 (64)	14 (54)
2500	25.0	27.5	71	217	19 (74)	16 (60)	65	218	18 (67)	15 (56)	56	218	15 (58)	13 (49)
2500	24.0	26.0	68	214	18 (70)	15 (58)	62	215	17 (64)	14 (53)	53	214	15 (55)	12 (47)
2500	22.0	23.5	61	208	17 (63)	14 (53)	55	208	15 (57)	13 (48)	46	206	13 (49)	11 (41)
2500	20.0	21.0	54	201	15 (56)	13 (48)	48	200	14 (51)	11 (43)	39	197	12 (44)	9 (36)
2400	33.0		90	231	27 (103)		84	235	24 (92)		75	238	21 (79)	
2400	31.0		85	227	25 (93)		79	231	22 (84)		70	233	19 (73)	
2400	30.0		82	226	24 (89)	18 (68)	76	228	21 (80)	17 (64)	67	230	18 (69)	15 (57)
2400	28.0	30.5	77	221	21 (81)	17 (64)	71	224	19 (73)	16 (60)	62	224	17 (63)	14 (53)
2400	26.0	28.5	70	217	19 (73)	16 (60)	64	218	18 (66)	15 (55)	55	218	15 (58)	13 (49)
2400	25.0	27.0	67	214	18 (70)	15 (57)	61	215	17 (63)	14 (53)	52	214	15 (55)	12 (46)
2400	23.0	25.0	61	208	17 (63)	14 (53)	55	208	15 (57)	13 (48)	46	206	13 (49)	11 (41)
2400	20.0	21.0	51	197	14 (54)	12 (45)	45	196	13 (49)	11 (41)	36	193	11 (41)	9 (33)
2300	34.0		88	229	26 (98)		82	233	23 (89)		73	236	20 (76)	
2300	33.0		86	228	25 (94)		80	231	22 (85)		71	233	19 (73)	
2300	31.0		81	224	23 (87)	18 (67)	75	227	21 (78)	17 (63)	66	228	18 (68)	15 (56)
2300	29.0	31.5	75	221	21 (79)	17 (63)	69	222	19 (72)	16 (59)	60	223	16 (62)	14 (52)
2300	27.0	29.5	70	216	19 (72)	16 (59)	64	217	17 (66)	14 (55)	55	217	15 (57)	13 (48)
2300	26.0	28.5	67	213	18 (69)	15 (57)	61	214	17 (63)	14 (53)	52	213	14 (54)	12 (46)
2300	24.0	26.5	61	208	17 (63)	14 (53)	55	208	15 (57)	13 (48)	46	206	13 (49)	11 (41)
2300	21.0	23.5	51	198	14 (54)	12 (46)	45	197	13 (49)	11 (41)	36	194	11 (41)	9 (34)

3600 lbs. (1633 kg) Gross Weight. Flaps Up. Recommended Mixture Setting. Data in these charts are based on this leaning schedule discussed on page 4-25. Best Power or Lean of Peak.

LEAN OF PEAK ENGINE OPERATION

The TSIO-550-C engine can be operated lean of peak at lower power settings. At higher power settings the TIT limit could be exceeded during the leaning process, in general leaning past peak TIT is only possible below about 65% power (varies with ambient conditions). Starting from full rich, the power increases about 1% as "Best Power" mixture is reached. For cruise operation, best power is at or near 1625˚F TIT rich of peak. If the mixture is leaned further past peak EGT (TIT), the power drops 8-12%. "Best Economy" is reached at about 50˚F lean of peak. Because of the drop in power, speed will be reduced. Once lean of peak mixture setting is reached, the RPM and manifold pressure can be increased carefully. By increasing the manifold pressure while operating lean of peak (do not exceed29 in. Hg), the power loss from leaning can be compensated. For continuous operation, TIT should be at or below 1625˚F. Figure 4-30 below shows a comparison of fuel flows for best power and best economy and is valid for one RPM setting (about 2400RPM). At higher RPM the fuel flow is slightly higher or slightly lower at lower ROM respectively. The power setting in Figure 4-20 is actual power.

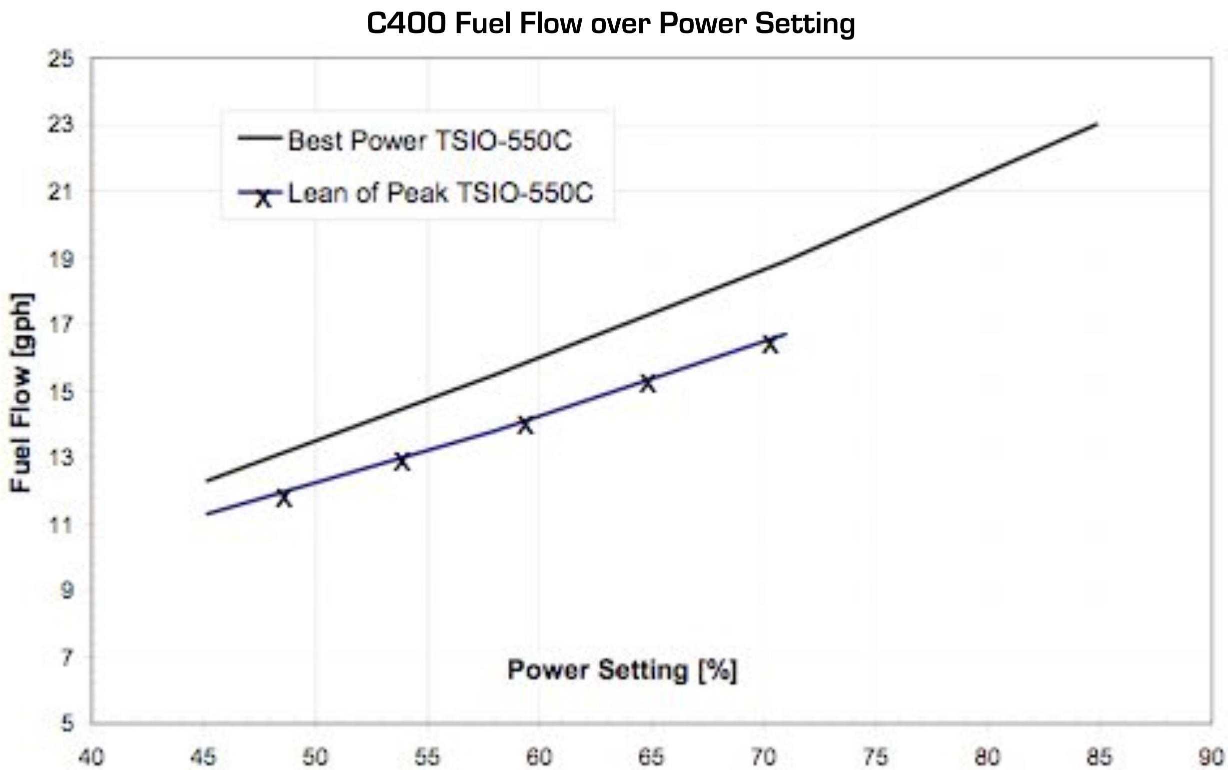
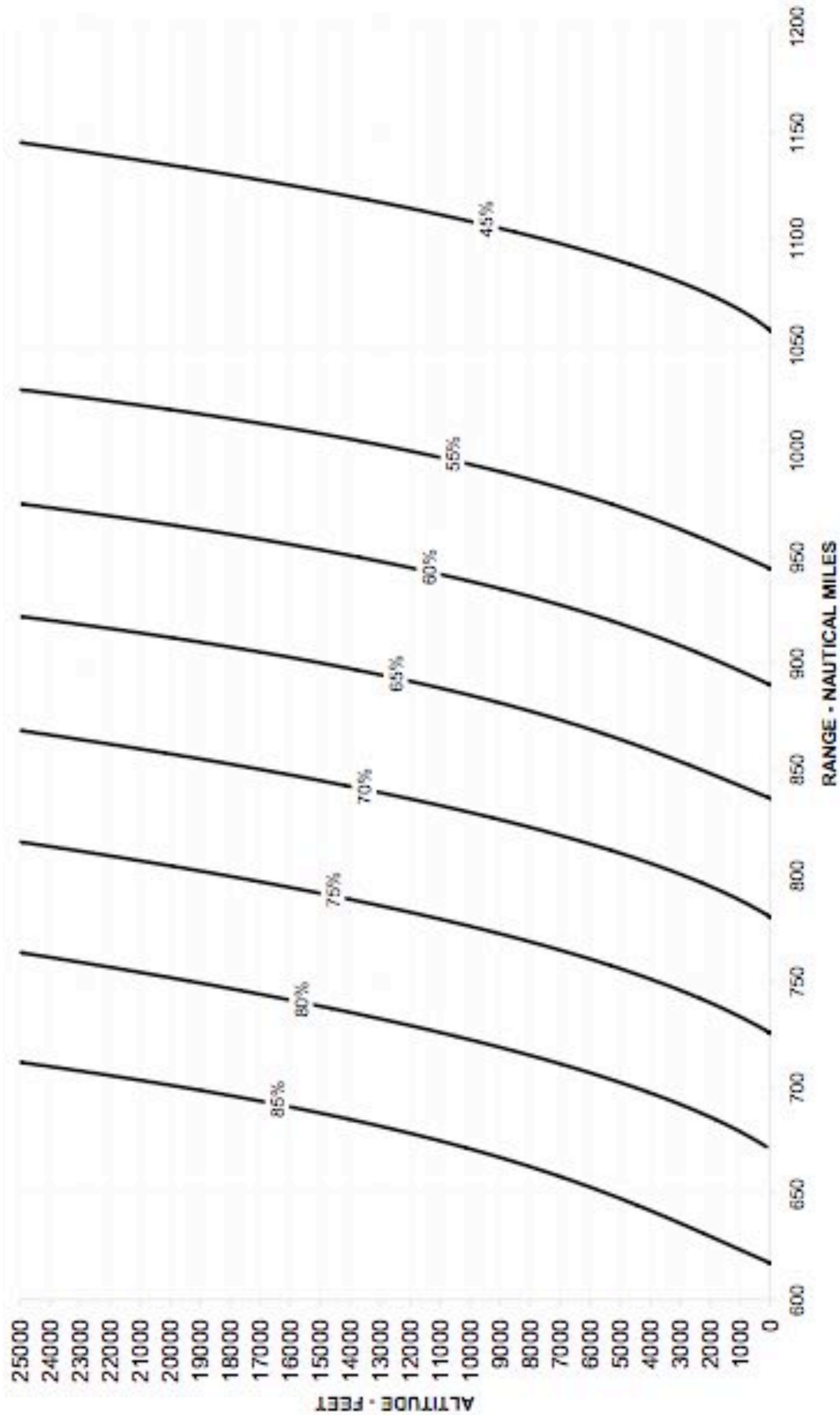


Figure 4-16

RANGE PROFILE

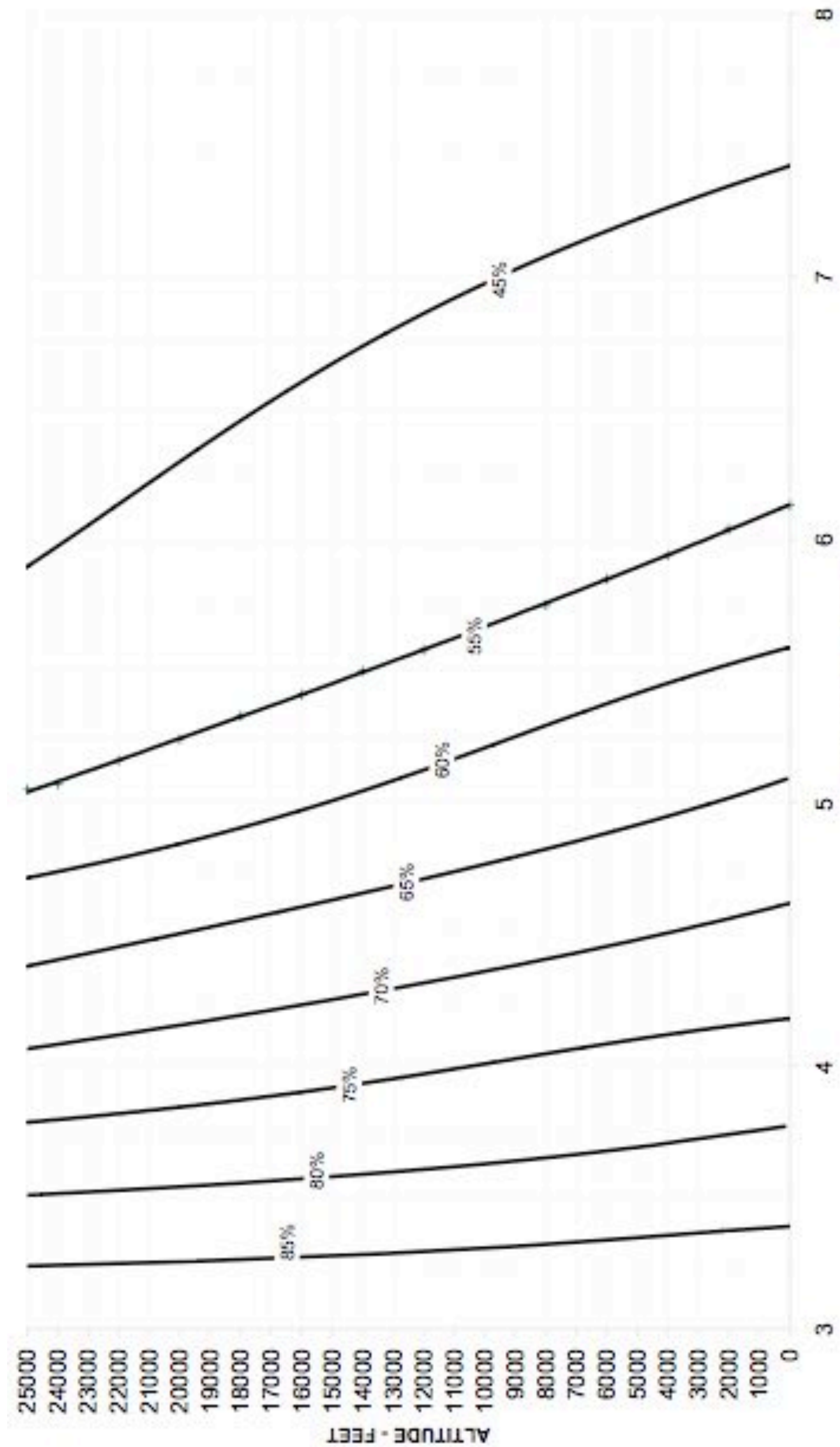


Conditions	Assumptions	Note
3600 lbs. (1633 kg) Max. Gross Weight Standard Temperature Proper Leaning Fuel Tanks Filled To 98 Gallons (371 L)	Chart assumes applicable BHP is maintained to maximum flight altitude	The chart includes fuel for starting the engine, taxi, takeoff, and climb to altitude. The 45 minute reserve allowance is based on the applicable percentage of BHP for 45 minutes.

Example: At a pressure altitude of 11,000 feet, with an 85% BHP best power setting, the range is approximately 675 nm.

Figure 4-17

ENDURANCE PROFILE



Conditions	Assumptions	Note
3600 lbs. (1633 kg) Max. Gross Weight Standard Temperature Proper Leaning Fuel Tanks Filled To 98 Gallons (371 L)	Chart assumes applicable BHP is maintained to maximum flight altitude	The chart includes fuel for starting the engine, taxi, takeoff, and climb to altitude. The 45 minute reserve allowance is based on the applicable percentage of BHP for 45 minutes.

Example: At a pressure altitude of 9,000 feet, with a 75% BHP best power setting, the endurance is approximately 4.05 hours.

Figure 4-18

HOLDING CONSIDERATIONS
When holding is required, it is recommended that takeoff flaps be used with an indicated airspeed of 120 +/- knots. Depending on temperature, gross weight, and RPM, the manifold pressure will range from about 13 to 17 inches. The fuel consumption has wide variability as well and can range from about 8 to 10 GPH. The graph below, Figure 4-19, provides information to calculate either fuel used for a give holding time or the amount of holding time available for a set quantity of fuel.

The graph is based on a fuel consumption of 9 GPH and is included here to provide a general familiarization overview. Under actual conditions, most pilots can perform the calculation for fuel used or the available holding time without reference to the graph. Moreover, the graph is only an approximation of the average anticipated fuel consumption. There will be a wide variability under actual conditions.

In the example below, a 35-minute holding time will use about 5.2 gallons of fuel. Conversely, if only 8 gallons of fuel are available for holding purposes, the maximum holding time is 53 minutes before other action must be taken. Note that this is about the amount of fuel remaining in a tank when the low-level fuel warning light illuminates.

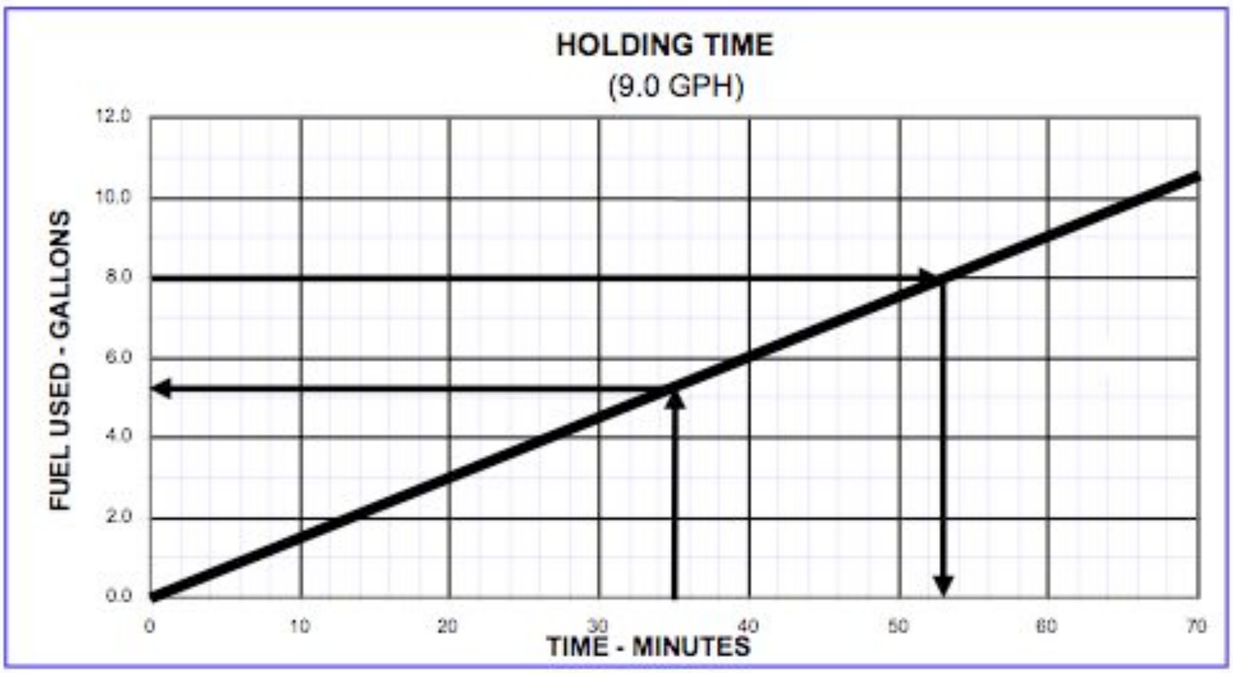


Figure 4-19

TIME, FUEL, AMD DISTANCE FOR CRUISE DESCENT

The table below, Figure 4-20, has information to assist the pilot in estimating cruise descent times, fuel used, and distance traveled from cruise altitude to sea level or to the elevation of the destination airport.. For descents from cruise altitude to sea level, locate the cruise altitude for the descent rate in use, and read the information directly. These data are determined for a weight of 3600 lb., flaps up, 2600 RPM, standard temperature, and zero winds.

For example, a descent at 500 FPM from 9000 feet to sea level will take approximately 18 minutes (50 - 32 = 18), consume 5 gallons of fuel (14 - 9 = 5), and 57 miles (175 - 118 = 57) will be traveled over the ground under no wind conditions. For descent from cruise altitude to a field elevation above sea level, subtract the performance data numbers for the field elevation data from the cruise altitude.

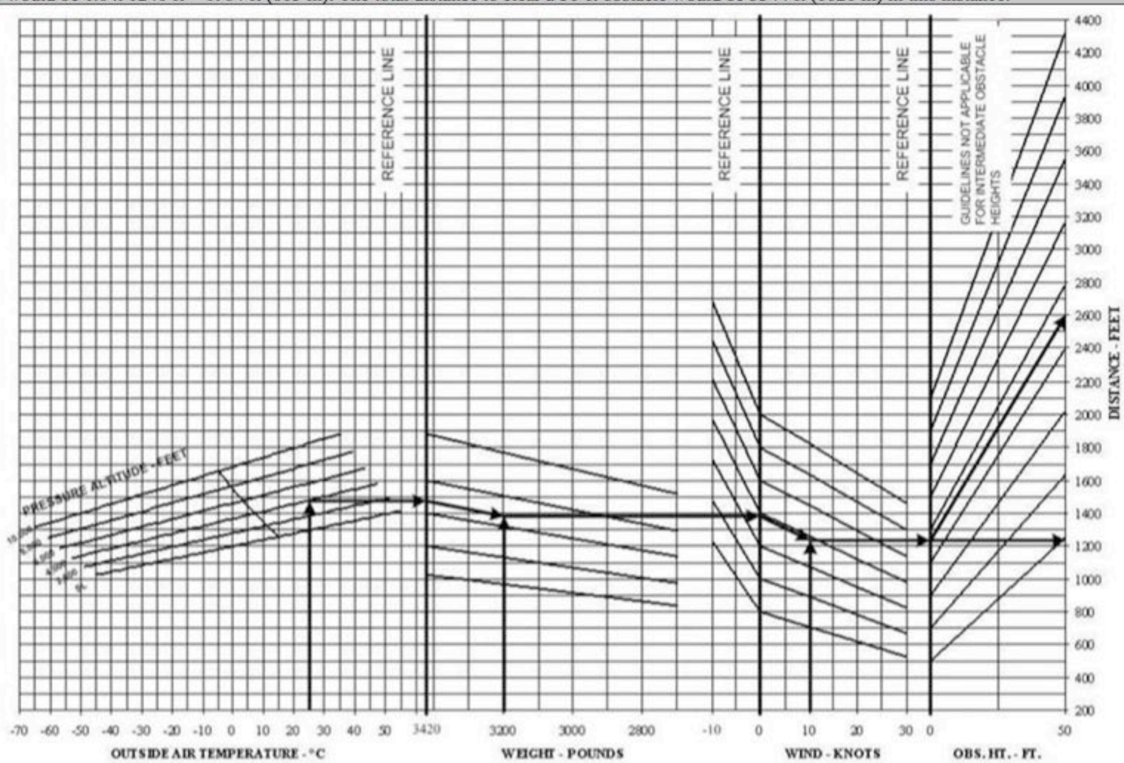
Pressure Altitude	Descent Speed KIAS	Rate of Descent FPM	Fuel Flow GPH	Time Min	Fuel Used Gal.	Distance NM
25000	159	500	19.0	0.0	0	0
24000	160	500	18.8	2.0	1	8
23000	161	500	18.6	4.0	1	16
22000	161	500	18.3	6.0	2	24
21000	162	500	18.1	8.0	2	32
20000	163	500	17.9	10.0	3	39
19000	164	500	17.7	12.0	4	47
18000	164	500	17.4	14.0	4	54
17000	165	500	17.2	16.0	5	62
16000	166	500	17.0	18.0	5	69
15000	167	500	17.0	20.0	6	76
14000	167	500	17.0	22.0	7	86
13000	168	500	17.0	24.0	7	90
12000	169	500	17.0	26.0	8	97
11000	170	500	17.0	30.0	9	111
10000	170	500	17.0	30.0	9	111
9000	171	500	16.8	32.0	9	118
8000	172	500	16.7	34.0	10	124
7000	173	500	16.5	36.0	10	131
6000	173	500	16.3	38.0	11	137
5000	174	500	16.2	40.0	12	144
4000	175	500	16.0	42.0	12	150
3000	176	500	16.0	44.0	13	157
2000	177	500	16.0	46.0	13	163
1000	178	500	16.0	48.0	14	169
0	179	500	16.0	50.0	14	175

Figure 4-20

SHORT FIELD LANDING DISTANCE (40° – LANDING FLAPS

ASSOCIATED CONDITIONS		EXAMPLE	
Power	As required to maintain 3° approach	OAT	25°C
Flaps	40°	Pressure Altitude (PA)	4000 ft
Runway	Paved, Level, Dry Surface	Takeoff Weight	3200 lb.
Approach Speed	See Speed Schedule	Headwind Component	10
Braking	Maximum	**Ground Roll = 1240 ft (378 m)** **50 ft Obstacle = 2600 ft (793 m)**	

Runway Slope Correction: Add 1% to ground roll for every 0.1° (0.2%) of downhill slope.
For operation on a known level, smooth, mowed grass runway, which is either wet or dry but does not include standing water, the ground roll distance obtained from this landing performance chart must be multiplied by a factor of 1.6 to obtain the correct field length. In the above example, the ground roll distance would be 1.6 x 1240 ft = 1984 ft (605 m). The total distance to clear a 50-ft obstacle would be 3344 ft (1020 m) in this instance.



LANDING SPEED SCHEDULE

The following chart should be used in conjunction with the landing distance chart in Figure XXX to determine the proper landing speed based on aircraft weight.

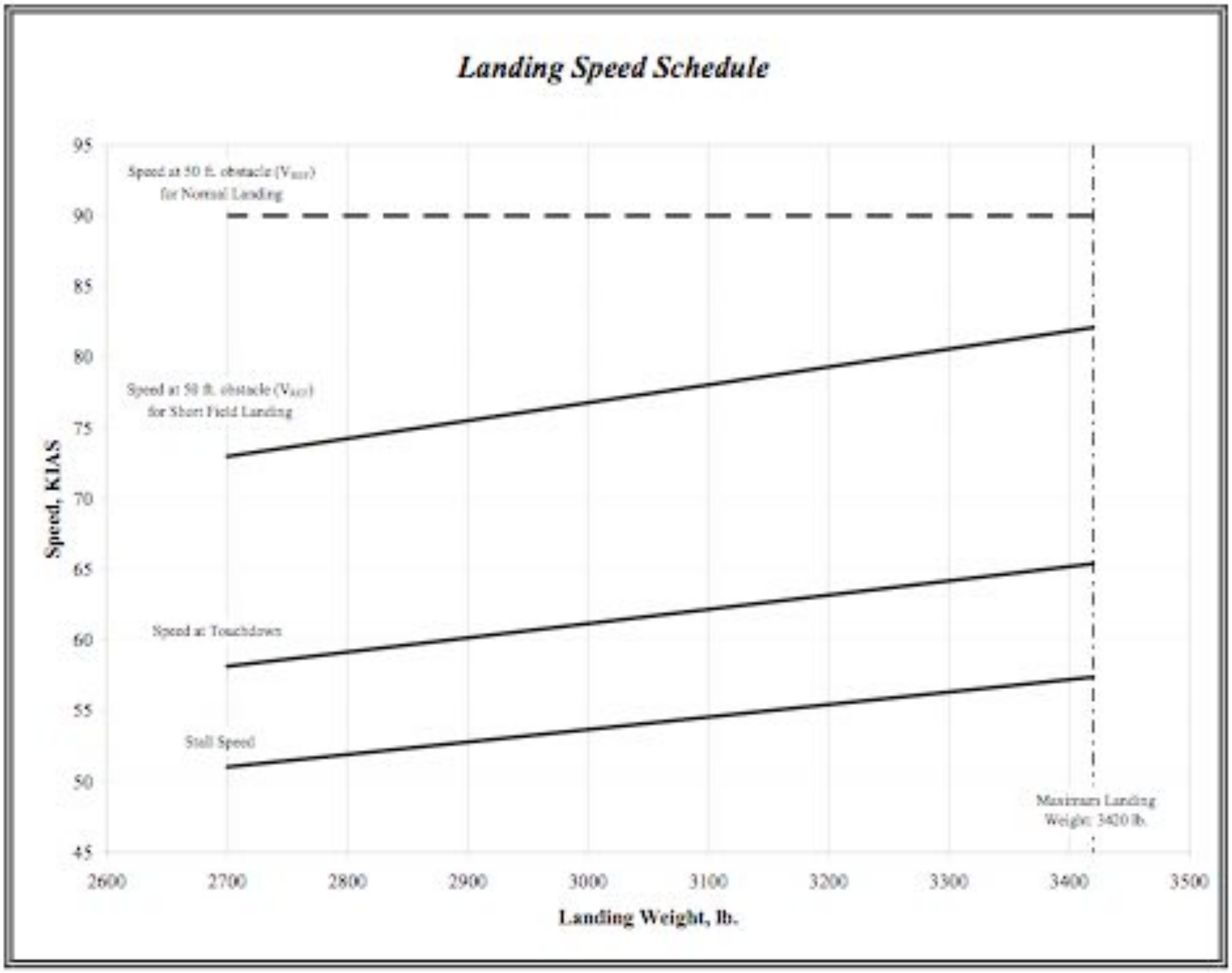


Figure 4-22

Section 5 – Description of Airplane and Systems

INTRODUCTION

Section 5 provides a basic understanding of the airplane's airframe, powerplant, systems, avionics, and components. The systems include: electrical and lighting, flight control, wing flaps, fuel, braking, heating and ventilating, door sealing, pitot pressure, static pressure, and stall warning. In addition, various non-system components are described. These include: doors and exits, baggage compartment, seats, seat belts and shoulder harnesses, and the instrument panel.

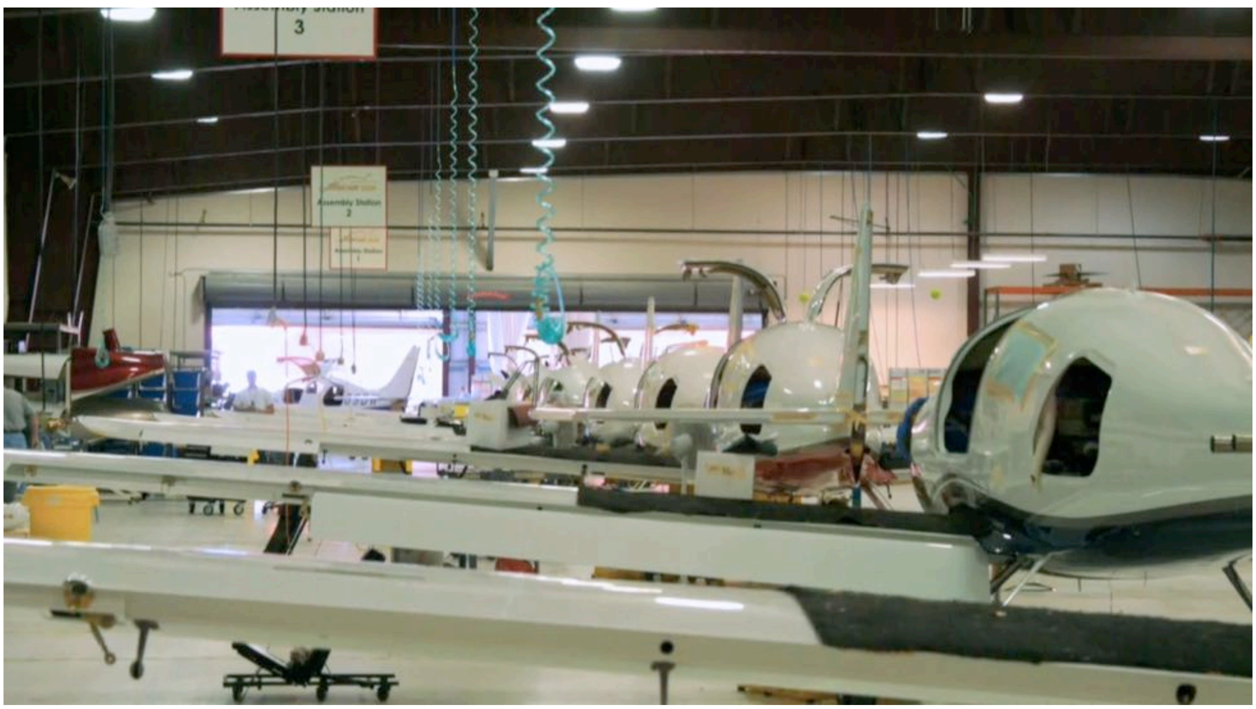
Terms that are not well known and not contained in Section 1 are explained in general terms. The description and discussion on the following pages assume a basic understanding or airplane nomenclature and operations.

AIRFRAME AND RELATED ITEMS

The C400 is a pre-molded, composite built, semi-monocoque, four seat, single engine, low wing, tricycle design airplane. The airplane is certified in the utility category and is used primarily for transportation and related general aviation uses.

BASIC CONSTRUCTION TECHNIQUES

The construction process used to build the shell or outer surfaces of the fuselage, an most control surfaces involves creating a honeycomb sandwich. The sandwich consists of outer layers of pre-preg fiberglass around a honeycomb interior. The term "pre-preg fiberglass" means the manufacturer impregnates the fibrous material with catalyzed epoxy resin. The process ensures consistency in surface thickness and strength. The honeycomb sandwich is assembled in molds of the wing, fuselage, and control surfaces. Air pressure is used during the heat curing process to ensure a tight bond. Other structural components of the airplane, like ribs, bulkheads, and spars, are constructed in the same manner. In areas where added strength is needed, such as the wing spars, carbon fibers are added to the honeycomb sandwich.



Fuselage – The fuselage is built in two halves, the left and right sides; each side contains the area from the firewall back to and including the vertical stabilizer. The bulkheads are inserted into the right side of the fuselage through a process known as bonding. The two fuselage halves are bonded together, and the floors are bonded in after the fuselage halves are joined. Before the fuselage is assembled into one unit, cables, control actuating devices, and conduits are added because of the ease in access. To prevent damage to the leading edge of the vertical stabilizer, anti-erosion tape may be installed.

Wings and Fuel Tanks – The bottom of the wing is one continuous piece. The spars are placed in the bottom of the wing and bonded to the bottom inside surface. Next, the ribs are inserted and bonded to the inside surfaces of the bottom of the wing and to the spars. Finally, after wires, conduits, and control tubes are inserted, the two top wing halves are bonded to the bottom wing and all the spars and ribs. The airplane has integral fuel tanks, commonly referred to as a "wet wing." The ribs, spars, and wing surfaces are the containment walls of the fuel tanks. All interior seams and surfaces within the fuel tanks are sealed with a fuel impervious substance. The wing cuffs (specially shaped pieces of composite material, are bonded to the outboard leading edge of the wing to increase the camber, or curvature, of the airfoil. This improves the slow-flight and stall characteristics of the wing. To prevent damage to the leading edge of the wing, anti-erosion tape may be installed.

Horizontal Stabilizer – The horizontal stabilizer is two separate halves bonded to two horizontal tubes that are bonded to the fuselage. The shear webs and ribs are bonded into the inside surface of the lower skin and the upper skin is then bonded to the lower assembly. To prevent damage to the leading edge of the horizontal stabilizer, anti-erosion tape may be installed.

FLIGHT CONTROLS

Ailerons – The ailerons are of one-piece construction with most of the stresses carried by the control surface. The end caps and drive rib that are used to mount the control's actuating hardware provide additional structural support. The aileron control system is operated through a series of actuating rods and bellcranks that run between the control surface and the control stick in the cockpit.

Aileron Servo Tab – The aileron servo tab on the trailing edge of the left aileron assists in movement of the aileron. The servo tab is connected to the aileron in a manner that causes the tab to move in a direction opposite the movement of the aileron. The increased aerodynamic force applied to the tab helps to move the aileron and reduces the level of required force applied to the control stick.

Elevator – The elevator is a two-part control surface with each half connected by a torque tube. Like the ailerons, most of the stresses are carried by the control surface. The end caps and drive rib used to mount the control's actuating hardware provide additional structural support. The elevator control system is operated through a series of actuating rods and bellcranks that run between the control surface and the control stick in the cockpit.

Rudder – The rudder is of one-piece construction with most of the stresses carried by the control surface. The drive rib that is used to mount the control's actuating hardware provides additional structural support. The rudder control system is operated through a series of cables and mechanical linkages that run between the control surface and the rudder pedals in the cockpit. A rudder pedal to rudder cable connector that allows positioning of the rudder pedals in a forward or aft position (approximately 1 inch difference) may be installed on the aircraft: if installed re-rigging of the rudder is required to alter the pedal position.

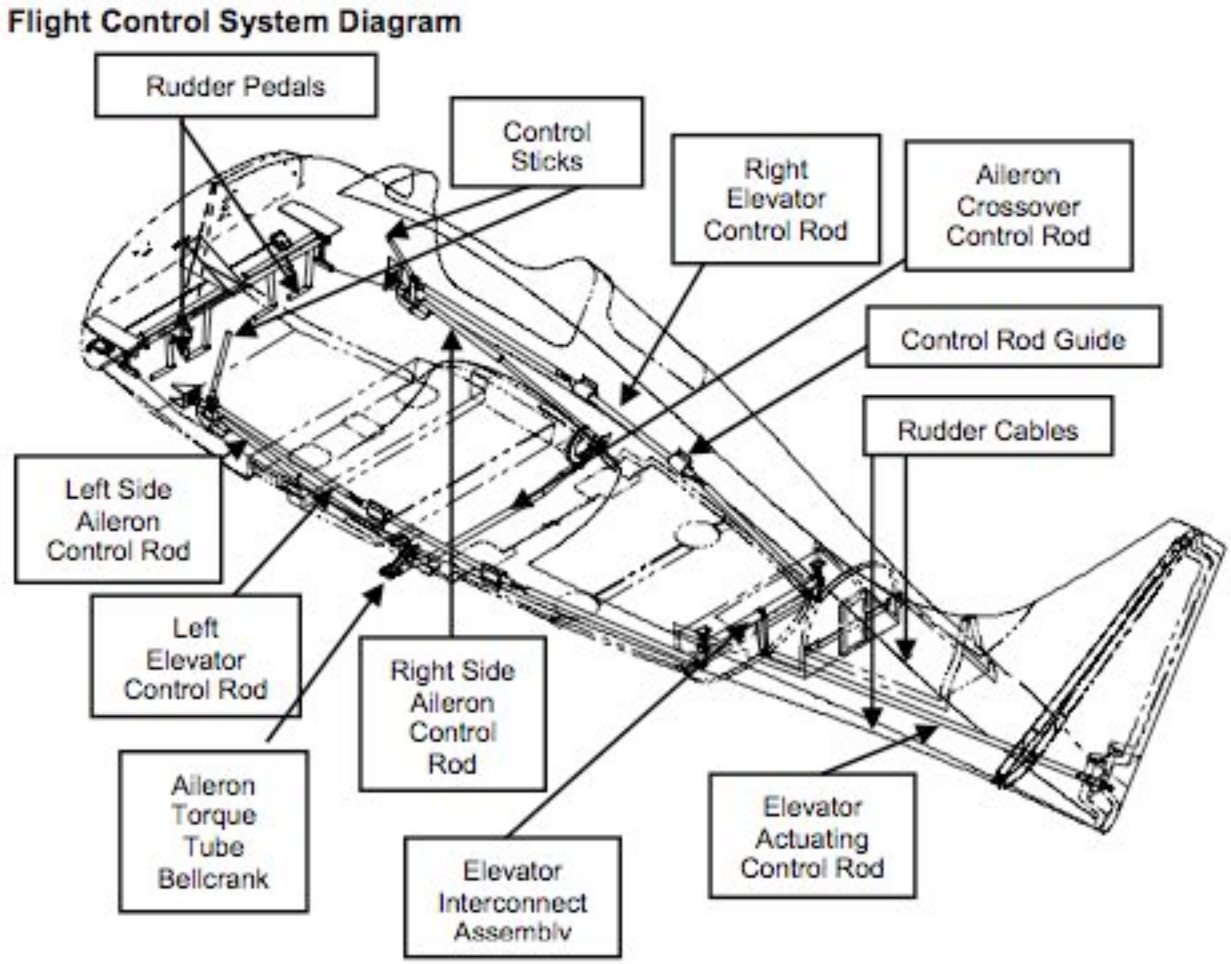

Flight Control System Diagram
Rudder Pedals
Control Sticks
Right Elevator Control Rod
Aileron Crossover Control Rod
Control Rod Guide
Rudder Cables
Left Side Aileron Control Rod
Left Elevator Control Rod
Right Side Aileron Control Rod
Aileron Torque Tube Bellcrank
Elevator Interconnect Assembly
Elevator Actuating Control Rod

Figure 5-1

TRIM SYSTEM

Elevator and Aileron – The aileron has a two axis trimming system. The elevator trim tab is located on the right side of the elevator, and the aileron trim tab is on the right aileron. A hat switch located on each control stick electrically controls both tabs, and the trim position is annunciated on various pages of the MFD. The trim servos are protected by ten-amp circuit breakers. See Figure 5-2 for an illustration of the trim system

Trim System Diagram

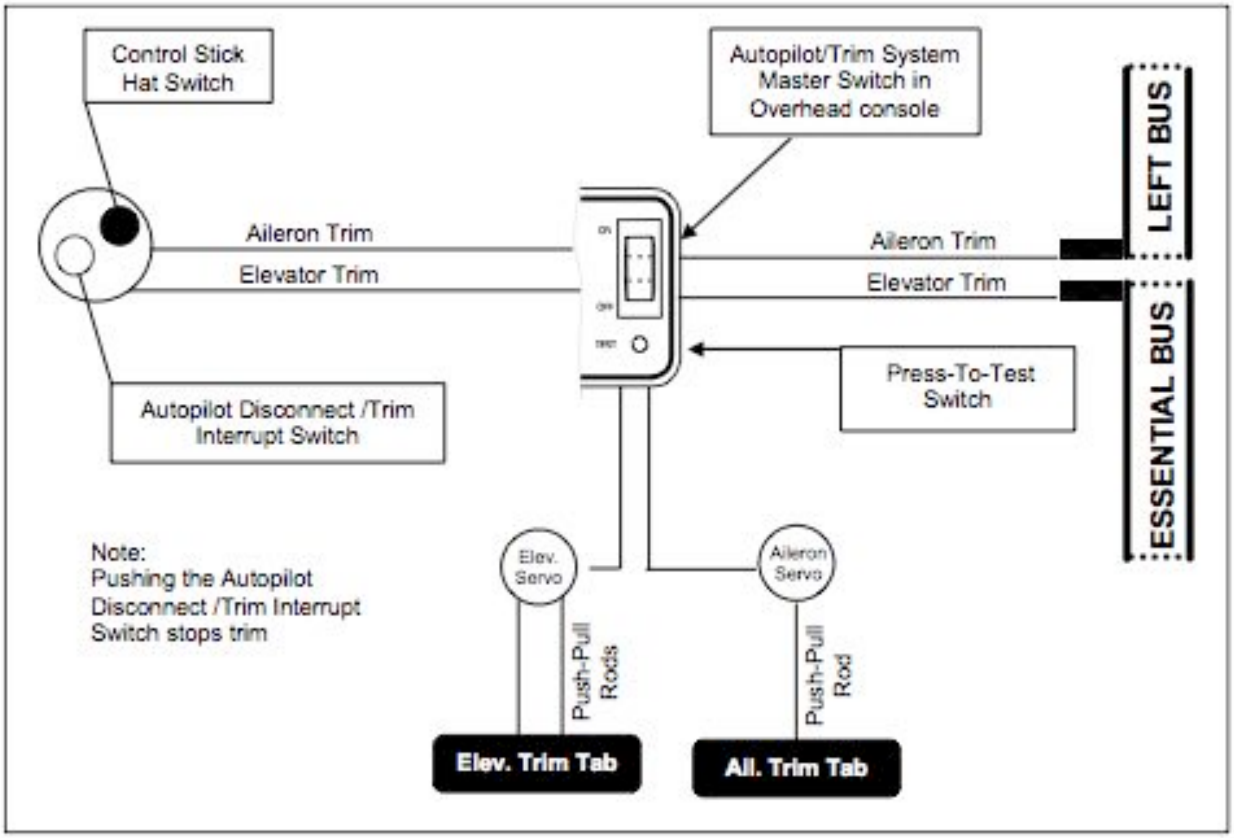


Figure 5-2

The trim surfaces are moved by push rods connected between each tab and a servomotor. The aileron tab has one actuating rod and the elevator tab has two. The second actuating rod on the elevator is a redundant system and is provided for the more critical tab in the system. The frictional device installed on the aileron tab should never be lubricated.

Hat Switches – The trim tabs are controlled through use of a hat switch on the top portion of the pilot and copilot's control stick. Moving the switch forward will correct a tail-heavy condition, and moving it back will correct a nose heavy condition. Moving the hat switch left or right will correct right wing heavy and left wing heavy conditions, respectively.

Simultaneous Trim Application – If both switches, pilot's and copilot's, are moved in the **same** direction at the same time, the trim will operate in the direction selected. For example, nose down trim is selected on both hat switches. If the switches are simultaneously moved in opposite directions, eg., pilot's is nose down and copilot's is nose up, the trim will not move. Finally, if trim is simultaneously selected in different directions, eg., elevator trim is input by one plot and aileron trim is input by the other, each trim tab will move in the direction selected.

Trim Position Indicator –The trim position is displayed in the Trim Group on the System page of the MFD. Other pages on the MFD also display the elevator trim position. The vertical mark indicates the position of the elevator trim and the horizontal mark shows the position of the aileron trim. The green band for each axis indicates the approved takeoff ranges.

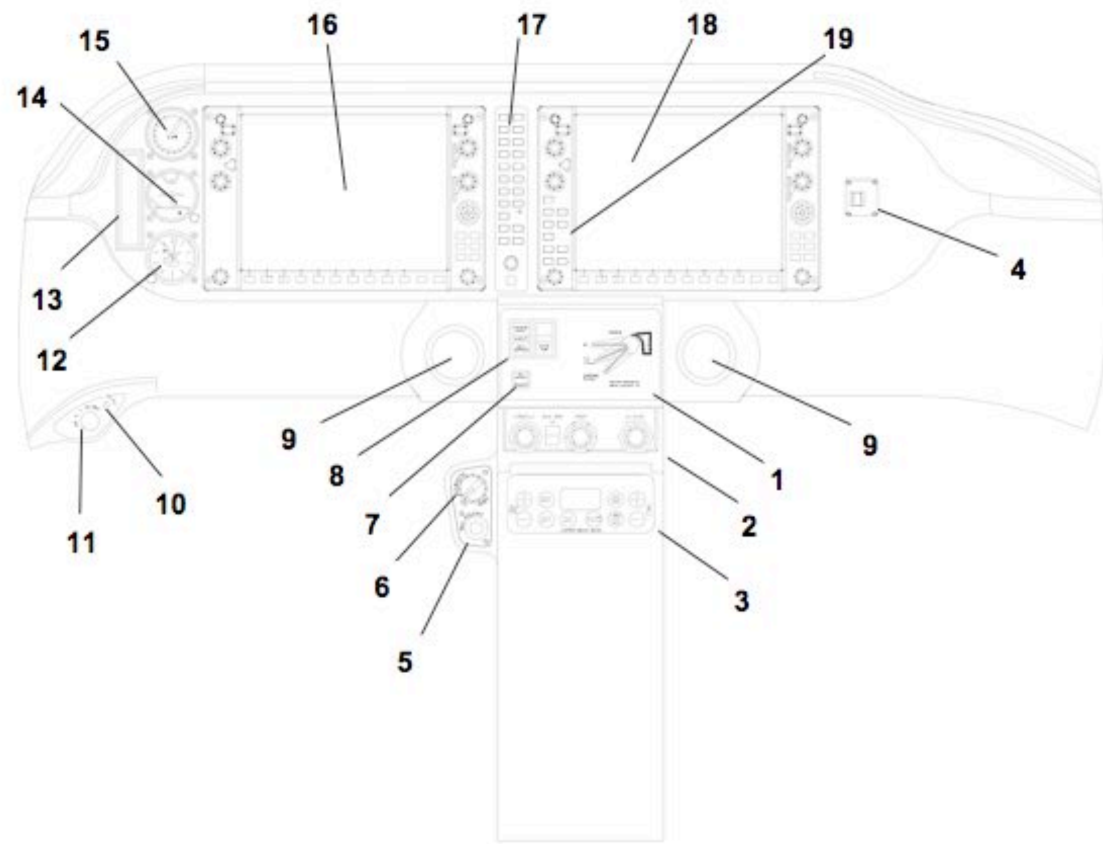
Autopilot/Trim Master Switch (A/P Trim) – The autopilot/trim master switch, to the right of the avionics master switch in the overhead console, turns off power on all the trim tabs. This switch is used of a runaway trim condition is encountered. The switch can be cycled to reset or restore normal trim operations.

Rudder Trim – The airplane has a manually adjustable tab on the lower portion of the rudder. The tab is adjusted at the factory to produce near neutral rudder pressures at typical cruise altitude and power settings. At other power settings and/or altitudes a slight amount of rudder pressure or aileron trim may be required. The owner or operator of the airplane may wish to adjust this tab to accommodate the most frequently used cruise configuration.

NOTE

Do not adjust the manual rudder tab by hand since this can produce an uneven deflection or warping of the tab.

INSTRUMENT PANEL AND COCKPIT LAYOUT DIAGRAM



Instrument Panel and Cockpit

1. Flap Panel – Flap Switch and Annunciator
2. Engine Controls
3. Environmental Control System (ECS) or Automatic Climate Control System (ACCS) Panel
4. ELT Remote Switch
5. Heated Induction Air
6. Alternate Static Air
7. Go Around Switch
8. Rocker Switches: Backup Fuel Pump and Vapor Suppression
9. Air Vents
10. Primer Switch
11. Ignition Switch
12. Altimeter
13. Pitot Heat, Door Seals, and Prop Heat
14. Attitude Indicator
15. Airspeed Indicator
16. Primary Flight Display (PFD)
17. Audio Panel
18. Multi-Function Display (MFD)
19. Autopilot Controls

Figure 5-3

WING FLAPS

The airplane is equipped with electric Fowler-type flaps. During flap extension, the flaps move out from the trailing edge of the wing, which increases both the camber and surface area of the wing. A motor located under the front passenger's seat and protected by a 10-amp circuit breaker powers the flaps. A flap-shaped switch located in the flap switch panel, which is above the of the engine controls, operates the flaps.

The flap switch is labeled with three positions: **UP** (0˚), **T/O** (12˚), and **LANDING** (40˚). Rotating the flap switch clockwise retracts the flaps, and moving it counterclockwise extends the flaps. A light bar on the flap knob flashes, at approximately 2 hertz, while the flaps are in motion. When the flaps reach the selected position the flashing light stops. When landing flaps is selected, the in-transit light will not extinguish until the airspeed drops below 100 KIAS. The load caused by the higher airspeed prevents the flaps from going past approximately 37˚ until the speed drops below 100 KIAS, and thus the load on the flaps is reduced. The illumination of the flaps switch does not change with adjustments to the dimmer switch.

When the flaps are in the up position, the knob is in a position parallel to the floor and points to the UP label on the panel overlay. When flaps are in the takeoff position the knob is rotated 30˚ counterclockwise from UP, and pointed to the T/O label. When flaps are in the down position, the knob is rotated 30˚ more and points to the LANDING label. Flap extension speed placards are posted on the flap switch panel overlay. See Figure 5-4 for a drawing of the flap panel.

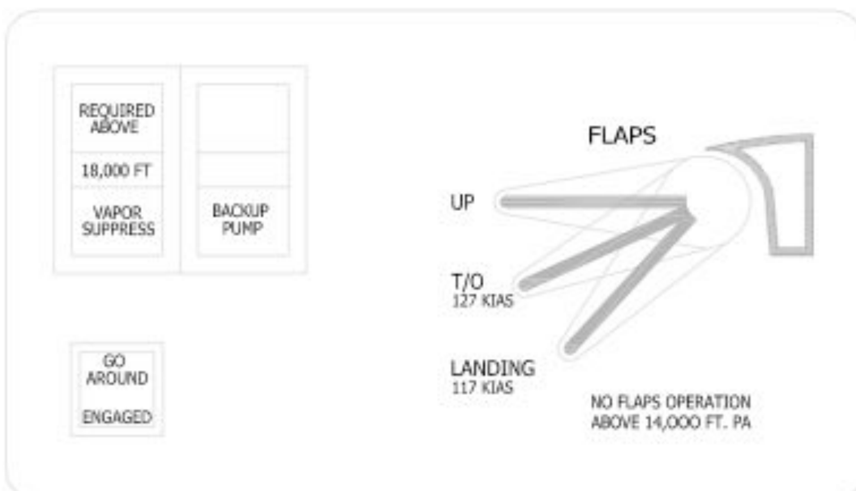


Figure 5-4

LANDING GEAR

Main Gear – The airplane has tricycle landing gear with the two main wheels located behind the center of gravity (CG) and a nose wheel well forward of the CG point. The main gear is made from high quality rod steel that has been gun-drilled (drilled through the center like the bore of a gun barrel). The main gear is attached to a tubular steel gearbox that is bolted to the bottom of the fuselage, just aft of the wing saddle. There are 15x6.00-6 tires (tire width and rim diameter in inches) that are inflated to 55 psi and mounted to the gear with Cleveland disc brakes. Composite fairings are mounted over each tire to reduce drag.

Nose Gear – The nose gear has a nitrogen and oil-filled oleo-type strut that is bolted to the engine mount and serves as a shock absorber. Forcing oil through orifices in the piston and internal plug or barrier absorbs landing or vertical impact. A rotation key or vane working within an oil-filled pocket contains rotational movements (shimmy dampening). Both of these movements, vertical and rotational, are fully contained within the main cylinder body and under normal usage will require little maintenance. Pressurized (250 psi) nitrogen supports the aircraft weight, absorbs small shocks from taxiing, and returns the oleo to full extension.

When the airplane is on the ground, with pressure on the nose strut, the nose wheel is free castoring and has rotational travel through about 120°, 60° to the left and 60° to the right. When the airplane is in flight with pressure off the nose strut, the nose wheel will self-center, which is accomplished by a key in the cylinder rod and a fixed cam. The nose tire is a 5.00-5 and should be filled to 88 psi.

SEATS

Front Seats (General) – Two individual, adjustable, tubular frame seats provide the front seating for the pilot and passenger. The base of the tubular seat frame is covered with sheet aluminum, and the seat cushions are attached to the aluminum through a series of Velcro strips. The seatbacks on the front seats fold forward to permit access to the aft seating area. The seat cushions and seatbacks are foam filled and covered with a natural leather and ultra-leather. For added protection, both the front and rear seats incorporate a special rigid, energy absorbing foam near the bottom of the cushion. The cushion is designed for the loads applied by a seated passenger, and it is possible to damage the seat if concentrated loads are applied. Care must be taken to avoid stepping on the seats with high-heeled shoes or placing heavy objects on the seat that have small footprints.

Front Seat Adjustment – The front seats are adjustable fore and aft through a range of approximately seven inches. The adjustment control for the seats is located below the seat cushion at the front. To adjust the position of either seat, move the control lever towards the middle until the seat unlocks from the seat track, and adjust the seat to the desired position. Release the adjustment control when the seat is in the desired position, and test for positive seat locking by applying a slight fore and aft movement to the seat cushion. The tilt of the front seat back is adjustable on the ground by loosening the jam nut on the coarse-threaded bolts on each side of the seatback and then raising or lowering the bolts that control the tilt of the seat.

Rear Seats – The rear seats are a split bench-type design and are nonadjustable. The bench seat frame is composite construction and bolted to the interior of the fuselage. The foam-filled seat and seatback cushions are covered with natural leather and ultra-leather and attached to the seat bench with Velcro fasteners. The seatbacks are attached to a metal crossbar and secured with quick release pins; however, removal of the rear seat back is not permitted for normal operation.

SEAT BELTS AND SHOULDER HARNESSES

The seat belts and shoulder harnesses are an integrated three-point restraint type of device. With this type of restraint, the lap belt and diagonal harness are incorporated using one continuous piece of belt webbing. The webbing is anchored on each side of the seat for the lap belt restraint and then in the overhead for the harness restraint.

DOORS

Gull Wing Cabin Doors – The airplane has entrance door son each side, which permit easy access to front and rear seat positions. The doors are hinged at the top and open to an almost vertical position above the fuselage. The doors are part of the fuselage contour and when both are fully opened, have a gull wing type of appearance. In the full up or full open position, each door is supported and kept open by a gas strut. The strut will only hold the door open when the door is in the vertical or near vertical position.

Door Locks – There are door locks for each door that restrict use of the latching mechanism and are intended as antitheft devices. The door lock on the pilot's side is a tube-type lock and is operated with a key. On the passenger's side, there is an interior latch control for locking the door. The keyed lock and the latch are moved counterclockwise to lock the door.

Door Seal System – The airplane is equipped with a pneumatic door seal system that limits air leakage and improves soundproofing. An inflatable gasket around each door expands when the door seal system is turned on. An electric motor near the pilot's rudder pedals operates the system, which maintains a differential pressure of 12 to 15 psi. The system is activated by a switch to the left of the PFD labeled "Door Seals" and is protected by a five-amp circuit breaker. The cabin and baggage doors must be closed for the door seal system to operate.

Baggage Door – The baggage access door is located on the left side of the airplane, approximately two and one half feet from the left cabin entrance door. The door has Ace type locks on each side of the door, and both locks are used to secure and unsecure the door. There is a piano hinge at the top, and the door is held open by a gas strut during loading and unloading operations.

Step – On each side of the airplane there is an entrance step mounted to the fuselage and located aft of the flaps. The entrance step is used for access to the airplane; however, the flaps cannot be stepped on during ingress and egress operations. Placing weight on the top of the flaps imposes unnatural loads on the control's surface and hardware and may cause damage. Both flaps are placarded with the words "No Step."

Handles – Optional fuselage handles are available with some aircraft to assist entering the aircraft. The handles are located behind the passenger windows. Do not hang or otherwise put your full weight on the handles.

BRAKE SYSTEM

The airplane braking system is hydraulically operated by a dedicated braking system. Each rudder pedal has a brake master cylinder built into it. Depressing the top portion of the rudder pedals translates this pressure into hydraulic pressure. This pressure is transmitted through a series of hard aluminum and steel grade Teflon lines to pistons in the brake housing of each brake. The piston activates the brake calipers that apply friction to the chrome steel discs. Each disc is connected to a wheel on the main landing gear, and when the caliper clamps onto the disc, it creates friction, which impedes its rotation. Since the disc is part of the wheel, the friction on the disc slows or stops the forward momentum of the airplane.

Parking Brake – The parking brake is near the floor, forward of the circuit breaker panel on the pilot's side of the airplane. When disengaged, the handle is flush with the side panel. The black handle is placarded with the red lettered statement, "Brake Engaged", which is only visible when the brake is engaged.

Steering – Directional control of the airplane is maintained through differential braking. Applying pressure to a single brake introduces a yawing moment and causes the free castoring nose wheel to turn in the same direction. As is the case with most light aircraft, turning requires a certain amount of forward momentum. Once the airplane is moving forward, applying a right or left brake will cause the airplane to steer in the same direction. There are two important considerations. First, use enough power so that forward momentum is maintained, otherwise the differential braking will stop the airplane. Second, avoid the tendency to ride the brakes since this will increase wear. Some momentary differential braking may be required for takeoff until the control surfaces become effective.

ENGINE

ENGINE SPECIFICATIONS

The airplane engine is a Teledyne Continental Motors Aircraft Engine Model TSIO-550-C. It is a twin-turbocharged, horizontally opposed, six-cylinder, fuel injected, air-cooled engine that uses a high-pressure, wet-sump type of oil system for lubrication. There is a full flow, spin-on, disposable oil filter. The engine has top air induction, and engine mounted throttle body, and a bottom exhaust system. On the front of the engine, accessories include a hydraulically operated propeller governor, a gear driven alternator, and a belt driven alternator. Rear engine accessories include a starter, gear-driven oil pump, gear-driven fuel pump, and dual gear-driven magnetos.

TURBOCHARGES

The TISO-550-C has twin turbochargers, which use exhaust gas flow to provide high pressure to the engine for increased power. There is one turbocharger on each side of the engine. The hot gas flow from the left side exhaust drives the left turbocharger and the hot gas flow from the right side exhaust drives the turbocharger on the right side. The turbocharger compresses and raises the temperature of the incoming air before going to the intercoolers. The compressed air is then run through the intercoolers where it is cooled down before entering the throttle body and cylinders. The dual turbochargers are lubricated from external oil lines supplied from a source at the bottom of the oil cooler. There is one mechanical wastegate on the left side of the engine. The wastegate controls the amount of high pressure air to the engine by automatically sensing manifold pressure. An overboost valve in the inductions system provides protection from too much pressure.

ENGINE CONTROLS

Throttle – The throttle controls the volume of air that enters the cylinders. The control has a black circular knob and is located below and to the left of the flap switch. The control has a vernier feature, which permits small adjustments by rotating the knob either clockwise (increase) or counterclockwise (decrease). Changes in throttle settings are displayed on the manifold pressure indicator. Moving the throttle forward increases engine power and manifold pressure, while moving it back will reduce power and manifold pressure.

Propeller – The propeller control allows the pilot to vary the speed or RPM of the propeller. The control has a blue knob with large raised ridges around the circumference and is located between the throttle and the mixture controls. The control has a vernier feature, which permits small adjustments by rotating the knob either clockwise (increase) or counterclockwise (decrease). Large adjustments, such as "exercising the prop" (moving the control to the full aft position), can be made by pressing in the locking button in the center of the knob and moving the control as desired. The high-speed position is with the control full forward.

Mixture – The mixture control allows the pilot to vary the ratio of the fuel-air mixture. The control has a ed knob with small raised ridges around the circumference and is located below the flap switch. The control has a vernier feature, which permits small adjustments by rotating the knob either clockwise (increase) or counterclockwise (decrease). Large adjustments, such as when the control is set to idle cutoff (moving the control to the full aft position), can be made by pressing the locking button in the center of the knob and moving the control as desired. The richest position is with the control full forward.

ENGINE SUB-SYSTEMS

Starter and Ignition – Turning the keyed ignition switch, which is located by the pilot's left knee, activates the starter. The key rotates in a clockwise direction and is labeled: "Off" – "R" – "L" – R/L" – "Start". The "r" and "L" items of this label relate to which magneto (left or right) is turned on or not grounded. Turning the key to "R/L" will cause both magnetos to be ungrounded or "Hot".

Propeller and Governor – The airplane is equipped with a Hartzell three-bladed constant speed propeller with a McCauley governor. In a constant speed propeller system, the angle of the propeller blade changes automatically to maintain the selected RPM. For this to happen the angle of the propeller blade must change as power, air density, or airspeed changes. A decrease in blade angle decreases the air loads on the propeller, while an increase in blade angle increases air loads. If, for example, the manifold pressure is reduced, the angle of the blade will decrease (decreased air loads) to maintain a constant RPM. When operating at high altitudes with reduced air resistance, the blade angle will increase; hence, propeller and engine RPM indications are the same.

The sequence in which power changes are made is important. The objective is to not have a high manifold pressure setting in conjunction with a low RPM setting. When increasing power settings, increase RPM first with the propeller control, and then increase manifold pressure with the throttle. When decreasing power settings, decrease manifold pressure first and then decrease the RPM setting.

Induction – The induction system routes outside air through an air filter to the left and right side turbocharger and then to each individual cylinder where the fuel from the injector nozzle of the cylinder is mixed with the induction air.. The components of the induction system include the air filter and the left and right heated induction air valves. Ram air enters through both the left and right intake holes in the front of the cowling and passed through the air filter where it is sent on to the compressors and then the intake manifold.

In the event the normal induction system is obstructed by ice, there is a control, which permits introduction of heated air in the induction system. This control is below the rocker switch panel near the pilot's right knee and labeled "Induction Heat". Heated induction air is routed through the induction system when the knob is pulled. The heated induction air valves are located next to the right and left side turbochargers. When the induction heat control is pulled out, it moves a butterfly inside the valves that opens the airflow for heated air from the lower engine area. There is no need for an air-to-air heat exchanger manifold. The ambient air that circulates around the engine provides a sufficient temperature rise for the heated induction air. If the filter is not clogged, alternate induction air can be used at any time. If the filter is clogged and alternate induction air is selected, the engine id drawing hot air into the induction system. This increases the chance of engine detonation. To limit the chance for engine detonation, set the mixture to full rich and do not use more than 85% power if the outside air temperature is greater than 32˚F.

Cooling – The airplane has a pressure cooling system. The basic principle of this design is to have high pressure at the intake point and lower pressure at the exit point. This type of arrangement promotes a positive airflow since higher pressure air moves towards the area of low pressure. The high-pressure source is provided by ram air that enters the left and right intake openings in the front of the cowling. The low pressure point is created at the bottom of the cowling near the engine exhaust stacks. The flared cowl bottom causes increased airflow, which lowers pressure.

Within the cowling, the high-pressure intake air is routed around and over the cylinders through an arrangement of strategically placed baffles as it moves towards the lower pressure exit point. In addition, fins on the cylinders and cylinder heads, which increase the surface area and allow greater heat radiation, promote increased cooling. The system is least efficient during ground operations since the only source of ram air is from the propeller or possibly a headwind.

INSTRUMENTS

FLIGHT INSTRUMENTS

The backup attitude, airspeed, and altitude indicators are located in a column next to the PFD. The discussion that follows will identify each instrument.

Magnetic Compass – The airplane has a conventional aircraft, liquid filled, magnetic compass with a lubber line on the face of the window, which indicates the airplane's heading in relation to magnetic north. The instrument is located on the top of the windshield and is labeled at the 30˚ points on the compass rose with major increments at 10˚ and minor increments at 5˚. A compass correction card is on the compass and displays compass error are 30˚ intervals with the engine, radios, and strobes operating.

Backup Airspeed Indicator – The backup airspeed indicator is part of the pitot-static system. The instrument measures the difference between total pressure and static pressure and, through a series of mechanical linkages, displays an airspeed indication. The source of the ram pressure is from the pitot tube, and the source of the static pressure is from the static air vent. The instrument shows airspeed in knots on the outer circumference of the instrument, which ranges from 0 to 260 knots with 10-knot increments. Airspeed limitations in KIAS are shown on colored arcs as follows: white arc – 60 to 117 knots; green arc – 73 to 181 knots; yellow arc – 181 to 230 knots; and red line – 230 knots.

Backup Attitude Indicator – The backup attitude indicator is electrically powered and protected by a three-amp circuit breaker. The instrument uses a self-contained vertical gyroscope mounted in a pitch gimbal that is mounted on a roll gimbal. The gyro provides information relating to movement around the pitch and roll axes. The indicator has not restriction on operation through 360 degrees of aircraft pitch and roll displacement. The instrument has a caging knob that provides simultaneous erection of the pitch and roll axes. The instrument has a power warning flag on the lower left side of the instrument. When the flag is in view, power is off. When retracted, normal operation is indicated.

Backup Altimeter – The backup altimeter is part of the pitot-static system. The instrument measures the height above sea level and is correctable for variations in local pressure. The pressure source for the instrument is from the static air vent. An aneroid or diaphragm within the instrument either expands or contracts from changes in air pressure, and this movement is transferred, through a series of mechanical linkages, into an altitude reading. Adjustments for variations in local pressure are accounted for by setting the station pressure (adjusted to sea level) into the pressure adjustment window, most commonly known as the Kollsman Window. The altimeter has one Kollsman Window calibrated in inches of mercury (labeled inches Hg). The adjustment knob for the window is at the seven o'clock position on the dial

ENGINE REALTED SYSTEMS

FUEL SYSTEM

The fuel system has two tanks that gravity feed to a three position (Left, Right, and Off) fuel selector valve located in the forward part of the armrest between the pilot and the copilot seats. The fuel flows from the selected tank to the auxiliary fuel pump and then to the strainer. From this point it goes to the engine-driven pump where, under pressure, it is sent to the throttle/mixture control unit and then to the fuel manifold valve for distribution to the cylinders. Unused fuel from the continuous flow is returned to the selected fuel tank. The diagram in Figure 5-5 shows a general layout of the fuel system.

Each fuel tank contains a slosh box near the fuel supply lines. A partial rib near the inboard section of the fuel tank creates a small containment are with a check valve that permits fuel flow into the box but restricts outflow. The slosh box is like a mini-fuel tank that is always full. Its purpose, in conjunction with the flapper valves, is to ensure short-term positive fuel flow during adverse flight attitudes, such as when the airplane is in an extended sideslip or subject to the bouncing of heavy turbulence.

Fuel Quantity Indication – The airplane has integral fuel tanks, commonly referred to as a "wet wing". Each wing has two internal, interconnected compartments that hold fuel. The wing's' slope or dihedral produces different fuel levels in each compartment and requires two floats in each tank to accurately measure total quantity.

The floats move up and down on a pivot point between the top and bottom of the compartment, and the position of each float is summed into a single indication for the left and right tanks. The positions of the floats depend on the fuel level; changes in the float position increases or decreases resistance in the sending circuit, and the change in resistance is reflected as a fuel quantity indication on the MFD.

The pilot is reminded that the fuel calculation group of the MFD System page provides approximate indications and never substitutes for proper planning and pilot technique. Always verify the fuel onboard through a visual inspection, and compute the fuel used through time and established fuel flows.

Fuel Selector – The fuel selector handle is between the two front seats, at the forward part of the armrest. The selector is moveable to one of three positions: Left, Right, and Off. The fuel tank selector handle is connected to a drive shaft that moves the actual fuel valve assembly, which is located in the wing saddle. Moving the fuel tank selector handle applies a twisting force to move the fuel selector valve.

When the fuel tank selector handle is moved to a particular position, positive engagement occurs when the fuel selector valve rests in one of the three available detents: Left, Right, and Off. Rotating he handle to the desired tank position changes the left and right tanks; initially, a small amount of additional pressure is required to move the valve out of its detent.

Fuel System Diagram

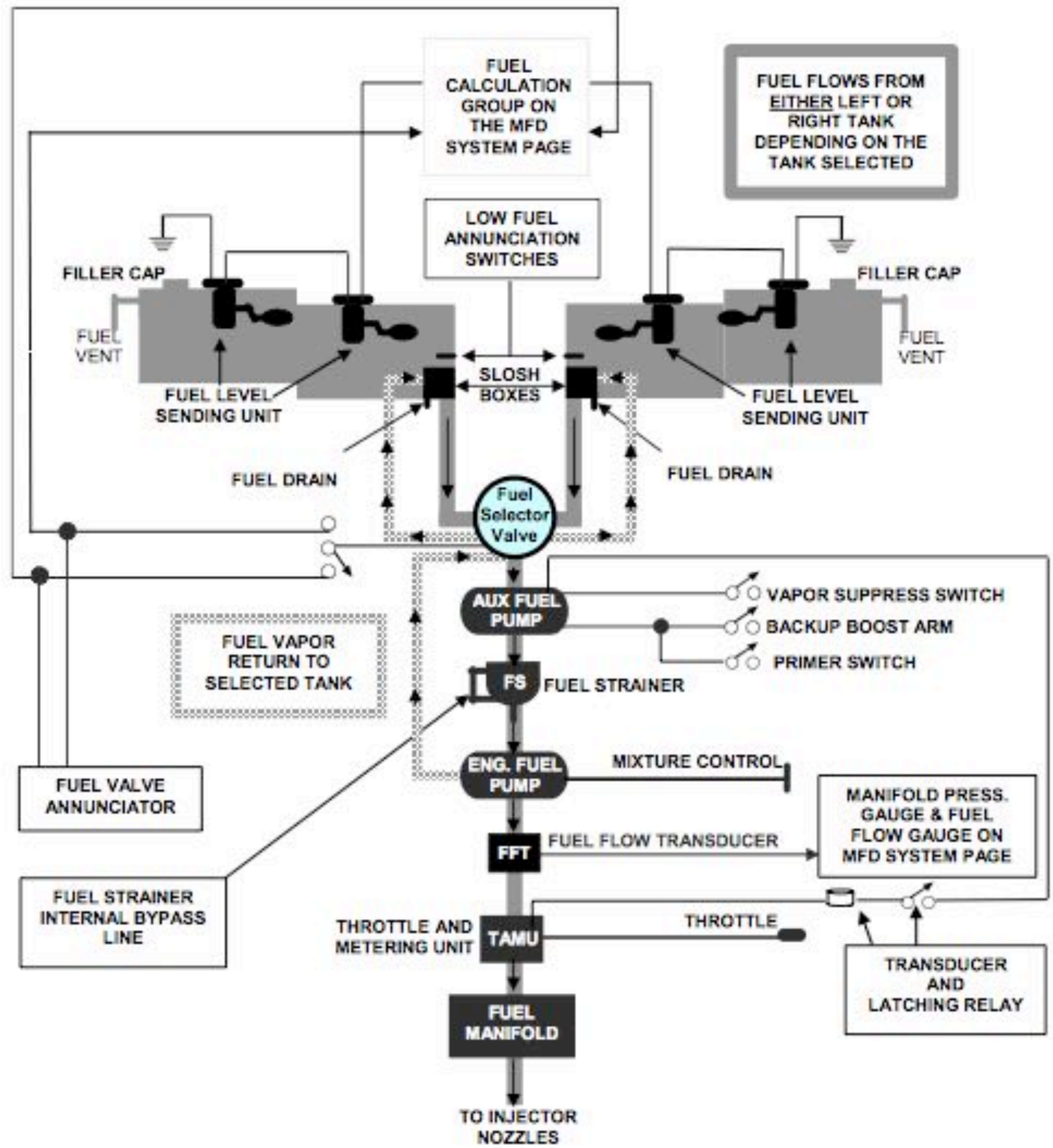


Figure 5-5

When a tank is selected and the selector is properly seated in its detent, one of the two blue lights on the fuel gauges on the MFD System page will illuminate to indicate which tank is selected. If the fuel selector is in the Off position, the PFD annunciation window will display a red FUEL VALVE message.

Fuel Low Annunciation Messages – There is a separate system, independent of the fuel quantity indicators, which displays a low fuel state. A fuel level switch in each tank activates a L LOW FUEL or R LOW FUEL message in the PFD annunciation window when there is less than 10 gallons US of usable fuel remaining in that tank. The fuel warning annunciation message has a 30 second delay switch, which limits false indications during flight in turbulent air conditions.

Backup Fuel Pump and Vapor Suppression – The auxiliary fuel pump is connected to two switches located in the flaps panel, just to the left of the flaps switch. One switch is labeled BACKUP PUMP with red letters, and the other is labeled VAPOR SUPPRESS with amber letters. The vapor suppression switch, which uses the low power function of the auxiliary pump, is used primarily to purge the system of fuel vapors that form in the system at high altitudes or atypical operating conditions. The vapor suppression must be turned on before changing the selected fuel tank. If proper engine operations are observed, turn off the pump.

Primer – The primer is a push-button switch located next to the ignition switch. Depressing the primer button activates the backup fuel pump and sends raw gasoline, via the fuel manifold, to the cylinders. The mixture must be rich and throttle partially open for the primer to work properly.

ELECTRICAL AND RELATED SYSTEMS

ELECTRICAL SYSTEM

General Description – The electrical system in this aircraft consists of two independent buses, which are referred to as the left and right bus. The left and right (continuous output) alternators are 65 amp and 52 amp, respectively, and provide charging power for the two 28 volt lead-acid batteries, as well as system power. The batteries will also provide additional power in the vent of an over demand situation where the requirements of the system are greater than what can be provided by the alternator. The left and right buses in turn feed the avionics and essential buses. Please refer to Figure 5-7 for a diagram of the electrical system. A summary of buses and related circuit breaker protection is shown in Figure 5-6.

Five current limiters protect the alternators and bus options. In addition, the left and right buses are physically isolated at the aft end of the avionics bay. Left and right bus controls, grounds, and outputs are routed through separate holes, connectors, and cable runs so any failure on one bus will not affect the operation of the other bus.

Control of the buses is via the master switch panel located on the overhead. There is also a crosstie switch on this panel, which will restore power in the event of failure of the right or left systems. For example, if the alternator or some other component on the left side should fail, the crosstie switch will restore power to the electrical items on the left bus by connecting the left bus to the right bus.

As its name may suggest, power to the essential bus is never affected, provided power from at least one bus (left or right) is available. The essential bus is diode fed, ie., current will only flow in one direction, from both the right bus and left bus allowing the essential equipment to have two sourced of power.

Avionics Bus – The avionics bus provides power to the Audio/<KR, Integrated Avionics #2, Com #2, Transponder, Avionics Fan, Traffic, Autopilot, MFD, and Weather.

Left Bus – The left bus provides power for the Aileron Trim, Pitot Heat, SpeedBrakes, Position Lights, Landing Lights, Left Voltage Regulator, and Fan.

Right Bus – The right bus provides power for the Strobe Lights, Taxi Light, Right Voltage Regulator, Door Seal/Power Point, Carbon Monoxide Detector, Oxygen, Display Keypad, and Air conditioning.

Essential Bus – The essential bus is diode fed from either the right or the left bus and provides power for the PFD, Attitude Horizon, Elevator Trim, Panel Lights, Air Data Computer, Engine Airframe, Integrated Avionics #1, Com #1, Left Bus Relays, Fuel Pump, Stall Warnings, Flaps, Standby Attitude Horizon, and the Right Bus Relays.

Battery Bus – The Hobbs Meter, ELT, and courtesy lights/flip lights are connected to the battery bus. These items will operate even if the left and right buses are turned off since the Hobbs meter and ELT are directly connected to the right battery, and the courtesy lights/flip lights are directly connected to the left battery. A 3-amp fuse protects each component and is not accessible from the cockpit.

Master Switches – The system's two master switches are located in the master switch panel in the overhead console. This manual refers to each of the left and right split-rocker switches as a master (left master switch and right master switch). Although these switches are not technically "master" switches, as they do not control the entire system, it is a common term used to prevent confusion. Each switch is a split-rocker design with the alternator switch on the left side and the battery switch on the right side. Pressing the top of the alternator portion of the split-switch turns on both switches, and pressing the bottom of the battery portion of the split-switch turns off both switches. The battery side of the switch is used on the ground for checking electrical devices and will limit battery drain since power is not required for alternator excitation. The alternator switches are used individually (with the battery on) to recycle the system and are turned off during load shedding.

Crosstie Switch – The crosstie switch is the white switch located between the left and right master switches. This switch is to remain in the OFF position during normal operations. The crosstie switch is only closed, or turned on, when the aircraft is connected to ground power or in the event of an alternator failure. This switch will join the left and tight buses together for ground operations when connected to ground power. In the event of a left or right alternator failure, this switch will join the two buses allowing the functioning alternator to carry the load on both buses and charge both batteries. If the crosstie switch is turned on during normal operations, the system will operate normally, however, the two main buses will not be isolated and they will function as a single bus.

Avionics Master Switch – The avionics master switch is located in the right side in the master switch panel. The switch is a rocker-type design and connects the avionics distribution bus to the primary distribution bus when the switch is turned on. The purpose of the switch is primarily for protection of delicate avionics equipment when the engine is started. When the switch is turned off, no power is supplied to the avionics distribution bus.

Summary of Buses

SUMMARY OF BUSES		
Bus	**Bus Component**	**Circuit Breaker**
AVIONICS BUS	• Audio/MKR	5 amp
	• Integrated Avionics #2	5 amp
	• Com #2	5 amp
	• Transponder	5 amp
	• Avionics Fan	3 amp
	• Traffic	3 amp
	• Autopilot	5 amp
	• MFD	5 amp
	• Weather	3 amp
LEFT BUS	• Aileron Trim or Rudder Hold/Aileron Trim	2 amp
	• Pitot Heat	7.5 amp
	• SpeedBrakes	3 amp
	• Position Lights	5 amp
	• Landing Light	5 amp
	• Left Voltage Regulator	5 amp
	• Fan	5 amp
RIGHT BUS	• Strobe Lights	5 amp
	• Taxi Light	2 amp*
	• Right Voltage Regulator	5 amp
	• Door Seal/Power Point	5 amp
	• Carbon Monoxide Detector	2 amp
	• Oxygen	3 amp
	• Display Keypad	2 amp
	• Air Conditioning	15 amp
ESSENTIAL BUS	• Attitude Horizon	5 amp
	• Elevator Trim	2 amp
	• Panel Lights	7.5 amp
	• Air Data Computer	5 amp
	• PFD	5 amp
	• AHRS	5 amp
	• Engine Airframe	5 amp
	• Integrated Avionics #1	5 amp
	• Com #1	5 amp
	• Left Bus Relays	1 amp
	• Fuel Pump	5 amp
	• Stall Warning	2 amp
	• Flaps	10 amp
	• Standby Attitude Horizon	3 amp
	• Right Bus Relays	1 amp
BATTERY BUS	• Hobbs Meter	3 amp
	• ELT	3 amp
	• Courtesy Lights	3 amp

* 5 amp for Precise Flight taxi light, S/N 41563 and on.

Figure 5-6

Electrical System Diagram

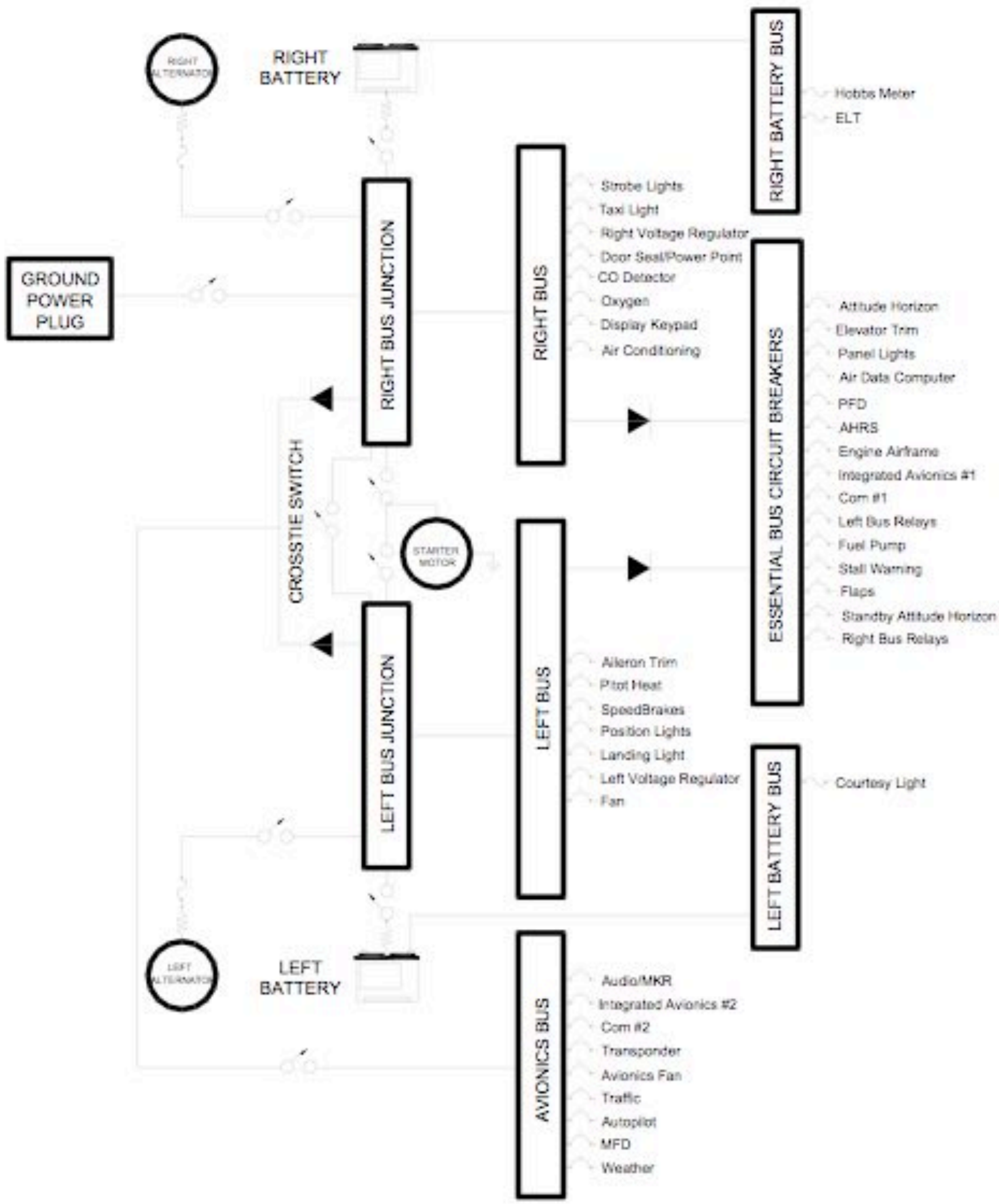


Figure 5-7

AIRPLANE INTERIOR LIGHTING SYSTEM
The interior lighting system is on of the more sophisticated systems available for single-engine, general aviation airplanes. A good understanding of the following discussion is important to properly use all the features of the interior lighting system. The salient features of this system are summarized in Figure 5-8.

Flip and Access Lights – The flip lights are rectangular shaped fixtures located in the middle of the overhead panel and in the baggage compartment. The lights bypass the system master switch and operate without turning on power to the system. Rotating of flipping the lens right or left turns on the two flip lights. In the center position, they are used as part of the airplane's access lighting system.

When either entrance door is unlatched, a switch in the door latching mechanism activates the two flip lights and two lights that illuminate each entrance step. The access lights are on a ten-minute timer and turn off automatically unless reset by activating both main door-latching mechanisms when all the doors are closed.

This design has two advantageous features. First, opening either of the main cabin doors provides an immediate light source for preflight operations, passenger access, and baggage loading. Second, the flip lights, when rotated either left or right, serve as emergency lighting in situations, which necessitate turning off the master switch. The only disadvantage is that the flip lights can inadvertently be left on, depleting battery power. To prevent this from happening, ensure the flip lights are in the centered or flush position when securing the airplane at the end of a flight.

Overhead Reading Lights – There are four overhead reading lights, two between the front seats and two between the backseat positions. Each light is on a swivel that can be adjusted to an infinite number of positions. The intensity of the lights can be adjusted by moving the left slide-type dimmer switch located in the center of the overhead panel, just aft of the master switches. The dimmer has an on-off switch at the extreme forward position, and moving the slide aft increases the light intensity.

Instrument Flood Bar – There is a tube array of LEDs inserted under the glare shield. The intensity of the lights can be adjusted by moving the right slide-type dimmer switch located in the center of the overhead panel, just aft of the master switches. The dimmer has an on-off switch at the extreme forward position, and moving the slide aft increases the light intensity.

Upper Instruments – The brightness of the PFD, MFD, audio panel, and keypad are controlled by photo cells located on the devices. The brightness of backlighting for the backup flight instruments is controlled by the left slide dimmer switch at the front of the center console. The dimmer has an on-off switch at the extreme up position, and moving the slide down increases the light intensity.

Lower Instruments, Circuit Breakers, and Master Switch Panels – Backlighting of the pitot heat, door seals, and optional equipment switches, flap panel, lighted position bar, slide dimmer labels, master switches and circuit breaker panel is controlled by the right side switch at the front of the center console. Backlighting of the fuel pump "armed" light is controlled by the position lights switch. The backlighting illuminates the placards on or next to the breaker., switch or control, and the internally lighted switches. The dimmer has an on-off switch at the extreme up position, and moving the slide down increases the light intensity. Backlighting of the pitot heat, door seals, and optional items switches will dim down to a preset value while all other lighting controlled by this switch will dim to zero.

NOTE

The slide dimmer switches are "alive" at all times. During daylight operation they should be slide to "off" to increase bulb life.

Summary of Interior Lights and Switches

LIGHT	LOCATION OF LIGHTS	LOCATION OF SWITCH	REMARKS
Courtesy Lights	• Front and rear flip lights in overhead console • Exterior lights near the right and left entrance steps	♦ If all doors are latched, flip-light is activated by flipping the lens from the neutral position. ♦ If a door is unlatched, a switch activates flip-lights when the lens is in the neutral position.	▪ Door switch activates timer that turns off access lights after 10 minutes. ▪ Operates with master switch on or off
Overhead Swivel Lights	• Two overhead swivel lights in the front seat area • Two overhead swivel lights in the rear seat area	♦ The left slide-type dimmer switch is in the overhead panel.	▪ Master switch and navigation lights must be on for the system to operate.
Glare Shield Flood Bar	• Flood bar under the glare shield which lights the flight instruments and front panel areas	♦ The right slide-type dimmer switch is in the overhead panel.	▪ Master switch must be on for the system to operate.
Upper Instrument Panel	• Provides backlighting for the flight instruments	♦ The left slide-type dimmer switch is on the front of the center console.	▪ Master switch must be on for the system to operate.
Lower Inst. & Circuit Breaker Panels	• Provides backlighting for switches, or placards next to switches, circuit breakers, and controls	♦ The right slide-type dimmer switch is on the front of the center console.	▪ Master switch must be on for the system to operate.

Figure 5-8

Press-to-Test PTT Button – The Press-to-Test PTT button is located to the right side of the master switches in the overhead console. Pushing the test button verifies the operation of the LEDs or indicators associated with the flaps panel, pitot heat, door seals, rudder hold switch, and optional equipment switches. When the test position is selected, all related LEDs illuminate in the bright mode. A light that fails to illuminate should be replaced. The rudder hold assembly brake will engage while the button is pressed and disengage when the button is released; system override by pedal pressure will function normally.

When the position lights are on, these lights operate in the dim mode. When the position lights are off, the lights operate in the bright mode. The degree of luminance is set at the factory and cannot be adjusted manually. In the daytime, during periods of reduced ambient light, the position lights can be turned on if the illumination of the LEDs is distracting.

Interior Light Protection – With the exception of the flip lights, all interior lights are connected to the essential bus and will only operate when the master switches are on. The light systems are protected by circuit breakers in the circuit breaker panel.

AIRPLANE EXTERIOR LIGHTING SYSTEM
Aircraft position and anti-collision or strobe lights are required to be lighted whenever the aircraft is on operation. Anti-collision lights, however, need not be lighted when the pilot-in-command determines that, because of operating conditions, it would be in the interest of safety to turn off the lights. For example, strobe lights shall be turned off on the ground if they adversely affect ground personnel or other pilots and in flight when there are adverse reflections from clouds.

The exterior lighting system includes the position lights, the strobe or anti-collision lights, the landing light, and the taxi light. These lights are activated through the use of switches located on the center console. The light system is protected by circuit breakers in the circuit breaker panel.

Position and Anti-collision Lights – The left and right position lights (red and green) are mounted on each wing tip. Each wing position light contains the required aft or rearward projecting white lights. The anti-collision lights are on each wingtip and contained within the same light fixture as the position lights.

Taxi and Landing Lights – The taxi and landing lights are contained in the leading edge of the left wing. The outboard bulb in the light housing is the taxi light that provides a diffused light in the immediate area of the airplane. The inboard bulb is the landing light, which has a spot presentation with a slight downward focus. The taxi and landing lights are sized for continuous duty and can be left on for operations in high-density traffic areas.

STALL WARNNG SYSTEM
Stall Warning – The aural stall warning buzzer in the overhead console is actuated by a vane-type switch located on the leading edge of the left wing. Under normal flight conditions, the angle of relative wind flow keeps the vane in the down position. The vane is connected to an electrical switch that is open under normal flight operations. When the airplane approaches its critical angle of attack, the relative wind pushes the vane up and closes the switch. The switch is set to activate approximately five to ten knots above the actual stall speed in all normal flight configurations.

Stall Warning System (Electrical) – Operation of the stall warning system requires the master switch to be on since the stall warning is connected to the left and right buses. Breakers in the circuit breaker panel protect the stall warning indicator. The stall warning is protected by a 2-amp circuit breaker.

Section 6 – Simulation & G1000

INTRODUCTION

Welcome to JGX-Aircraft's simulation of the Columbia 400/Cessna Corvaliis TT. Many hours have been spent on recreating the C400 with as much accuracy in systems and appearance as possible. This is an ongoing project and features will continue to be added in the future.

We suggest that you read through all the previous sections of the POH to become familiar with the JGX C400. There are many avionics, systems, and features that you want to be familiar with.

This section will focus mainly on the simulation of the G1000 flight deck and how to operate the various aspects of the G1000. Although we have attempted to simulate as many features of the G1000 as possible, not all features have been recreated and some systems vary from the exact functionality of the G1000.

2D PANEL

The 2D panel of the C400 measures 2048 x 1920 pixels. The panel was designed at a screen resolution of1680 x1050. Larger resolutions (up to 2048) should work fine, while anything over 2048 will stretch to fill the screen. While you could run the simulation at a lower resolution (for 2D), parts of the panel will be cut off and reduce the screen visibility of critical items that may be needed while flying. Of course, if you use the virtual (3D) cockpit, the resolution is not critical.

The Entire Panel (2D – 2048 x 1920)

Figure 6-1

The red outline in Figure 6-1 above indicates the visible area when running at a resolution of 1680 x 1050 in 2D mode. The other areas of the cockpit can be made visible by scrolling up, down, right and left using the arrow keys.

The 2d Panel Layout

1. Overhead Console
2. Compass
3. Accessory Controls
4. Backup Airspeed Indicator
5. Backup Attitude Indicator
6. Backup Altimeter
7. PFD
8. Audio Control Panel
9. MFD
10. ELT
11. Flap Control Panel
12. Ignition and Primer
13. Panel Light Dimmer Panel
14. Exterior Light Panel
15. Alt Static Air & Heted Ind Air
16. Engine Control Panel
17. Fuel Valve Selector
18. A/C Control Panel

VIRTUAL COCKPIT (3D)
The virtual (3D) cockpit/cabin features 3D lighting, multiple animations, and manipulator technology to provide an immersive 3D experience. To enter 3D mode press Ctrl–O.

Figure 6-3

COCKPIT AND CABIN LIGHTING
The following lighting is available in the 3D cockpit:

- Cockpit Dome (Flip) Light – In the overhead console there is a "flip" light that when pressed provides illumination of the entire cockpit and cabin area.

- Instrument Flood Bar – In the overhead console there is a slider-type dimmer switch that controls the instrument panel flood lighting.

- Backup Flight Instruments Backlighting – The three backup flight instruments have backlighting that is controlled by a slider-type dimmer switch located on the front of the center console.

- Panel Backlighting – The backlighting of the pitot heat, door seals, optional equipment switches, flap panel, lighted position bar, slide dimmer labels, master switches, A/C panel, and circuit breaker panel is controlled by the right side slider-type dimmer switch at the front of the center console.

NOTE
Because the Backup and Panel dimmers are difficult to access in the simulation, a pop-up (duplicate) of this panel has been provided. On the forward most part of the center console, just forward of the ReadyPad, there is a placard that has two arrows on it indicating

where the dimmer switches are located. By clicking on this placard a pop-up panel will appear with the slider-type dimmer switches for the Backup Instrument Backlighting and the Panel Backlighting.

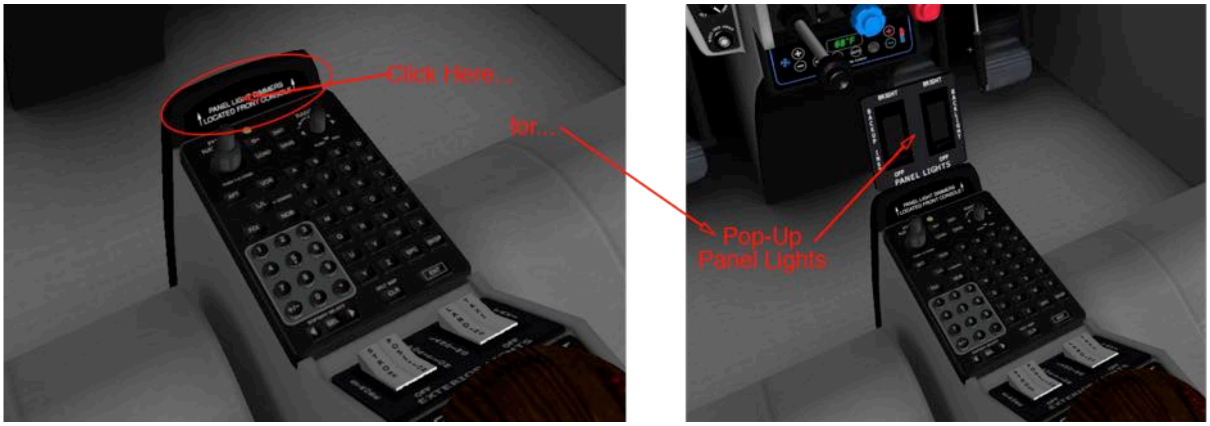


Figure 6-4 Panel Light Pop-up

- The backlighting of the PFD and MFD displays, bezels, and keys , as well as the Audio Control Panel and ReadyPad keys, are controlled by photo cells located on the devices. These instruments are set to automatically adjust for all ambient lighting conditions and normally will not have to be manually adjusted. If you wish to manually adjust the backlighting of these instruments you can do so as follows:

Figure 6-5 PFD Setup Menu

Adjusting display backlighting:

1. Press the PFD **MENU** Key to display the PFD Setup Menu. "AUTO" is now highlighted next to "PFD DSPL".
2. Turn the small **FMS** Knob to select "MANUAL".
3. Turn the large **FMS** Knob to highlight the light percentage.
4. With the intensity value now highlighted, turn the small **FMS** Knob to enter the desired backlighting.

5. Turn the large **FMS** Knob to highlight "AUTO" next to "MFD DSPL" and repeat steps 2–4
6. To remove the menu, press the **CLR** or **MENU** Key.

Adjusting key backlighting:

1. Press the PFD **MENU** Key to display the PFD Setup Menu. "AUTO" is no highlighted next to "PFD DSPL".
2. Turn the large **FMS** Knob to the left to highlight "PFD DSPL".
3. Turn the small **FMS** Knob in the direction of the green arrowhead to display "PFD KEY".
4. Turn the large **FMS** Knob to highlight "AUTO".
5. Turn the small **FMS** Knob to select "MANUAL".
6. Turn the large **FMS** Knob to highlight the light percentage.
7. With the intensity value now highlighted, turn the small **FMS** Knob to enter the desired backlighting.
8. Turn the large **FMS** Knob to highlight "MFD DSPL".
9. Turn the small **FMS** Knob in the direction of the green arrowhead to display "MFD KEY" and repeat steps 4–7.
10. To remove the menu, press the **CLR** or **MENU** Key.

VIRTUAL COCKPIT CONTROLS & ANIMATIONS

Panel clicks, manipulators, and animations are available in the 3D Cockpit as follows:

- Overhead Dome Light
- Overhead Instrument Panel Flood Light Slider Switch
- Overhead Reading Light Slider Switch
- Door Seal Switch
- Pitot Heat Switch
- Prop Heat Switch
- Flap Panel Vapor Suppression Switch
- Flap Panel Backup Fuel Pump Switch
- Flap Panel Go Around Switch
- Flap Panel Flap Handle Control
- Ignition Switch
- Primer Switch
- Alternate Static Air Control
- Heated Induction Air Control

- Throttle Control
- Propeller Control
- Mixture Control
- SpeedBrakes™ Switch
- Backup Instrument Backlight Slider Switch
- Panel Backlight Slider Switch
- Popup Panel Lights Switch
- Strobe Light Switch
- Position Light Switch
- Landing Light Switch
- Taxi Light Switch
- Fuel Selector Control
- PFD Buttons and Knobs
- MFD Buttons and Knobs
- ACP (Audio Control Panel) Buttons and Knobs
- ReadyPad Buttons and Knobs

EXTERIOR ANIMATIONS

The following items on the exterior of the airplane are animated:

- Nose Gear Steering, Strut Shock Absorber, and Tire Rotation
- Main Gear Tire Rotation
- Ailerons
- Flaps
- SpeedBrakes™
- Elevator
- Rudder
- Propeller and Spinner

EXTERIOR LIGHTING

All of the exterior lights have been customized to exactly match those of the C400 as follows:

- Taxi Light
- Landing Light
- Wing Position Lights (Red & Green Nav Lights)
- Wing (Aft-Facing) White Navigation Lights
- Wing Anti-Collision Strobe Lights featuring custom C400 strobe pattern.

THE FLIGHT DECK (G1000)

System Power-Up

Normally, when X-Plane starts-up, the airplane is positioned on a runway with the engine running. In this case the PFD and MFD will display "INITIALIZING SYSTEM" and after a few seconds the PFD will display the usual instrumentation. A second later, the MFD initialization will complete and the MFD will display the splash screen. Pressing the **ENT** Key (or right-most Softkey) acknowledges the MFD information displayed, and then the Navigation Map Page is displayed.

Normal Display Operation

In normal operating mode, the PFD presents graphical flight instrumentation (attitude, heading, airspeed, altitude, vertical speed), replacing the traditional flight instrument cluster. The MFD normally displays a full-color moving map* with navigation information while the left portion of the MFD is dedicated to the Engine Indication System (EIS). Both displays offer control for COM and NAV frequency selection.

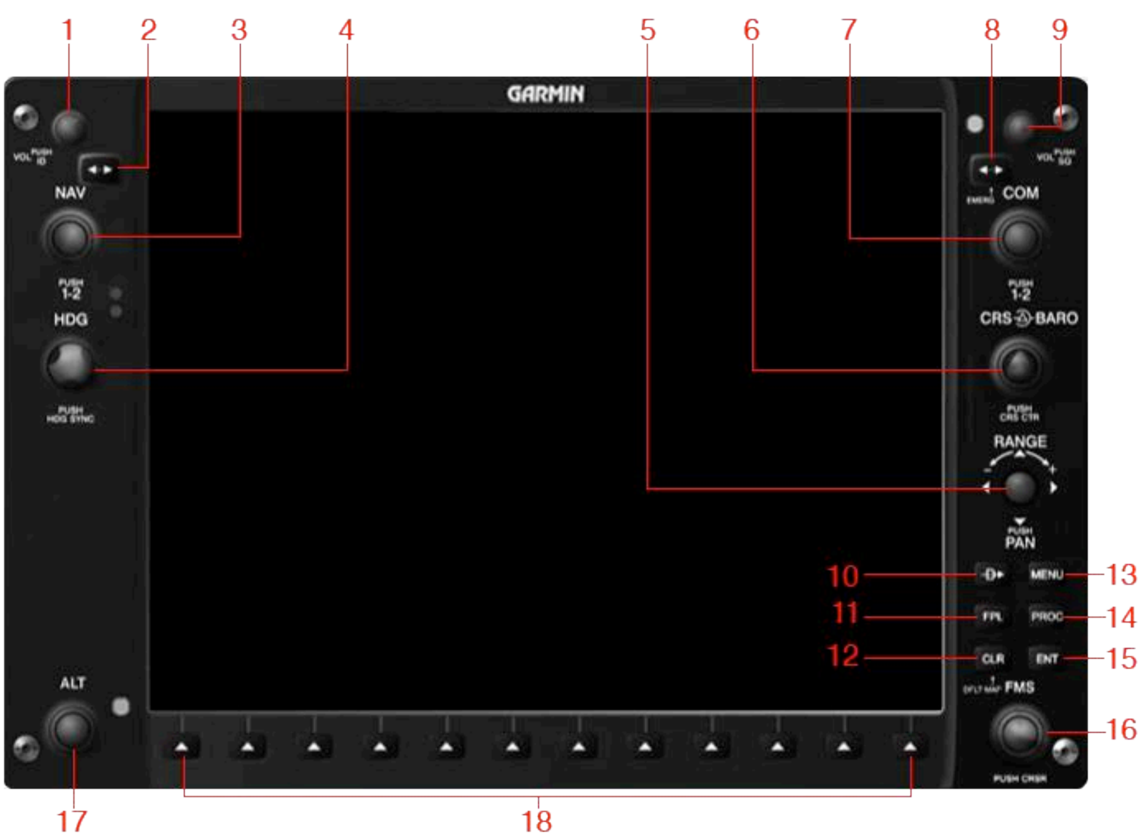
***NOTE**

A full-color moving map has been added the C400 v1.3. This is NOT a simulation of the actual G1000 map however it does provide topography and terrain capabilities. The standard X-Plane map functions are integrated with the color moving map.

Reversionary Display Operation

Reversionary Mode is not simulated at this time.

PFD/MFD Controls



The NAV, CRS/BARO, COM, FMS, and ALT knobs are concentric dual knobs, each having small (inner) and large (outer) control portion.

1. NAV VOL/ID Knob	NOT SIMULATED
2. NAV Frequency Transfer Key	Transfers the standby and active NAV frequencies
3. NAV Knob	Turn to tune NAV receiver frequencies (large knob for MHz; small for kHz)
4. Heading Knob	Turn to manually select a heading Press to display a digital heading momentarily to the left of the HIS and synchronize the Selected Heading to the current heading
5. Joystick	Turn to change map range
6. CRS/BARO Knob	Turn large knob for altimeter barometric pressure setting Turn small knob to adjust course (only when HSI is in VOR or OBS Mode) Press to re-center the CDI and return course pointer directly TO bearing of active waypoint/station
7. COM Knob	Turn to tune COM transceiver standby frequencies (large knob for MHz; small for kHz) Press to toggle light blue tuning box between COM1 and COM2 The selected COM (green) is controlled with the **COM MIC** Key (Audio Panel)
8. COM Frequency Transfer Key	Transfers the standby and active COM frequencies The Press and Hold feature to tune the emergency frequency automatically is NOT SIMULATED
9. COM VOL/SQ Knob	NOT SIMULATED
10. Direct-to-Key	NOT SIMULATED
11. FPL Key	Displays flight plan information (MFD ONLY)
12. CLR Key	Erases information, cancels entries, or removes menus
13. MENU Key	Displays a context-sensitive list of options for accessing additional features or making setting changes
14. PROC Key	NOT SIMULATED
15. ENT Key	Vallidates/confirms menu selection or data entry
16. FMS Knob	Various context-sensitive functions including "highlighting fields", "scrolling" and "page selection"
17. ALT Knob	Sets the Selected Altitude, shown above the Altimeter (the large knob selects the thousands, the small knob selects the hundreds.
18. Softkey Selection Keys	Press to select softkey shown above the bezel key on the PFD/MFD display.

MFD/PFD Control Unit
The MFD/PFD Control unit (ReadyPad) is a pedestal-mounted user interface allowing ease of data entry. In the C400 simulation the only feature that is implemented for use with the ReadyPad is data entry and management of the FMS (flight plan). As such, some of the keys have been changed from those found on the ReadyPad in the real world airplane.

1. LOAD Key	Opens the standard X-Plane FMS "Open Flight Plan" Window
2. Direct-to-Key	Standard X-Plane FMS Direct-to-Key Function
3. INIT Key	Standard X-Plane FMS INIT Function
4. SAVE Key	Standard X-Plane FMS Opens the standard X-Plane FMS "Save Flight Plan" Window
5. Joystick	NOT SIMULATED
6. Alphanumeric Keys	Standard X-Plane FMS Alphanumeric Key Functions
7. BKSP Key	Standard X-Plane FMS "Back" Key Function
8. SPC Key	Standard X-Plane FMS "Space" Key Function
9. ENT Key	Standard X-Plane FMS "Enter" Key Function
10. CLR Key	Standard X-Plane FMS "Clear" Key Function
11. SEL Key	Standard X-Plane FMS "Prev" (Left) and "Next" (Right) Key Functions
12. Decimal Key	NOT SIMULATED
13. Plus/Minus Key	Standard X-Plane FMS +/– Key Function
14. FIX Key	Standard X–Plane FMS "Fix" Key Function
15. NDB Key	Standard X-Plane FMS "NDB" Key Function
16. L/L Key	Standard X-Plane FMS "Lat/Lon" Key Function
17. APT Key	Standard X-Plane FMS "APT" Key Function
18. VOR Key	Standard X-Plane FMS "VOR" Key Function
19. FMS Knob	Various context-sensitive functions including "highlighting fields", "scrolling" and "page selection"

The availability of the ReadyPad keys (and their associated functions) is based on the status (open/closed) of the FPL Window and Waypoint Entry Window.

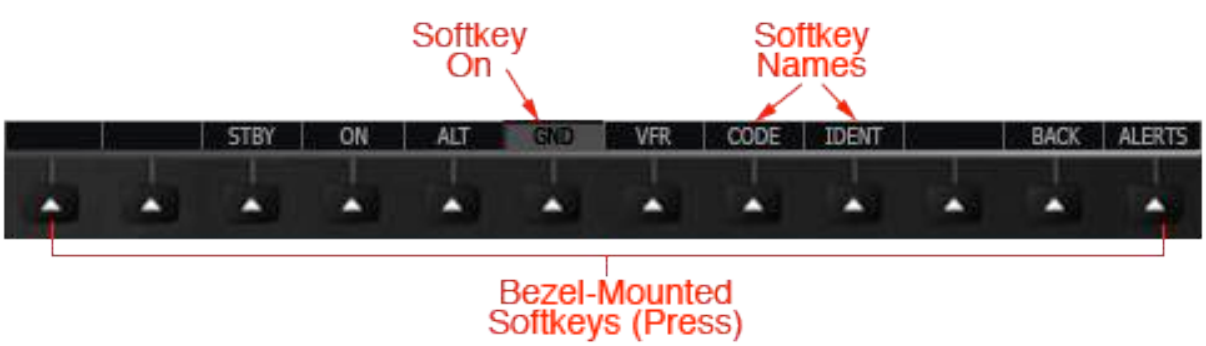
In 2D Cockpit Mode the ReadyPad is a pop-up instrument that appears to the right of the MFD. To bring up the ReadyPad in 2D press the **FPL** Key on the MFD, which will open the Active Flight Plan Window, then push the **ReadyPad** button at the top right of the FPL Window to "pop-up" the ReadyPad as shown below:

Softkey Function

The softkeys are located along the bottom of the PFD and MFD displays. The softkeys shown depend on the softkey level or page being displayed. The bezel keys below the softkeys can be used to select the appropriate softkey. When a softkey is selected, its color changes to black text on a gray background and remains this way until it is turned off, at which time it reverts to whit text on a black background.

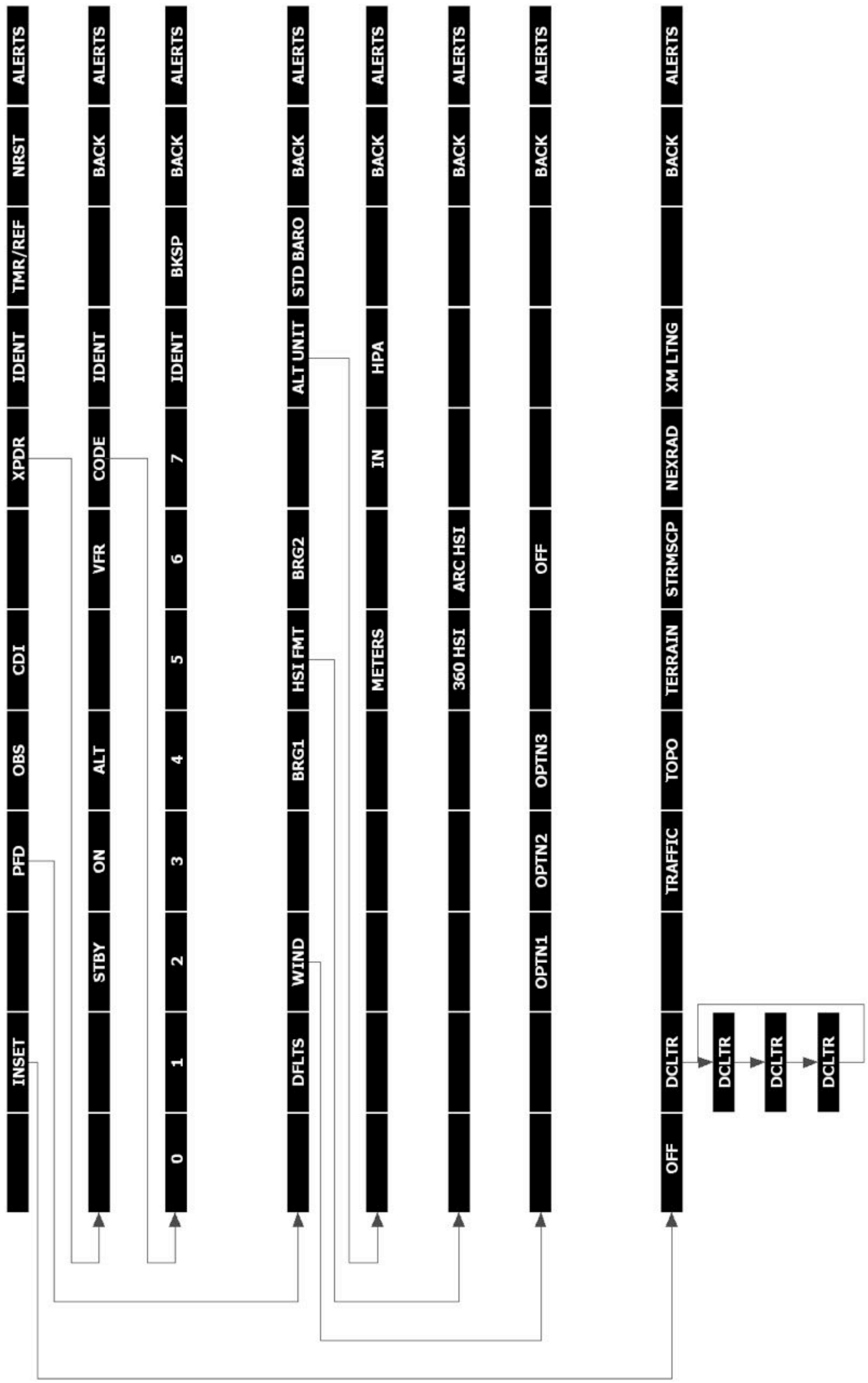
NOTE

In the actual G1000 the softkeys will revert to the previous level after 45 seconds of inactivity. This feature is NOT SIMULATED.

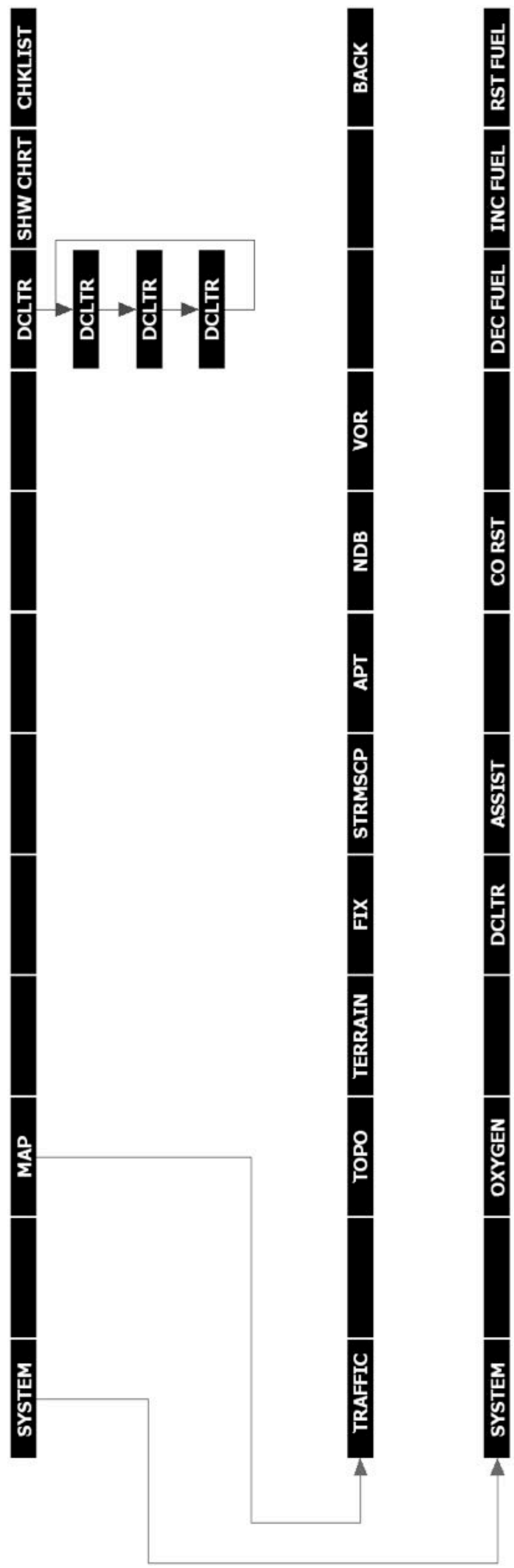


Softkeys (Transponder Level PFD Configuration)

PFD Softkey Layout



MFD Softkey Layout



The PFD TMR/REF Window

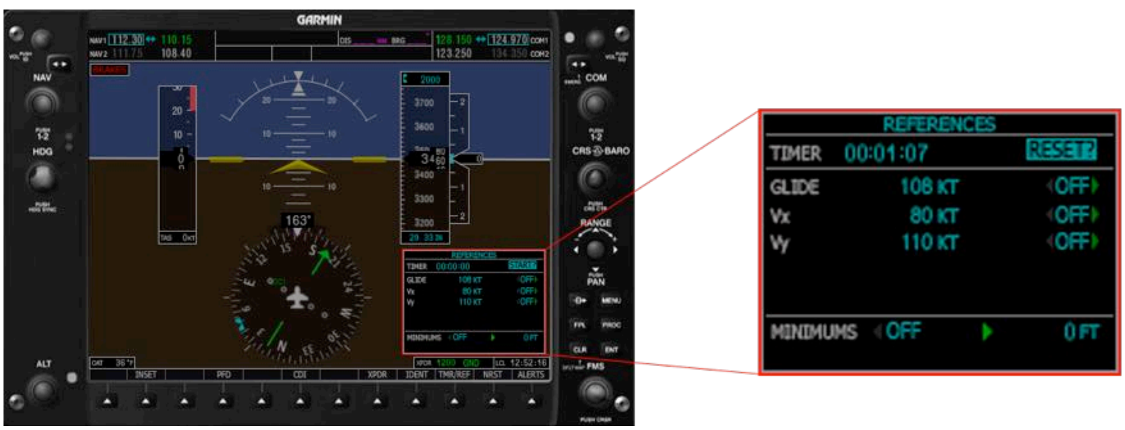
The TMR/REF window includes settings for a timer and Barometric Minimum Descent Altitude (decision height). The Vspeed references are not adjustable in the simulation.

Timer

The G1000 PFD TMR/REF window includes a stopwatch-like generic timer. The real-llife timer can be set to count up or down from a specified time however, in the simulation, the timer can only be set to count up. Resetting the timer will set the digits to zero.

Setting the generic timer (PFD):

1. Select the **TMR/REF** Softkey.
2. With "START?" highlighted, press the **ENT** Key to start the timer. The field changes to "STOP?".
3. To stop the timer, press the **ENT** Key with "STOP?" highlighted. The field changes to "RESET?".
4. To reset the timer, pres the **ENT** Key with "RESET?" highlighted. The field changes back to "START?" and the digits are reset.
5. To remove the window, press the **CLR** Key or select the **TMR/REF** Softkey.



PFD TMR/REF Window

Setting the Barometric Minimum (PFD):

1. Select the **TMR/REF** Softkey.
2. Turn the large **FMS** Knob to highlight the "ON/OFF" field.
3. Turn the small **FMS** Knob to select "BARO".
4. Turn the large **FMS** Knob to highlight the next field.
5. Turn the small **FMS** Knob to enter the desired altitude (from zero to 16,000 feet).
6. To remove the window, press the **CLR** Key or select the **TMR/REF** Softkey.

PAGE GROUPS (MFD)
At this time the only (main) Page that is simulated is the (X-Plane standard) Navigation Map with full-color moving map. The softkeys associated with this map allow you to turn off and on the usual X-Plane map functions including "APT", "FIX", "NDB", "TRAFFIC", "VOR", and "STRMSCP", as well as select the moving map type between “TOPO” and “TERRAIN”.

In addition to the main (Map) Page, there are pages for flight planning (FPL), which are accessed by the **FPL** Key.

DATE/TIME
The System time is displayed in the lower right corner of the PFD in local 24-hour format.

FLIGHT INSTRUMENTS

WARNING

> In the event the G1000 airspeed, attitude, altitude, or heading indications become unusable, refer to the backup instruments.

Increased situational awareness is provided by replacing the traditional instruments on the panel with an easy-to-scan Primary Flight Display (PFD) that features a large horizon and attitude, altitude, vertical speed, and course deviation information. In addition to the flight instruments, navigation, communication, traffic, and weather information are also presented on the PFD.

The following flight instruments and supplemental flight data are dislpayed on the PFD:

- Airspeed Indicator, showing
  - True airspeed
  - Airspeed awareness ranges
  - Reference flags
- Attitude Indicator with slip/skid indication
- Altimeter, showing
  - Barometric setting
  - Selected altitude
- Glideslope Indicator
- Horizontal Situation Indicator, showing
  - Turn Rate Indicator
  - Course Deviation Indicator (CDI)
  - Bearing Pointers and information windows
- Vertical Speed Indicator (VSI)
- Outside Air Temperature
- Wind Data

The PFD also displays various alerts and annunciations

Primary Flight Display (Default)

1. NAV Frequency Box	12. Altimeter Barometric Setting
2. Airspeed Indicator	13. Vertical Speed Indicator
3. True Airspeed	14, Selected Altitude Bug
4. Current Heading	15. Altimeter
5. Horizontal Situation Indicator	16. Selected Altitude
6. Outside Air temperature	17. COM Frequency Box
7. Softkeys	18. AFCS Status Box
8. System Time	19. Navigation Status Box
9. Transponder Data Box	20. Slip/Skid Indicator
10. Selected Heading Bug	21. Attitude Indicator
11. Turn Rate Indicator	

Additional PFD Information

1. Traffic Annunciation	6. Barometric Minimum Descent Altitude
2. Selected Heading	7. Annunciation Window
3. Wind Data	8. Selected Course
4. Inset Map	9. Glideslope Indicator
5. Barometric Information Windows	10. Marker Beacon Annunciation

Heading and Course Settings

The selected heading is shown to the upper left of the HSI for a few seconds after being adjusted. The light blue bug on the compass rose corresponds to the Selected Heading.

Adjusting the Selected Heading:

- Turn the **HDG** Knob to set the Selected Heading.
- Press the **HDG** Knob to synchronize the bug to the current heading.

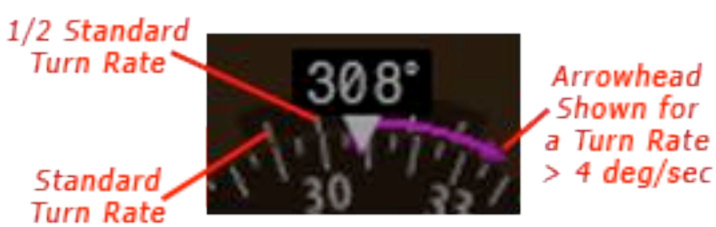
The Selected Course is shown to the upper right of the HSI for a few seconds after being adjusted.

Adjusting the Seletced Course:

- Turn the **CRS** Knob to set the Selected Course.
- Press the **CRS** Knob to re-center the CDI and return the course pointer to the bearing of the active waypoint or navigation station.

Turn Rate Indicator

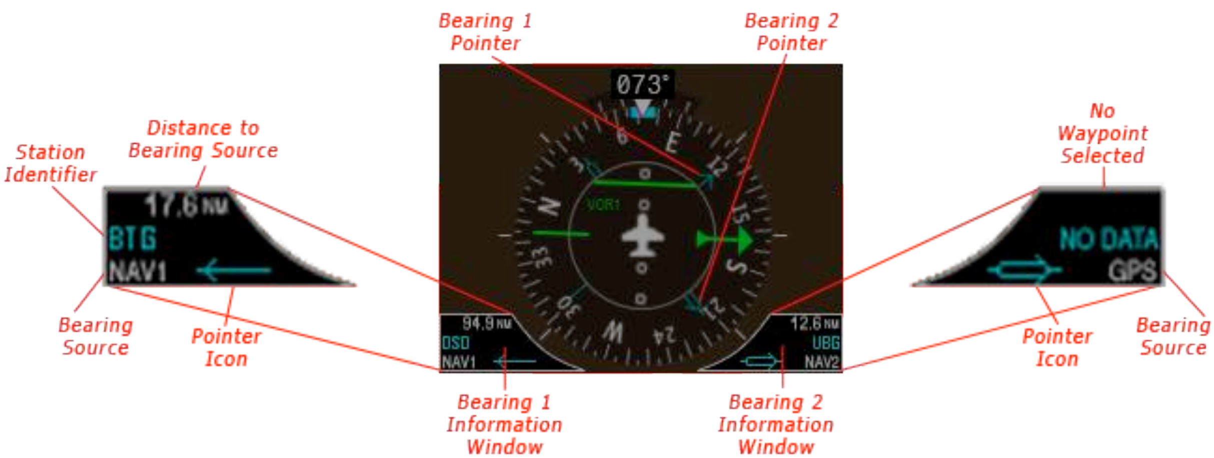
The Turn Rate Indicator is located directly above the rotating compass card. Tick marks to the left and right of the lubber line denote half-standard and standard turn rates. A magenta Turn Rate Trend Vector shows the current turn rate. The end of the trend vector gives the heading predicted in 6 seconds, based on the present turn rate. A standard-rate turn is shown on the indicator by the trend vector stopping at the standard turn rate tick mark, corresponding to a predicted heading of 18° from the current heading. At rates greater than 4 deg/sec, an arrowhead appears at the end of the magenta trend vector and the prediction is no longer valid.



Turn Rate Indicator and Trend Vector

Bearing Pointers and Information Windows

Two bearing pointers and associated information can be displayed on the HIS for NAV and GPS sources. The pointers are light blue and are single-lined (BRG1) or double-lined (BRG2); an icon is shown in the respective information window to indicate the pointer type. The bearing pointers never override the CDI and are visually separated from the CDI by a white ring (shown when bearing pointers are selected but not necessarily visible due to data unavailability).



HSI with Bearing Information

When a bearing pointer is displayed, its associated information window is also displayed. The Bearing Information windows are displayed to the lower sides of the HIS and show:

- Bearing source (NAV, GPS)
- Pointer Icon (BRG1 = single line, BRG2 = double line)
- Frequency (NAV)
- Station/waypoint identifier (NAV, GPS)
- GPS-derived great circle distance to bearing source

If the NAV radio is the bearing source and is tuned to an ILS frequency, the bearing pointer is removed from the HIS and the frequency is replaced with "ILS". When NAV1 or NAV2 is the selected bearing source, the frequency is replaced by the station identifier when the station is within range. If GPS is the bearing source, the active waypoint identifier is displayed in lieu of a frequency.

The bearing pointer is removed from the HIS and "NO DATA" is displayed in the information window if:

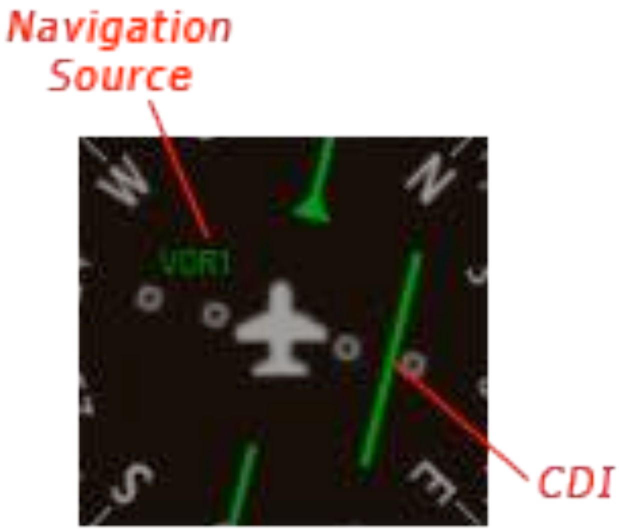
- The NAV radio is not receiving the tuned VOR station
- GPS is the bearing source and an active waypoint is not selected.

Selecting bearing display and changing sources:

- Select the PFD Softkey.
- Select a BRG Softkey to display the desired bearing pointer and information window with a NAV source.
- Select the BRG Softkey again to change the bearing source to GPS
- To remove the bearing pointer and information window, select the BRG Softkey again.

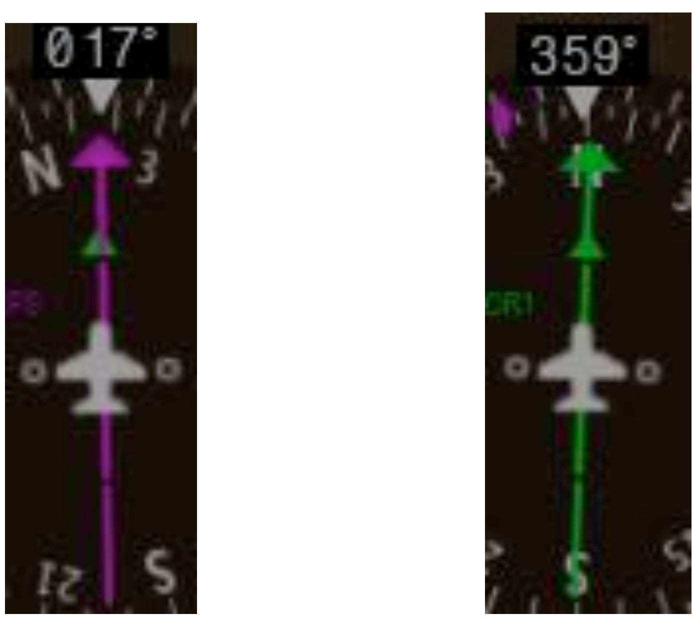
Course Deviation Indicator

The Course Deviation Indicator (CDI) moves left or right from the course pointer along a lateral deviation scale to display aircraft position relative to the course. If the course deviation is not valid, the CDI is not dislpayed.



Course Deviation Indicator

The CDI can display two sources of navigation: GPS or NAV (VOR, localizer). Color indicates the current navigation source: magenta (for GPS) or green (for VOR and LOC),



Navigation Sources

Changing navigation sources:

1. Select the **CDI** Softkey to change from GPS to VOR1 or LOC1. This places the light blue tuning box over the NAV1 standby frequency in the upper left corner of the PFD.

2. Select the **CDI** Softkey again to change from VOR1 or LOC1 to VOR2 or LOC2. This places the light blue tuning box over the NAV2 standby frequency.

3. Select the **CDI** Softkey a third time to return to GPS.

OBS Mode
OBS Mode is not simulated.

Wind Data
Wind direction and speed (relative to the aircraft) in knots can be displayed in a window to the upper left of the HIS. When the window is selected for display, but wind information is invalid or unavailable, the window shows "NO WIND DATA". Wind data can be displayed in three different ways.

Displaying wind data:

- Select the **PFD** Softkey

- Select the WIND Softkey to display wind data below the Selected Heading.

- Select one of the **OPTN** softkeys to change how wind data is dislpayed:
    - **OPTN 1** – Head and crosswind components (NOT SIMULATED)
    - **OPTN 2** – Total wind direction and speed
    - **OPTN 3** – Total wind direction with head and crosswind speed components (NOT SIMULATED)

- To remove the window, select the **OFF** Softkey.

Altitude Alerting
The Altitude Alerting function provides the pilot with visual and aural alerts when approaching the Selected Altitude. Whenever the Selected Altitude is changed, the Altitude Alerter is reset. The following occur when approaching the Selected Altitude:

- Upon passing through 1000 feet of the Selected Altitude,, the Selected Altitude (shown above the Altimeter) changes to black text on a light blue background, flashes for 5 seconds, and an aural tone is generated.

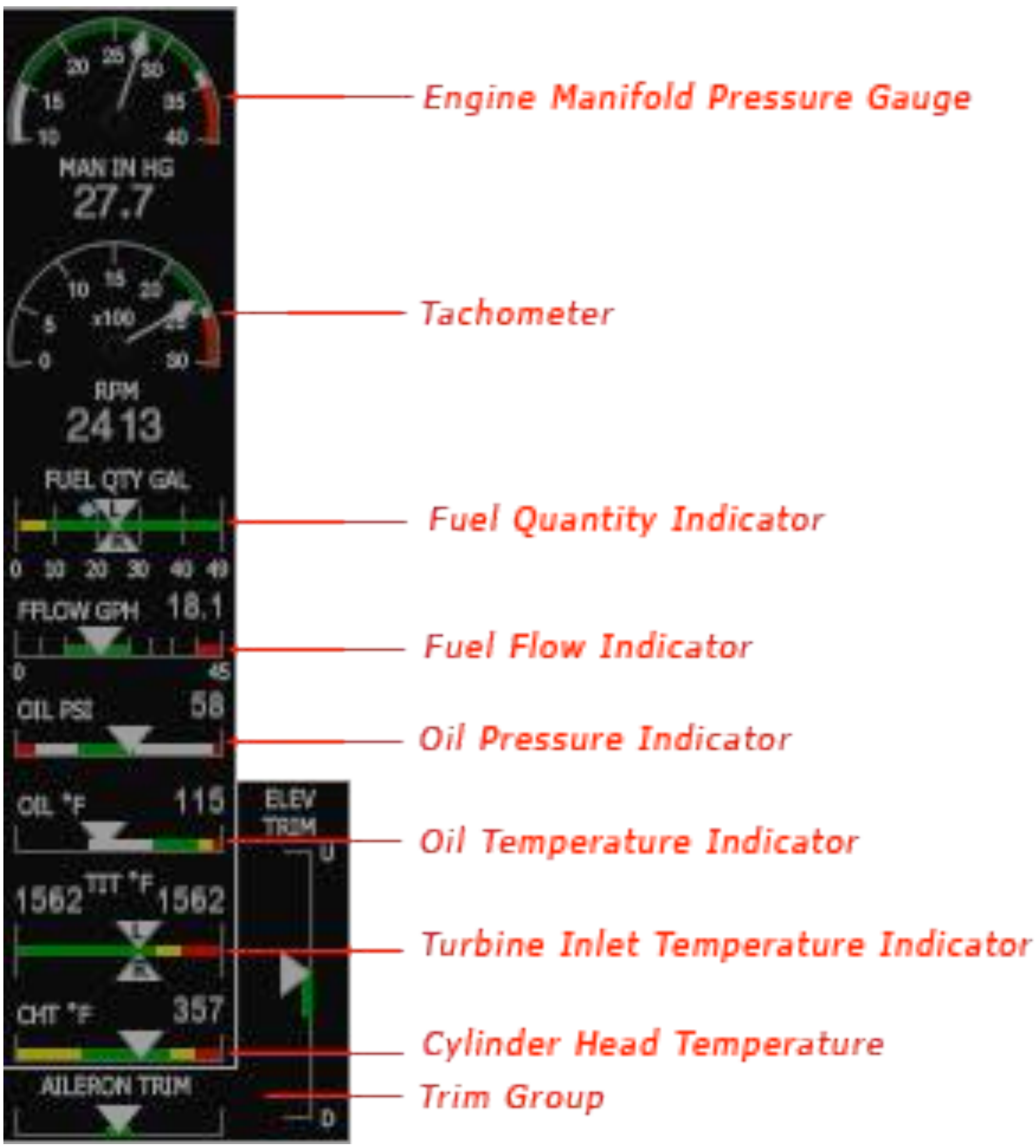
- When the aircraft passes within 200 feet of the Selected Altitude, the Selected Altitude changes to light blue text on a black background and flashes for 5 seconds.

- After reaching the Selected Altitude, if the pilot flies outside the deviation band (+/– 200 feet of the Selected Altitude), the Selected Altitude changes to yellow text on a blask background, flashes for 5 seconds, and an aural tone is generated.

ENGINE INDICATION SYSTEM
The G1000 Engine Indication System (EIS) for the C400 displays critical engine, electrical, fuel, and other system parameters on the left side of the MFD during normal operations. EIS information can be fully expanded to n entire page (Engine Page) using the SYSTEM Softkey. In reversionary display mode, the remaining display is re-configured to present PFD symbology together with the EIS Display.

Instrument types include dial gauges, horizontal and vertical bar indicators, digital readouts, slide bars, and bar graphs. Green bands indicate normal ranges of operation, yellow and red bands indicates caution and warning, respectively. White bands indicate areas outside of normal operation not yet in the caution or warning ranges.

When unsafe operating conditions occur, the corresponding readouts flash (NOT SIMULATED) to indicate cautions and warnings. If sensory data to an instrument becomes invalid or unavailable, a red "X" (NOT SIMULATED) is displayed across the instrument.



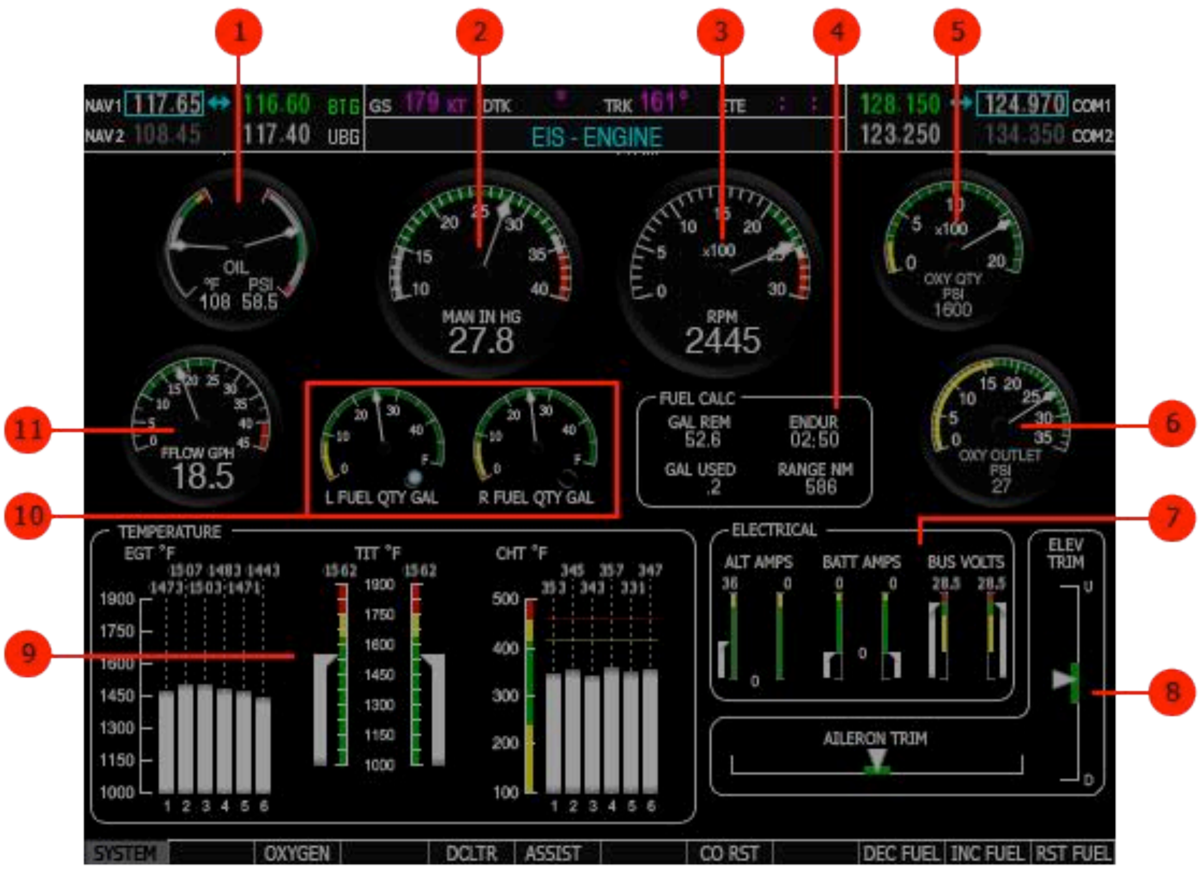
EIS Display

ENGINE PAGE

Selecting the SYTEM Softkey on the MFD accesses the Engine Page, which displays all Engine Indication System instruments; selecting the softkey again exits the Engine Page.

The Engine Page displays engine, fuel, fuel calculation, electrical, oxygen, and trim information using round dial gauges, bar indicators, bar graphs, digital readouts, and slide bars. As in the EIS Display, the manifold pressure gauge, tachometer, and trim slide bars are shown. Fuel flow and oil parameters are displayed using gauges rather than horizontal bar indicators.

Oxygen (NOT SIMULATED) quantity and outlet pressure are also shown on the Engine Page.



Engine Page

1. Oil Temperature/Pressure Gauge	6. Oxygen Outlet Pressure
2. Engine Manifold Pressure Gauge	7. Electrical Group
3. Tachometer	8. Trim Group
4. Fuel Calculations Group	9. Engine Temperature Group
5. Oxygen Quantity Gauge	10. Fuel Flow Gauge

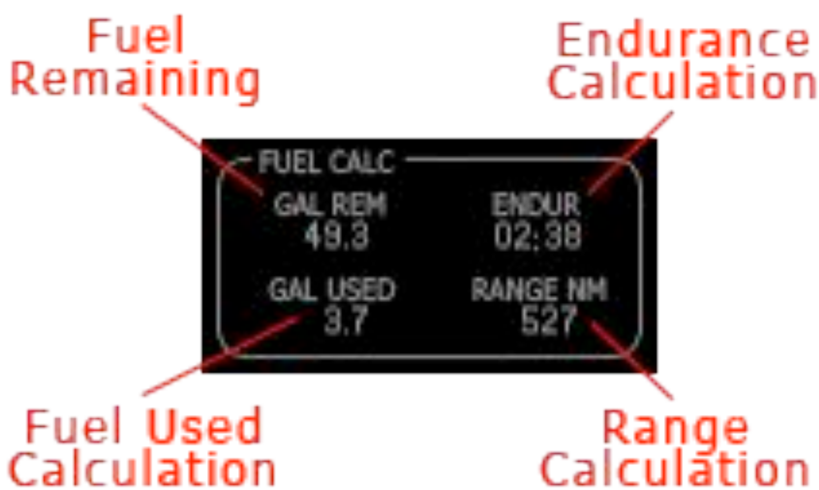
Carbon Monoxide Detection
NOT SIMULATED

FUEL CALCULATIONS GROUP

NOTE
Fuel Calculations do not use the aircraft fuel quantity indicators except at startup.

Fuel used (GAL USED), endurance (ENDUR), and range (RANGE NM) are all calculated based on the displayed fuel remaining (GAL REM) and the fuel flow totalizer. The fuel remaining can be adjusted using the following softkeys:

- **DEC FUEL** – Decreases totalizer-based fuel remaining in one-gallon increments.
- **INC FUEL** – Increases totalizer-based fuel remaining in one-gallon increments.
- **RST FUEL** – Resets totalizer-based fuel remaining to the aircraft fuel capacity (98 gal usable) and sets the GAL USED display to zero.

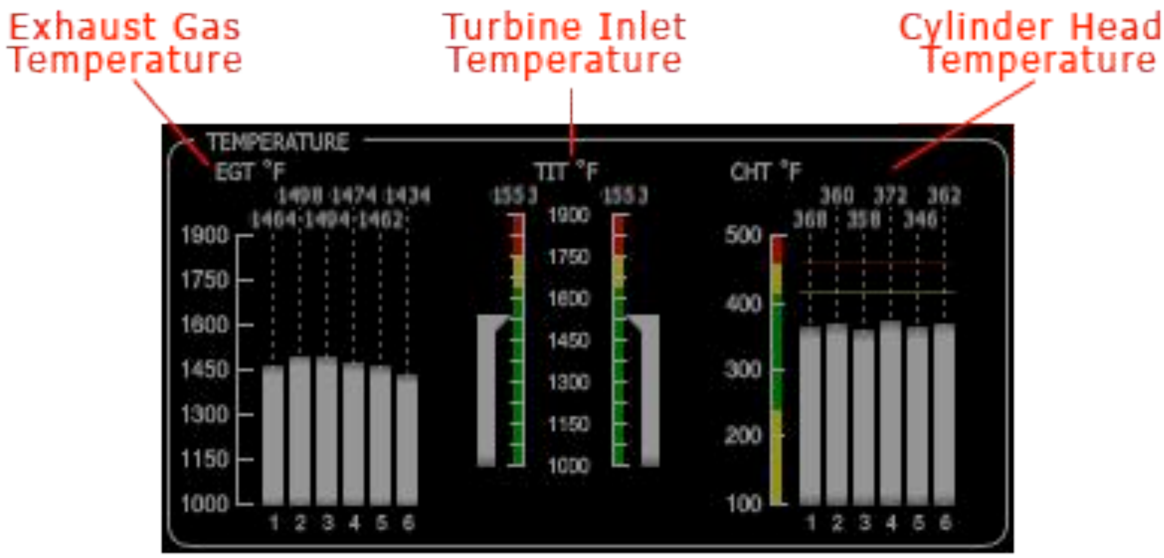


Fuel Calculations Group

ENGINE TEMPERATURE GROUP
The engine temperature group displays the Cylinder Head Temperature (CHT) and Exhaust Gas Temperature in degrees Fahrenheit for each cylinder using bar graphs and digital readouts. The Turbine Inlet Temperature (TIT) is shown on a sliding bar scale.

The following softkeys can be used to modify the display of engine temperature information:

- **DCLTR** – Removes/displays the EGT and CHT readouts from the display.
- **ASSIST** – Accesses the Engine Leaning Assist Mode

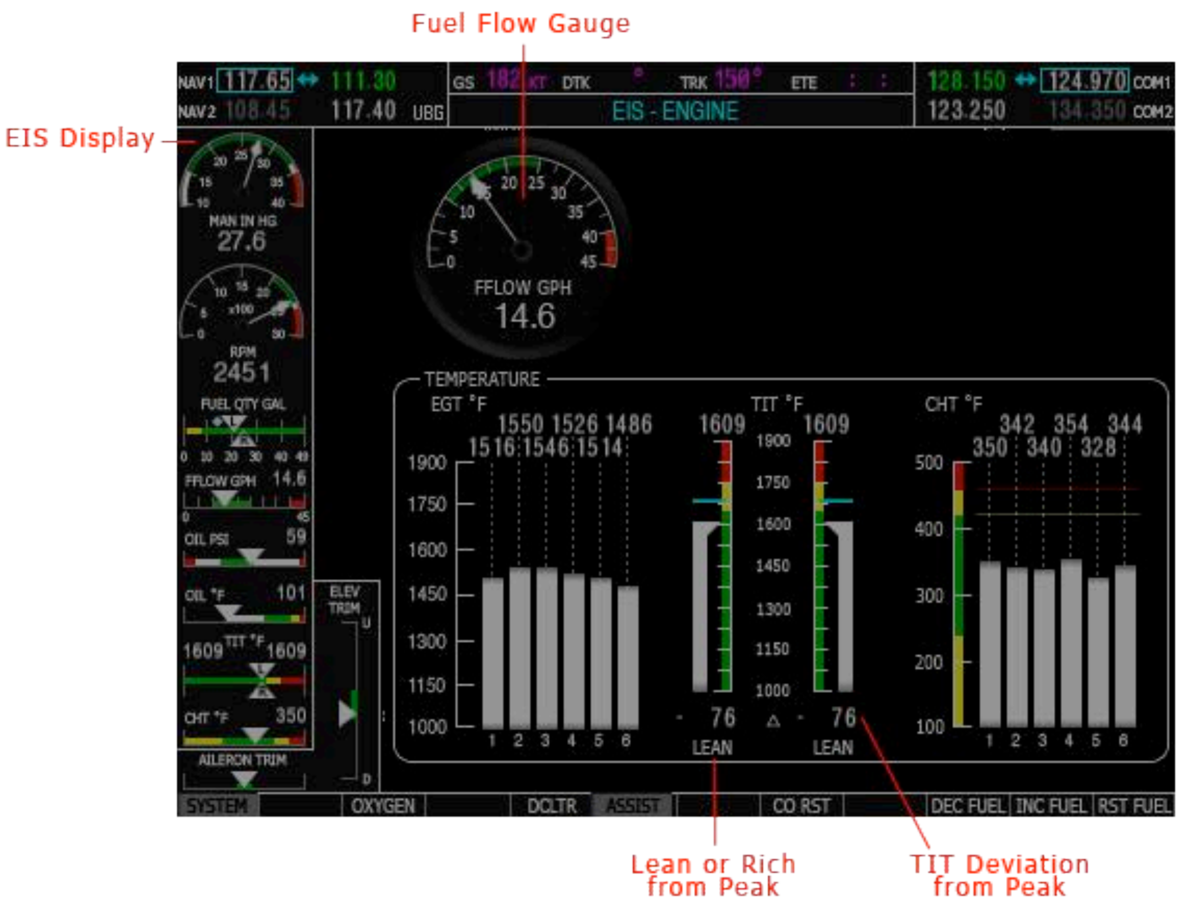


Engine Temperature Group

ENGINE LEANING ASSIST MODE

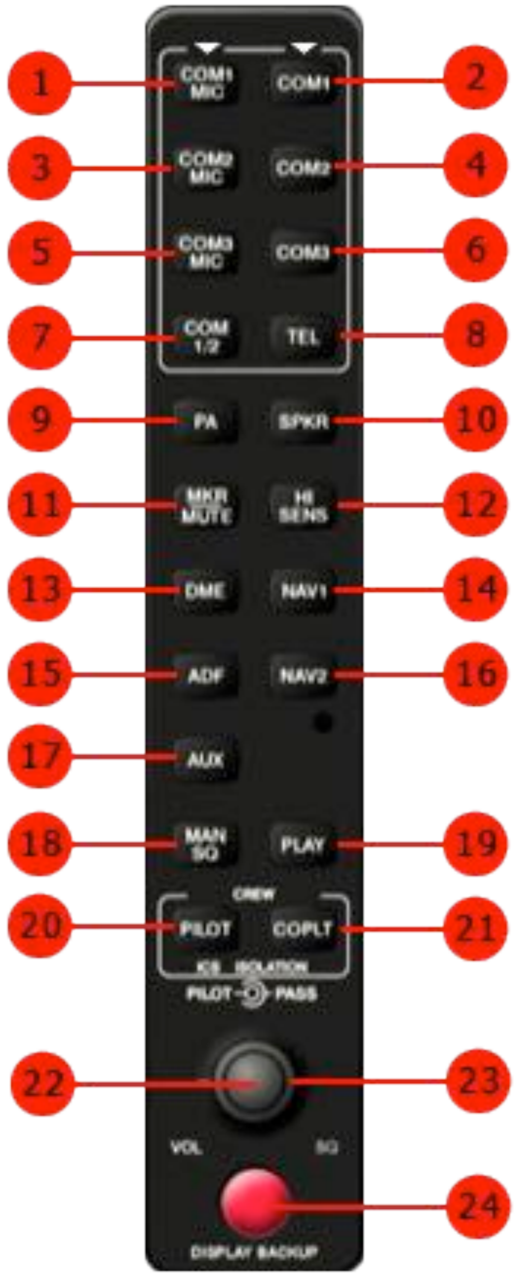
From the Engine Page, the Engine Leaning Assist Mode may be accessed by selecting the **ASSIST** Softkey. Selecting the **ASSIST** Softkey again returns the MFD to the Engine Page. Use the **SYSTEM** Softkey to exit the Engine Page.

While in Assist Mode, the EIS display is shown along with the Fuel Flow Gauge and an expanded Engine Temperature Group.



Engine Leaning Assist Mode

AUDIO PANEL
The Audio Panel provides the traditional audio selector functions of microphone and receiver audio selection. The Audio Panel includes and intercom system (ICS) between the pilot, copilot, and passengers, a marker beacon receiver, and a COM clearance recorder. Ambient noise from the aircraft radios is reduced by a feature called Master Avionics Squelch (MASQ). When no audio us detected, MASQ processing further reduces the amount of background noise from the radios.



Audio Control Panel

NOTE
When a key is selected, a triangular annunciator above the key is illuminated

1. **COM1 MIC**	Selects the #1 transmitter for transmitting. COM1 receive is simultaneously selected when this key is pressed allowing received audio from the #1 COM receiver to be heard. COM2 receive can be added by pressing the **COM2** Key
2. **COM1**	When selected, audio from the #1 COM receiver can be heard.
3. **COM2 MIC**	Selected the #2 transmitter for transmitting. COM2 receive is simultaneously selected when this key is pressed allowing received audio from the #2 COM receiver to be heard. COM1 receive can be added by pressing the **COM1** Key.
4. **COM2**	When selected, audio from the #2 COM receiver can be heard.
5. **COM3 MIC**	Not used in the C400 aircraft.
6. **COM3**	Not used in the C400 aircraft.
7. **COM 1/2**	Split **COM** Key. Allows simultaneous transmission on COM1 and COM2 by the pilot and copilot. (NOT SIMULATED)
8. **TEL**	Not used in the C400 aircraft.
9. **PA**	Selects the passenger address system. The selected COM transmitter is deselected when the PA Key is pressed. (NOT SIMULATED)
10. **SPKR**	Selects and deselects the cabin speaker. COM and NAV receiver audio can be heard on the speaker. (NOT SIMULATED)
11. **MKR/MUTE**	Selects marker beacon receiver audio. Mutes the currently received marker beacon receiver audio. Unmutes automatically when new marker beacon audio is received. Also, stops play of recorded COM audio.
12. **HI SENS**	Press to increase marker beacon receiver sensitivity. Press again to return to low sensitivity. (NOT SIMULATED)
13. **DME**	Not used in the C400 aircraft
14. **NAV1**	When selected, audio from the #1 NAV receiver can be heard.
15. **ADF**	Not used in the C400 aircraft.
16. **NAV2**	When selected, audio from the #2 NAV receiver can be heard.
17. **AUX**	Not used in the C400 aircraft.
18. **MAN SQ**	Enables manual squelch for the intercom. When the intercom is active, press the **PILOT** Knob to illumnate SQ. Turn the **PILOT/PASS**

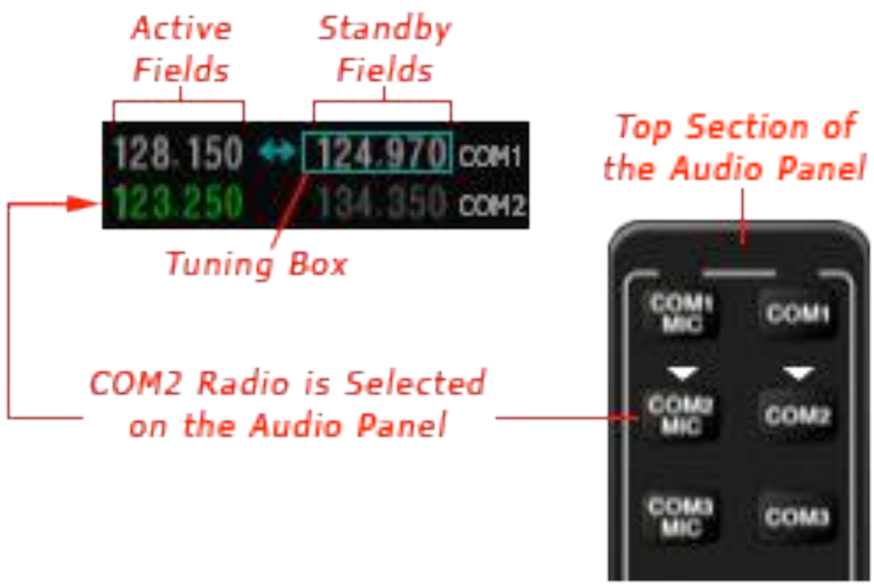
	Knobs to adjust squelch. (NOT SIMUJLATED)
19. **PLAY**	Press once to play the last recorded COM audio. Press again while audio is playing and the previous block of recorded audio will be played. Each subsequent press plays each previously recorded block. Pressing the **MKR/MUTE** Key during play of a memory block stops play. (NOT SIMULATED)
20. **PILOT**	Selects and deselects the pilot intercom isolation. (NOT SIMULATED)
21. **COPILOT**	Selects and deselects the copilot intercom isolation. (NOT SIMULATED)
22. **PILOT** Knob	Press to switch between volume and squelch control as indicated by illumination of VOL or SQ. Turn to adjust intercom volume or squelch. The **MAN SQ** Key must be selected to allow squelch adjustment. (NOT SIMULATED)
23. **PASS** Knob	Turn to adjust Copilot/Passenger intercom volume or squelch. The **MAN SQ** Key must be selected to allow squelch adjustment. (NOT SIMULATED)
24. **DISPLAY BACKUP** Button	Manually selects Reversionary Mode. (NOT SIMULATED)

COM TRANSCEIVER AND ACTIVATION

The COM Frequency Box is composed of four fields; the two active frequencies are on the left side and the two standby frequencies are on the right. The COM transceiver is selected for transmitting by pressing the **COM MIC** Key on the Audio Panel. During receptio of audio from the COM radio selected for transmission, audio from the other COM radio is muted.

An active COM frequency dislpayed in green indicates that the COM transceiver is selected on the Audio Panel (**COM1 MIC** or **COM2 MIC** Key). Both active COM frequencies appearing in white indicate that no COM radio is selected for transmitting (**PA** Key is selected on the Audio Panel).

Frequencies in the standby field are dislpayed in either white or gray. The standby frequency in the tuning box is white. The other stanby frequency is gray.



Selecting a COM Radio for Transmit

Transmit/Receive Indications

NOT SIMULATED

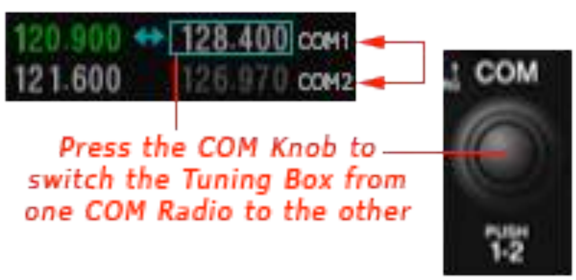
Com Transceiver Manual Tuning
The COM frequency controls and frequency boxes are on the right side of the MFD and PFD.

Manually Tuning a COM frequency:

- Turn the **COM** Knob to tune the desired frequency in the COM Tuning Box (large knob for MHz; small knob for kHz).
- Press the **Frequency Transfer** Key to transfer the frequency to the active field.
- Adjust the volume level with the COM **VOL/SQ** Knob. (NOT SIMULATED)
- Press the COM **VOL/SQ** Knob to turn automatic squelch on and off.

COM Frequency Tuning

Selecting The Radio To Be Tuned
Press the COM Knob to transfer the frequency tuning box and Frequency Transfer Arrow between the upper and lower radio frequency fields.



Switching COM Tuning Boxes

Quick-Tuning and Activating 121.500 MHz
NOT SIMULATED

NAV RADIO SELECTION AND ACTIVATION
The NAV Frequency Box is composed of four fields; two standby fields and two active fields. The active frequencies are on the right side and the standby frequencies are on the left.

A NAV radio is selected for navigation by selecting the **CDI** Softkey located on the PFD. The active NAV frequency selected for navigation is displayed in green. Selecting the **CDI** Softkey once selects the NAV1 as the navigation radio. Selecting the **CDI** Softkey twice selects the NAV2 radio. Selecting the **CDI** Softkey a third time activates GPS Mode. Selecting the **CDI** Softkey again cycles back to NAV1.

While cycling through the CD Softkey selections, the NAV Tuning Box and the Frequency Transfer Arrows are placed in the active NAV Frequency Field and the active NAV frequency color changes to green.

The three navigation modes that can be cycled through are:

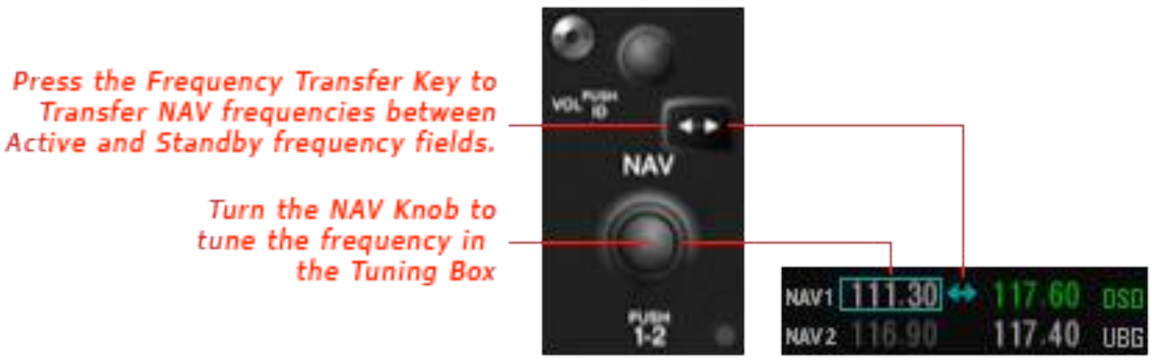
- VOR1 (or LOC1) – if NAV1 is selected, a green single line arrow (shown) labeled either VOR1 or LOC1 is displayed on the HSI and the active NAV1 frequency is displayed in green.
- VOR2 (or LOC2) – if NAV2 is selected, a green single line arrow (shown) labeled either VOR2 or LOC2 is displayed on the HSI and the active NAV2 frequency is displayed in green.
- GPS – If GPS Mode is selected, a magenta single line arrow (not shown) appears on the HIS and neither NAV radio is selected. Both active NAV frequencies are then displayed in white.

Selecting a NAV Radio for Navigation

NAV Receiver Manual Tuning
The NAV frequency controls and frequency boxes are on the left side of the PFD and MFD.

Manually tuning a NAV frequency:

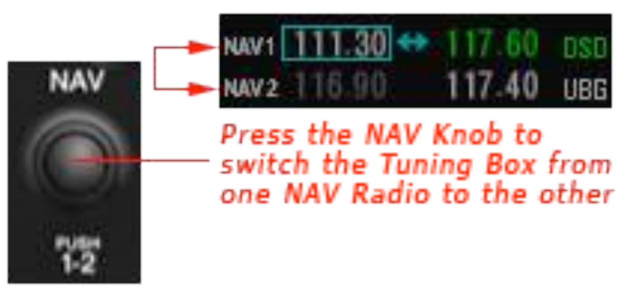
- Turn the **NAV** Knob to tune the desired frequency in the NAV Tuning Box.
- Press the **Frequency Transfer** Key to transfer the frequency to the NAV Active Frequency Field.
- Adjust the Volume Level with the NAV **VOL/ID** Knob. (NOT SIMULATED).
- Press the NAV **VOL/ID** Knob to turn the Morse Code identifier audio on and off. (NOT SIMULATED).



NAV Frequency Tuning

Selecting the Radio to be Tuned

Press the small **NAV** Knob to transfer the frequency tuning box and Frequency Transfer Arrow between the upper and lower radio frequency fields.



Switching NAV Tuning Boxes

GTX 33 MODE S TRANSPONDER

The GTX 33 Mode S Transponder provides Mode A, Mode C, and Mode S interrogation and reply capabilities. Selective addressing or Mode Select (Mode S) capability includes the following features:

Level-2 reply data link capability (used ot exchange information between aircraft and ATC facilities)

Surveillance identifier cap[ability

Flight ID (Flihgt Identification) reporting – The Mode S Transponder reports aircraft identification as either the aircraft registration or a unique Flight ID.

Altitude reporting

Airborne status determination

Transponder capability reporting

Mode S Enhanced Surveillance (EHS) requirements

Acquisition Squitter – Acquisition squitter, or short squitter, is the transponder 24-bit identification address. The transmission is sent periodically, regardless of the presence of interrogation. The purpose of acquisition squitter is to enable Mode S ground stations and aircraft equipped with a Traffic Avoidance System (TAS) to recognize the presence of Mode S-equipped aircraft for selective interrogation.

Transponder Controls

Transponder function is displayed on three levels of softkeys on the PFD: Top-level, Mode Selection, and Code Selection. When the top-level **XPDR** Softkey is pressed, the Mode Selection softkeys appear: **STBY**, **ON**, **ALT**, **VFR**, **CODE**, **IDENT**, **BACK**.

When the **CODE** Softkey is selected, the numbers softkeys appear: **0**, **1**, **2**, **3**, **4**, **5**, **6**, **7**, **IDENT**, **BKSP**, **BACK**. The digits 8 and 9 are not used for code entry. Selecting the numbered softkeys in sequence enters the transponder code. If an error is made, selecting the **BKSP** Softkey moves the code selection cursor to the previous digit (NOT SIMULATED).

Selecting the **BACK** Softkey during code selection reverts to the Mode Selection Softkeys. Selecting the **BACK** Softkey during mode selection reverts to the top-level softkeys.

The code can also be entered with the **FMS** Knob on the PFD or MFD/PFD Control Unit. Code entry must be completed with either the softkeys or the **FMS** Knob, but not a combination of both. (NOT SIMULATED)

Selecting the **IDENT** Softkey while in Mode or Code Selection intiaites the ident function and reverts to the top level softkeys.

After 45 seconds of transponder inactivity, the system reverts back to the top-level softkeys. (NOT SIMULATED)

Transponder Mode Selection
Mode selection can be automatic (Ground and Altitude) or manual (Standby, ON, Altitude Modes). The **STBY**, **ON**, and **ALT** softkeys can be accessed by selecting the **XPDR** Softkey.

Selecting a transponder mode:

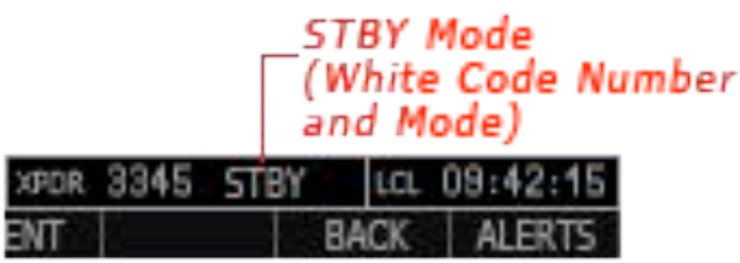
- Select the **XPDR** Softkey to display the Transponder Mode Selection softkeys.
- Select the desired softkey to activate the transponder mode.

Ground Mode
Ground Mode is normally selected automatically when the aircraft is on the ground. Ground Mode can be overridden by selecting any one of the Mode Selection Softkeys. A green GND indication and transponder code appear in the mode field of the Transponder Data Box. In Ground Mode, the transponder does not allow Mode A and Mode C replies, but it does permit acquisition squitter and replies to discretly addressed Mode S interrogations.

When Standby Mode has been selected on the ground, the transponder can be returned to Ground Mode by sleecting the **GND** Softkey.

Ground Mode

Standby Mode
Standby Mode can be selected at any time by selecting the **STBY** Softkey. In Standby, the transponder does not reply to interrogations, but new codes can be entered. When Standby is selected a white STBY indication and transponder code appear in the mode field of the Transponder Data Box. In all other modes, these fields appear in green.



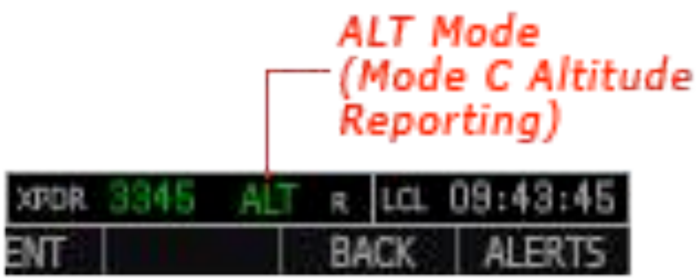
Standby Mode

Manual ON Mode
ON Mode can be selected at any time by selecting the **ON** Softkey. ON Mode generates Mode A and Mode S replies, but Mode C altitude reporting is inhibited. In ON Mode, a green ON indication and transponder code appear in the field of the Transponder Data Box.

ON Mode

Altitude Mode (Automatic or Manual)
Altitude Mode is automatically selected when the aircraft becomes airborne. Altitude Mode may also be selected manually by selecting the **ALT** Softkey.

If Altitude Mode is selected, a green ALT indication and transponder code appear in the mode field of the Transponder Data Box, and all transponder replies requesting altitude information are provided with pressure altitude information.



Altitude Mode

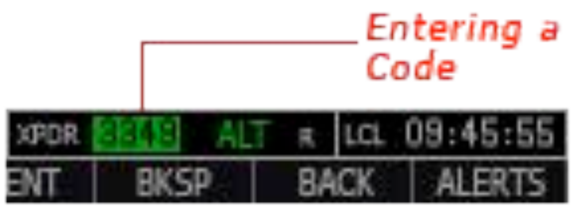
Reply Status
When the transponder send replies to interrogations, a white R indication appears momentarily in the reply status field of the Transponder Data Box.

Reply Indication

Entering a Transponder Code

Entering a transponder code with softkeys:

- Select the **XPDR** Softkey to display the Transponder Mode Selection softkeys.
- Select the **CODE** Softkey to display the Transponder Code Selection softkeys.
- Select the digit softkeys to enter the code in the code field. Immediately after entering the fourth digit, the transponder code becomes active. (NOTE: THIS IS A VARIATION FROM THE REAL WORLD G1000)

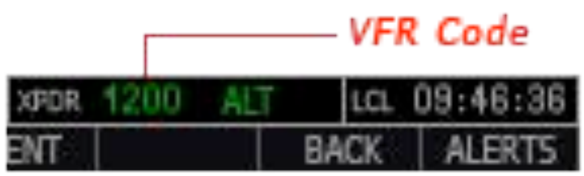


Entering a Code

Entering a transponder code with the PFD FMS Knob:
NOT SIMULATED

VFR Code
The VFR Code can be entered manually or by selecting the **XPDR** Softkey, then the **VFR** Softkey. When the **VFR** Softkey is selected, the pre-programmed VFR code is automatically displayed in the code field of the Transponder Data Box.

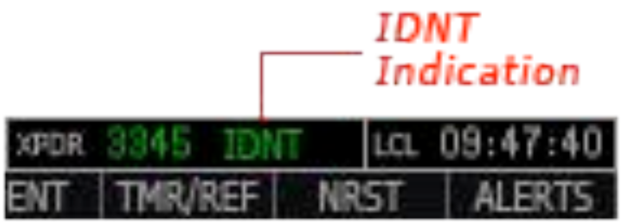
The pre-programmed VFR Code is set at 1200. Changing this is NOT SIMULATED.



VFR Code

IDENT Function
Selecting the **IDENT** Softkey sends an ID indication to Air Traffic Control (ATC). The ID return distinguishes one transponder from all others on the air traffic controller's radar screen. The **IDENT** Softkey appears on all levels of transponder softkeys. When the **IDENT** Softkey is selected, a green IDNT indication is dislpayed in the Mode field of the Transponder Data Box.

After the **IDENT** Softkey is selected while in Mode or Code Selection, the system reverts to the top-level softkeys. (NOT SIMULATED)



IDENT Indication

Flight ID Reporting
NOT SIMULATED

NEAREST AIRPORTS
The G1000 provides a **NRST** Softkey on the PFD, which gives the pilot quick access to nearest airport information (very useful if an immediate need to land is required). The Nearest Airports Window displays a list of 25 nearest airports (three entries can be displayed at one time). If there are more than three they are displayed on subsequent "pages" of the Nearest Airports Window, which can be selected with the large FMS Knob. If there are no nearest airports available, "NONE WITHIN 200NM" is dislpayed.

Nearest Airports Window on PFD

NOTE
The information displayed in the Nearest Airports Window is different than that found in the real-life G1000. Also, no additional information is available regarding any specific airport as is available on the real G1000. The MFD Nearest Airports Page is NOT SIMULATED.

FLIGHT PLANNING

Flight planning consists of building a flight plan by entering waypoints one at a time as needed. At this time flight planning information can only be entered on the MFD. The flight plan is displayed on the standard X-Plane navigation map using a red line.

Up to 96 waypoints can be created for a flight plan. NOTE: This is a variation from the standard number of waypoints available in X-Plane as well as a variation from the real-life G1000. If you load an existing flight plan that has more than 96 waypoints the FMS may not function as desired.

OPENING AN EXISITNG FLIGHT PLAN

1. Press the **FPL** Key on the MFD.
2. If you are in 2D Mode - Press the **Ready Pad** button in the upper right corner of the Active Flight Plan Page to "pop-up" the ReadyPad.

3. Press the **LOAD** Key on the ReadyPad
4. The standard X-Plane "Open FMS Plans" window will open.
5. Select the flight plan you wish to load and press **OPEN** (or **CANCEL** to exit).

CREATING AN ACTIVE FLIGHT PLAN

1. Press the **FPL** Key on the MFD.
2. If you are in 2D Mode – Press the **Ready Pad** button in the upper right corner of the Active Flight Plan Page to "pop-up" the ReadyPad.
3. Press the **INIT** Key on the ReadyPad.

4. Press the **DIRECT TO** (D→) Key on the ReadyPad.

5. The currently selected waypoint will be highlighted in the Active Flight Plan Page. (NOTE: Use the **SEL** Key to change the selected waypoint if necessary.)

6. Turn the small **FMS** Knob to the right to display the Waypoint Information Window:

7. Press one of the five "Type"" keys on the ReadyPad to indicate the type of waypoint you want to enter; **APT**, **VOR**, **L/L**, **FIX**, or **NDB**:

8. Using the ReadyPad alphanumeric keypad, enter the identifier of the waypoint – when you have completed the entry, the name of the waypoint, its type, and its location information will display.

9. Once you have entered the correct waypoint, press and "hold" the **ENT** Key on the ReadyPad until the waypoint is accepted.

10. The Waypoint Information Window will close and the waypoint ID will appear in the appropriate field of the Active Flight Plan Page.

11. To enter the next waypoint press the (right arrow) of the SEL Key on the ReadyPad to advance the FMS to the next waypoint and then repeat steps 6 through 10.

EDITING A WAYPOINT

1. Press the **FPL** Key on the MFD.

2. If you are in 2D Mode – Press the **Ready Pad** button in the upper right corner of the Active Flight Plan Page to "pop-up" the ReadyPad.

3. Use the **SEL** Key (left side of the key to go up and right side to go down) on the ReadyPad to select the waypoint you wish to edit. You can use the large **FMS** Knob to change the current page of the Active Flight Plan Page.

4. Once the waypoint that you wish to edit is selected (highlighted), turn the small **FMS** Knob to the right to display the Waypoint Information Window. The current waypoint information will be displayed.

5. Using the ReadyPad press the **CLR** Key to clear the current waypoint information. Note: Pressing **CLR** and then **ENTER** WILL NOT delete the waypoint – you must enter new waypoint information or the old one will be retained.

6. Press one of the five "Type"" keys on the ReadyPad to indicate the type of waypoint you want to enter; **APT**, **VOR**, **L/L**, **FIX**, or **NDB**.

7. Using the ReadyPad alphanumeric keypad, enter the identifier of the waypoint – when you have completed the entry, the name of the waypoint and its type will appear.

8. If this is the correct waypoint press and "hold" the **ENT** Key to accept.

9. The Waypoint Information Window will close and the waypoint ID will appear in the appropriate field of the Active Flight Plan Window.

10. To edit another waypoint repeat steps 3 though 9.

SAVING A FLIGHT PLAN

1. Press the **FPL** Key on the MFD.

2. If you are in 2D Mode - Press the **Ready Pad** button in the upper right corner of the Active Flight Plan Page to "pop-up" the ReadyPad.

3. Create a Flight Plan as described above.

4. Press the **SAVE** Key on the ReadyPad

5. The standard X-Plane "Save FMS Plans" window will open.

6. Enter a name for the flight plan you wish to save and press **SAVE** (or **CANCEL** to exit).

ACTIVATING A FLIGHT PLAN

1. Press the **FPL** Key on the MFD.

2. If you are in 2D Mode – Press the **ReadyPad** button in the upper right corner of the Active Flight Plan Page to "pop-up" the ReadyPad.

3. Open or Create a Flight Plan as described above.

4. Use the **SEL** Key on the ReadyPad to select the first waypoint to navigate to.

5. Press the **CDI** Softkey to select GPS on the HSI.

6. Press the **NAV** Key on the MFD (Autopilot) (Be sure the autopilot is already engagd).

7. Press the **DIRECT TO** (D→) Key on the Ready Pad.

8. The plane should turn (if necessary) and navigate to the first waypoint chosen. The FMS will manage the rest of the flight plan without any other input.

FLIGHT PLAN VIEWS

The Active Flight Plan Page in the C400 simulation can only be viewed in narrow mode. The wide view is NOT SIMULATED. In the narrow view the active flight plan can be configured to show cumulative distance over the length of the flight plan or the distance for each leg of the flight plan.

Switching between leg-to-leg waypoint distance and cumulative waypoint distance:

1. Press the **FPL** Key on the MFD to display the Active Flight Plan Page.

2. Select the **VIEW** Softkey to display the **CUM** and **LEG-LEG** Softkeys.

3. Select the **CUM** Softkey to view cumulative waypoint distance, or select the **LEG-LEG** Softkey to view leg-to-leg waypoint distance.

4. Select the **BACK** Softkey to return to the top level active flight plan softkeys.

AFCS CONTROLS
The following dedicated AFCS keys are located on the bezel of the MFD.

Dedicated MFD AFCS Controls

1. AP Key	Engages/disengages the autopilot
2. FD Key	Activates/deactivates the flight director only. Pressing once turns on the flight director in the default pitch and roll modes. Pressing again deactivates the flight director and removes the Command Bars. If the autopilot is engaged, the key is disabled.
3. NAV Key	Selects/deselects Navigation Mode
4. ALT Key	Selects/deselects Altitude Hold Mode
5. VS Key	Selects/deselects Vertical Speed mode
6. FLC Key	Selects/deselects Flight Level Change Mode
7. HDG Key	Selects/deselects Heading Select Mode
8. APR Key	Selects/deselects Approach Mode
9. NOSE-UP/NOSE-DN Keys	Controls the mode reference in Pitch Hold, Vertical Speed, and Flight Level Change Modes

NOTE: The GA Switch (Go Around) disengages the autopilot and selects flight director go around Mode. The GA Switch is located on the flap panel.

FLIGHT DIRECTOR OPERATION

The flight director function provides pitch and roll commands to the AFCS and displays then on the PFD. With the flight director activated, the aircraft can be hand-flown to follow the path shown by the Command Bars. The flight director also provides commands to the autopilot.

Activating the Flight Director

An initial press of a key listed in the following table (when the flight director is not active) activates the flight director in the listed modes. The flight director may be turned off and the Command Bars removed from the display by pressing the **FD** Key again. The **FD** Key is disabled when the autopilot is engaged.

Control Pressed	Modes Selected			
	Lateral		Vertical	
FD Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
AP Key	Roll Hold (default)	ROL	Pitch Hold (default)	PIT
GA Switch	Takeoff (on ground)	TO	Takeoff (on ground)	TO
	Go Around (in air)	GA	Go Around (in air)	GA
ALT Key	Roll Hold (default)	ROL	Altitude Hold	ALT
VS Key	Roll Hold (default)	ROL	Vertical Speed	VS
NAV Key	Navigation	GPS	Pitch Hold (default)	PIT
		VOR		
		LOC		
APR Key	Approach	GPS	Pitch Hold (default)	PIT
		VOR		
		LOC		
HDG Key	Heading Select	HDG	Pitch Hold	PIT

Flight Director Activation

AFCS STATUS BOX

Flight director mode annunciations are displayed on the PFD when the flight director is active. Autopilot status is displayed in the center of the AFCS Status Box. Lateral flight director modes are displayed on the left and vertical on the right. Armed modes are displayed in white and active in green.

AFCS Status Box

PFD AFCS Display

FLIGHT DIRECTOR MODES

Flight director modes are normally selected independently for the pitch and roll axes. Unless otherwise specified, all mode keys are alternate action (ie., press on, press off). In the absence of specific mode selection, the flight director reverts to the default pitch and roll mode(s).

Armed modes are annunciated in white and active in green in the AFCS Status Box. Under normal operation when the control for the active flight director mode is pressed, the flight director reverts to the default mode(s) for the axis(es). Automatic transition from the armed mode to active mode is indicated by the white armed mode annunciation moving to the green active field and flashing for 10 seconds.

Vertical Modes

The following table lists the vertical modes with their corresponding controls and annunciations. The mode reference is displayed next to the active mode annunciation for Altitude Hold, Vertical Speed, and Flight Level Change Modes. The NOSE UP/NOSE DN Keys can be used to change the vertical mode reference while operating under Pitch Hold, Vertical Speed, or Flight Level Change Mode. Increments of change and acceptable ranges of values for each of these references using the NOSE UP/NOSE DN Keys are also listed in the table.

Vertical Mode	Description	Control	Annunciation	Reference Range	Reference Change Increment
Pitch Hold	Holds aircraft pitch attitude; may be used to climb/descend to the Selected Altitude	(default)	PIT	-15° to +20°	0.5°
Selected Altitude Capture	Captures Selected Altitude	*	ALTS		
Altitude Hold	Holds current Altitude Reference	ALT Key	ALT nnnnn FT		
Vertical Speed	Holds aircraft vertical speed; may be used to climb/descend to the Selected Altitude	VS Key	VS nnnnn fpm	-2000 to +1500 fpm	100 fpm
Flight Level Change	Holds aircraft speed while aircraft is climbing/descending to Selected Altitude	FLC Key	FLC nnn kt	80 to 210 kts	1 kt
Glideslope	Captures and tracks the ILS glideslope on approach	APR Key	GS		
Go Around	Disengages the autopilot and commands a constant pitch angle and wings level	GA Switch	GA	7°	

PITCH HOLD MODE (PIT)

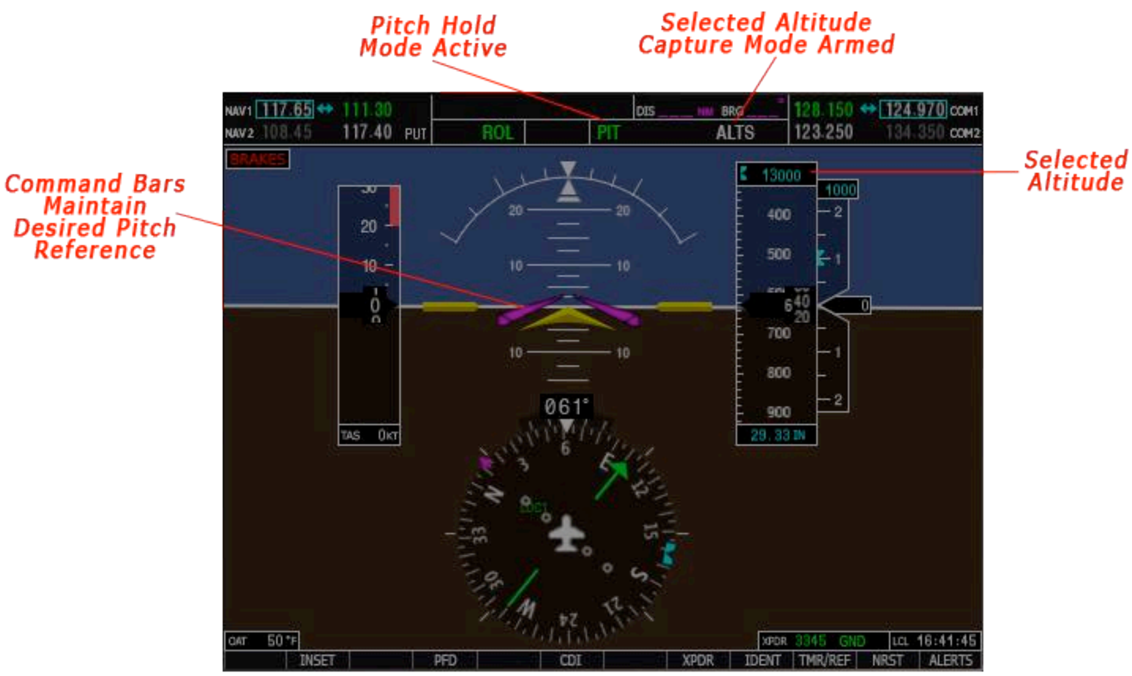
When the flight director is activated (the FD Key is pressed), Pitch Hold Mode is selected by default. Pitch Hold Mode is indicated as the active pitch mode by the green annunciation 'PIT'. This mode may be used for climb or descent to the Selected Altitude *shown above the Altimeter), since Selected Altitude Capture Mode is automatically armed when Pitch Hold Mode is activated.

In Pitch Hold Mode, the flight director maintains a constant pitch attitude, the pitch reference. The pitch reference is set to the aircraft pitch attitude at the moment of mode selection. If the aircraft pitch attitude exceeds the flight director pitch command limitations, the flight director commands a pitch angle equal to the nose-up/nose-down limit.

Changing Pitch Reference

When operating in Pitch Hold Mode, the pitch reference can be adjusted by:

- Using the NOSE UP/NOSE DN Keys



Pitch Hold Mode

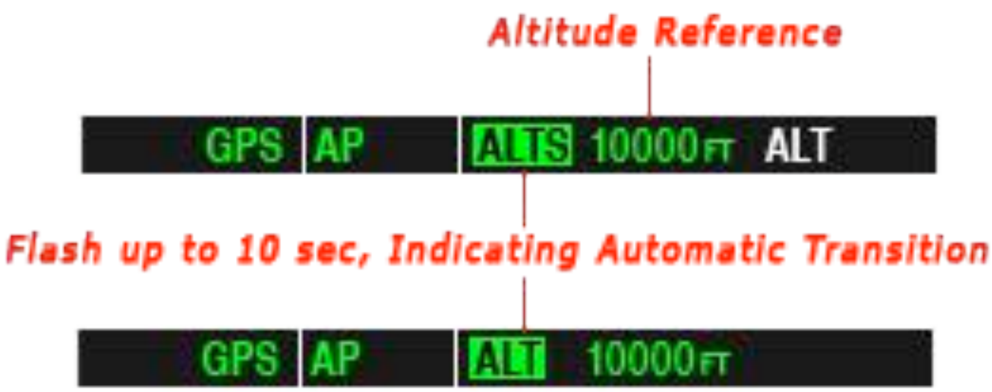
SELECTED ALTITUDE CAPTURE MODE (ALTS)
Selected Altitude Capture Mode is automatically armed with activation of the following modes:

- Pitch Hold
- Vertical Speed
- Flight Level Change
- Go Around

The white 'ALTS" annunciation indicates Selected Altitude Capture Mode. The ALT Knob is used to set the Selected Altitude (shown above the Altimeter) until Selected Altitude Capture Mode becomes active.

As the aircraft nears the Selected Altitude, the flight director automatically transitions to Selected Altitude Capture Mode with Altitude Hold Mode armed. This automatic transition is indicated by the green "ALTS" annunciation flashing for up to 10 seconds and the appearance of the white "ALT" annunciation. The Selected Altitude is shown as the Altitude Reference beside the 'ALTS' annunciation.

At 50 feet from the Selected Altitude, the flight director automatically transitions from Selected Altitude Capture to Altitude Hold Mode and holds the Selected Altitude (shown as the altitude reference). As Altitude Hold Mode becomes active, the white 'ALT' annunciation moves to the active pitch mode field and flashes green for 10 seconds to indicate the automatic transition.



Automatic Mode Transitions During Altitude Capture

ALTITUDE HOLD MODE (ALT)

Altitude Hold Mode can be activated by pressing the ALT Key; the flight director maintains the current aircraft altitude (to the nearest 10 feet) as the Altitude Reference. The flight director's Altitude Reference, shown in the AFCS Status Box, is independent of the Selected Altitude, displayed above the Altimeter. Altitude Hold Mode active is indicated by a green 'ALT' annunciation in the AFCS Status Box.

Altitude Hold Mode is automatically armed when the flight director is on Selected Altitude Capture Mode. Selected Altitude Capture Mode automatically transitions to Altitude Hold Mode when the altitude error is less than 50 feet. In this case, the Selected Altitude becomes the flight director's Altitude Reference.

NOTE

Turning the ALT Knob while in Altitude Hold Mode changes the Seletced Altitude, but not the flight director's Altitude Reference, and does not cancel the mode.

Altitude Hold Mode

VERTICAL SPEED MODE (VS)
Vertical Speed Mode is activatd by pressing the VS Key. The annunciation 'VS' appears in the active pitch mode field, along with the Vertical Speed Refernce to the right; the Vertical Speed Reference is also dislpayed above or below the Vertical Speed Indicator, depending on whether the aircraft is climbing or descending.

In Vertical Speed Mode, the flight director acquires and maintains a Vertical Speed Reference as it climbs or descends to the Selected Altitude (shown above the Altimeter), Current aircraft vertical speed besomes the Vertical Speed Reference at the moment of Vertical Speed Mode engagement. A Vertical Speed Reference Bug corresponding to the Vertical Speed Reference is shown on the indicator.

Changing the Vertical Speed Reference
The Vertical Speed Reference (shown both in the AFCS Status Box and above/below the Vertical Speed Indicator) may be changed:

- Using the NOSE UP/NOSE DN Keys

Vertical Speed Mode

FLIGHT LEVEL CHANGE MODE (FLC)
Flight Level Change Mode is selected by pressing the FLC Key. This mode acquires and maintains the Airspeed Reference while climbing or descending to the Selected Altitude (shown above the Altimeter). When Flight Level Change Mode is active, the flight director continuously monitors the Selected Altitude, airspeed, and altitude.

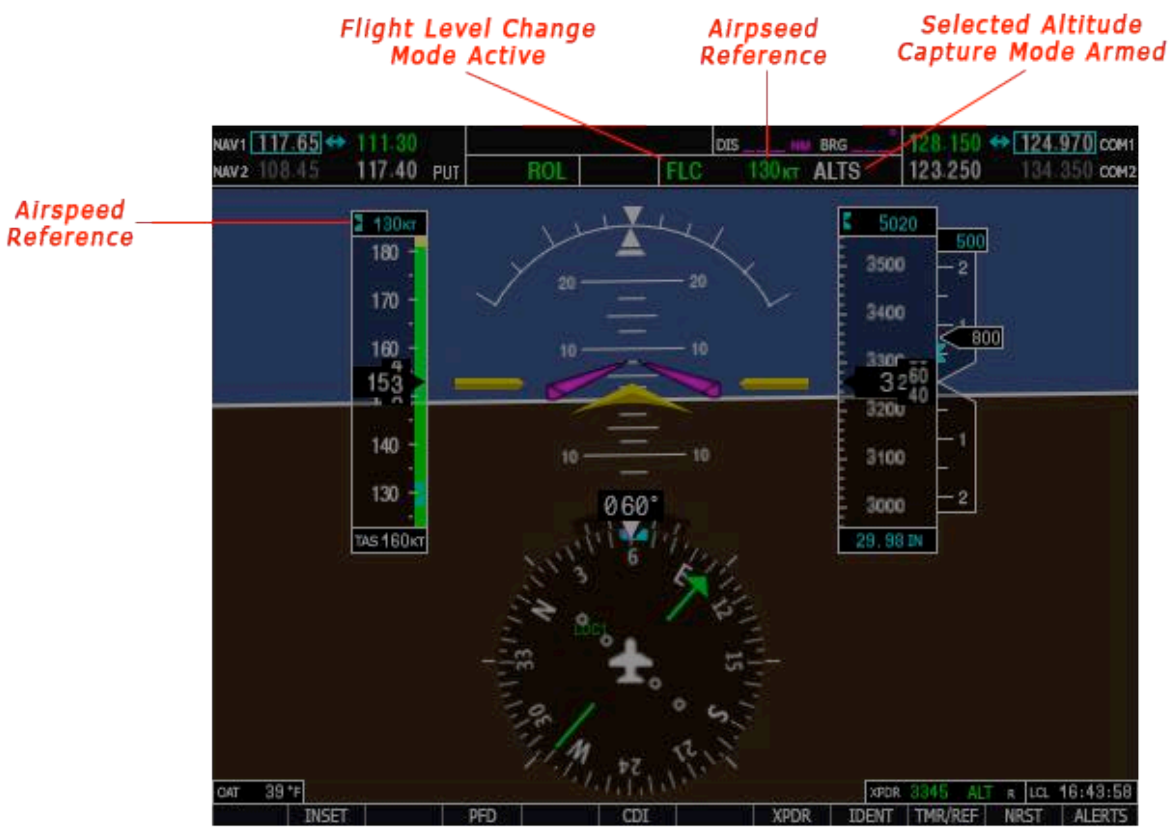
The airspeed reference is set to the current airspeed upon mode activation. Flight Level Change Mode is indicated by an 'FLC' annunciation beside the Airspeed Reference in the FCS Status Box. The Airspeed Reference is also displayed directly above the Airspeed Indicator.

Engine power must be adjusted to allow the autopilot to fly the aircraft at a pitch attitude corresponding to the desired flight profile (climb or descent) while maintaining the Airspeed Reference. The flight director maintains the current altitude until either engine power or the Airspeed Reference is adjusted and does not allow the aircraft to climb or descend away from the Selected Altitude.

Changing the Airspeed Reference
The Airspeed Reference (shown in both the AFCS Status Box and above the Airspeed Indicator) may be adjusted by:

- Using the NOSE UP/NOSE DN Keys

NOTE
The Seleced Altitude should be set before engaging Flight Levell Change Mode.



GLIDESLOPE MODE (GS)
Glideslope Mode is available for LOC/ILS approaches to capture and track the glideslope. When Glideslope Mode is armed (annunciated as 'GS' in white), LOC Approach Mode is armed as the lateral flight director mode.

Selecting Glideslope Mode:

Ensure a valid localizer frequency is tuned.

Ensure that LOC is the selected navigation source (use the DDI Softkey to cycle through navigation sources).

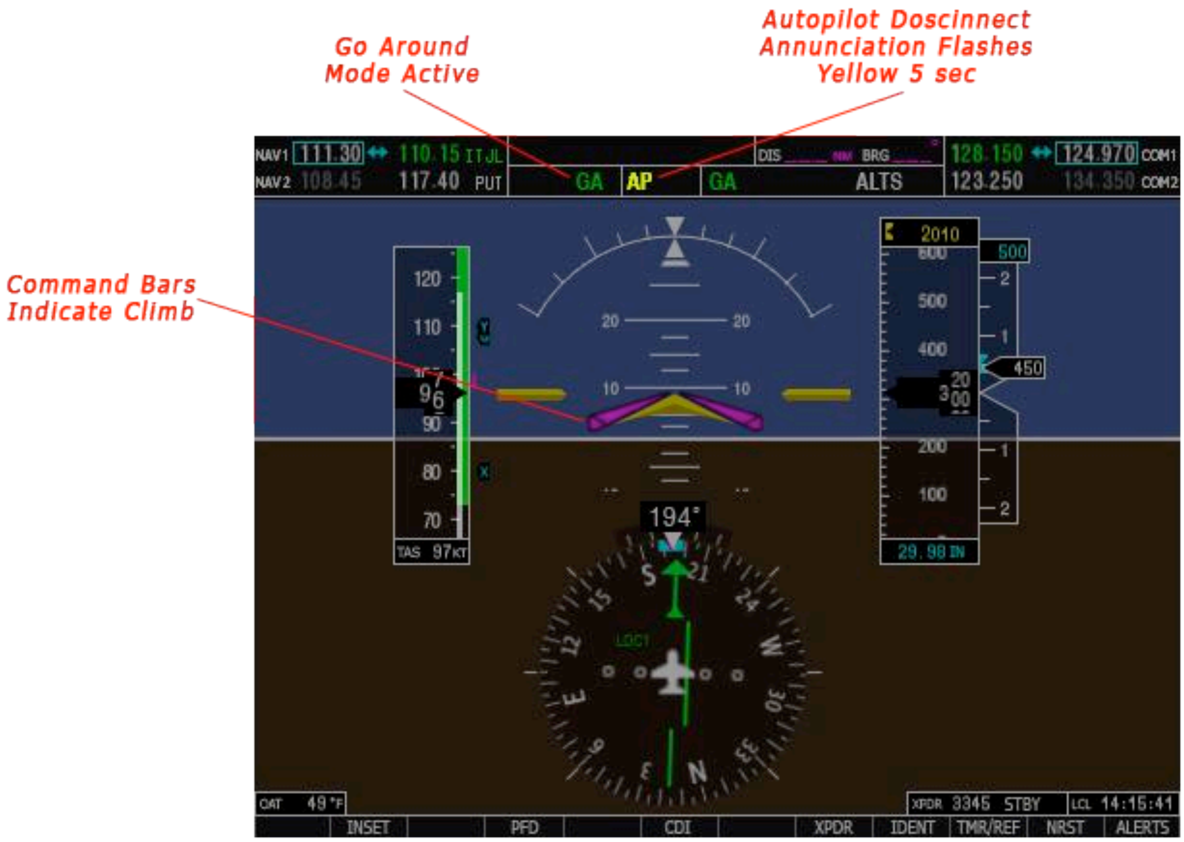
Press the APR Key

Glideslope Mode Armed

Once LOC is the navigation source, the localizer and glideslope can be captured. Upon reaching the glideslope, the flight director transitions to Glideslope Mode and begins to intercept and track the glideslope.

Glideslope Mode

GO AROUND MODE (GA)
Pushing the GA Switch engages the flight director in a wings=level, pitch-up attitude, allowing the execution of a missed approach or go around. This mode is a coupled pitch and roll mode and is annunciated as 'GA' in both the active pitch and roll mode fields. Go Around Mode disengages the autopilot and arms Selected Altitude Capture Mode automatically. Subsequent autopilot engagement is allowed. Attempts to modify the aircraft attitude (ie., with the NOSE UP/NIOSE DN Keys) result in reversion to Pitch and Roll Hold modes.



Go Around Mode

LATERAL MODES

The GFC700 Autopilot offer the lateral modes listed in the table below. Refer to the vertical modes section for information regarding the Go Around Mode.

Lateral Mode	Description	Control	Annunciation	Maximum Roll Command Limit
Roll Hold	Holds the current aircraft roll attitude or rolls the wings level, depending on the commanded bank angle	(default)	ROL	22°
Heading Select	Captures and tracks the Selected Heading	HDG Key	HDG	22°
Navigation, GPS	Captures and tracks the selected navigation source (GPS, VOR, LOC)	NAV Key	GPS	22°
Navigation, VOR Enroute Capture/Track			VOR	22° Capture 10° Track
Navigation, LOC Capture/Track			LOC	22° Capture 10° Track
Approach, LOC Capture/Track	Captures and tracks the selected navigation source (LOC)	APR Key	LOC	22° Capture 10° Track
Go Around	Disengages the autopilot and commands a constant pitch angle and wings level	GA Switch	GA	Wings Level

Lateral Modes

ROLL HOLD MODE (ROL)

When the flight director is activated, Roll Hold Mode is selected by default. This mode is annunciated as 'ROL' in the AFCS Status Box. The current aircraft bank angle is held, subject to the bank angle conditions listed in the table below.

Roll Hold Mode Annunciaton

Bank Angle	Flight Director Response
< 6˚	Rolls wings level
6˚ to 22˚	Maintains current aircraft attitude
> 22˚	Limits bank to 22˚

Roll Hold Mode Responsed

HEADING SELECT MODE (HDG)

Heading Select Mode is activated by pressing the HDG Key. Heading Select mode acquires and maintains the Selected Heading. The Selected Heading is shown by a light blue bug on the HIS and in the box to the upper left of the HIS.

Changing the Selected Heading

The Selected Heading is adjusted using the HDG Knob. Turns are commanded in the same direction as Selected Heading Bug movement, even if the Bug is turned more than 180˚ from the current heading (eg., a 270˚ turn to the right). However, Selected Heading changes of more than 340˚ at a time result in turn reversals.

Heading Select Mode

NAVIGATION MODE (GPS, VOR, LOC)

Pressing the NAV Key selects Navigation Mode. Navigation Mode acquires and tracks the selected navigation source (GPS, VOR, LOC). The flight director follows GPS roll steering commands when GPS is the selected navigation source. When the navigation source is VOR or LOC, the flight director creates roll steering commands from the Selected Course and deviation. Navigation Mode can also be used to fly non-precision GPS and LOC approaches where glideslope is not required.

If the CDI Deviation Indicator (CDI) shows greater than one dot when the NAV Key is pressed, the selected mode is armed. If the CDI is less than one dot, Navigation mode is automatically captured when the NAV Key is pressed. The armed annunciation appears in white to the left of the active roll mode.

GPS Navigation Mode Armed

Changing the Selected Course

The Selected Course is controlled using the CRS Knob (while in VOR or LOC Mode).

Navigation Mode

APPROACH MODE

Approach Mode is activated when the **APR** Key is pressed. Approach Mode acquires and tracks he selected navigation source (LOC). Pressing the **APR** Key when the CDI is greater than one dot arms the selected approach mode (annunciated in white to the left of the active lateral mode.) If the CDI is less than one dot, the LOC is automatically captured when the **APR** Key is pressed.

LOC Approach Mode allows the autopilot to fly a LOC/ILS approach with a glideslope. When LOC Approach mode is armed, Glideslope Mode is also armed automatically. LOC captures are inhibited if the difference between the aircraft heading and localizer course exceeds 105°.

Selecting LOC Approach Mode:

1. Ensure a valid localizer is tuned.

2. Ensure that LOC is the selected navigation source (use the **CDI** Softkey to cycle through navigation sources if necessary).

3. Press the **APR** Key

Navigation/Approach Mode Armed

AUTOPILOT OPERATION

The autopilot operates flight control surface servos to provide flight control. Pitch and roll commands are provided to the servos, based on the active flight director modes. The autopilot uses pitch and roll rates to stabilize the aircraft attitude during upsets and flight director maneuvers. Fllight director commands are rate-and attitude-limited, combined with pitch and roll damper control, and sent to the pitch and toll servo motors.

Pitch autotrim provides trim commands to the pitch trim servo to relieve any sustained effort required by the pitch servo. The pitch servo measures the output effort (torque) and provides this signal to the pitch trim servo. The pitch trim servo commands the motor to reduce the average pitch servo effort.

Engaging the Autopilot

When the AP Key is pressed, the autopilot and flight director (if not already engaged) are activated. Engagement is indicated by a green 'AP' annunciation in the center of the AFCS Status Box. The flight director engages in Pitch and Roll Hold modes when initially activated.

Autopilot Engaged

Disengaging the Autopilot
The autopilot is manually disengaged by pushing the AP DISC Switch, GA Switch, or the AP Key on the MFD. Manual disengagement is indicated by a five-second flashing yellow 'AP' annunciation and autopilot disconnect aural alert.

Manual Autopilot Disconnect

Automatic autopilot disengagement is indicated by a flashing red 'AP' annunciation and by the autopilot disconnect aural alert. Automatic disengagement occurs due to:

- System failure
- Inability to compute default flight director modes (FD also disengages automatically)
- Invalid sensor data

Automatic Autopilot Disengagement