RANGER

Flight Training Supplement

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SECTION 1

Introduction

This pilot Flight Training Supplement (FTS) was carefully prepared by the test pilots, flight instructors, and test engineers of Vashon Aircraft – the manufacturer of the Ranger R7 light sport aircraft. These individuals have significant experience with the airplane's flight qualities and performance, as well as information on the design, manufacture, and testing of this airplane.

Purpose of this manual

This FTS is provided to supplement the information provided in the Pilot's Operating Handbook (POH) but does not replace it. Some sections of the POH are mirrored in this manual but this manual provides expanded, more detailed, and in-depth information than is practical to include in the POH. It is, therefore, strongly recommended that the pilot be familiar with this Flight Training Supplement, the Pilot's Operating Handbook, and the aircraft prior to flight.

This supplement does not propose to substitute for more comprehensive handbooks explaining a theory and aerodynamics of flying, weather theory, airport operations, airspace classification, navigation etc. It is highly recommended that student refer for such information to the handbooks listed in Section 1 - Recommended Reading, any other suitable aeronautical publications, or available information on the Internet.

IT IS MANDATORY TO CAREFULLY STUDY THIS MANUAL PRIOR TO USE OF AIRCRAFT

Vashon Aircraft is not responsible for any damage or injury resulting from not following the instructions contained in this manual.

Definitions

The words "WARNING", "CAUTION", and "NOTE" are used throughout the manual with the following definitions:

WARNING

AN OPERATING PROCEDURE, PRACTICE, OR A CONDITION, WHICH, IF NOT CORRECTLY FOLLOWED OR REMEDIED, COULD RESULT IN SERIOUS PERSONAL INJURY OR LOSS OF LIFE.

CAUTION

An operating procedure, practice, or a condition, which, if not strictly observed or corrected, could result in destruction of, or damage to equipment.

Note

An operating procedure, practice, or condition, which is important to emphasize.

Recommended Reading

[1] Pilot's Operating Handbook (POH) for Ranger R7

[2] Aircraft Maintenance and Inspection Procedures for Ranger R7

[3] User Manuals of components and accessories

[4] Airplane Flying Handbook [FAA-H-8083-3A]

[5] Pilot's Handbook of Aeronautical Knowledge

[6] Certification of Aircraft and Airmen for the Operation of Light Sport Aircraft, issued by FAA, Doc. No. 4910-13, Effective September 1, 2004

[7] Standard Specification for Design and Performance of a Light Sport Airplane, designation F 2245-04 or latest

[8] ASTM F2483 Standard Practice for Maintenance and the Development of Maintenance Manuals for Light Sport Aircraft

[9] ASTM F2245 Specification for the Design and Performance of a Light Sport Aircraft

[10] ASTM F2295 Practice for Continued Operational Safety Monitoring of a Light Sport Aircraft

[11] 14 CFR Part 43 Maintenance, Preventative Maintenance, Rebuilding, and Alteration

Recommended Links

1. General information about Vashon Aircraft as well as drawing and manual revisions:
http://www.vashonaircraft.com/

2. General information about the Sport Pilot rule and Light Sport Aircraft:
http://sportpilot.org/

3. Dynon Avionics:
http://dynonavionics.com/

4. Information about Matco wheels and brakes:
http://matcomfg.com/

5. Continental Engines
http://continentalmotors.com

6. ACK 406 ELT
http://www.ackavionics.com/406%20Page.html

SECTION 2

Description of the Ranger Light Sport Airplane

The Ranger is a light sport aircraft built by Vashon Aircraft, an aircraft manufacturer located in Woodinville, Washington, USA. The Ranger aircraft has been designed to comply with all applicable requirements of Light Sport Aircraft Category. The airplane is intended primarily for sport and recreation, cross country flying and flight training.

Ranger aircraft are built ready to fly and hold the S-LSA designation.

Light Sport Airplane Overview

The light sport category is not a new type of airplane. It is a classification that intends to broaden the access of flight to more people. LSA has been defined as a simple-to-operate, easy-to-fly aircraft; however, "simple-to-operate" and "easy- to-fly" does not negate the need for proper and effective training.

The primary concept of the LSA is built around a defined set of standards:

- Powered (if powered) by single reciprocating engine
- Fixed landing gear, seaplanes are excluded
- Fixed pitch or ground adjustable propeller
- Maximum takeoff weight of 1,320 pounds for landplane, 1,430 for seaplane
- Maximum of two occupants
- Non-pressurized cabin
- Maximum speed in level flight at maximum continuous power of 120 knots calibrated airspeed (CAS)
- Maximum stall speed of 45 knots.

The Sport Pilot certificate is discussed later in this manual. Aircraft that are specifically manufactured for the LSA market are included in either the Special (S-LSA) or Experimental (E-LSA) designations. An approved S-LSA is manufactured in a ready-to-fly condition and an E-LSA is either a kit or plans-built aircraft based on an approved S-LSA model.

The Airframe

The Ranger is an all-metal, two-place, high-wing, single engine airplane equipped with tricycle landing gear and castering (non-steerable) nose wheel. The fuselage structure is of monocoque design in which the outer skin carries the major part of the load.

Engine and Propeller

The airplane is powered by a Continental 0-200-D four cylinder, horizontally opposed, air cooled, rated at 100 HP @2750RPM. The engine is furnished with a starter, ignition and fuel systems. The propeller is a Catto model 2B-70x48, a hybrid construction of wood and composite materials consisting of two-blades, fixed pitch and 70-inch diameter.

Flight Instruments

The airplane's instrument panel employs the Dynon Avionics HDX SkyView electronic flight instrument system (EFIS) display unit. All flight, navigation and engine parameter data are displayed in one screen with an optional second screen.

Refer to the HDX SkyView systems documentation and manuals for further information on the airplane's avionics.

SECTION 3

Sport Pilot Flight Training

Introduction to Flight Training
It is highly recommended that student pilots obtain all the necessary information on flight training requirements per the Federal Aviation Administration (FAA) prior to beginning flight training. Additional resources can be found at www.eaa.org as well as visiting the FAA website at www.faa.gov and by reading various training guides such as the FAA-H-8083-3 Airplane Flying Handbook.

The Sport Pilot Certificate
The sport pilot certificate is a pilot certification category created by the FAA specifically to address the desire of individuals wishing to fly aircraft primarily for recreational purposes. A sport pilot may only operate an aircraft during daylight hours (civil twilight).

The requirements to earn a pilot certificate in this category are aimed at teaching the core knowledge that individuals must understand and demonstrate to safely operate in the airspace system. By passing a knowledge (written) and practical (flight) test, a prospective sport pilot will demonstrate the proficiency necessary to operate a variety of aircraft safely.

Sport pilots will be limited to operating aircraft that meet the definition of a light-sport aircraft. That includes aircraft in the following categories:

- **Airplanes (single-engine only)**
- Gliders
- Lighter-than-air ships (airship or balloon)
- Rotorcraft (gyroplane only)
- Powered Parachutes
- Weight-Shift control aircraft (e.g. trikes)

Sport Pilot Eligibility

If you are an aviation enthusiast seeking your first pilot certificate, the sport pilot certificate provides the easiest and least costly way to fly for fun and recreation.
To earn a sport pilot certificate, one must:

- Be at least 16 to become a student sport pilot.
- Be at least 17 to test for a sport pilot certificate.
- Be able to read, speak, write, and understand English.
- Hold a current airman's medical certificate or a current and valid U.S. driver's license as evidence of medical eligibility (provided the FAA didn't deny, revoke, or suspend the pilot's last medical certificate application).
- Pass an FAA sport pilot knowledge test.
- Pass an FAA sport pilot practical (flight) test.

Medical Certification

To obtain a sport pilot certificate you must have either an FAA airman medical certificate or a current and valid U.S. driver's license issued by a state, the District of Columbia, Puerto Rico, a territory, a possession, or the Federal government, provided you do not have an official denial or revocation of medical eligibility on file with FAA.

You then must comply with the restrictions placed on whichever method you choose. For example, if you choose to use your driver's license as your medical certificate, you must comply with all restrictions on that license. In addition, *you must not act as a pilot- in- command of an aircraft if you know or have reason to know of any medical condition that would make you unable to operate the aircraft in a safe manner.*

However, a pilot who has had his or her last medical "denied" or "revoked" by the FAA will be required to obtain a special issuance medical before being allowed to base his or her medical fitness solely on driver's license requirements.

Privileges and Limitations of a Sport Pilot Certificate

A sport pilot may:

- Share the operating expenses of a flight with a passenger, provided the expenses involve only fuel, oil, airport expenses, or aircraft rental fees. A sport pilot must pay at least half the operating expenses of the flight.
- A sport may not act as pilot in command of a light-sport aircraft:
    - That is carrying a passenger or property for compensation or hire.
    - For compensation or hire.
    - In furtherance of a business.
    - While carrying more than one passenger.
    - At night.
    - In Class A airspace.
    - In Class B, C, or D airspace, at an airport located in Class B, C, or D airspace, and to, from, through, or at an airport having an operational control tower unless you have met the requirements specified in §**61.325**.
    - Outside the United States, unless you have prior authorization from the country in which you seek to operate. A sport pilot certificate carries the limitation "Holder does not meet ICAO requirements."
    - In a passenger-carrying airlift sponsored by a charitable organization.
    - At an altitude of more than 10,000 feet MSL or 2,000 feet AFL.
    - When the flight or surface visibility is less than 3 statute miles.
    - Without visual reference to the surface.
    - If the aircraft has a maximum forward speed in level flight that exceeds 87 knots CAS, unless having met the requirements of §**61.327**.
    - If the aircraft has a maximum forward speed less than or equal to 87 knots CAS, unless you have met the requirements of §**61.327**(a) or have logged flight time as pilot in command of an airplane with a maximum forward speed less than or equal to 87 knots CAS before April 2, 2010.
    - Contrary to any limitation or endorsement on your pilot certificate, airman medical certificate, U.S. driver's license, or any other limitation or logbook endorsement from an authorized instructor.
    - Contrary to any restriction or limitation on the sport pilot's U.S. driver's license or any restriction or limitation imposed by judicial or administrative order when using a driver's license to satisfy the requirements of Part 61.
    - While towing any object.
    - As a pilot flight crewmember on any aircraft for which more than one pilot is required by the type certificate of the aircraft or the regulations under which the flight is conducted.

Airmen Certification – Training Requirements for Sport Pilot

Training requirements for a sport pilot certificate with airplane category —

- A minimum of 20 hours flight time including:
    - 15 hours of flight training from an authorized instructor.
    - 5 hours solo flight.
- Flight training must include at least:
    - 2 hours cross-country flight training.
    - 10 takeoffs and landings to a full stop.
    - One solo cross-country flight of at least 75 nautical miles total distance with a full-stop landing at a minimum of two points and one segment of the flight consisting of a straight-line distance of at least 25 nautical miles between takeoff and landing locations.
    - 3 hours flight training in preparation for the practical test.
    - Ground training from an instructor or home-study course.
- FAA knowledge test on applicable aeronautical knowledge areas.
- FAA practical test for the applicable light-sport aircraft privilege.
- Sport pilot certificates will be issued without category/class designation — logbook endorsement will be provided for category and class per **FAR 61.317**.

SECTION 4

Operating Limitations

Ranger Purpose of Use

As already stated in the introduction of this manual, the Ranger meets the Light Sport Aircraft category requirements as described in reference [5] and [6].

The airplane is intended primarily for sport and recreation, cross-country flying and flight training. The Ranger limitations are stated in the next section. Always refer to the Pilot Operating Handbook (reference [1]) to see all its valid limitations.

Transitioning into a light sport airplane (LSA) requires the same methodical training approach as transitioning into any other airplane. A pilot should never attempt to fly another airplane that is different than the pilot's current certification, experience, training, proficiency, or currency without proper training. Some pilots may be lulled into a false sense of security because LSAs seem to be simple. However, a pilot seeking a transition into light sport flying should follow a systematic, structured LSA training course under the guidance of a competent instructor with recent experience in the specific training airplane.

Introduction

The limitations on the following pages are for your information. Always refer to the Ranger's Pilot Operating Handbook [1] for a complete list of limitations.

The Ranger is designed for operation in the Light Sport Category. Operating limitations are displayed electronically.
Daytime flight in VFR conditions *only* is approved provided the aircraft is operating as specified under Part 91 of the Federal Air Regulations (FAR's).

WARNING

NIGHT FLIGHT IS PROHIBITED (UNLESS OPERATED BY APPROPRIATELY RATED PILOT).

WARNING

FLIGHT IN IFR/IMC CONDITIONS IS PROHIBITED.

WARNING

FLIGHT INTO KNOWN ICING CONDITIONS IS PROHIBITED.

Approved Maneuvers

The Ranger is approved for the following maneuvers:

- Steep Turns up to bank angle 60°
- Climbing turns
- Lazy eights
- Stalls (except for steep stalls)
- Normal flight maneuvers

WARNING

AEROBATICS as well as INTENTIONAL SPINS are prohibited!

Airspeed Limitations

	Speed	KCAS	Meaning
VNE	Never Exceed Speed	131	Do not exceed this speed in any operation.
VNO	Maximum Structural Cruising Speed	103	Do not exceed this speed except in smooth air, and then only with caution.
VA	Maneuvering Speed	90	Do not make full or abrupt control movements above this speed.
VFE	Maximum Flap Extended Speed	82	Do not exceed this speed with flaps down.

Airspeed Indicator Markings

Marking	KCAS Value or Range	Significance
White Arc	41-82	Full Flap Operating Range. Lower limit is maximum weight Vs0 in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	45-103	Normal Operating Range. Lower limit is maximum weight Vs1 at most forward CG with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	103-131	Operations must be conducted with caution and only in smooth air.
Red Line	131	Maximum speed for all operations.

NOTE

CAS Calibrated airspeed is indicated airspeed (IAS) corrected for installation and instrument error.

IAS Indicated airspeed assumes zero instrument error only.

TAS Speed of the aircraft relative to the air mass in which it is flying.

Ceiling

Service Ceiling (estimated) 12,000 ft

Limit Load Factors

Maximum positive limit load factor ….4.0 g
Maximum negative limit load factor… -2.0 g

Prohibited Maneuvers

AEROBATICS PROHIBITED!
Intentional spinning prohibited

Wind Limitations

Maximum Direct Crosswind Component	15 kts
Maximum Wind Limitation	30 kts

Refer to the Pilot Operating Handbook [1] for all limitations of the aircraft.

Power Plant Limitations

Tachometer	
Normal Range (green arc)	1200 to 2500 RPM
Caution Range (yellow arc)	2500 to 2750 RPM
Maximum (red line)	2750 RPM
Cylinder Head Temperature	
Minimum for Take-Off	240°F
Normal in Cruise (green arc)	240° to 420°F
Caution Range (yellow arc)	420° to 525°F
Maximum (red line)	525°F
Oil Temperature	
Minimum for Take-Off	75°F
Normal in Cruise	170° - 220°F
Caution Range (yellow arc)	220°-240°F
Maximum (red line)	240°F
Oil Pressure	
Minimum at Idle (red line)	10 psi
Normal Operation	30-60 psi
Maximum-Cold (red line)	100 psi
Fuel Pressure	
Minimum	0.1 psi
Normal Range (aux pump on	2.2- 4.8 psi
(pump off)	0.1 – 1.1 psi
Maximum (red line)	4-8 psi

Fuel Limitations

Fuel Type	100 LL Aviation Fuel
Capacity Total	28.1 US Gallons
Capacity Usable	27.6 US Gallons

NOTE

When there is less than 2.5 gallons of useable fuel remaining, the EFIS will display a "LOW FUEL" warning.

SECTION 5

Airplane and System Description

Prior to the pilot's initial flight in a Ranger it is essential to become familiar with:

- Pilot Operating Handbook (POH) [1]
- Aircraft Maintenance Manual [2]
- Manuals supplied with installed equipment (COM, NAV, IC, etc.)
- Radio procedures
- Airport frequency
- Airport conditions (current weather, traffic pattern and runway in use)
- Airspace restrictions
- Navigation procedures

Cockpit Layout

It is essential for the pilot to become familiar with the aircraft cockpit layout and arrangement and use of controls, instruments and equipment.

Refer to the Pilot Operating Handbook [1], Aircraft Maintenance Manual [2] and manuals supplied with your specific installed equipment.

See Figure 5-1 for layout of the Ranger cockpit. Refer to the POH for your specific cockpit layout and instrument panel.

Figure 5-1: Ranger Cockpit Panel

Doors and Latches

Both doors incorporate a flush-mount outside door handle, key-operated door lock, and a conventional inside door handle. The door latch handle is located under the window. Latching pins at the rear top and rear bottom of each door are engaged by that door's handle. To open either door from outside the airplane; push in on the forward end handle to release the handle from the flush mount position, rotate handle down and forward to the OPEN position. To close the door from inside, pull the door shut and rotate handle to the CLOSED position ensuring pins are intact. From the outside, latch the door by rotating the outside door handle up and forward to the CLOSED position. See Figure 5-2.

Both pilot and co-pilot side doors have sliding glass windows that can be fully opened in flight for ventilation.

Figure 5-2: Door Handles Interior/Exterior

Entering the Cockpit

The Ranger is equipped with adjustable rudder pedals so it is best to make the adjustment before sitting in the seat. Adjustment from the sitting position is very difficult.

When rudder pedals are adjusted, it is easiest to sit in the seat first and then gently adjust knees around the control stick. Use the black bars or seat for grip. Do not put extreme weight on the doors or dashboard for balance.

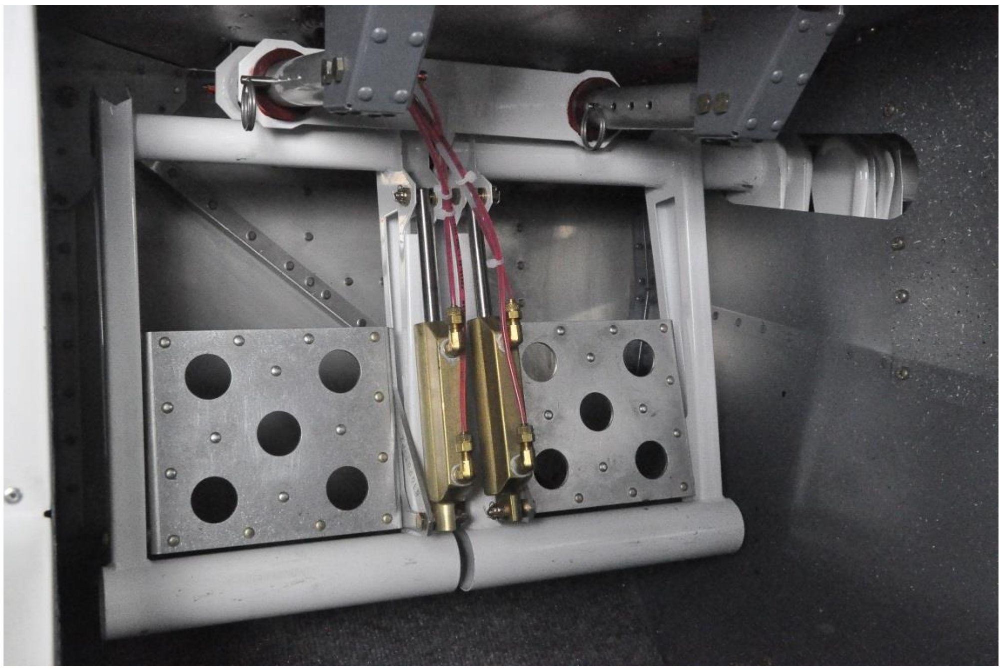

Figure 5-3: Adjustable Rudder Pedals

Sitting Position

Ensure the position of the rudder pedals are comfortable and allow for full deflection of the rudder when strapped in.

When seated with seatbelts fastened you should be able to fully deflect the stick in all directions and reach all the necessary controls. Small pilots may require cushions to place them closer to controls and tall pilots may need to remove the middle part of the seat upholstery.

To be most effective the lap portion of the seatbelt should be tightened first. Ensure the belt is quite snug around the lower pelvis. Tighten the shoulder straps only enough so that you can insert your fist between the strap and your chest. See Figure 5-4.

Figure 5-4 Sitting Position

Seatbelts
The Ranger comes standard with 5-point harness seatbelts which are fully adjustable.

Strap in procedure:

It does not matter in which order the 5 points are inserted as each strap has its own adjustable strap as shown.

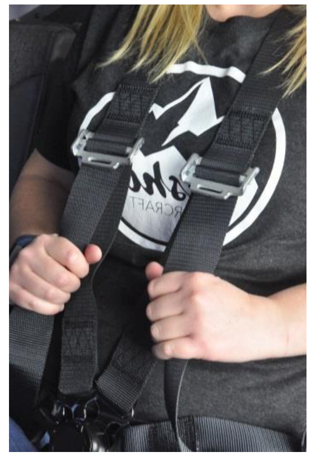

Figure 5-5: Buckling and Unbuckling the Seatbelts

Exiting the Airplane
Remove seatbelt and grasp the black bar near the front windshield for support. Bring inside leg gently over control stick and step out using care not to tug on door. Use black bars or seat for grip.

Airplane Flight Controls

Introduction

The Ranger belongs to a category of aerodynamically controlled airplanes around three axes. Aerodynamically controlled means, that the flight direction is changed due to aerodynamic effect of air flow that circumfluents the control surfaces which deflection is controlled with the airplane controls.

The three axes are the longitudinal axis, the lateral axis and the vertical axis.

The Ranger's flight control system consists of primary and secondary control system. The primary control system serves to safely control the Ranger during flight. It includes control of the ailerons, elevator and rudder. Movement of any of these three primary flight control surfaces changes the airflow and pressure distribution over and around the airfoil. These changes affect the lift and drag produced by the airfoil/control surface combination, and allow a pilot to control the Ranger about its three axes of rotation.

The secondary control system consists of the wing flaps control and elevator trim tab control.

The following pictures show the Ranger's control surfaces, movement, axes of rotation, and type of stability.

Primary Control Surface	Airplane Movement	Axes of Rotation	Type of Stability
Aileron	Roll	Longitudinal	Lateral
Elevator	Pitch	Lateral	Longitudinal
Rudder	Yaw	Vertical	Directional

Primary Controls

The Ranger has conventional ailerons and elevators that are operated with a stick and are mechanically actuated via systems of pushrods and bell cranks.

The rudder is operated with overhead pivoting rudder pedals and is actuated via cables. Each set of rudder pedals is independently adjustable to accommodate variations in height and body proportions of both pilot and passenger.

Flight control checks on the ground should include checking for movement in the proper direction and full travel in all directions.

Secondary Controls

Trim Control

The aircraft is trimmed in flight by changing the position of a tab on the left elevator. The elevator trim tab control lever is operated via a rocker switch located on the control stick.

The SkyView HDX Autopilot, when engaged, can also provide automatic trim control – Auto-trim.

Wing Flaps System

The airplane is equipped with plain flaps with settings at 0°, 20°, and 40°. The flaps are extended or retracted by positioning the wing flap switch lever on the instrument panel to the desired flap deflection position.

The flap actuator is controlled via a rocker switch located on the instrument panel. Flap position is displayed on the EFIS screen with the signal coming from a position potentiometer inside the flap linear actuator.

Landing Gear System

The landing gear is of the tricycle type, with a castering nose wheel and two main wheels. Each main gear wheel is equipped with a hydraulically actuated disc type brake on the inboard side of each wheel.

There are two basic types of nose wheels: steerable and non-steerable, or castering. The Ranger uses a castering nose wheel system. This means the airplane will use differential braking for directional control on the ground. It also allows for tighter turns while taxiing.

Because of the castering nose wheel, the Ranger will generally want to point into the wind. This tendency is countered with opposite braking, as needed. The only real trick will come when stopping or turning while the wind is blowing—slightly more pressure on the downwind brake will be necessary to keep the airplane straight.

Instrument Panel

The Ranger is equipped with Dynon's SkyView system. SkyView is an integrated glass panel avionics system. Its capabilities include Primary Flight Display (PFD) information, Engine Monitoring, GPS moving map with procedure and en-route charts, two-axis approach-capable Autopilot, Mode-S Transponder with 2020-compliant ADS-B Out capability, ADS-B Traffic and Weather (US only), and COM Radio.

The Ranger comes standard with a single 10" Dynon HDX SkyView. An additional 10" SkyView panel is included as an upgrade option.

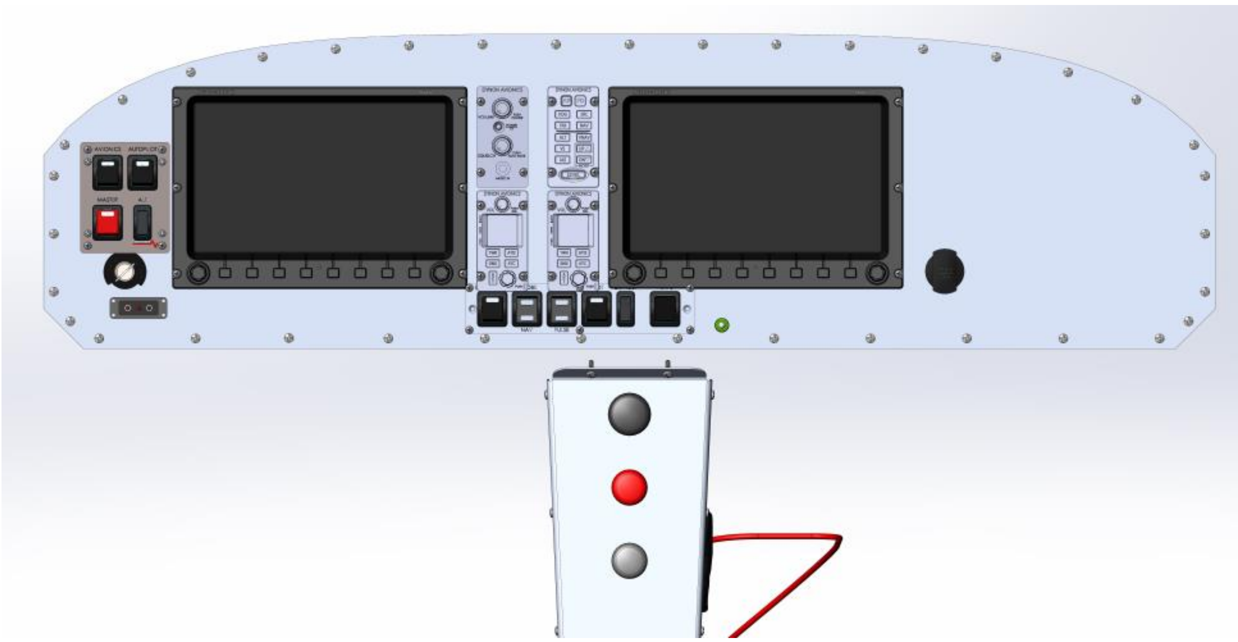

Figure 5-6 Instrument Panel

INSTRUMENTS	STANDARD	OPTIONAL
SV-HDX1100 EFIS (left side)	X	
SV-HDX1100 EFIS (right side)		X
SV-ADAHRS-200	X	
SV-ADAHRS-201		X
SV-EMS-220	X	
SV-BAT-320	X	
COM SYSTEM	**STANDARD**	**OPTIONAL**
SV-COM-C25 VHF Transceiver (primary)	X	
SV-COM-C25 VHF Transceiver (secondary)		X
SV-INTERCOM-2S Intercom	X	
NAV SYSTEM	**STANDARD**	**OPTIONAL**
SV-XPNDR-261 Mode S Transponder	X	
SV-GPS-2020 GPS Antenna/Receiver Module (primary)	X	
SV-GPS-2020 GPS Antenna/Receiver Module (secondary)		X
SV-ADS-B-472	X	
SV-VOR-9999 VOR/GS Receiver		X
AUTOPILOT SYSTEM	**STANDARD**	**OPTIONAL**
SV-42 Autopilot Servo (roll)	X	
SV-42 Autopilot Servo (pitch)	X	
SV-AP-PANEL Autopilot Panel	X	

Table 5-1: Instrument and Avionics Equipment List

Instruments

SV-HDX1100

The primary instrument is the Dynon Avionics SkyView HDX EFIS as shown in Figure 5-7. As an option, a second SV-HDX1100 EFIS may be installed. SkyView HDX features icon-driven touch controls and simplified screen navigation for reduced workload.

Figure 5-7: SV-HDX1100 Electronic Flight Instrument System

SV-ADAHRS-200/201

The primary ADAHRS is the SV-ADAHRS-200 as shown in Figure 5-8. For redundancy, a second ADAHRS, the SV-ADAHRS-201 may be installed as an option. ADAHRS stands for Air Data/Attitude/Heading Reference System, which provides primary flight instruments, including attitude, airspeed, altitude, magnetic heading, DG, VSI, AOA, G-meter, turn rate, slip/skid ball, OAT, and TAS.

Figure 5-8: SV-ADAHRS-200

SV-EMS-220

The Engine Monitoring System receives signals from engine sensors for display on your EFIS. Some of the parameters you can measure with the SkyView EMS include:

- Tach
- Manifold Pressure
- Oil Pressure
- Oil Temperature
- Fuel Flow with Fuel Computer
- Fuel Pressure
- CHT
- EGT
- Voltage
- Current
- Fuel Computer
- Engine and Flight Timers (It also can monitor discrete sensors for):
    - Trim Position
    - Flap Position
    - And other aircraft parameters

Figure 5-9: SV-EMS-220

SV-BAT-320

The SkyView backup battery provides at least an hour of power to a single SkyView display and all connected SkyView Network Modules, including the ADAHRS and EMS.

Figure 5-10: SV-BAT-320

Com System

SV-COM-C25

The SkyView COM radio tunes frequencies by airport and station type – rather than by spinning in a number - at the touch of a button. You can also send frequencies over from the SkyView map airport info pages.

Figure 5-11: SV-COM-C25

SV-INTERCOM-2S

The SV-INTERCOM-2S solves the problem of having to choose between an under featured intercom or an expensive audio panel. With ample inputs for EFIS systems, stereo music, and all the other technology in your panel, the SV-INTERCOM-2S has the features that your modern connected 2-place aircraft requires. See Figure 5-12.

Figure 5-12: SV-INTERCOM-2S

Navigation System

SV-XPNDR-261

The Mode S transponder with ADS-B out meets the 2020 ADS-B mandate. Also features TIS traffic (USA) only). See Figure 5-13.

Figure 5-13: SV-XPNDR-261

SV-GPS-2020

The SV-GPS-2020 is a sensitive WAAS enabled GPS receiver and antenna that meets the 2020 ADS-B Out requirements. For redundancy, a second GPS may be installed as an option. Both the standard and optional GPS's are mounted externally on the upper surface of the wing. See Figure 5-14.

Figure 5-14: SV-GPS-2020

SV-ADS-B-472

Dynon's new dual band ADS-B receiver receives weather & traffic on both 978 MHz and 1090 MHz frequencies. You can also receive free text and graphical weather from the FAA's network of ADS-B ground stations. See figure 5-15.

Figure 5-15: SV-ADSB-472

Autopilot System

SV-42

The autopilot consists of two SV-42 servos connected to the SkyView system. One servo is used to drive the aileron control, and the other servo is used to drive the elevator control. An SV-42 servo is shown in Figure 5-16. Both servos are mounted in the aft fuselage below the baggage floor.

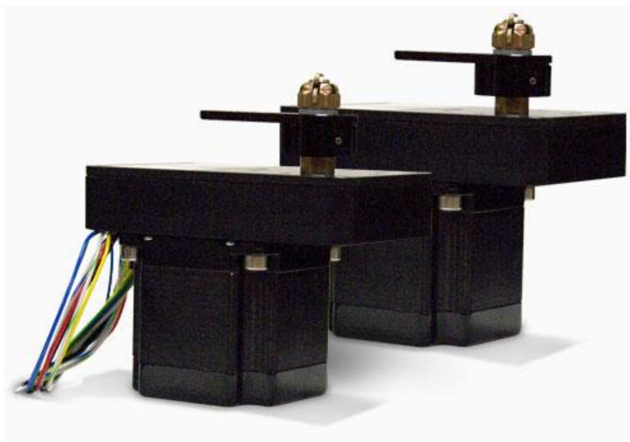

Figure 5-16: SV-42

SV-AP-PANEL

The SV-AP-PANEL, shown in Figure 5-17, has dedicated buttons for all autopilot modes, including the flight director and level mode. It also has an integrated two channel trim controller that eliminates the need to equip with relay decks for trim control. The trim controller does not depend on the autopilot servos and continues to operate independently of them. It has SkyView-adjustable airspeed based speed scheduling that can slow down trim motor movements as airspeed increases and it is even able to continue operation without SkyView as long as it is receiving aircraft power. Safety features include trim runaway protection and pilot command priority override.

Figure 5-17: AV-AP-Panel

Antennas

ANTENNA LOCATIONS

See Figure 5-18 for the location of the various standard and optional antennas on the aircraft.

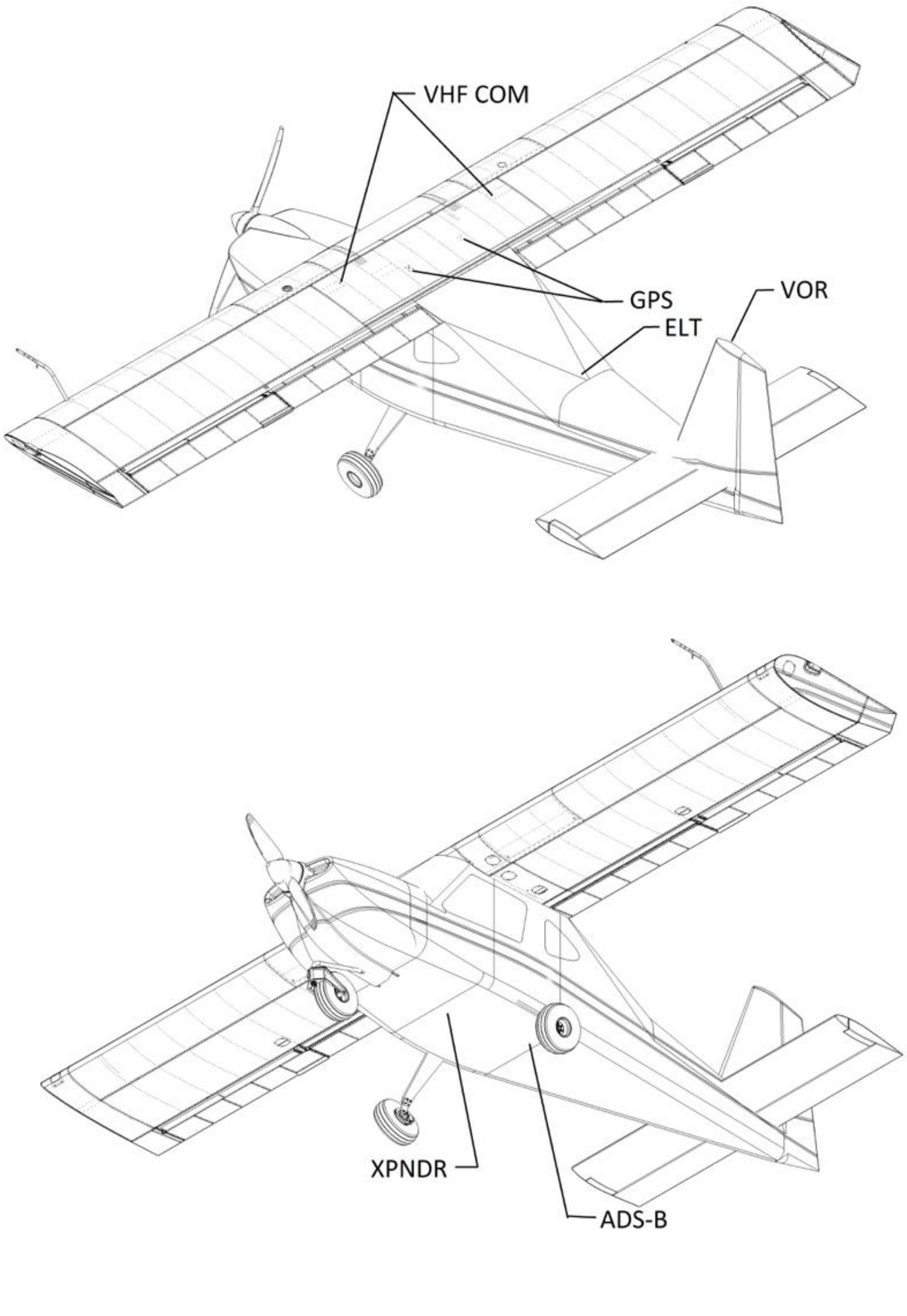

Figure 5-18: Antenna Locations

Engine

The engine is powered by a horizontally opposed, four cylinder, overhead valve, air cooled, wet sump oil lubricated Continental O-200D engine and is rated at 100 HP at 2750 RPM. The engine has a direct propeller drive (no reduction unit) and dual magneto ignition (8 spark plugs total). See Figure 5-19.

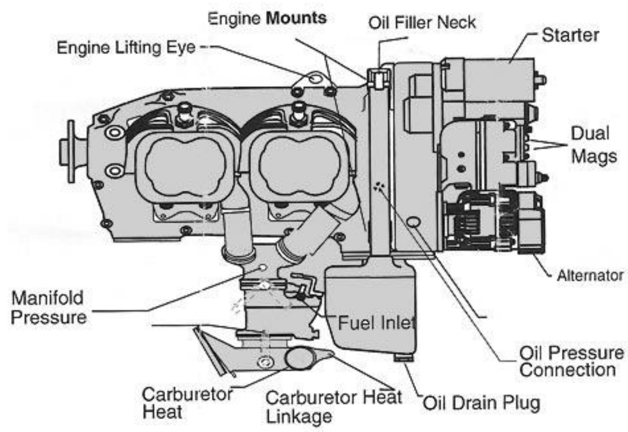

Figure 5-19: Continental O-200-D Engine

Engine Controls

Engine power is controlled by a friction lock throttle located on the center console and is accessible from either seating position. The throttle is open in the full forward position and closed in the full aft position. See Figure 5-20.

Figure 5-20: Throttle Control

The mixture control, mounted adjacent to the throttle control, is a red knob with raised points around the circumferences and is equipped with a lock button at the end of the knob. The rich position is full forward, and full aft is the idle cutoff position.

The air-to-fuel mixture is adjusted manually with a control in the center console. Pulling the mixture control all the way back operates a cut-off valve on the carburetor that stops the supply of fuel to the engine. The mixture control should always be used to stop the engine. See Figure 5-21.

Figure 5-21: Mixture Control

Engine Instruments

The Dynon SkyView EFIS provides graphical indicators and numeric values for engine, fuel, and electrical system parameters to the pilot.

For more information on SkyView see the Dynon Avionics guide.

Priming the Engine

Priming is usually required on the first start of the day or when the temperature is near 0° or lower. To prime, use carburetor accelerator pump.

If engine is cold – fully open and close the throttle 3 to 5 times.
If engine is hot – DO NOT PRIME BEFORE STARTING.

NOTE

The amount of prime required depends on engine temperature. Familiarity and practice will enable the operator to accurately estimate the amount of prime to use.

See the Engine Start checklist in the POH for proper engine priming.

New Engine Break-in and Operation

The engine underwent a run in at the factory and is ready for the full range of use. It is, however, suggested that cruising be accomplished at 75% power as much as practical until a total of 50 hours has accumulated or oil consumption has stabilized. This will ensure proper seating of the piston rings.

Ignition and Starter System

Engine ignition is provided by two engine-driven magnetos, and two spark plugs in each cylinder. The right magneto fires the lower right and upper left spark plugs, and the left magento fires the lower left and upper right spark plugs. Normal operation is conducted with both magnetos due to the more complete burning of the fuel/air mixture with dual ignition.

Air Induction System

The engine air induction system receives ram air through an intake on the lower front portion of the engine cowling. The intake is covered by an air filter which removes dust and other foreign matter from the induction air. Airflow passing through the filter enters an air box. The air box has a spring loaded alternate air door. If the air induction filter should become blocked, suction created by the engine will open the door and draw unfiltered air from inside the lower cowl area. An open alternate air door will result in an approximate 10% power loss at full throttle. After passing through the air box, induction air enters a fuel/air control unit under the engine, and is then ducted to the engine cylinders through intake manifold tubes.

Exhaust System

Exhaust gas from each cylinder passes through riser assemblies to a muffler and tailpipe. Outside air is pulled in around shrouds which are constructed around the outside of the muffler to form heating chambers which supply heat to the cabin.

Carburetor System

The engine is equipped with a float-type carburetor consists essentially of six subsystems that control the quantity of fuel discharged in relation to the flow of air delivered to the engine cylinders. These systems work together to provide the engine with the correct fuel flow during all engine operating ranges. The essential subsystems of a float-type carburetor are illustrated in Figure 5-22. These systems are:

1. Float chamber mechanism system
2. Main metering system
3. Idling system
4. Mixture control system
5. Accelerating system
6. Economizer system

Figure 5-22: Carburetor System

Carburetor Heat

The carb heat knob is a push-pull control that delivers heated air to the carburetor when selected on (pulled out.) Selecting carb heat on will reduce the engine speed. Use as per directions in Chapter 4 of the Pilot Operating Handbook. The carb heat knob is the lower black knob on the center panel labeled CARB.

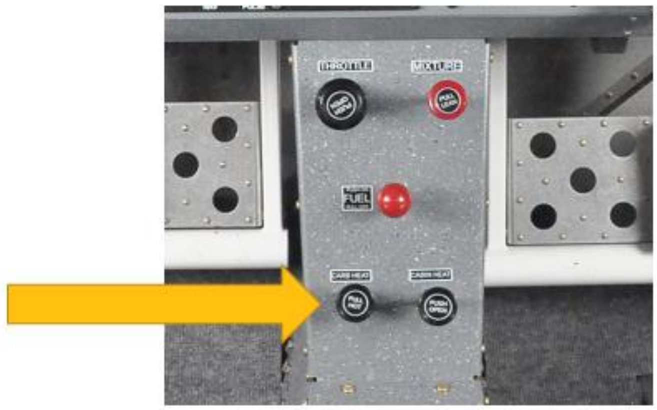

Figure 5-23: Carburetor Heat

NOTE

Extended periods of ground operation with carburetor heat ON should be avoided as the air filter is bypassed when carburetor heat is selected.

Cooling System

Ram air for engine cooling enters through two intake openings in the front of the engine cowling. The cooling air is directed around the cylinders and other areas of the engine by baffling, and is then exhausted through an opening at the bottom aft edge of the cowling. No manual cowl flap cooling system control is required.

Propeller

The airplane is equipped with a two bladed, fixed pitch, Catto propeller, model number 2B-70x48, a hybrid construction of wood and composite materials. The propeller is 70 inches in diameter.

Figure 5-24: Propeller

Fuel System

The aircraft is equipped with two 11.7 US gallon main tanks integral to the main spar of the wing and a single non-integral 2.0 US gallon header tank located in the aft baggage area. The fuel system sump is in the header tank and the drain is located on the bottom of the fuselage just aft of the right side main landing gear leg. There are two drains on the bottom of each wing, one inboard and one outboard. Fuel samples should be taken at each of the five drain locations before each flight to verify that there is no water or sediment in the fuel system.

Fuel flows via gravity from the main tanks to the header tank then through a filter, the fuel flow transducer, shut-off valve, and then to the carburetor. The header tank remains full whenever there is fuel in either main tank. There is an electric boost pump located just downstream of the header tank outlet which is to be turned-on any time the header tank is not full.

The air-spaces at the tops of all three tanks are interconnected and the fuel system is vented via an aluminum vent tube connected to the top of the outboard end of the right main fuel tank that runs along the front side of the main spar to the the pitot/static/aoa mast. The vent line opening faces downward from the pitot/static/aoa mast to discharge clear of the leading edge of the wing. The vent line discharge is shielded to prevent in-flight obstruction of the vent opening due to bird/insect/debris impact or icing. The vent opening should be inspected for obstruction prior to each flight.

If the aircraft is parked on a slope for longer than just a few minutes, the "low-side" tank will have more fuel than the "high-side" tank. For this reason, when visually checking the quantity of the low-side tank it is suggested to first unlatch the filler cap and only if fuel does not flow out from under the filler cap should it then be slowly removed. When fueling the aircraft, it is suggested that the high-side tank be filled first to maximize the amount of fuel that may be added.

The quantity of fuel in each main fuel tank is displayed on the EFIS. The electrical signal to the EFIS is derived from a float-type variable resistance sender located in each main tank. The header tank fuel state ("Full" or "Not Full") is displayed on the EFIS. The electrical signal to the EFIS comes from an "on/off" float switch mounted near the top of the header tank.

Prior to refueling the aircraft, connect the fueling equipment's grounding cable to either of the wing tie-downs or to the engine exhaust pipe. This will ensure that there is no difference in electrical potential between the aircraft and the fueling equipment and will minimize the risk of electrical sparks when the aircraft is being refueled.

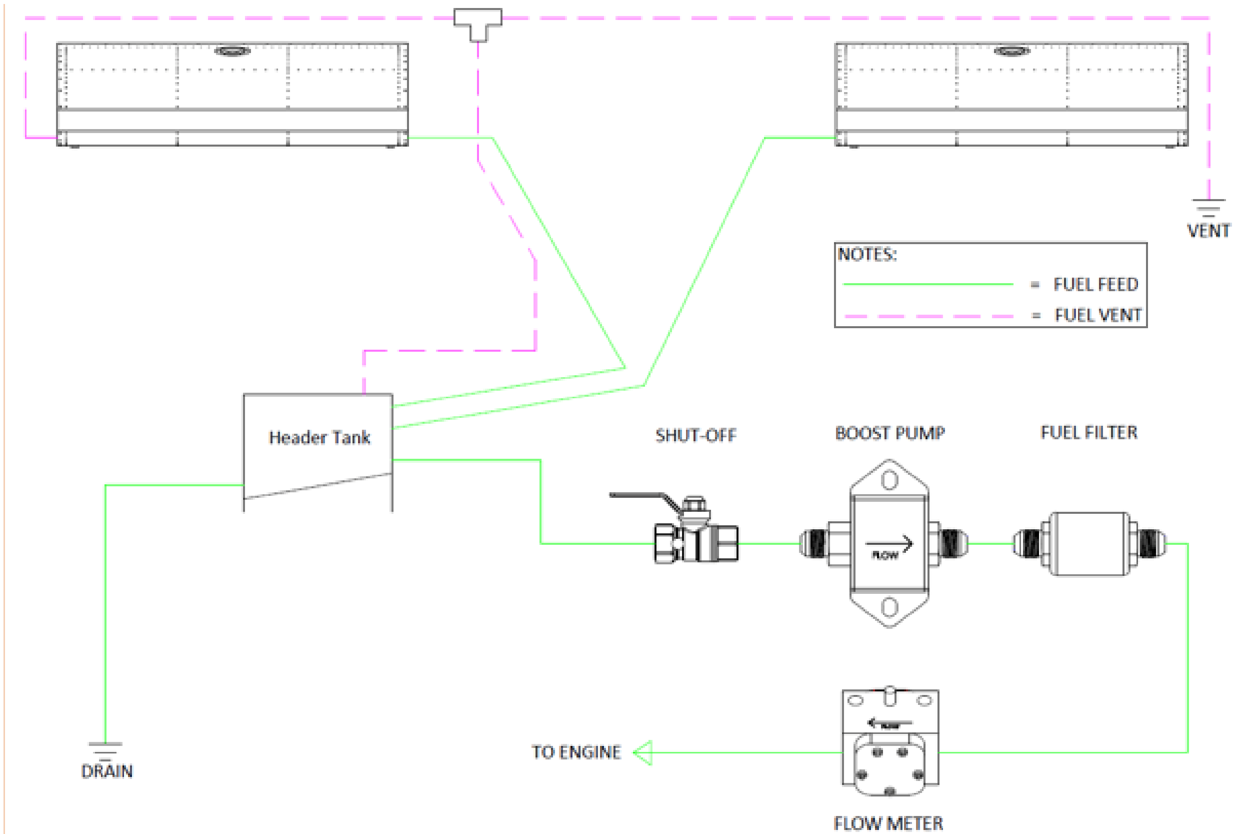

Figure 5-25: Fuel System

Brake System

The airplane has a single disc, hydraulically actuated brake on each main landing gear wheel. Each brake is connected, by a hydraulic line, to a master cylinder attached to each of the pilot's rudder pedals. The brakes are operated by applying pressure to the top of either the left (pilot's) or right (co-pilot's) set of rudder pedals, which are interconnected.

Electrical System

The airplane is equipped with a 14-volt direct current (DC) electrical system powered by a 50-amp engine driven alternator. A 12-volt main storage battery is located on the forward side of the firewall. The alternator and main battery are controlled by the MASTER switch found on the left side of the instrument panel.

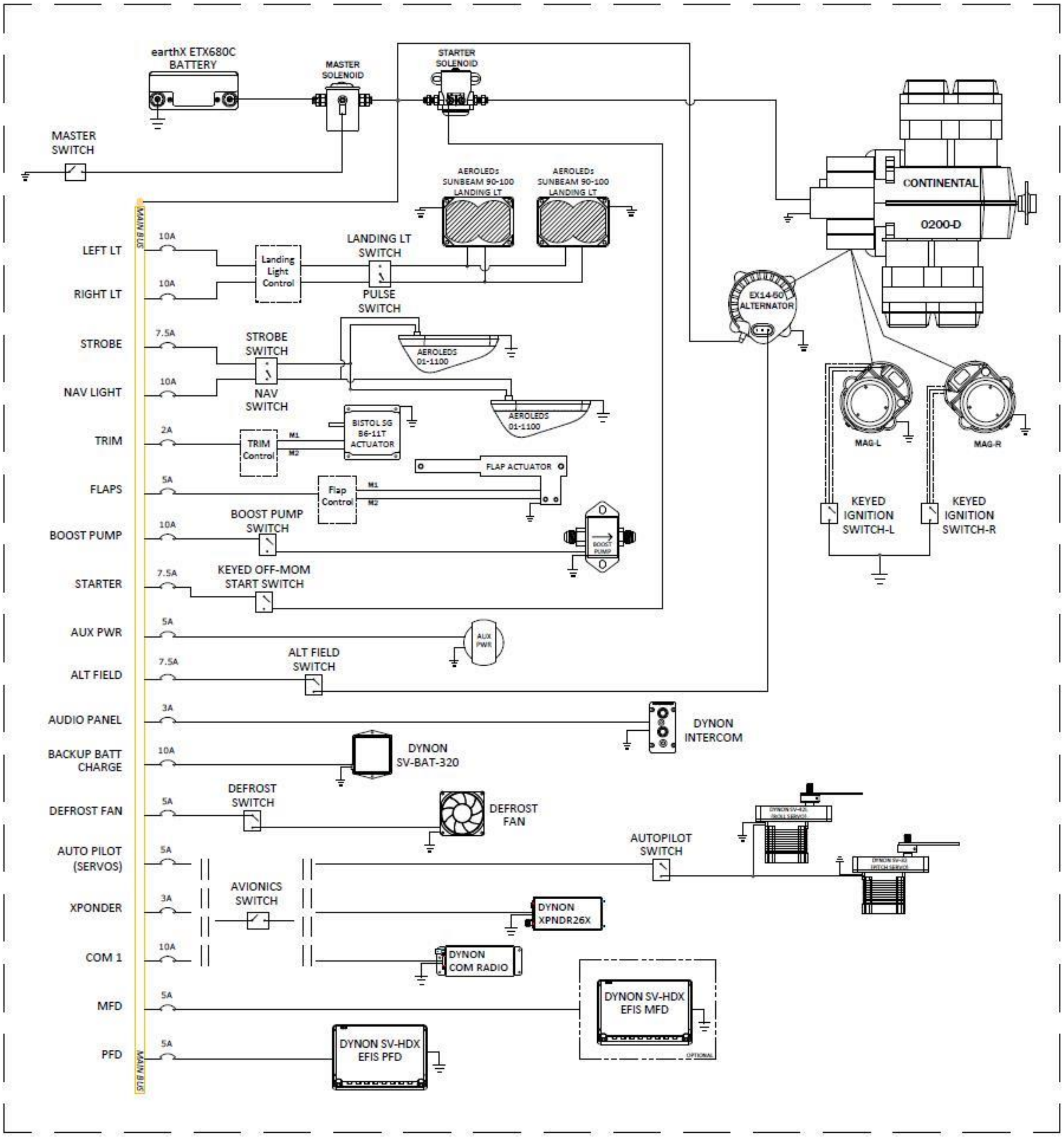

Figure 5-26: Electrical System

Master Switch

The red master switch is located on the instrument panel to the left of all the other electrical services. See Figure 5-35. When the master is turned ON and the engine is OFF all selected services and the engine instruments operate on battery power. Once the engine starts, electrical power is supplied to all systems by the alternator and the battery is also recharged.

The Hobbs meter begins to record airframe time as soon as the master switch is turned on.

Electrical System Monitoring

Main battery current, and system voltage indications are available on the SkyView System.

Circuit Breakers

The airplane is equipped with electronic circuit breakers that interface through SkyView system. Advanced Flight Systems supplies the "Advanced Control Module" (Red Box), which provides the electronic circuit breakers that interface with SkyView. These electronic circuit breakers are always visible to the pilot on the HDX.

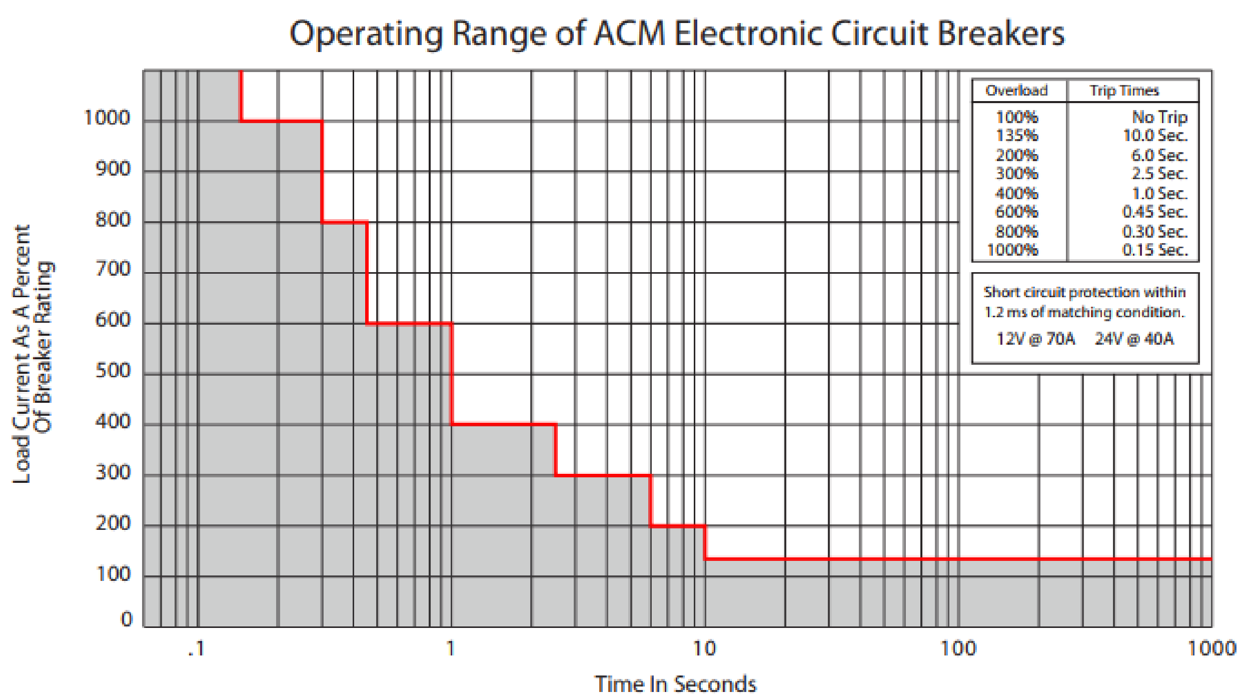

Table 5-2: Circuit Breaker Operating Range

Switch Panel Assembly

The switch panel contains the following 4 switches:

- Avionics
- Autopilot
- Master
- Alternator

Figure 5-27: Switch Panel Assembly

12V Power Outlet

A 12-volt power outlet connector (POWER OUTLET 12V - 7.5A) is provided by an automotive style power outlet located on the center pedestal. The power outlet receives electrical power from a dedicated 7.5-amp circuit breaker located in the switch/circuit breaker panel.

CAUTION

Charging lithium batteries may cause the lithium batteries to explode.

Take care to observe the manufacturer's power requirements prior to plugging any device into the 12 Volt cabin power system connector. This system is limited to a maximum of 7.5 amps.

Use caution with power / adapter cables in the cabin to avoid entangling occupants or cabin furnishings and to prevent damage to cables supplying live electric current.

Disconnect power/adapter cables when not in use.

Headsets
The headset sockets are located between the seats in the center console. The left headset must be plugged into the left pair of sockets and the right headset into the right pair because the radio transmits only the input from the left sockets when the left seat transmit button is pressed and the same for the right seat transmit button. If not plugged in correctly the pilot will not be able to transmit using the mic button on his stick.

CAUTION

It is recommended to store headsets in areas other than direct sunlight when not in use.

NOTE

Headset storage is not recommended on the cockpit dashboard. This can scratch the forward window panel.

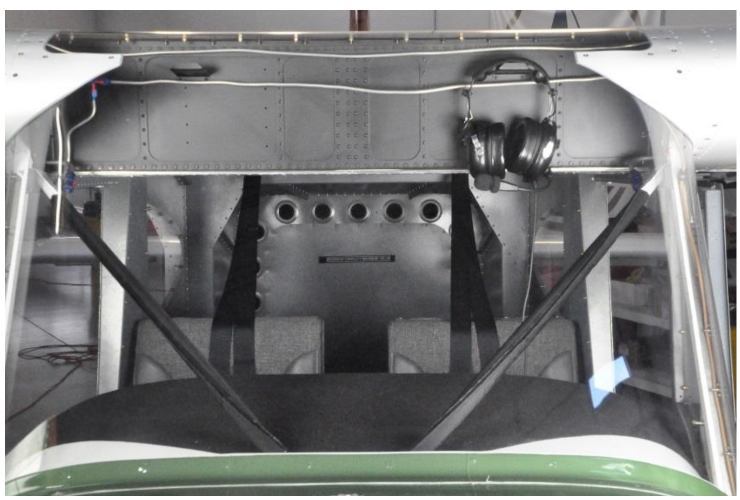

Figure 5-28: Headset Storage

Lighting Systems

An LED anti-collision light assembly is installed on each wing tip. Each anti-collision light assembly consists of a front-facing red or green position light, a strobe light, and an aft-facing white position light.

An LED landing light is installed in the outboard leading edge of each wing. Refer to Chapter 6.3.19 for maintenance of Lighting Systems.

Figure 5-29: LED Landing Light

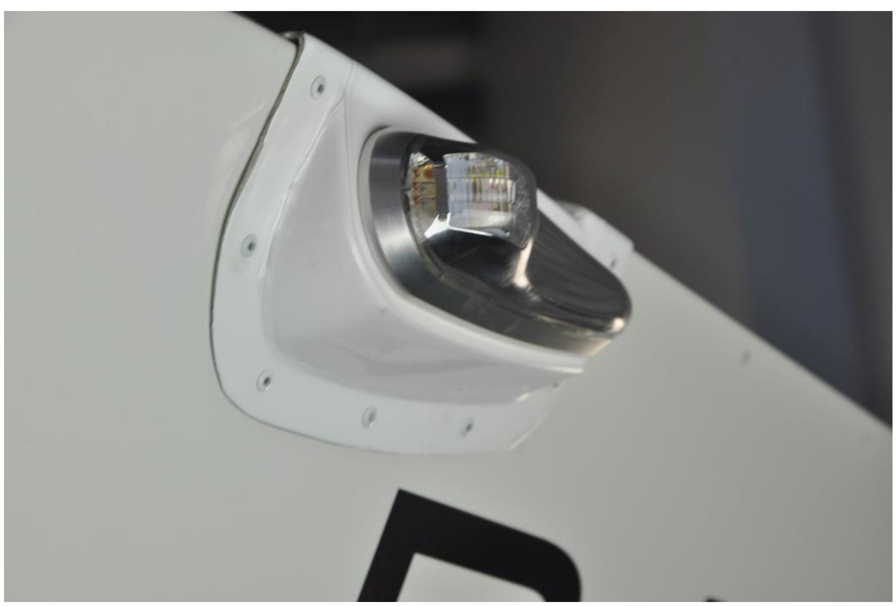

Figure 5-30: LED Anti-Collision Lights

Cabin Heating, Ventilating, and Defrosting System

Cabin Heat

The Ranger is equipped with a cabin heat system that draws ambient air from the high-pressure side of the engine cooling baffles, which passes the air through a heat exchanger located around the engine exhaust, and then directs the heated air through a diverter box which routes the air either out of the bottom of the cowling with the rest of the engine cooling air or into the cabin through an opening in the firewall. To select cabin heat, the control on the lower part of the center console must be pulled aft. See Figure 5-31.

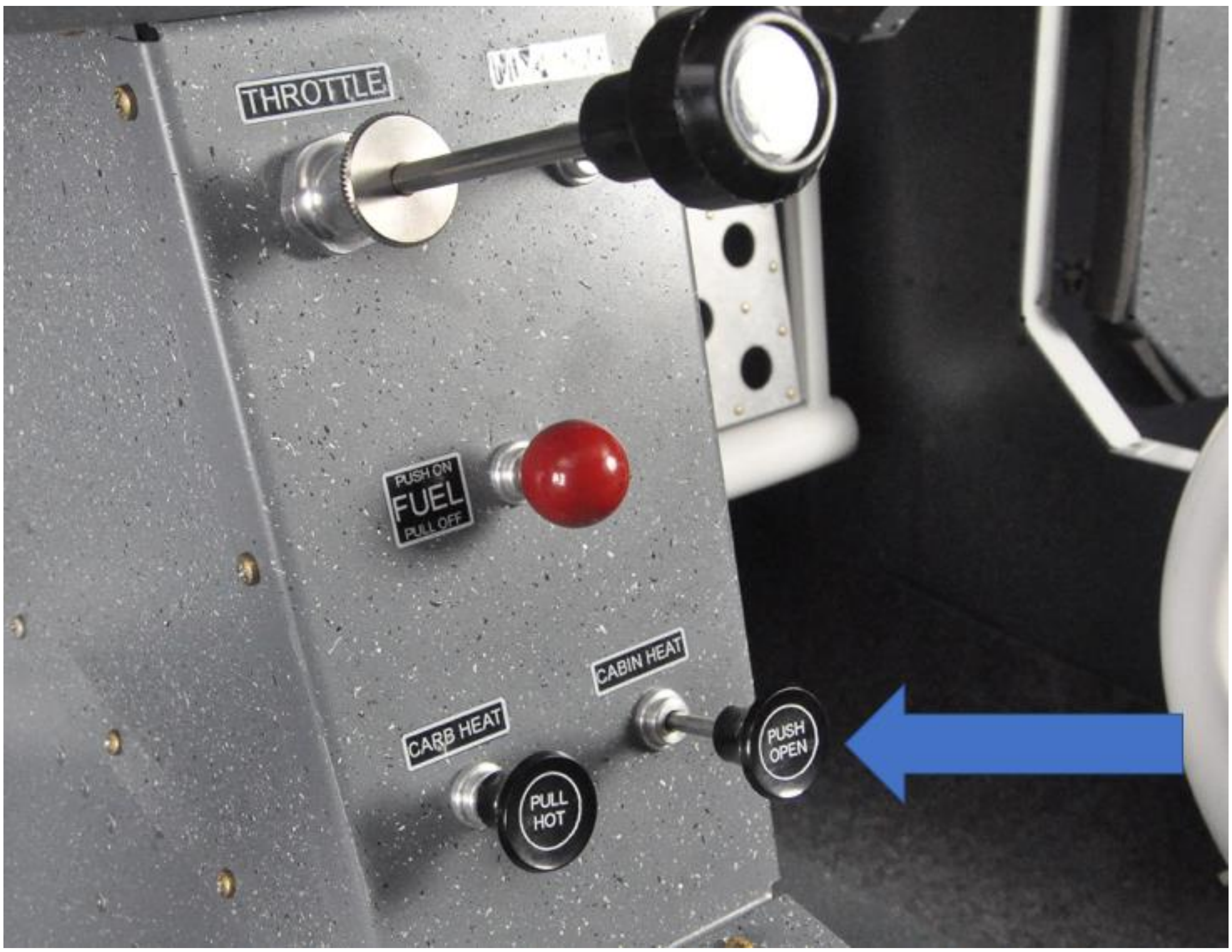

Figure 5-31: Cabin Heat Control

Vent

Open the sliding windows on either side of the cabin doors to vent.

Defrost

Pressing the DEFROST switch to the up position on the center instrument panel will blow warm air over the windshield to clear moisture and increase visibility. To turn the defrost off simply push the DEFROST switch on to the down position.

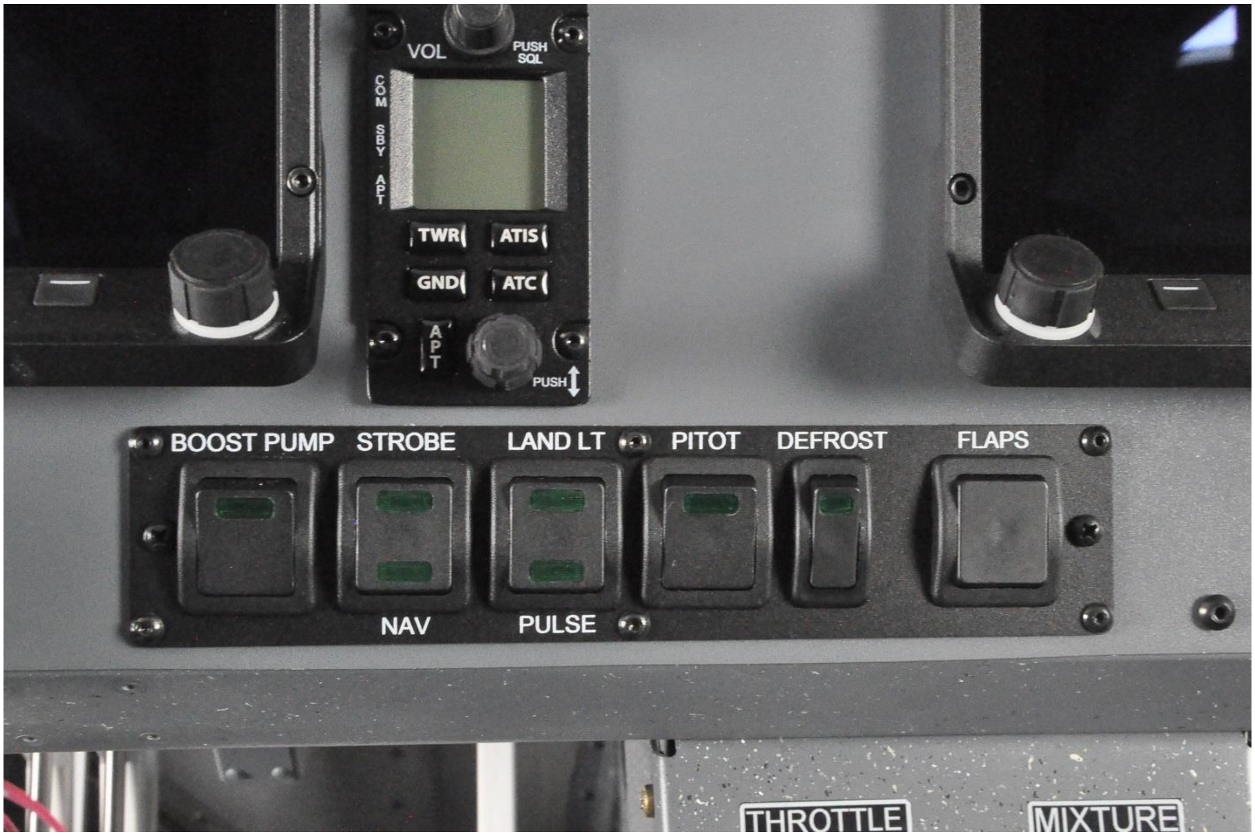

Figure 5-32: Defrost

Angle of Attack System

The airplane is equipped with an Angle of Attack (AoA) system that warns of impending stall via visual indication and audio indications beginning approximately 5 knots above stall speed.

Aileron control response in a fully stalled condition is marginal.
Large aileron deflections will aggravate a near stalled condition and their use is not recommended to maintain lateral control. The rudder is very effective and should be used for maintaining lateral control in a stalled condition with the ailerons placed in a neutral position.

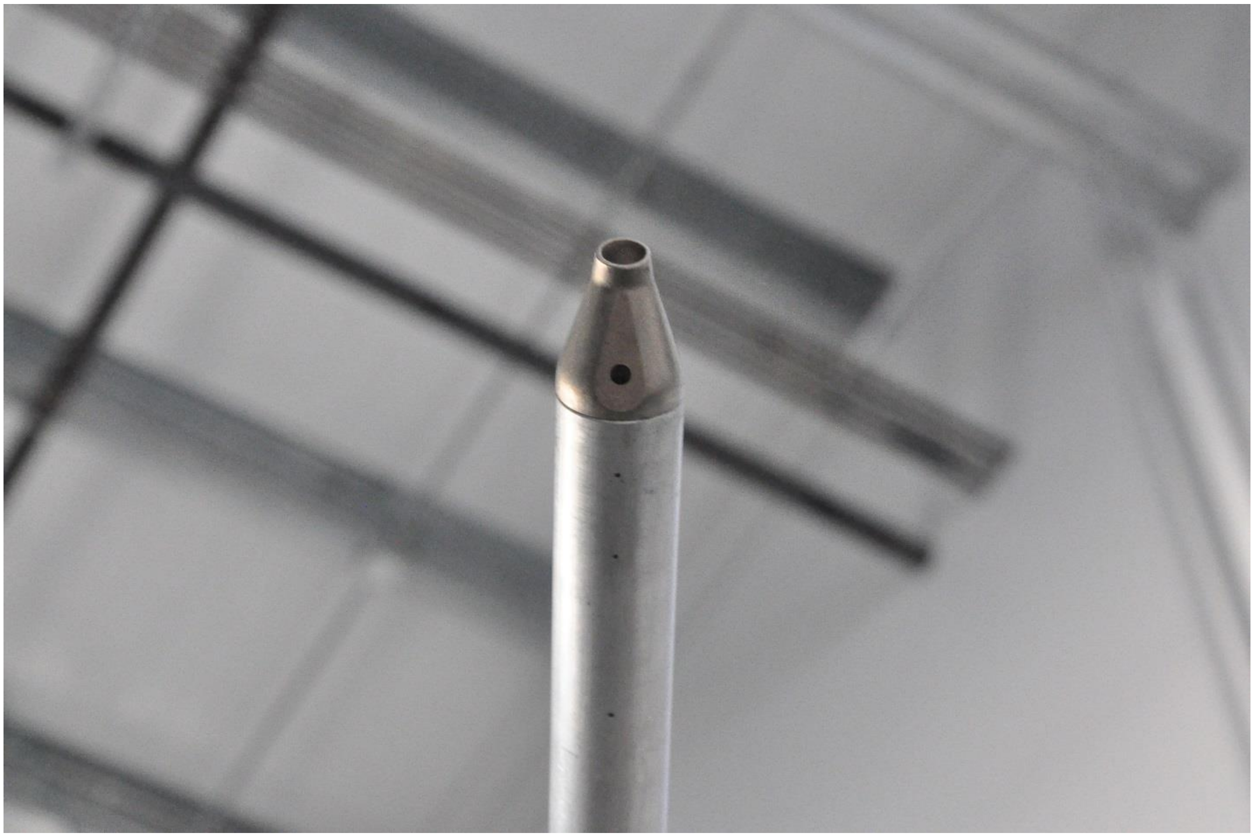

Figure 5-33: Angle of Attack

ELT

The aircraft is supplied with an emergency locator transmitter (ELT) that meets TSO C91a. The ELT is mounted in the aft fuselage and may be accessed by removing the baggage bulkhead close-out panel. The ELT remote control/indicator panel is mounted on the right side of the instrument panel.

SECTION 6

Normal Procedures

Preflight Inspection

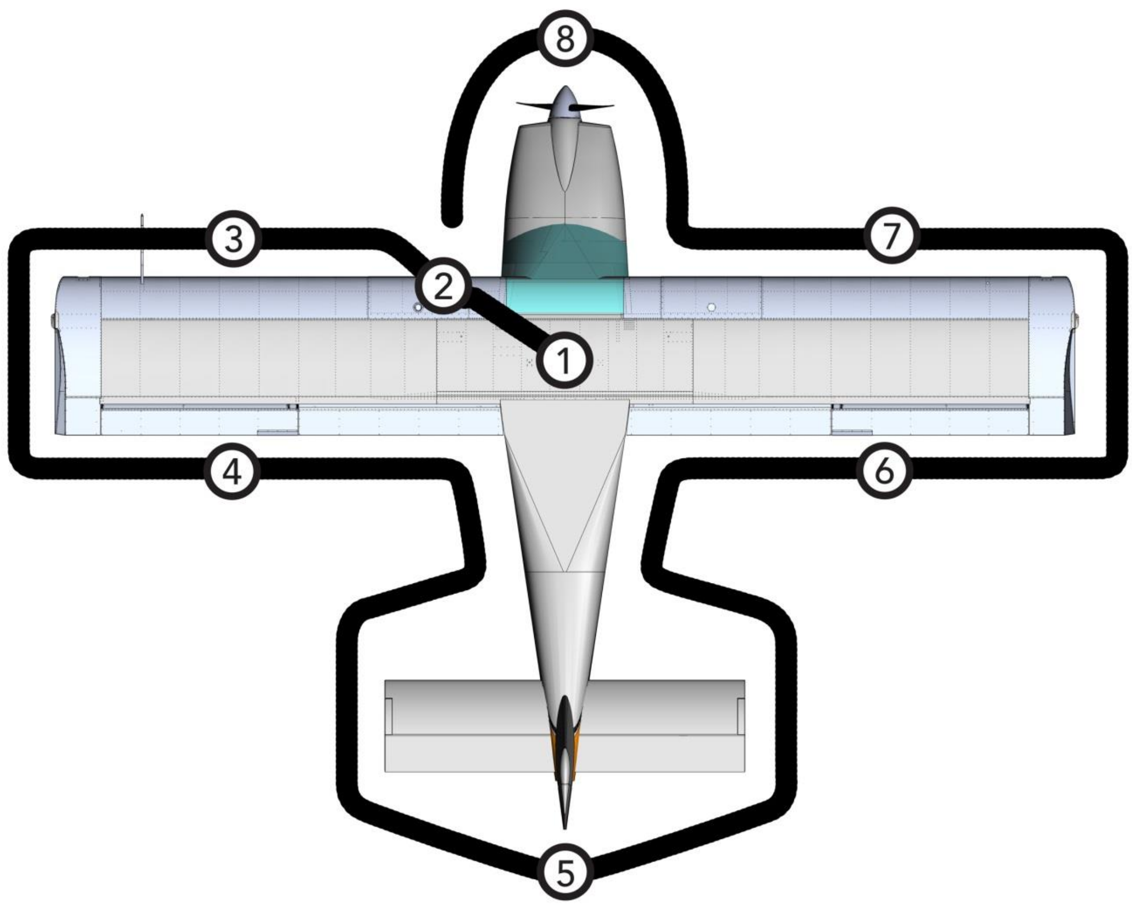

Figure 6-1: Preflight Walk Around Inspection

Cabin

- Left Door – OPEN check condition, operation
- Master Switch - ON
- Flight Control Locks – REMOVE
- Flaps – FULL DOWN, check indication on EFIS
- Header Tank-check FULL indication on EFIS
- Fuel gauge – check FUEL LEVEL indication on EFIS (no take-off with less than 4 gallons fuel in wing tanks)
- Master Switch - OFF

- EFIS-POWER OFF
- ELT – check OFF
- Baggage – RESTRAINED

Left Main Landing Gear

- Tire – CONDITION, proper inflation 25psi
- Brake – CHECK condition, no leakage
- Axle Nut – CHECK cotter pin installation
- Wheel Attach Bolts – CHECK proper installation
- Brake Line – CHECK condition, no leakage at either end
- Wheel Chocks – REMOVE

Left Wing

- Flap – CHECK condition, security
- Inbd Access Plates, Fwd & Aft – CHECK proper screw installation
- Outside Air Temperature (OAT) probe – CHECK condition
- Flap Hinge Pins – CHECK installation
- Outbd Access Plate –CHECK proper screw installation
- Inbd Aileron Hinge Bracket - CHECK bolt/washer/nut installation
- Aileron Pushrod - CHECK installation, freedom of bearing, jamnut tight
- Aileron – CHECK condition, straightness of trailing edge, freedom of movement
- Tie-Down – UNTIE RESTRAINT from eyelet, REMOVE eyelet (as desired)
- Wing Lower Surface – CHECK overall condition, no dents, damage, missing or loose rivets
- Wing Upper Surface – CHECK overall condition, no dents, damage, missing or loose rivets
- Outbd Aileron Hinge Bracket - CHECK bolt/washer/nut installation
- Wing Tip – CHECK condition, NAV/Strobe light, access plate installation
- Landing Light – CHECK condition, all screws installed
- Pitot/Static/AoA & Fuel Vent Mast – CHECK attachment to wing
- Pitot/Static/AoA & Fuel Vent - all ports CLEAN & OPEN
- Wing Leading Edge – CHECK overall condition, no dents, damage, missing or loose rivets
- Fuel Outlet – DRAIN fuel sample, CHECK for leakage
- Fuel Sample – CHECK for water or sediment contamination
- Fuel Cap – REMOVE
- Fuel Level – CHECK
- Fuel Cap – INSTALLED
- Comm Antenna - CHECK condition & security

Nose Section

- Windscreen – CHECK overall condition, all screws installed, cleanliness
- Exhaust Pipe – CHECK condition, security of attachment
- Nose Landing Gear Leg – CHECK attachment to fuselage
- Cowling – CHECK condition, screws properly installed on bottom edge
- Nose Tire – CHECK condition, proper inflation 22psi
- Nose Wheel – CHECK axle bolt/washer/nut installation
- Nose Landing Gear Fork – CHECK pivot nut cotter pin installation, pivot flange stop screw installation
- Wheel Chocks - REMOVE
- Cowl Door - OPEN
- Engine Oil – CHECK quantity, color, and clarity
- Cowl Door – CLOSED
- Left Air Inlet – CHECK unobstructed
- Left Side Cowl Hinge Pin – CHECK proper installation, security
- Propeller and Spinner – CHECK condition, security
- Cowl Attach Screws aft of spinner – CHECK for proper installation
- Right Air Inlet – CHECK unobstructed
- Right Side Cowl Hinge Pin – CHECK proper installation, security
- Top Cowl Hinge Pin Retainer – CHECK proper installation, security

Right Wing

- Wing Leading Edge – CHECK overall condition, no dents, damage, missing or loose rivets
- Fuel Outlet – DRAIN fuel sample, CHECK for leakage
- Fuel Sample – CHECK for water or sediment contamination
- Fuel Cap – REMOVE
- Fuel Level – CHECK
- Fuel Cap – INSTALLED
- Comm Antenna (if installed) - CHECK condition & security
- Landing Light – CHECK condition, all screws installed
- Wing Tip – CHECK condition, NAV/Strobe light, access plate installation
- Outbd Aileron Hinge Bracket - CHECK bolt/washer/nut installation
- Wing Upper Surface – CHECK overall condition, no dents, damage, missing or loose rivets
- Wing Lower Surface – CHECK overall condition, no dents, damage, missing or loose rivets
- Tie-Down – UNTIE RESTRAINT from eyelet, REMOVE eyelet (as desired)
- Aileron – CHECK condition, straightness of trailing edge, freedom of movement
- Aileron Pushrod - CHECK installation, freedom of bearing, jamnut tight
- Inbd Aileron Hinge Bracket - CHECK bolt/washer/nut installation

- Outbd Access Plate – CHECK proper screw installation
- Flap – CHECK condition, security
- Flap Hinge Pins – CHECK installation
- Inbd Access Plates, Fwd & Aft – CHECK proper screw installation

Right Main Landing Gear

- Tire – CONDITION, proper inflation 25psi
- Brake – CHECK condition, no leakage
- Axle Nut – CHECK cotter pin installation
- Wheel Attach Bolts – CHECK proper installation
- Brake Line – CHECK condition, no leakage at either end
- Wheel Chocks – REMOVE

Fuselage (Right Side)

- Right Door – OPEN check condition, operation
- Fuel Outlet – DRAIN fuel sample, CHECK for leakage
- Fuel Sample – CHECK for water or sediment contamination
- ELT Antenna – CHECK condition & security
- Fuselage Lower, Right Side, & Upper Surfaces – CHECK overall condition, no dents, damage, missing or loose rivets

Empennage

- Vertical Stabilizer (Right Side) – CHECK overall condition, no dents, damage, missing or loose rivets
- Horizontal Stabilizer (Right Side) – CHECK overall condition, no dents, damage, missing or loose rivets
- Right Elevator - CHECK condition, freedom of movement
- Rudder – CHECK condition, proper attachment, freedom of movement
- Rudder Cables – CHECK proper attachment to rudder horn, presence of cotter pins in cable attach nuts
- Tie-Down – UNTIE RESTRAINT from hole in structure
- Left Elevator - CHECK condition, freedom of movement
- Left Elevator Trim Tab – CHECK attachment of actuator, hinge pin safety wire, free play not greater than 3 mm/1/8 inch
- Trim Motor Access Plate – CHECK proper screw installation
- Horizontal Stabilizer (Left Side) – CHECK overall condition, no dents, damage, missing or loose rivets
- Vertical Stabilizer (Left Side) – CHECK overall condition, no dents, damage, missing or loose rivets
- Nav Antenna (if installed) - CHECK condition & security

Fuselage (Left Side)

- Fuselage Lower, Left Side, & Upper Surfaces – CHECK overall condition, no dents, damage, missing or loose rivets

Before Starting Engine

- Rudder Pedal Position – ADJUST as necessary/desired
- Seat Belt/Shoulder Harness/Crotch Strap – FASTENED & SNUG
- Passenger Briefing - PERFORMED
- Doors – CLOSED and LATCHED
- Master Switch – ON
- Avionics Switch – ON
- Autopilot Switch – ON
- Alternator Field Switch – ON
- Flaps - UP
- Fuel Valve – OPEN (push down)
- Throttle – ADJUST FRICTION
- Mixture – RICH
- Carburetor Heat – COLD

Engine Start

CAUTION

Do not start engine with outside air temperature below -13°F (-25°C) or above 122°F (50°C).

- Fuel Pressure – 0.5 psi min
- Prime – AS REQUIRED using carburetor accelerator pump.
  Engine Cold - fully open then close the throttle 3 to 5 times.
  Engine Hot - do not prime before starting.

NOTE

The amount of prime required depends on engine temperature. Familiarity and practice will enable to operator to accurately estimate the amount of prime to use.

- Throttle – 1/8 in OPEN
- Brakes – HOLD
- Propeller – CLEAR
- Ignition Key – START, release to BOTH after engine fires
- Throttle – 900 to 1000 RPM
- Oil Pressure – CHECK 10 psi min within 30 seconds or immediately shutdown the engine
- Volt Meter – 13.8 to 14.4 Volts

CAUTION

Limit the use of the starter to 10 seconds duration maximum with a 20 second cooling off period between each starter engagement.

After Start

- Nav/Strobe Lights – ON, strobe for day ops, nav for night ops
- Landing Light – ON, pulse for day ops, steady for night ops
- COM Radio – TUNE as desired, ADJUST volume
- Intercom – CHECK functionality, ADJUST volume, squelch as desired

Taxiing

Taxiing during high winds requires the conventional use of the flight controls. With a head wind or quartering head wind, place the control stick full aft and into the wind. With a tail wind or quartering tail wind, use the opposite procedures. The use of the wheel brakes in conjunction with the rudder will assist the pilot in maintaining directional control.

- Engine Gauges – CHECK
- Brakes – RELEASE
- Taxi rpm – 900–1000 RPM until oil temp over 75° F (24° C)

Before Takeoff

- Brakes – HOLD
- Flight Controls – CHECK freedom of movement, proper operation
- Flight Instruments – CHECK & SET
- Fuel Valve – CHECK OPEN
- Fuel Quantity Indication - CHECK (no take-off with less than 4 gallons fuel)
- Trim – SET for takeoff - tab "in-trail" with left elevator
- Flaps – SET –20° or UP (as desired)
- Doors – CHECK Closed and Latched
- Engine Run-Up
  Elevator – STICK BACK
  Minimum Oil Temp 75° F
  Throttle – 1700 RPM
  Ignition Key -L then BOTH, note RPM drop
  R then BOTH, note RPM drop
  (max drop – 150 RPM)
  (max difference between drops – 75 RPM)
  Carb Heat -ON, note increase in carb temp, then COLD
  Engine Instruments – CHECK
  Normal Indications
  Fuel Pressure – CHECK 0.5 psi minimum
  Volt Meter – CHECK
- Throttle – IDLE
- Seat Belt, Pilot and Passenger – FASTENED & SNUG
- Brakes – RELEASE

NOTE

Extended periods of ground operation with carburetor heat ON should be avoided as the air filter is bypassed when carburetor heat is selected.

NOTE

High power operation (above 1500 RPM) and engine run-up should be made into the wind and kept to a minimum especially during high temperature conditions.

Takeoff (Normal)

- Control Stick – half way between neutral and aft
- Throttle – smoothly FULL OPEN
- Elevator Control –
  RAISE NOSE just clear of ground, release back pressure on stick as required
- Rotate – LIFT OFF 50-55 kts CAS
- Climb – 75 kts CAS
- Flaps – UP
- Trim – AS REQUIRED to hold desired airspeed

During crosswind conditions, place the control stick into the wind (up wind aileron UP) and raise the nose just clear of the ground as early in the take-off roll as possible to improve rudder authority and prevent drifting or premature lift-off. When taking off with a left crosswind and full power, right rudder is a limiting factor.

Takeoff (Obstacle)

During an obstacle take-off, use the normal take-off procedures with the following exceptions:

- Flaps – 20°
- Hold Brakes – until application of full power
- Lift –Off – 50 to 55 kts CAS
- Climb – 60 kts (best angle of climb) until clear of obstacle

Take-Off (Soft Field)

For soft field take-off, use the normal take-off procedures with the following exceptions:

- Flaps – 20°
- Elevator Control – RAISE NOSE to Take-Off Attitude
- Lift-Off – as EARLY as possible
- After Lift-Off – LEVEL FLIGHT to obtain safe margin of airspeed prior to climb

WARNING

THE AIRCRAFT WILL LIFT OFF AT VERY LOW CAS BUT CONTINUED CLIMB OUTBELOW 60 KTS IMMEDIATEY AFTER TAKEOFF IS NOT RECOMMENDED.

Climb

- Throttle – FULL
- Airspeed –
  Best Rate 75 kts CAS
    Flaps – UP
  Best Angle 60 kts CAS
    Flaps – 20°
  Cruise-climb 85 kts CAS
    Flaps – UP
- Trim – AS REQUIRED to hold desired airspeed

Cruise

- Flaps – CHECK UP
- Level-off – TRIM as required
- Airspeed – ACCELERATE to desired cruise airspeed
  above 103 kts CAS in smooth air only
- Throttle – SET to cruise power
- Mixture – LEAN when below 75% power
- Engine Gauges – CHECK

Descent

- Airspeed – AS DESIRED
  103 kts CAS to 131 kts TAS in smooth air only
- Throttle – REDUCE as desired (2750 RPM max)
- Mixture – ADJUST as required
- Flaps – UP (above 82 kts CAS),
  AS DESIRED (below 82 kts CAS)
- Trim –AS REQUIRED to hold desired airspeed

The descent should be made with enough power to maintain cylinder head and oil temperatures in green arc. If possible, avoid windmilling the engine with the propeller by reducing airspeed or increasing power.

Landing

- Seat Belt – Pilot and Passenger – FASTENED & SNUG
- Mixture - RICH
- Brakes – CHECK firm then release
- Ignition Switch – BOTH ON
- Throttle – AS DESIRED to control rate of descent
- Carburetor Heat - ON
- Trim - AS REQUIRED
- Flaps – AS DESIRED (below 82 kts CAS)
- Approach Speed – 55-60 kts
- Touch Down - MAIN WHEELS FIRST
- After Touch Down –
- Elevator Control – FULL AFT
- Brakes – AS REQUIRED

The best technique for use on soft or rough fields is to fly the landing approach at minimum speed carrying power into the landing flare and using an extreme nose high landing attitude so as to touch down with minimum airspeed.

During gusty wind conditions, fly the landing approach at approximately 5 kts above normal and touch down with the nose slightly lower than for a normal landing.

Crosswind approaches can best be accomplished by using the wing down top rudder method touching first on the down wing side main wheel, followed by the other main wheel, and finally lowering the nose wheel all the while keeping the stick into the wind.

Landing (Obstacle)

Use of normal landing procedures in addition:

- Flaps – FULL DOWN
- Approach Airspeed – 55 kts
- Throttle – AS DESIRED to control rate of descent
- Slip aircraft as necessary to increase rate of descent

NOTE

If a crosswind exists, place the lower wing into the wind. Indicated airspeed in a full-rudder deflection slip is 3 kt higher than in coordinated flight.

WARNING

A RELATIVELY HIGH RATE OF DESCENT IS POSSIBLE IN THIS CONFIGURATION WHEN AT FULL GROSS WEIGHT AND THE THROTTLE CLOSED. IF AIRSPEED IS DECREASED BELOW 55 KTS, LEVEL OFF CAN ONLY BE ASSURED WITH AN APPLICATION OF POWER.

Landing (Balked)

Use of normal landing procedures in addition at the time of going around:

- Throttle – FULL OPEN
- Carburetor Heat - COLD
- Flaps – 20°
- Airspeed –
  Best Angle 60 kts CAS
    Flaps – 20° until clear of obstacle, then
  Best Rate 75 kts CAS
    Flaps – UP

Shutdown

- Throttle – 900 to 1000 RPM
- ELT – CHECK LIGHT OFF & CHECK signal on 121.5 MHZ
- Mixture – IDLE CUT-OFF
- Ignition Key – OFF
- Avionics – OFF
- Master – OFF
- Tie Down – CHOCK two wheels min

NOTE

If high winds are anticipated, the aircraft should be hangared. If the aircraft must be left out, park with the aircraft headed into the wind and use additional tie-down ropes for security. Place the flaps in the full up position and secure the control stick full aft with the lap belt.

AMLIFIED NORMAL PROCEDURES

Preflight Inspection

The preflight inspection, described in this Figure 6-1 and adjacent checklist, is required prior to each flight. If the airplane has been in extended storage, has had recent major maintenance, or has been operated from rough runways, a more extensive exterior inspection is recommended.

Before every flight, check the condition of main and nose landing gear tires. Keep tires inflated to the pressure specified in the airplane maintenance manual. Examine tire sidewalls for patterns of shallow cracks called weather checks. These cracks are evidence of tire deterioration caused by age, improper storage, or prolonged exposure to weather. Check the tread of the tire for depth, wear, and cuts. Replace the tire if fibers are visible.

After major maintenance has been performed, the flight and trim tab controls should be double checked for free and correct movement and security. The security of all inspection plates on the airplane should be checked following periodic inspections. If the airplane has been waxed or polished, check the external static pressure source hole for stoppage.

If the airplane has been kept in a crowded hangar, it should be checked for dents and scratches on wings, fuselage, and tail surfaces, damage to navigation/strobe light assemblies, wing tip fairings and avionics antennas.

Outside storage for long periods may result in dust and dirt accumulation on the induction air filter, obstructions in airspeed system lines, water contaminants in fuel tanks, and insect/bird/rodent nests in any opening. If any water is detected in the fuel system, the fuel tank sump quick drain valves, fuel sump quick drain valve, and fuselage sump quick drain valve should all be thoroughly drained again. The wings should then be gently rocked and the tail lowered to the ground to move any further contaminants to the sampling points. Repeated samples should then be taken at **all** quick drain points until **all** contamination has been removed.

NOTE

Collect all sampled fuel in a safe container. Dispose of the sampled fuel so that it does not cause a nuisance, hazard, or damage to the environment.

WARNING

IF, AFTER REPEATED SAMPLING, EVIDENCE OF CONTAMINATION STILL EXISTS, THE AIRPLANE SHOULD NOT BE FLOWN. TANKS SHOULD BE DRAINED AND SYSTEM PURGED BY QUALIFIED MAINTENANCE PERSONNEL. ALL EVIDENCE OF CONTAMINATION MUST BE REMOVED BEFORE FURTHER FLIGHT.

To prevent loss of fuel in flight, make sure the fuel tank filler caps are tightly sealed after any fuel system check or servicing. Fuel system vents should also be inspected for obstructions, ice or water, especially after exposure to cold, wet weather.

If the airplane has been stored outside in windy or gusty areas, or tied down adjacent to taxiing airplanes, special attention should be paid to control surface stops, hinges, and brackets to detect the presence of potential wind damage. Use of external gust locks on flaps and control surfaces is recommended for outside storage.

Airplanes that are operated from rough fields, especially at high altitudes, are subjected to abnormal landing gear abuse. Frequently check all components of the landing gear, strut, tires, and brakes. If the airplane has been operated from muddy fields or in snow or slush, check the main and nose gear wheel fairings for obstructions and cleanliness.

Operation from a gravel or cinder field will require extra attention to propeller tips and abrasion on leading edges of the horizontal tail. Stone damage to the propeller can seriously reduce the fatigue life of the blades.

Before Starting Engine

Rudder pedals should be adjusted fore and aft as needed to ensure the pilot has full brake deflection with the rudder fully deflected. A small percentage of pilots may require additional cushions to correctly position themselves for visibility and control.

Ideally, the pilot should be positioned so that the outboard elbow naturally rests on the door armrest and the control stick falls within the hand of that arm. Correct positioning allows for relaxed flying using wrist movements and assists the new pilot to adjusting to the Ranger flight controls.

Starting Engine

Engine starting can differ depending on the temperature of the engine and surrounding ambient air which affects the amount of fuel priming required. Standard priming is done using the throttle control. Pumping the throttle, by rapidly advancing the throttle control fully in and out, works an accelerator pump in the engine carburetor for priming. In this way, the throttle may be pumped or given some number of "strokes" to provide the required prime.

If the engine is already warm, pump the throttle once then leave the throttle closed to start. No additional priming should be required. A cold engine with moderately warm (room temperature) ambient air will require 1 or 2 strokes of the throttle (or primer). A cold engine with cold ambient air (temperatures above freezing) will require up to 3 or 4 strokes of throttle (or primer). A cold engine should have the throttle open approximately 1/4 inch for start.

In extremely cold temperatures, it may be necessary to continue priming while cranking the engine. If the engine is under primed, most likely in cold weather with a cold engine, it will not fire at all, and additional priming will be necessary. As soon as the cylinders begin to fire, open the throttle slightly to keep it running.

Weak intermittent firing followed by puffs of black smoke from the exhaust stack indicates over priming or flooding. Excess fuel can be cleared from the combustion chambers by the following procedure: set parking brake and hold brakes, set the mixture control full lean (idle cutoff) and the place throttle control to full open; then crank the engine through several revolutions with the starter. Be prepared to immediately reduce throttle control to idle once engine starts. Repeat the starting procedure without any additional priming.

After starting, if the oil pressure gage does not begin to show pressure within 30 seconds in the summertime and about twice that long in very cold weather, stop the engine and investigate. Lack of oil pressure can cause serious engine damage. After starting, avoid the use of carburetor heat unless icing conditions prevail.

NOTE

> Additional details concerning cold weather starting and operation may be found under COLD WEATHER OPERATION paragraphs in this section.

After the completion of normal engine starting procedures, it is a good practice to verify that the engine starter has disengaged. If the starter contactor were to stick closed, causing the starter to remain engaged, an excessively high charge indication (full scale at 1000 RPM) would be evident on the ammeter. In this event, immediately shut down engine and have electrical system inspected by qualified maintenance personnel prior to next flight.

Recommended Starter Duty Cycle

Operate the starter motor for 10 seconds followed by a 20 second cool down period. This cycle can be repeated five additional times, followed by a thirty minute cool down period before resuming cranking. After cool down, operate the starter motor again, six cycles of 10 seconds followed by 20 seconds of cool down. If the engine still does not start, try to find the cause.

Leaning for Ground Operations

For all ground operations, after starting the engine and when the engine is running smoothly:

1. THROTTLE Control - 1200 RPM
2. Mixture Control - ADJUST (lean for maximum RPM)
3. THROTTLE Control - ADJUST for ground operation (800 to 1000 RPM recommended)

Taxiing

CAUTION

Due to lower weights and slower stall speeds than larger airplanes, proper taxi techniques should be used in windy conditions. Operations in Wind condition above 22 knots are not recommended.

When taxiing, the combination of differential braking and free-castering nosewheel provide excellent ground maneuvering in tight spaces as well as control during normal taxiing. Differential brake application should be done by firm, short taps of the brake pedal so as to nudge the airplane in the desired direction. Excess speed and "riding a brake" should be avoided since this can cause brake heating, brake fade, or loss of braking effectiveness resulting in loss of control or stopping ability.

It is important that taxi speed be held to that of a brisk walk and all flight controls be utilized up to their maximum deflection (refer to Figure 6-2, Taxiing in Wind Diagram) to aid in maintaining directional control. This is particularly important in windy conditions.

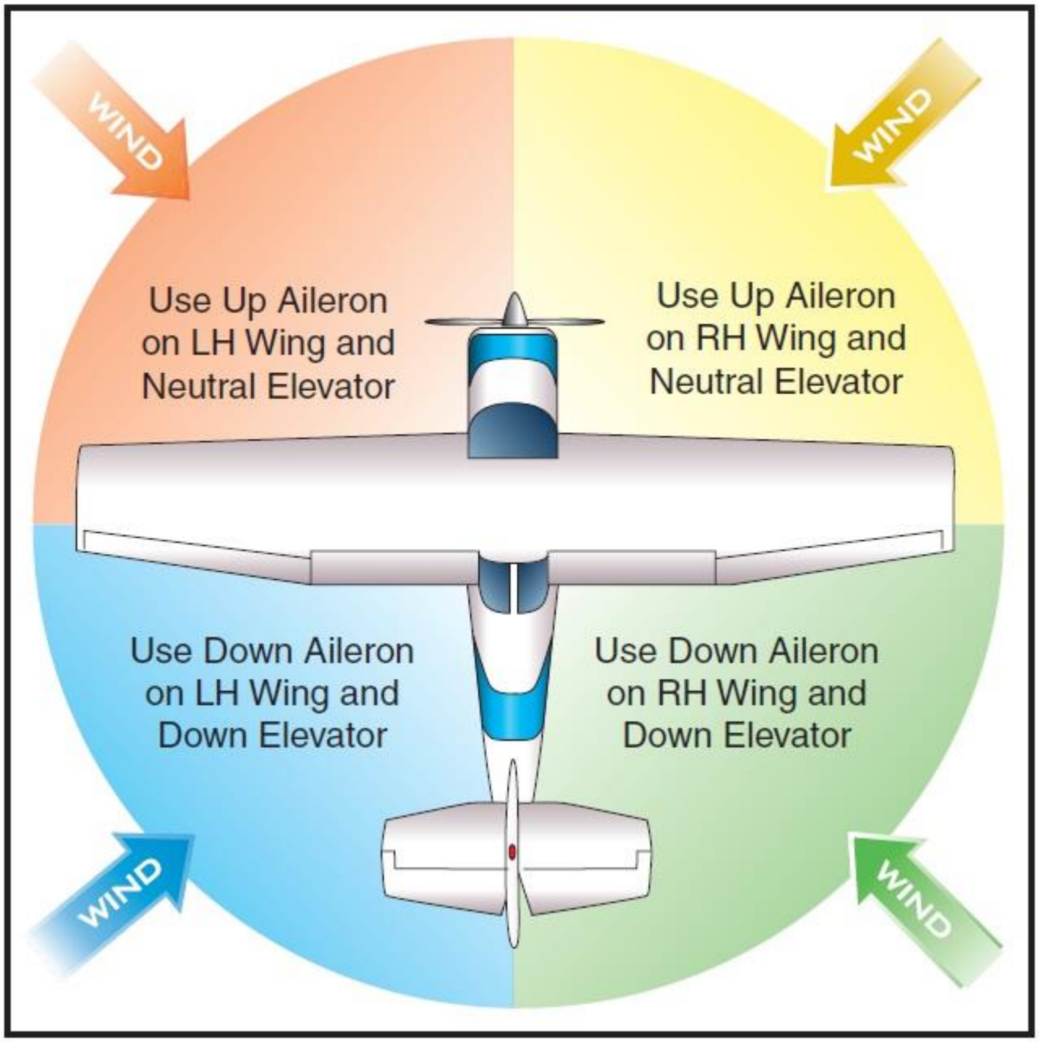

Figure 6-2: Taxiing in Wind

The CARB HEAT control knob should be pushed full in to the OFF position during all ground operations unless carb heat is absolutely necessary to correct engine roughness. When the CARB HEAT control knob is pulled out to the ON position, air entering the engine is not filtered. However, if needed, use FULL CARB HEAT until engine roughness clears. Monitoring the CARB °F Indicator will assist in amount of carb heat required to keep the carburetor temperature out of the yellow caution range and prevent engine roughness.

Taxiing over loose gravel or cinders should be done at the lowest engine RPM possible to avoid abrasion and stone damage to the propeller tips.

NOTE

Strong quartering tail winds require caution. Avoid sudden bursts of the throttle and sharp braking when the airplane is in this attitude. Use differential braking and rudder to maintain direction.

Before Takeoff Warm Up

If the engine idles with the throttle against the idle stop, approximately 700 to 800 RPM and accelerates smoothly, the engine is warm enough for takeoff. Since the engine is closely cowled for efficient in-flight engine cooling, the airplane should be pointed into the wind to avoid overheating during prolonged engine operation on the ground. Refer to Leaning For Ground Operations procedures to prevent spark plug fouling that can occur from long periods of idling and prolonged ground operations.

Magneto Check

CAUTION

Make sure engine oil temperature is above 75°F and oil pressure is within the green band range prior to performing a magneto check.

The magneto check must be made at 1700 RPM. Turn the MAGNETOS switch from the BOTH position to the R position. Note the new RPM, then turn the MAGNETOS switch back to the BOTH position to clear the spark plugs. Turn the MAGNETOS switch to the L position, note the new RPM, then turn the switch back to the BOTH position. RPM decrease should not be more than 150 RPM on either magneto or be greater than 50 RPM differential between magnetos. If there is a doubt concerning operation of the ignition system, RPM checks at higher engine speeds will usually confirm whether a deficiency exists.

No RPM drop may indicate a faulty ground to one magneto or magneto timing set in advance of the angle specified.

Alternator Check

The alternator should be checked for proper operation before every flight. Electrical power is essential for all flight instrumentation, navigation, and radio operation. Check the electrical system during the MAGNETO check (1700 RPM) by setting all electrical equipment required for the flight to the ON position. When the alternator is operating properly, the ammeters will show zero or positive current (+ amps), the voltmeter will show 13 to 15 volts, and the LOW VOLTS annunciator will not be shown on the SkyView.

Electric Elevator Trim

Make sure the elevator trim tab is in the takeoff position when the trim pointer is aligned with the T/O index mark on the SkyView TRIM indicator. Adjust the trim during flight as necessary to make control wheel forces more neutral.

Takeoff

Power Check

It is important to check full throttle engine operation early in the takeoff roll. Any sign of rough engine operation or sluggish engine acceleration is good cause for discontinuing the takeoff. If this occurs, you are justified in making a thorough full throttle static run-up before another takeoff is attempted. An engine operating at normal temperature should run smoothly and turn approximately 2280 - 2380 RPM with carburetor heat off and the mixture leaned to provide maximum RPM.

NOTE

> Carburetor heat should not be used during takeoff unless it is absolutely necessary to obtain smooth engine acceleration.

Full throttle run-ups over loose gravel are especially harmful to propeller tips. When takeoffs must be made over a gravel surface, advance the throttle slowly. This allows the airplane to start rolling before high RPM is developed, and the gravel will be blown behind the propeller rather than pulled into it.

Prior to takeoff from fields above 3000 feet pressure altitude, the mixture should be leaned to give maximum RPM at full throttle, with the airplane not moving.

Wing Flap Settings

Normal takeoffs use wing flaps UP - 20°. Using 20° wing flaps reduces the ground roll to lift off while keeping the total distance over an obstacle by equivalent to the flaps UP distances. **Flap deflections greater than 20° are not approved for takeoff.** If 20° wing flaps are used for takeoff, the flaps should stay at 20° until all obstacles are cleared and a safe flap retraction speed of 60 KIAS is reached.

Soft or rough field takeoffs are performed with 10° flaps by lifting the airplane off the ground as soon as practical in a slightly tail low attitude. If no obstacles are ahead, the airplane should be leveled off immediately to accelerate to a higher climb speed. When departing a soft field with an aft C.G. loading, the elevator trim control should be adjusted towards the nose down direction to give comfortable control wheel forces during the initial climb.

Crosswind Takeoff

Takeoffs under strong crosswind conditions normally are performed with the minimum flap setting necessary for the field length, to minimize the drift angle immediately after takeoff. Begin the takeoff with ailerons fully deflected into the wind. As the airplane is accelerated, reduce aileron deflection maintaining directional control down the runway. Reaching a speed slightly higher than normal rotation speed, apply gentle back pressure to the elevator control and quickly, but carefully, lift the airplane off the ground. Do not over rotate but keep positive pitch angle and airspeed to prevent possible settling back to the runway. When well clear of the ground, make a coordinated turn into the wind to correct for drift.

Enroute Climb

Normal enroute climbs are performed with flaps up, at full throttle and 75 KIAS for the best combination of performance, visibility and engine cooling. The mixture should be full rich during climb at altitudes up to 3000 feet pressure altitude. Above 3000 feet pressure altitude, the mixture can be leaned as needed for increased power or to provide smoother engine operation.

If it is necessary to climb more rapidly to clear mountains or reach favorable winds at higher altitudes, the best rate of climb speed is 62 KIAS and should be used with Maximum Continuous Power (MCP).

If an obstruction dictates the use of a steep climb angle, the best angle of climb speed is 60 KIAS and should be used with flaps UP and MCP. This type of climb should be of the minimum duration and engine temperatures should be carefully monitored due to the low climb speed.

Cruise

Normal cruise is performed between 40% and 75% power. The engine RPM and corresponding fuel consumption for various altitudes can be determined by using the data in Section 5 of the Pilot Operating Handbook.

NOTE

> Cruise flight should use 75% power as much as possible until the engine has operated for a total of 50 hours or oil consumption has stabilized. Operation at this higher power will ensure proper seating of the piston rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.

The Cruise Performance charts should be used as a guide, along with the available winds aloft information, to determine the most favorable altitude, power setting and fuel needed for a given flight.

The selection of cruise altitude on the basis of the most favorable wind conditions and the use of low power settings are significant factors that should be considered on every trip to reduce fuel consumption.

Proper leaning techniques also contribute to greater range and are figured into cruise performance tables. To achieve the recommended lean mixture fuel consumption figures shown in Section 5 of the Ranger Pilot Operating Handbook, the mixture should be leaned per recommended procedures.

In the event that unusual conditions cause the intake air filter to become clogged or iced over, apply carburetor heat immediately to bypass the intake air filter therefore providing unfiltered heated air as the alternate air intake. Engine RPM can decrease from a cruise power setting. This RPM loss should be recovered by increasing the throttle setting to maintain desired power.

Carburetor ice, as evidenced by an unexplained drop in RPM, can be removed by application of full carburetor heat. Upon regaining the original RPM (with heat off), use the minimum amount of heat (reference SkyView CARB °F display) to prevent ice from forming. Since the heated air causes a richer mixture, readjust the mixture setting when carburetor heat is to be used continuously in cruise flight.

The use of full carburetor heat is recommended during flight in heavy rain to avoid the possibility of engine stoppage due to excessive water ingestion or carburetor ice. The mixture setting should be readjusted for smoothest operation. Power changes should be made cautiously, followed by prompt adjustment of the mixture for smoothest operation.

For additional information on leaning in cruise flight see the SkyView HDX documentation manual.

Stalls

The RANGER R7 stall characteristics are conventional. Additionally, the RANGER R7 is equipped with an Angle of Attack (AoA) system that warns of impending stall via visual indication and audio indications beginning approximately 5 knots above stall speed.

Aileron control response in a fully stalled condition is marginal.
Large aileron deflections will aggravate a near stalled condition and their use is not recommended to maintain lateral control. The rudder is very effective and should be used for maintaining lateral control in a stalled condition with the ailerons placed in a neutral position.

To recover from a stall, proceed as follows:

- Nose attitude – LOWER with relaxation of back pressure on control stick
- Throttle – FULL OPEN simultaneously with relaxation of back pressure on stick
- Use rudder to maintain lateral control

Descent

Normal descent from altitude may be made with flaps retracted or with flaps extended to increase drag for a steepened descent angle. Caution should be used to observe flap limit speeds. Slips may be made in all flap configurations and are useful to increase descent rates while allowing power to be kept above idle. Carburetor heat should be used as needed for engine roughness and applied before reducing power to prevent carburetor ice from forming during low power descent. Since heated air causes a richer fuel mixture, readjust the mixture setting when carburetor heat is to be used for extended descent. If a low power descent is made, it is recommended that the throttle be cycled occasionally to check for engine roughness at higher power.

NOTE

Extended low power descents should be avoided during the first 25 hours of operation of a new engine.

Landing

Normal Landing

Normal landing approaches can be made with power on or power off with any flap setting within the flap airspeed limits. Surface winds and air turbulence are usually the primary factors in determining the most comfortable approach speeds. Slips to landing are very effective and may be performed in all flap configurations.

Landing at slower speeds will result in shorter landing distances and reduce wear to tires and brakes. Pilots should monitor airspeed closely and be prepared to initiate a go around. Power should be at idle as the main wheels touch the ground. The main wheels must touch the ground before the nosewheel. The nosewheel must be lowered to the runway carefully after the speed has diminished to avoid unnecessary nose gear loads. This procedure is very important for rough or soft field landings. Directional control should be maintained using up to full rudder deflection and differential braking as necessary.

Short Field Landing

For a short field landing in smooth air conditions, approach at 55 KIAS with FULL flaps using enough power to control the glide path. Slightly higher approach speeds should be used in turbulent air conditions.

After all approach obstacles are cleared, smoothly reduce power and hold the approach speed by lowering the nose of the airplane. The main wheels must touch the ground before the nosewheel with power at idle. Immediately after the main wheels touch the ground, carefully lower the nosewheel and apply heavy braking as required. For maximum brake performance, retract the flaps, hold the control stick full back, and apply maximum brake pressure without skidding the tires or loosing directional control. Use of full rudder authority will assist directional control.

Crosswind Landing

When landing in a strong crosswind, use the minimum flap setting required for the field length. Sideslips with full rudder deflection, may be made in all flap configurations. Although the crab or combination method of drift correction may be used, the wing low method gives the best control. After touchdown, hold a straight course with the rudder and use up to full aileron deflection as required, and differential braking as necessary.

The maximum allowable crosswind velocity is dependent upon pilot capability as well as airplane limitations. Operation in direct crosswinds of 15 knots has been demonstrated (not an operating limitation).

Balked Landing

In a balked landing (go-around) climb, reduce the flap setting to 20° immediately after full power is applied and climb at 60 KIAS. Above 3000 feet pressure altitude, lean the mixture to obtain maximum RPM. After clearing any obstacles, allow the airplane to accelerate to 75 KIAS and carefully retract the flaps to 0°.

High Wind Operations

Takeoff and landings have been demonstrated in winds up to 22 knots and crosswinds up to 15 knots. The pilot should be cautious of gusts and turbulence from terrain or buildings when in close proximity to the ground during takeoff and landing. Prompt and positive control inputs should be used to counter flight path deviations.

Proper taxi control techniques must be used at all times during ground operations. Operations in wind conditions above 22 knots are not recommended.

Securing Airplane

Refer to Section 8, Ground Handling in your Ranger Pilot Operating Handbook for information on Parking and Tiedown of the airplane.

Cold Weather Operations

Special consideration should be given to the operation of the airplane fuel system during the winter season or prior to any flight in cold temperatures. Proper preflight draining of the fuel system is especially important and will eliminate any free water accumulation. The use of additives such as isopropyl alcohol or Diethylene Glycol Monomethyl Ether (DIEGME) may also be desirable.

Cold weather often causes conditions that require special care during airplane operations. **Even small accumulations of frost, ice, or snow must be removed, particularly from wing, tail and all control surfaces to assure satisfactory flight performance and handling.** Also, control surfaces must be free of any internal accumulations of ice or snow.

If snow or slush covers the takeoff surface, allowance must be made for takeoff distances which will be increasingly extended as the snow or slush depth increases. The depth and consistency of this cover can, in fact, prevent takeoff in many instances.

The Dynon SkyView HDX Instrumentation Liquid Crystal Displays (LCD) may acquire a frosted or cloudy appearance at extremely cold temperatures. The displays may also be very slow to update information when cold soaked. Proper flight display clarity and flight data update rates may require extended warm-up.

Takeoff is not recommended until displays are clearly legible and information updates (as indicated by heading change during taxi, RPM changes with throttle, etc) are shown in real-time without hesitation.

Starting

When air temperatures are below 20°F (-7°C), use an external preheater and an external power source, if external power receptacle is installed, whenever possible to obtain positive starting and to reduce wear and abuse to both the engine and electrical system. Preheat will thaw the oil trapped in the oil cooler, which probably will be congealed prior to starting in extremely cold temperatures.

WARNING

WHEN TURNING THE PROPELLER BY HAND, TREAT IT AS IF THE MAGNETOS SWITCH IS IN THE ON POSITION. A LOOSE OR BROKEN GROUND WIRE ON EITHER MAGNETO COULD ENERGIZE THE ENGINE.

Prior to starting on cold mornings, it is advisable to turn the propeller manually through several engine compression cycles by hand to loosen the oil, so the engine cranks (motors) more easily and uses less battery power. When the propeller is turned manually, turn it in the opposite direction to normal engine rotation for greater safety. Opposite rotation disengages the magneto impulse couplings and prevents possible unwanted ignition.

Cold weather starting procedures are the same as the normal starting procedures. Refer to Amplified Normal Procedures, Starting Engine in this section. The amount of fuel priming required for engine start is dependant upon temperature. The colder the engine, the more prime is required. In extremely cold temperatures, it may be necessary to continue priming while cranking the engine. If the engine is under primed it will not fire at all, and additional priming will be necessary. As soon as the cylinders begin to fire, open the throttle slightly to keep it running. Use caution to prevent inadvertent forward movement of the airplane during starting when parked on snow or ice.

CAUTION

Heavy priming and throttle pumping during start increases the risk of induction system fire resulting from a backfire or other abnormality during start. In the event of an engine fire, continue cranking to suck the flames into the engine. Refer to Section 3,

Emergency Procedures, Fires, During Start on Ground.

NOTE

If the engine does not start during the first few attempts, or if engine firing diminishes in strength, the spark plugs may be frosted over. Preheat must be used before another start is attempted.

During cold weather operations, the oil temperature indicator may not be in the green band range when ready to perform the BEFORE TAKEOFF checklist if outside air temperatures are very cold. After a suitable warm up period of 2 to 5 minutes at 1000 RPM, slowly accelerate the engine to higher engine RPM. The engine should not exceed 1700 RPM until oil temperature indicates more than 75°F (24°C) and oil pressure is within the green band range (30 to 60 PSI). Once engine oil pressure and oil temperature reach normal operating range perform the BEFORE TAKEOFF checklist followed by a immediate takeoff. If engine is allowed to idle for a extended period of time between the completion of the BEFORE TAKEOFF checklist and prior to TAKEOFF, oil temperature may fall below 75°F (24°C) requiring a slow engine acceleration to warm the engine oil prior to performing TAKEOFF.

Hot Weather Operations

Refer to the general warm engine starting information under Starting Engine in this section. Cabin doors may be left open for engine start and taxi if desired to aid cabin cooling. Face the airplane into the wind when possible for additional cooling airflow and avoid prolonged engine operation on the ground. Cabin doors must be closed for flight.

Noise Characteristics

No determination has been made that the noise levels of the Ranger are, or should be, acceptable or unacceptable for operation at, into, or out of, any airport.

The following procedures are suggested to minimize the effect of airplane noise on the public:

1. Pilots operating airplanes under VFR over outdoor assemblies of persons, recreational and park areas, and other noise sensitive areas should make every effort to fly not less than 2000 feet AGL, weather permitting, even though flight at a lower level may be consistent with the provisions of government regulations.

2. During departure from or approach to an airport, climb after takeoff and descent for landing should be made so as to avoid prolonged flight at low altitude near noise sensitive areas.

NOTE

> The above recommended procedures do not apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's judgment, an altitude of less than 2000 feet AGL is necessary to adequately exercise the duty to see and avoid other airplanes.

SECTION 7

EMERGENCY PROCEDURES
AMPLIFIED EMERGENCY PROCEDURES

The following Amplified Emergency Procedures provide additional information beyond that in the Emergency Procedures Checklists portion of the Pilot Operating Handbook. These procedures also include information not readily adaptable to a checklist format, and material to which a pilot could not be expected to refer in resolution of a specific emergency. This information should be reviewed in detail prior to flying the airplane, as well as reviewed on a regular basis to keep pilot's knowledge of procedures fresh.

ENGINE FAILURE

If an engine failure occurs during the takeoff roll, stop the airplane on the remaining runway. Those extra items on the checklist will provide added safety after a failure of this type.

If an engine failure occurs immediately after takeoff, in most cases, the landing should be planned straight ahead with only small changes in direction to avoid obstructions. Altitude and airspeed are seldom sufficient to execute the 180° gliding turn necessary to return to the runway. The checklist procedures assume that adequate time exists to secure the fuel and ignition systems prior to touchdown.

After an engine failure in flight, the most important task is to continue flying the airplane. The best glide speed, as shown on the SkyView HDX display, should be established as quickly as possible. While gliding toward a suitable landing area, an effort should be made to identify the cause of the failure. If time permits, an engine restart should be attempted as shown in the checklist. If the engine cannot be restarted, a forced landing without power must be completed.

FORCED LANDINGS

If all attempts to restart the engine fail and a forced landing is imminent, select a suitable field and prepare for the landing as discussed under the Emergency Landing Without Engine Power checklist. Transmit Mayday message on 121.5 MHz giving location, intentions and squawk 7700.

Before attempting an off airport landing with engine power available, one should fly over the landing area at a safe, but low altitude, to inspect the terrain for obstructions and surface conditions, proceeding as discussed in the Precautionary Landing With Engine Power checklist.

Prepare for ditching by securing heavy objects located in the baggage area and collect folded coats for protection of occupants' face at touchdown. Transmit Mayday messages on 121.5 MHz giving location, intentions and squawk 7700. Avoid a landing flare because of the difficulty in judging height over a water surface. The checklist assumes the availability of power to make a precautionary water landing. If power is not available, use of the airspeeds noted with minimum flap extension will provide a more favorable attitude for a power off ditching.

In a forced landing situation, DO NOT turn off the MASTER switch (BAT side) or AVN MASTER switch before the landing is assured unless specifically instructed by the emergency procedure checklist. Premature deactivation of these switches will disable all airplane electrical systems. Note however there are specific emergency procedures (such as Electrical Fire) which do require the ALT switch to be turned off. Exercise caution when performing these procedures to make sure that only the ALT switch is selected off, not the MASTER.

Before completing a forced landing, especially in remote and mountainous areas, activate the ELT by pressing the ELT ON button in the remote switch panel located on the right side of the instrument panel. For complete information on ELT operation, refer to Section 9, Supplements.

LANDING WITHOUT ELEVATOR CONTROL

Using throttle and electric elevator trim switch, trim for horizontal flight at 55-60 KIAS with flaps 20° selected. Then **do not change the elevator trim or the flap setting**; control the glide angle by making small changes in power.

Power changes should be made slowly and smoothly. The electric elevator trim is powerful. It is best to bump, or pulse, the trim switch to make changes. Holding the trim switch can result in over trimming and may start a Pilot Induced Oscillation (PIO) condition resulting in chasing the trim. If this occurs, it is best to let the airplane stabilize then start again by just bumping the trim switch.

When in the flare, the elevator trim switch should be pulsed aft toward the full-nose-up position at the same time slowly reducing power so that the airplane is rotated to a slightly nose-above-the-horizon attitude for touchdown. During the landing flare or round-out, the nose will come down when power is reduced and the airplane may touch down on the nosewheel before the main wheels. Maintain directional control and close the throttle at touchdown.

FIRES

Although engine fires are extremely rare in flight, if a fire is encountered, the steps of the appropriate checklist should be followed. After completion of the checklist procedure, execute a forced landing. Do not attempt to restart the engine. The first sign of an electrical fire is usually the smell of burning insulation. The checklist procedure for electrical fires calls for electrical power to be turned off. All flight instruments and navigation will be lost at this time. The checklist procedure should result in the elimination of the fire. When the fire is extinguished, electrical power may be turned on to those systems not involved. Navigation and flight information, if unaffected, should be reposted to instruments within 1-2 minutes. If the fire is not extinguished, a rapid descent should be initiated and the electrical system turned back on. This may provide airspeed and altitude data in preparation for a forced landing.

EMERGENCY OPERATION IN CLOUDS

The Ranger is not equipped or certified for IFR flight. The following instructions assume that the pilot is not very proficient at instrument flying and is flying the airplane without the autopilot engaged. The autopilot will not operate if the ADAHRS unit fails.

INADVERTENT FLIGHT INTO ICING CONDITIONS

Flight into icing conditions is prohibited and extremely dangerous. While an inadvertent encounter with these conditions can be resolved using the checklist procedures, the best action is to turn back or change altitude immediately to escape icing conditions.

In the event of an icing encounter, an unexplained loss of engine power could be caused by carburetor ice or ice blocking the air intake filter. Should this happen, apply full carburetor heat and adjust throttle to obtain maximum RPM. In some instances, the throttle may need to be reduced for maximum power. The mixture should then be adjusted, as required, to obtain maximum RPM. The SkyView CARB °F indicator should be monitored during carb heat application to ensure carb temperature rises. Refer to the CARBUETOR ICING AMPLIFIED EMERGENCY PROCEDURE section.

The autopilot should be disconnected at first indication of airframe icing and remain disconnected after any icing encounter due to the possibility of unseen residual ice on the airframe.

SPINS

If a spin is inadvertently entered, immediate recovery should be initiated. The recovery procedure is as follows:

- Throttle – CLOSED
- Rudder – FULL DEFLECTION opposite direction of rotation
- Elevator – SLIGHTLY FORWARD OF NEUTRAL
- Ailerons – NEUTRAL POSITION

When rotation stops (1/2 – 1 turn after recovery initiated):

- Rudder – NEUTRALIZE
- Nose Attitude – RAISE smoothly to level flight attitude

WARNING

DURING THE SPIN RECOVERY, THE AIRSPEED WILL BUILD VERY RAPIDLY WITH A NOSE LOW ATTITUDE. DO NOT USE FULL OR ABRUPT ELEVATOR CONTROL MOVEMENTS.

ROUGH ENGINE OPERATION OR LOSS OF POWER

CARBURETOR ICING

A gradual loss of RPM and eventual engine roughness may result from the formation of carburetor ice. To clear the ice, apply full throttle and pull the CARB HEAT control knob full out until the engine runs smoothly; then reduce carburetor heat and readjust throttle as necessary. Monitor the SkyView CARB °F indicator to verify the carburetor temperature rises out of the amber caution range. If conditions require the continued use of carburetor heat in cruise flight, use the minimum amount of heat necessary to prevent ice from forming and lean the mixture for smoothest engine operation. The SkyView CARB °F indicator provides advisory information but does not replace the need to monitor engine condition and adjust carburetor heat or mixture as needed for safe engine performance.

SPARK PLUG FOULING

A slight engine roughness in flight may be caused by one or more spark plugs becoming fouled by carbon or lead deposits. This may be verified by turning the MAGNETOS switch momentarily from BOTH to either L or R position. An obvious power loss in single magneto operation is evidence of spark plug or magneto trouble. Leaning the mixture to the recommended lean setting for cruising flight may resolve a spark plug fouling issue. If the problem does not clear up in several minutes, determine if a richer mixture setting will produce smoother operation. If not, proceed to the nearest airport for repairs using the BOTH position of the MAGNETOS switch unless extreme roughness makes the use of a single MAGNETO position necessary.

MAGNETO MALFUNCTION

Sudden engine roughness or misfiring is usually a sign of a magneto problem. Changing the MAGNETOS switch from BOTH to the L and R switch positions will identify which magneto is malfunctioning. Select different power settings and enrichen the mixture to determine if continued operation on BOTH magnetos is possible. If not, change to the good magneto and continue to the nearest airport for repairs.

IDLE POWER ENGINE ROUGHNESS

An excessively rich idle fuel flow may cause low speed engine roughness during flight. During most in-flight low engine speeds (power off stalls, approach to landing, etc.), the mixture control is normally in the full-rich position. However, to improve engine roughness during low engine speeds while in flight, you should pull the mixture control to lean of fuel mixture. You may also have to lean the fuel mixture if this low engine speed results in power loss and you need to restart the engine during flight. In all cases, you should land the airplane at the nearest airport for repairs if low speed engine roughness requires you to adjust the fuel mixture control to improve engine operation.

LOW OIL PRESSURE

If the low oil pressure indicator (OIL PSI) turns red, and oil temperature indicator (OIL °F) remains normal, it is possible that the oil pressure sending unit or relief valve is malfunctioning. Land at the nearest airport to determine the source of the problem.

If a total loss of oil pressure and a rise in oil temperature occur at about the same time, it could mean that the engine is about to fail. Reduce power immediately and select a field suitable for a forced landing. Use only the minimum power necessary to reach the landing site.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

Malfunctions in the electrical power supply system can be detected through regular monitoring of the main battery ammeter (AMPS) and the electrical bus voltmeter (VOLTS); however, the cause of these malfunctions is usually difficult to determine. A broken alternator shaft, excessive brush wear, or an internal wiring issue is most likely the cause of alternator failures, although other factors could cause the problem. Problems of this nature constitute an electrical emergency and should be dealt with immediately. Electrical power malfunctions usually fall into two categories: excessive rate of charge and insufficient rate of charge. The following paragraphs describe the recommended remedy for each situation.

EXCESSIVE RATE OF CHARGE

After engine starting and heavy electrical usage at low engine speeds, such as extended taxiing, the battery condition may be low enough to accept above normal charging during the initial part of a flight. However, after thirty minutes of cruising flight, the main battery ammeter (AMPS) should be indicating less than 5 amps of charging (+) current. If the charging current remains above this value on a long flight, the battery electrolyte could overheat and evaporate.

Electronic components in the electrical system can be adversely affected by higher than normal voltage. The built-in overvoltage protection circuit will automatically disconnect the alternator if the charge voltage increases to more than 16.5 volts. If the overvoltage sensor circuit does not operate correctly, as shown by voltage more than 16.5 volts on the electrical bus voltmeter, the MASTER switch ALT section should be set to the OFF position. Unnecessary electrical equipment should be de-energized and the flight terminated as soon as practical.

If excessive rate of charge is indicated but the electrical bus voltmeter indicates less than 15 volts, no immediate action is required. Continue monitoring and land as soon as practical.

INSUFFICIENT RATE OF CHARGE

When the overvoltage circuit, or other fault, opens the alternator (START/ALT) circuit breaker and de-energizes the alternator, a discharge (-) current will be shown on the main battery ammeter (AMPS) and the red LOW VOLTS annunciator will be displayed on the PFD. The Alternator Internal Control Unit (AICU) can de-energize the alternator due to minor disturbances in the electrical system, resulting in a nuisance opening of the START/ALT circuit breaker. If this happens, an attempt should be made to energize the alternator system.

To energize the alternator system

1. MASTER Switch (ALT Only) - OFF
2. START/ALT Circuit Breaker - CHECK IN
3. MASTER Switch (ALT Only) - ON

If the problem was a minor AICU disturbance in the electrical system, normal main battery charging will start. A charge (+) current will be shown on the main battery ammeter (AMPS) and the LOW VOLTS annunciator will go off.

If the red LOW VOLTS annunciator is displayed and a discharge (-) current is still shown on the AMPS Indicator, there is an alternator system problem. Do not repeat steps to energize the alternator system. Decrease the electrical load on the battery by de-energizing nonessential electrical equipment and avionics (consider exterior lights and radio equipment) because the battery can supply the electrical system for only a short time. Reduce electrical load as soon as possible to extend the life of the battery for landing. Land as soon as practical.

OTHER EMERGENCIES

WINDSHIELD DAMAGE

If a bird strike or other incident should damage the windshield in flight to the point of creating an opening, a significant loss in performance may be expected. Decrease airspeed and set power as necessary to maintain best glide speed (63 KIAS) to minimize stress on windshield and airframe structure. If airplane performance or other adverse conditions prevent landing at an airport, prepare for an off airport landing in accordance with the PRECAUTIONARY LANDING WITH ENGINE POWER or DITCHING checklists.

SKYVIEW HDX FAILURES

The SkyView HDX system provides all flight and engine instrument information via the Air Data Attitude and Heading Reference System (ADAHRS) unit. Individual sensors within the ADAHRS unit provide air and flight data information as well as serve as the central gateway for the engine data displayed on the EFIS.

The pilot should be thoroughly familiar with the SkyView operation, page and information location, and methods of accessing the GPS flight data before beginning any flight in the Ranger. It is recommended that the pilot step through each of the

SkyView emergency procedures in the Emergency Procedures Checklist for familiarization before operating the airplane.