

Sonex Aircraft

N360GS



Aircraft Flight Manual

Rev 20 – 4/23/2023

Aircraft Flight Manual

| | |
|------------------------|------------------------------|
| Make: | Dennis H Wright |
| Model: | Sonex |
| Serial Number: | 1153 |
| Registration Number: | N360GS |
| Date of Certification: | 24 November 2015 (as N581DW) |
| First Flight: | 6 December 2015 |

This Flight Manual incorporates all relevant material from *Sonex Flight Manual Part SNX-B06, Rev B11/04*.

The original manual describes the operation and performance of a Sonex which has been constructed carefully, and in accordance with the plans.

The order and contents of that manual are then customized in this document with specifications for Sonex Serial Number 1153 or amplified upon to reflect specific equipment fit or layout

THIS MANUAL MUST BE KEPT IN THE AIRCRAFT AT ALL TIMES.

Note - Refer to Revisions List in Section 1. Unless particularly worn - only revised pages are reprinted and changed in manual aboard the aircraft. Unchanged pages are not re-printed.

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1. Revisions List

Scored-Out Revisions have been superseded by later revisions.

| Rev # | Description | Date |
|--------------|--|-------------|
| 1 | Single Brake Lever replaced with differential brake levers. Picture Updated | 8/6/19 |
| 1 | Additional Cockpit lighting shown on Electrical Schematic | 8/6/19 |
| 1 | Updated Fuel Schematic to show check valve added to Vent Line | 8/6/19 |
| 1 | Moved Emergency and Operating Procedures to Checklists to be carried on the aircraft | 8/6/19 |
| 2 | Details of change to Garmin Radio and new Weight and Balance. New photograph of panel | 9/21/19 |
| 3 | Details of Cold Weather Oil cooler restrictor plates | 1/12/20 |
| 3 | Change in description of X-Wind Operations | 1/12/20 |
| 3 | Maximum Demonstrated X-Wind component updates and Minimum Maneuvering Airspeed defined | 1/12/20 |
| 3 | Use of Minimum Maneuvering speed in a glide and 180 degree turn procedure after engine failure described | 1/12/20 |
| 4 | Added description of new battery charge port on right side cowl | 1/22/20 |
| 5 | Added details of Solar Charging circuitry and operation | 1/31/20 |
| 5 | Added Engine Operation Section | 1/31/20 |
| 5 | Additional Performance/Fuel Consumption/Rate of Climb Figures | 1/31/20 |
| 6 | Added description of new Gascolator, updated schematic | 3/11/20 |
| 7 | Addition of Smoke System. New W&B | 7/16/20 |
| 7 | Measured Glide Ratios added | 7/16/20 |
| 8 | Fuel Tank Calibration—Tail on Ground Chart | 8/27/20 |

| | | |
|-----|--|-----------------------|
| 8 | Added Details of 500-5 tire option. New W&B | 8/27/20 |
| 8 | Abandon Aircraft Drill | 8/27/20 |
| 9 | Update Checklist Dates | 9/1/20 |
| 10 | Removed Skybrite Strobe and Nav Lights – Replaced with Aveo Engineering Powerburst NG Daylites. New W&B | 10/11/20 |
| 10 | Installed Anson Engineering Canopy Latch | 10/11/2020 |
| 11 | Incorporated Garmin GTR 200 Manual MicroAire T2000 Manual | 10/18/2020 |
| 12 | Fuel Tank capacity information updated. Tail On ground chart removed from this document as no longer valid. | 3/24/2021 |
| 12 | Revision 11 – removed from manual as it made it too unwieldy. | 3/24/2021 |
| 12a | Minimum Fuel Defined. Addition of Solar Powered USB charger on panel. Addition of Solar Panel Charger Schematic | 4/13/2021 |
| 14 | Moved W&B to separate sheet carried in plane. AoA probe under left wing removed. Proof read for minor typos. | 5/2/2021 |
| 15 | - Added notes about Oil Pressure when flying acro. - Change of primary battery to Earth-X type - Micro-Aire Transponder removed, Sandia STX165 installed | 9/27/21 |
| 16 | Clarified how to read Engine Oil Dipstick | 10/24/2021 |
| 17 | - Defined Carson and Hydroplane Speeds - Moved Revisions to front and renumbered Sections - Updated Checklists to Version 8 | 12/05/2021 |
| 18 | Added Details of new LiFePo4 backup battery | 4/15/2022 |
| 19 | New Vg defined – Checklist version updated | 1/14/2023 |
| 20 | Added Description of Flyboy Casting Tailwheel | 4/23/2023 |

| | | |
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| | | |
| | | |
| | | |
| | | |

2. Basic Specification List

Engine Information

Powerplant

Engine: AeroVee 2.1, 2180cc, 80hp
VW Conversion

Specifications

Serial #: 513
 Carburetor: AeroCarb ACV-C07
 Serial #: 957
 Type: 4 cylinder, 4 stroke, horizontally
 opposed, normally aspirated
 Cooling: Air cooled, with external oil cooler
 Drive: Direct drive
 Weight (complete, less oil) 168 lbs
 Rated HP: 80
 Static RPM at Standard Day: 3100
 Rated RPM: 3400
 Maximum RPM: 4000
 Cruise RPM: 2,900-3,100
 Idle RPM: 900-1000
 Bore: 92mm
 Stroke: 82mm
 Compression Ratio: 8:1
 Firing Order: 1-4-3-2
 Valve Gap Adjustment: .006"
 Alternator: 20 amp

Ignition

Timing: Fixed @ 28° BTDC
 Ignition Module Gap: .010 - .014"
 Spark Plugs: Autolite MP4163 or Champion RA6HC
 Plug Gap: Top: .018" Bottom: .032"

Ignition System: "Right" Setting

- Upper Magnetron Top Front Plugs
- Lower Magnetron Top Rear Plugs

Ignition System: "Left" Setting

- Right Ignition Coil Bottom Front Plugs
- Left Ignition Coil Bottom Rear Plugs

Lubricant**CAUTION****Do NOT use Aviation Lubricant!**

The oil passages in the AeroVee engine are quite small, and unsuitable for the larger molecular size of aviation oil.

Use only brand name multi-grade oil marked "SL" or "SJ" in accordance with the API system.

| | |
|-----------------------------|-----------------------------|
| Type: | SAE 20W-50 (Valvoline VR-1) |
| Oil Sump Capacity: | 2 $\frac{3}{4}$ Quarts |
| Oil Filter/Cooler Capacity: | $\frac{1}{2}$ Quart |
| Total System Capacity: | 3 $\frac{1}{4}$ Quarts |
| Minimum Safe Quantity: | 2 $\frac{3}{4}$ Quarts |
| Maximum Safe Quantity: | 3 $\frac{1}{4}$ Quarts |

Dip Stick Marked – tail on ground @

MIN - 2 $\frac{3}{4}$ Quarts MAX - 3 $\frac{1}{4}$ Quarts

NOTE – This is at variance with the AeroVee manual. The oil filter and cooler increases the system oil volume by adding a $\frac{1}{2}$ quart capacity outside the normal sump. The engine needs to still "see" the expected oil levels so the system capacity (and amount of oil used to service the engine) is increased. But the sump capacity remains per the AeroVee manual. Be guided by the dip stick which is calibrated to take account of the added filter.

Operating Conditions

| | |
|----------------------|---|
| Oil Temp: | 71°C (160°F) min, 110°C (230°F) Max |
| Oil Pressure (psi): | 20 min, 100 max, 30-40 cruise |
| Fuel Pressure (psi): | 1 psi min, 4 psi max |
| Cylinder Head Temp: | 177-190°C (350-375°F) desired, 215°C (420°F) max |
| Exhaust Gas Temp: | 760°C (1400°F) max |

Fuel

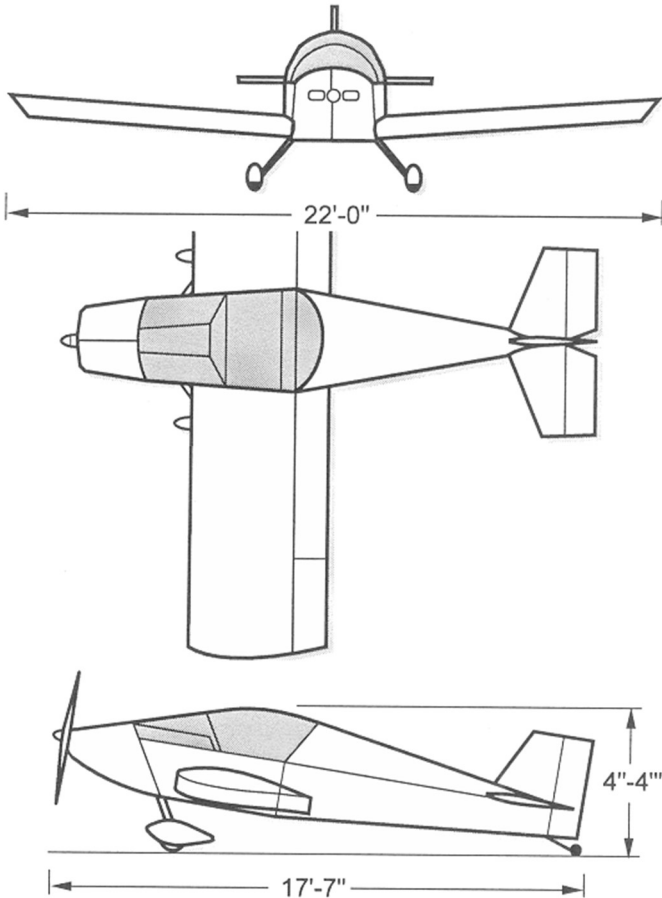
| | |
|-----------------------|---------------------------|
| Approved Fuel Grades: | 100LL Avgas |
| Total Fuel Capacity: | 16.7 Gallons (US) |
| Usable Fuel: | 16.2 Gallons 7 Pints (US) |

Propeller

Prince Wood Carbon P-Tip 54" diameter
x 44" pitch

Exterior Dimensions

| | |
|------------|-------------|
| Span: | 22 ft |
| Length: | 17 ft, 7 in |
| Height: | 4 ft, 4 in |
| Wing Area: | 98 sq ft |



Loadings

| | |
|-------------------|------------------------|
| Wing Loading: | 11.22 lb/sq ft (gross) |
| Power Loading: | 13.75 lb/hp (gross) |
| Load Factor Limit | |
| - 950 lbs | +6.0, -3.0 |
| - 1100 lbs | +4.4, -2.2 |

| | |
|-------|---------|
| Seats | Two (2) |
|-------|---------|

Weights (9/17/21 W&B)

| | |
|-------------------------|----------------------------|
| Empty Weight: | 633.6 lbs |
| Gross Weight: | 1100 lbs |
| Aerobatic Gross Weight: | 950 lbs |
| Useful Load (Utility) | 466.4 lbs |
| Fuel (16 gal): | 96 lbs |
| Full Fuel Payload: | 370.4 lbs |
| Max Baggage: | 40 lbs (10lb if Aerobatic) |

CG Limitations

| | |
|------------------------|----------------------------------|
| Datum | 53" Forward of Wing Leading Edge |
| Mean Aerodynamic Cord: | 54" |
| Forward CG Limit: | 63.8" (20% MAC) |
| Aft CG Limit: | 70.3 " (32% MAC) |
| Acro CG Limits: | 65.4" – 68.7" (23-29% MAC) |

Control Surface Deflections

| | |
|-------------------|--------------------|
| Ailerons | 20° up, 12° down |
| Flaps | 0°, 10°, 20°, 30° |
| Rudder | 25° right and left |
| Elevator | 25° up, 20° down |
| Elevator Trim Tab | 30° up, 30° down |

3. Description and Operation

The Sonex is a high-performance, homebuilt aircraft. Its compact external size and extremely efficient design results in good performance and fuel economy using a relatively low horsepower engine. Even at low horsepower, it can outperform many general aviation aircraft while retaining unequaled fuel economy. Typical cruise speed is 100 KIAS, burning around 4.4 gallons per hour, yielding fuel economy in excess of 23 nautical miles per gallon.

The structure of the Sonex is almost entirely 6061T6 aluminum, yielding a design that is easy to construct, conventional to maintain, and resistant the effects of weather and corrosion.

The engine that powers this Sonex is an AeroVee 2180 (v2.1) aircraft engine, produced by AeroConversions, Inc. This engine features a forged steel crankshaft, dual spark plugs per cylinder, 4 independent ignition modules, adjustable mixture control, alternator, and electric starter. It is a lightweight, modern, reliable aircraft engine that is user-assembled and easily maintained. The AeroVee is fitted with an AeroInjector slide-carb, requiring no carburetor heat.

Ground Controls - Rudder Pedals

The aircraft has a direct steering tailwheel. Push the right rudder pedal to turn right and the left pedal to turn left. OPTIONALLY a Flyboy Castering tailwheel may be installed which will break away to assist with steering if differential braking is applied firmly.

Flight Controls

Pitch and roll capability is via conventional dual control sticks located at each seat. Pitch control is provided by elevators mounted on the horizontal stabilizer. Roll capability is provided by ailerons on the outboard portion of the main wing. Yaw control is provided by a rudder mounted on the vertical stabilizer, and is actuated by conventional rudder pedals. All flight controls except the rudder are pushrod actuated.

An in-flight cockpit adjustable pitch trim system is provided. A lever mounted on the left cockpit sidewall adjusts a movable control tab mounted on the left elevator half. The trim system is completely independent of the normal pitch control system, thus providing back-up pitch control system in the event of a primary control problem. The primary pitch control system (i.e. the stick) can override any position of the trim system.

Flaps

30 degrees of flaps, in 10 degree intervals, are actuated by a lever on the left side of the cockpit.



Cabin Ventilation

A manual scoop on the forward left fuselage sides provide fresh air ventilation. This scoop feeds directly into the cockpit. The flow of air can be controlled by manually adjusting the vent opening.

Heating

There is no cabin heating provided

Engine Controls

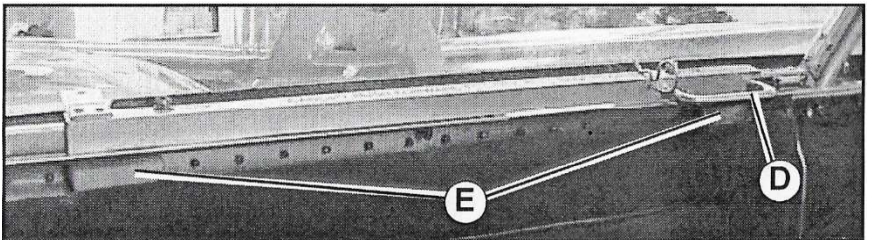
The throttle, identified with a black handle on red lever. It is located on the left fuselage side. A sliding mixture control is located at the left end of the panel, and is identified by a labelled black knob.

Instrument Panel



Canopy

The canopy is opened by pulling the canopy handle (D) rearwards until the tabs (E) on the latch can be lifted out of the side rail.



The canopy is closed by guiding the locating pin (F) into the hole on the rail and the tabs (E) into the side rail and turning the canopy latch back and downwards – drawing handle (D) fully forward



The canopy latch then locks by the action of the sprung red headed pin.
NEVER FLY THE AIRPLANE UNLESS THE CANOPY IS LOCKED.

To open the canopy – pull the red headed pin and simultaneously lift and turn the handle forward.

An intermediate position is provided on the securing tabs (E) to set the canopy approximately one inch open for ventilation.

The plane must not be flown with the canopy in this position.

Canopy Securing on the Ground

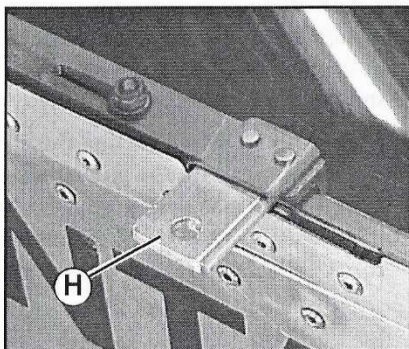
A small extension (H) on the rear canopy latch allows the canopy to be securely closed, and locked from outside the cockpit.

The canopy latch handle is closed from the outside.

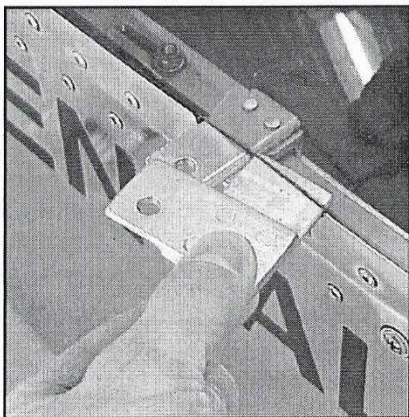


This draws the tab (H) forward and allows a lockplate and padlock to be installed.

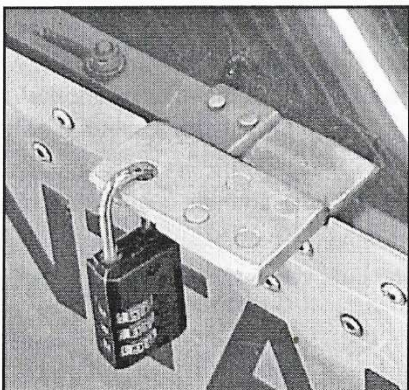
Slide the exterior handle
(H) forward to latch the
canopy from outside the
airplane.



To lock the canopy, insert
the lock plate...



...and install a lock.



Fuel System

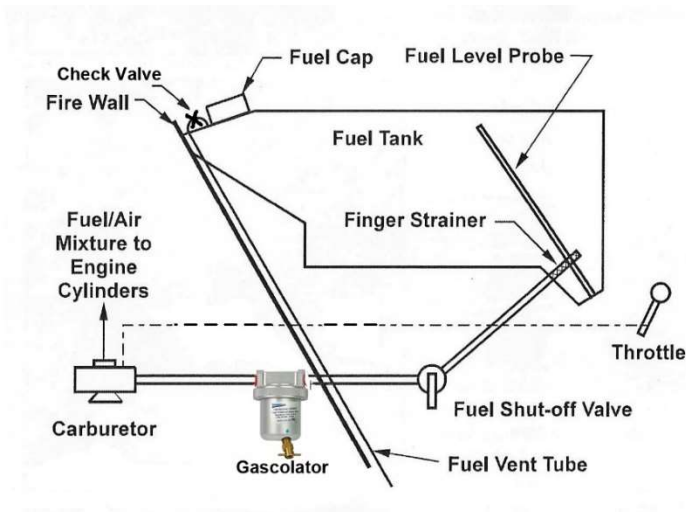
The 16.7 (nominal) gallon main fuel tank is located just aft of the firewall above the occupant's legs. The unusable fuel quantity is approximately 1 pint. The engine is gravity fed with a fuel shutoff valve located inside the cockpit at the tank outlet. It consists of a brass $\frac{1}{4}$ turn ball valve fitted with a red flag indicator/lever. The fuel valve is closed by pushing the flag downwards till the "FUEL CLOSED" flag shows. Fuel is turned on by pulling the flag back and up, flush to the tank. Fuel then passed through a heat proofed Gascolator just forward of the firewall to the carburetor.

The tank was recalibrated to the MGL ENIGMA EFIS and found to have an actual capacity of 16.6 gallons in level flight and 17 gallons indicated with the tail on the ground. The EFIS reflects this. The fuel gauge should be checked while in level, balanced flight to avoid inaccurate fuel quantity measurements. The fuel filler cap is provided on the upper forward fuselage, accessible from the outside of the aircraft through the fuel filler door in the cowling.

MINIMUM FUEL is 4 US Gall. The aircraft should not be operated with less than this quantity of fuel.

A vent line to allow air to enter the tank as fuel is used is fitted to the top of the tank and led down the firewall and out the bottom of the aircraft. A check valve allows air to enter the tank but restricts fuel from overflowing or syphoning out the line when the tail is lifted on the ground or the aircraft is in a dive with a full tank.

Approved fuels are 100LL aviation fuel ONLY. The addition of a TCP lead scavenger is recommended.

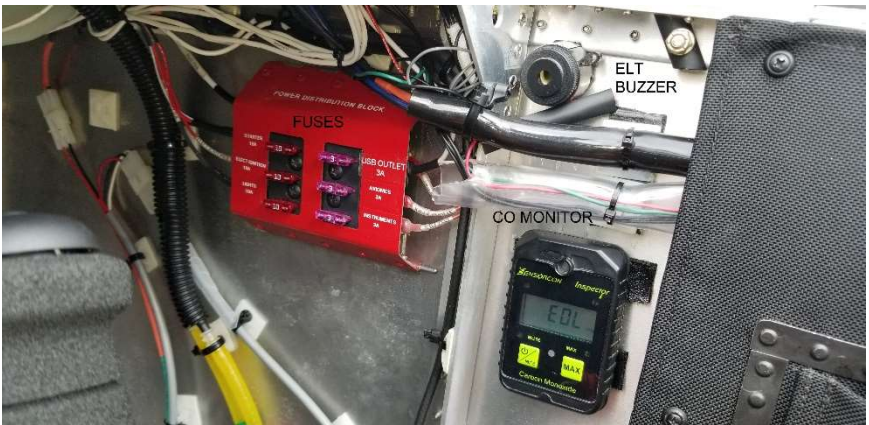


Electrical System

The Sonex is designed for Sport Pilot day VFR flight so no electrical components are necessary.

However this aircraft includes a 14v (nominal) electrical system and sufficient equipment to allow a suitably qualified pilot (US – PPL and above) to conduct day and night VFR flight in all US Classes of airspace where an IFR flight plan is not required.

See the Electrical Schematic in Section 10 and the Equipment List in Section 12 for details of installed equipment. Instruments and avionics are installed in either the control panel or in an avionics bay beneath the seats.



A fuse panel is mounted on the right side of the cockpit under the glareshield. 3 of each type of fuse should be carried as spares during night flight.

Landing Gear

The main landing gear legs are 1 1/8" titanium rod, mounted directly into the engine mount. Due to the mechanical properties of titanium, the Sonex gear is extremely robust, yet forgiving. The titanium gear legs will bend gently under landing loads, then rebound slowly without springing the aircraft back into the air. The tail wheel is mounted to a 5/8" titanium rod. Steering is accomplished through a direct linkage to the rudder, resulting in very accurate and positive directional control while taxiing, and during takeoff and landing. A Flyboy Castering tailwheel may optionally be installed – check which is fitted prior to flight.

Brakes

The braking system consists of cables and Azusa Machined Drum Brakes incorporating cooling fins for extended braking.

Brakes are actuated by two levers ahead of the flap handle that may be pulled together for both brakes or by twisting the “T” shaped top of the two levers – you may apply differential braking to each wheel to assist steering.

Note that hard differential braking is not recommended when the fixed tailwheel is installed as this sideloads the wheel fork.

Seat Belts and Shoulder Harnesses

A 4 point lap belt and shoulder harness is provided for both the pilot and passenger. Adjust the seat belt and shoulder harness so there is just enough slack to allow all controls to be reached.

Engine Cowling

The cowling is split into left and right sections. To remove the cowling, unlock the Camloc screws upper firewall edge and one below the propeller. Next, remove the bottom, side, and center piano hinge pins

Baggage Compartment

A baggage compartment is provided aft of the seat. The baggage limit is 40 pounds. (10lb in Aerobatic Category). Depending on the pilot, passenger, and fuel to be carried, baggage may have to be limited because of gross weight or center-of-gravity (CG) limits.

Starting the Engine

DANGER – Do not attempt to hand prop the engine. The electronic magnetos only work if the battery is providing sufficient current and the manual magnetos do not include a timing retarder – so a hand prop will be unsuccessful.

In temperatures of less than -7C (<20F) the engine must be preheated. Fit Restrictor Plates on the oil cooler cowl inlet

Brakes – Test & Set
Fuel selector

CHECK
OFF

COLD START

| | |
|---|--------------------|
| Throttle | ¼" (Line with "H") |
| Mixture | CUTOFF |
| Fuel Selector | ON |
| Master | ON |
| Instruments | ON |
| Mags | ON |
| ANNOUNCE | "CLEAR" |
| Mixture | IN-count 2-3 |
| Starter | ENGAGE |
| Throttle 7/900rpm till oil pressure then 1000 RPM | |

HOT START

| | |
|---|--------------------|
| Throttle | ¼" (Line with "H") |
| Mixture | CUTOFF |
| Fuel Selector | ON |
| Master | ON |
| Instruments | ON |
| Mags | ON |
| ANNOUNCE | "CLEAR" |
| Starter | ENGAGE |
| Mixture (as engine fires) | FULL RICH |
| Throttle 7/900rpm till oil pressure then 1000 RPM | |

Oil Pressure Check ALIVE 30 secs in warm weather.
60 secs in cold weather

Mixture – Lean for Ground Ops CHECK

The engine should fire in one or two turns of the propeller in warm weather and six to eight turns in cold weather. If the engine does not start. Pull Mixture off and fuel selector off

Weak and Intermittent firing indicates flooding. Excess fuel can be cleared from the combustion chambers with the following procedure:

| | |
|---------------|--------------------------|
| Fuel Selector | OFF |
| Mags | OFF |
| Throttle | FULL OPEN |
| Starter | Engage for a few seconds |

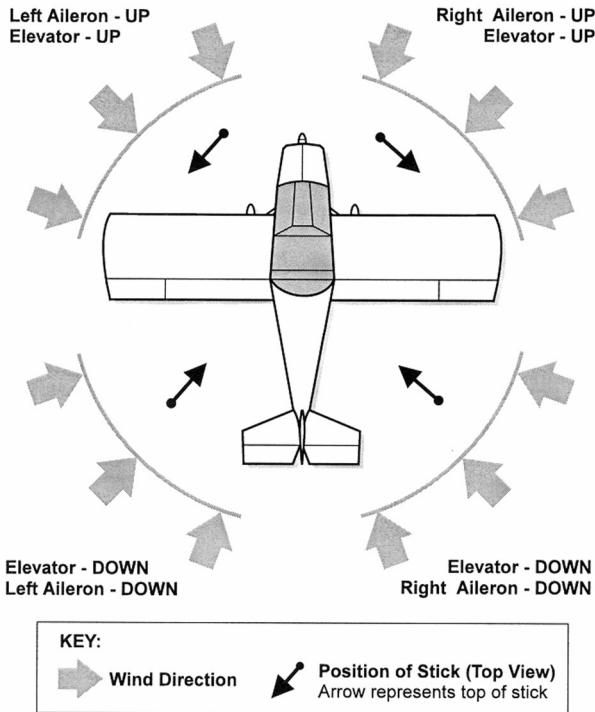
Repeat the starting procedure.

Taxiing

While taxiing it is important that speed and use of brakes be held to a minimum and that all controls be utilized to maintain directional control and balance. Taxiing over loose gravel or cinders should be done at a low engine RPM to avoid stone damage to the propeller and undercarriage and fuselage.

Normally the stick should be held full aft to pin the tail and maximize traction on the tail wheel, however in strong winds – especially quartering tail winds “climb towards/dive away” as shown in this diagram may be more appropriate.

CONTROL POSITIONS while TAXIING



Error! Bookmark not

defined.

Take Off

It is important to check full throttle operation early in the take off run. If there are any signs of rough engine operation or sluggish engine acceleration, discontinue the take off. Investigate the cause of the poor engine operation before attempting another take off.

Full throttle runups over loose gravel are especially harmful to propeller tips. When take offs must be made over a gravel surface it is very important that the throttle is advanced slowly. This allows the airplane to start rolling clear of gravel. Lifting the tail as soon as possible will reduce the amount of gravel thrown back at the empennage. After flying off grass and gravel strips the propeller should be carefully inspected.

Crosswind Take Off

Take offs into strong crosswinds are normally accomplished by rolling aileron into wind and opposite rudder appropriate to tracking straight. Use tail down to neutral elevator to maintain tailwheel steering while the plane accelerates. When rudder authority is established and on lifting the tail it may be necessary to cross control significantly to keep the plane tracking straight with the upwind main wheel pinned to the surface till it accelerates to flying speed. Then rotate off the surface and weathervane into wind to track runway centerline.

Climb Data

Climb Performance data is tabulated in Section 6

Due to air cooling limitations on hot high density altitude days – particular care should be taken to monitor all engine temperatures and consideration given to step climbing to keep the engine cool

Stalls

The stall characteristics are conventional. Slight buffeting will occur just before the stall. Stall speeds in the area of 35-40 Knots CAS are obtained at full aft CG, full gross weight conditions. This is CAS and not IAS. IAS is unreliable near the stall

Spins

Intentional spins in the Utility Category are prohibited. Spins are only approved in the Aerobatic category. For recovery from a spin the following procedure should be used (PARE):

1. Power to idle
2. Ailerons' neutral
3. Full rudder opposite to direction of rotation and after a minimum of a quarter rotation
4. Elevator forward of neutral with a brisk "pop" motion
5. As rotation stops, neutralize all controls and then recover from dive. A firm pull on the elevators may be required to promptly recover from the dive before the aircraft overspeeds. However care should be taken to ensure a secondary accelerated stall does not occur.

During a prolonged spin – the engine may stop. Spin recovery is not affected by engine stoppage.

Landing

Normal landing approaches can be made power on or off at approximately 60 knots CAS. If at full gross – 70 knots. Surface winds, turbulence and gust factors are primary factors in determining actual approach speeds. Actual touch down should be made power off at near stall speed.

A full three point landing should be achieved at stall speed with all three wheels touching simultaneously – at which point the stick should be held full back while the plane decelerates. Aileron deflection should be applied for crosswinds. Brake as necessary once the aircraft has slowed sufficiently.

Short Field Landings

For a maximum performance short field landing in smooth air make an approach at 52 knots CAS using enough power to control the sink rate. After obstacles are cleared reduce power to idle and control airspeed with pitch attitude – lowering the nose as necessary to maintain airspeed. Touchdown should be made in a 3 point full stall landing. Hold the stick full aft, flaps to zero and apply as much heavy braking as is safe. In turbulent air higher approach speeds should be adopted and full short field performance may not be achieved.

Slipping with flaps is permitted to control energy.

Crosswind Landings

Wing low, cross controlled and pin the upwind wheel or crab and kick straight methods of controlling drift are acceptable. If attempting to pin the upwind mainwheel care should be taken to not touch the upwind wingtip. In a strong crosswind - land on the upwind main AND tailwheel in a three point attitude and track straight – allowing the other main to drop onto the runway as flying speed is lost.

Wheel landings also work – however the aircraft is vulnerable at the end of the roll out as airspeed and rudder authority are lost, as the tail drops to the ground and before firm tailwheel contact is made.

EXTREME CARE should be taken if the crosswind component is greater than 14 knots. 17 knots has been demonstrated with a NON-CASTERING tailwheel but this is the limit of adhesion of the 6” tailwheel on dry pavement.

Go-Around

1. Apply full power holding the nose down to prevent pitching up and till a safe airspeed is obtained.
2. Retract flaps to 10 degrees as airspeed allows.
3. Begin a gentle climb
4. Retract remaining flaps as airspeed allows and without sinking.
5. Climb to safe altitude.

Mooring the plane

Proper tie-down is the best precaution against damage.

Tie the plane down by the wing tie downs and tail.
 Install gust locks on ailerons, elevators and rudder.
 Install pitot cover
 Chock the main wheels

4. Emergency Procedures

Emergencies caused by aircraft or engine malfunction are rare. If the aircraft is well maintained and a proper preflight is performed emergencies can be minimized.

Detailed Procedures are on the Checklist card aboard the aircraft. The checklists are considered part of this manual and must be carried aboard the aircraft

Checklists are currently v8 dated Dec 2021

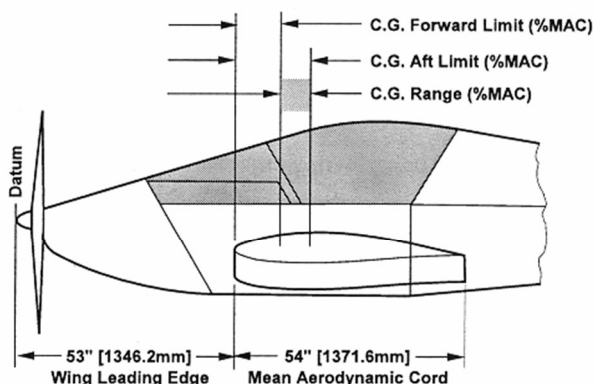
5. Weight and Balance

IMPORTANT – Operating the aircraft at weights or CG's outside the design envelope is dangerous and not permitted. Operating at the edges of the design envelope must be performed with caution

Allowable Weight and Balance Range.

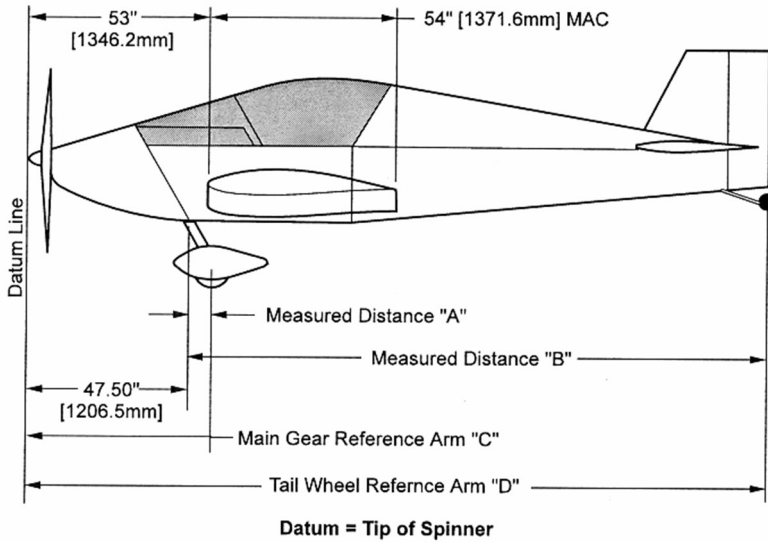
The center of gravity is defined as a percentage of the Mean Aerodynamic Chord (MAC). The aircraft must be operated within the design center of gravity range of 20%-32% at all times. If the Center of Gravity is outside the range the aircraft will be dangerous.

ALLOWABLE CENTER OF GRAVITY RANGE



| | Utility Category | Aerobatic Category |
|---------------------------|------------------|--------------------|
| Maximum Forward C.G. | 20% MAC | 23% MAC |
| Maximum Aft C.G. | 32% MAC | 29% MAC |

ARM DIAGRAM - CONVENTIONAL GEAR



Measured Distance "A" = _____

Measured Distance "B" = _____

Main Gear Reference Arm "C" = 47.50" [1206.5mm] + "A" = _____

Tail Wheel Reference Arm "D" = 47.50" [1206.5mm] + "B" = _____

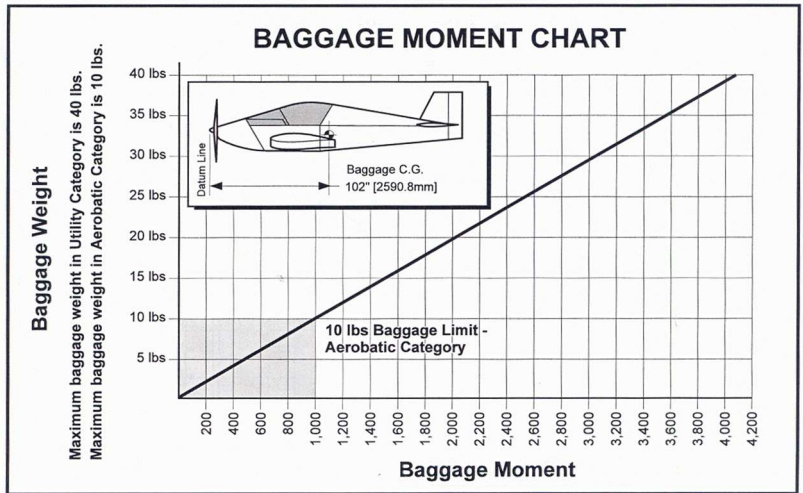
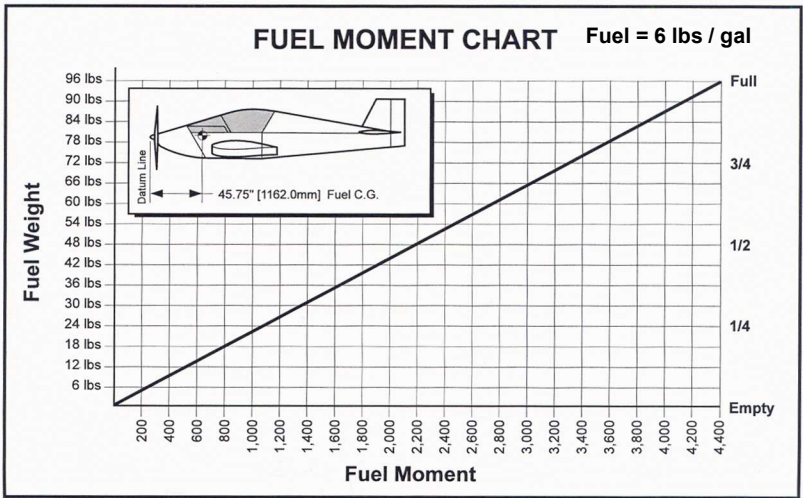
Right Hand Main Gear Weight = _____

Left Hand Main Gear Weight = _____

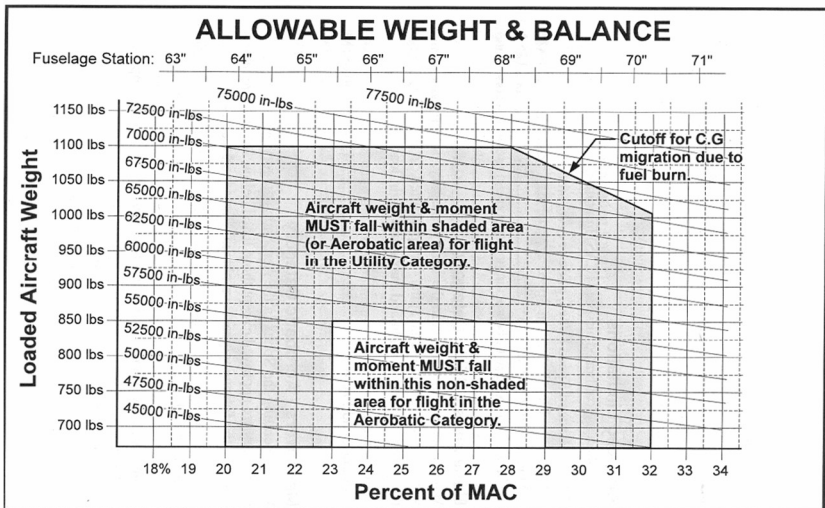
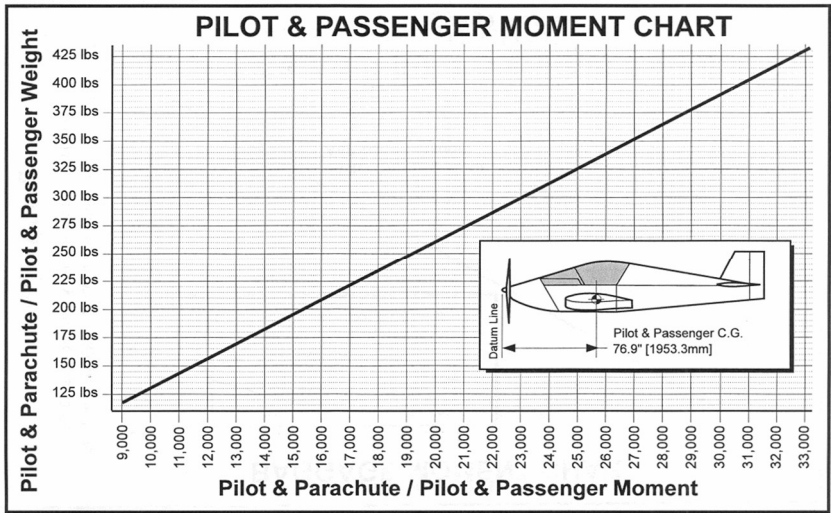
Tail Wheel Weight = _____

For current weights - See current W&B chart carried separately from this document. Dated May 2021

See also the "Quick Worksheet" carried in the flight box



Note: Under certain loading conditions (i.e. Occupant Weight of 360+ lbs), ballast (unusable) fuel must be carried in the fuel tank to keep the center of gravity from exceeding the aft limit before the end of the flight.



6. Operating Limitations

This plane exceeds the requirements of airworthiness set forth by Sonex Ltd, as submitted to the FAA. The airplane is approved for day VFR flight in the Sport Pilot Category. The airplane is approved for day/night VFR flight with a qualified Private Pilot or better. The airplane is not approved for IFR flight.

The aircraft must be operated in accordance with all FAA-approved markings, placards, and check lists in the airplane. If there is any contradiction with FAA approved markings, placards etc in this section – the advice in this section is to be disregarded.

Airspeed Limitations

| | Speed | IAS | Remarks |
|-----|---|----------------------------------|---|
| VNE | Never Exceed Speed | 171 KIAS (197 mph) | Do not exceed this speed in any operations |
| VNO | Maximum Structural Cruising Speed | 109 KIAS (125 mph) | Exceed this speed only in smooth air |
| VA | Maneuvering Speed | 109 KIAS (125 mph) | Do not make full control movements above this speed. Full elevator deflection will result in a 6 G load at this speed |
| VFE | Maximum Flap Extended Speed | 87 KIAS (100 mph) | Do not exceed this speed with flaps down |
| Vy | Best Rate of Climb | 69 KIAS (80 mph) | |
| Vx | Best Angle of Climb | 55 KIAS (63 mph) | |
| VS | Stall Speed Clean | 40 KIAS (46 mph) | Landing. Not taking pitot error into account, 26 KIAS in flight. |
| VSO | Stall Speed Landing Configuration | 35 KIAS (40 mph) | Lift-off speed 37-40 KIAS |
| | Cruise Climb Configuration | 70-80 KIAS (90-95 mph) | Engine temperatures dictate |
| | Maximum <u>Demonstrated</u> Crosswind (not a limitation) | 17 knots | Dry Pavement 6" Non-Castering Tailwheel |

Minimum Maneuvering Airspeed –

Maximum 45 degrees bank – 60 KIAS (69 mph)

Airspeed Indicator Markings

| Marking | Value / Range | Significance |
|-------------------|--------------------------------------|--|
| White Arc | 35-87 KIAS (40–100 mph) | Full Flap Operating Range. Lower limit is VSO. Upper Limit is maximum speed with flaps extended. |
| Green Arc | 40-109 KIAS (46–125 mph) | Normal Operating Range. Lower limit is VS. Upper limit is maximum structural cruising speed. |
| Yellow Arc | 109-171 KIAS (125–197 mph) | Operations must be conducted with caution and only in smooth air. |
| Red Line | 171 KIAS (197 mph) | Maximum speed for all operations. |

Maneuvers – Aerobatic Category

When operating in the aerobatic category (<950 lbs gross weight), the following maneuvers with recommended entry speeds have been tested:

| | | |
|--------------------|----|------------------------|
| Aileron Rolls | 3G | 120-130 |
| Barrel Rolls | 3G | 120-130 |
| Chandelles | | 69-95 |
| Hammerhead | | 100-110 |
| (AVOID TAIL SLIDE) | | |
| Loops / Cloverleaf | 3G | 125-140 |
| Lazy Eights | | 69-109 |
| Horizontal Eights | | 125-140 |
| Snap Roll | | NOT RECOMMENDED |
| Spins | | 35-40 |
| Split S | | 60-70 |
| Stalls | | <40 |
| Whip Stalls | | PROHIBITED |
| Wing Over | | 78-95 |

Left Aileron Rolls are preferred to right to keep oil on the pickup in the sump and avoid low oil pressure. Periods of low to zero G are to be avoided for the same reason.

While executing permitted maneuvers, do not use abrupt control inputs. Aerobatics that may impose high loads must not be attempted. Bear in mind that the airplane is clean in aerodynamic design and will build speed quickly with the nose down. Proper speed control is essential for execution of any maneuver, and care must be exercised to avoid excess speed which, in turn, can impose excessive loads.

Inverted Flight

Flight at negative “G” conditions is to be avoided due to lack of inverted fuel and oil systems.

Required Placards

The following placards must be in full view of passengers:

1. WARNING THIS AIRCRAFT IS AMATEUR BUILT AND MAY NOT
COMPLY WITH FEDERAL AIRWORTHINESS STANDARDS
2. EXPERIMENTAL

7. Engine Operation

Engine Instrument Markings

Engine Operating parameters are as follows and are programmed into the EFIS monitoring system using a simple **Green – OK**, **Orange – Caution**, **Red – Warning** display for the following figures?

| | |
|--|---------------|
| Oil Temperature | |
| Normal | 160-240 F |
| Maximum | 240 F |
| Oil Pressure (rule of thumb 10psi per 1,000RPM) | |
| Minimum Idling | 10 PSI |
| Normal range | 40-50 PSI |
| Maximum Allowable | 100 PSI |
| Fuel Quantity Indicator (in normal level flight) | |
| Maximum | 16 US Gallons |
| No take off | 4 US Gallons |
| Unusable | All usable |
| Tachometer | 4000 RPM MAX |
| Cylinder Head Temperatures | |
| Normal Range | 350-375 F |
| Maximum Continuous | 420 F |
| Maximum Allowable | 450 F |
| Exhaust Gas Temperatures | |
| Maximum Allowable | 1400 F |
| Fuel Flow | |

While the EFIS shows a fuel flow gauge no sender is fitted and it is normal to not show a reading

The AeroVee 2.1 engine is equipped with an AeroCarb float-less carburetor. The AeroCarb is not altitude compensating, but is designed with an in-flight mixture adjustment control. The ability to lean the engine in flight allows the pilot to configure the engine for peak performance. Generally, Exhaust Gas Temperature (EGT) is used as an indication of mixture setting. All references to engine EGT are typically to the hottest cylinder(s). Due to the design of the induction system, the rear cylinders typically run 35°C-65°C hotter (thus leaner) than the front cylinders.

Taxi

The design of the AeroCarb inherently results in a relatively rich mixture setting at low rpm. It is recommended to “aggressively lean” at low rpm to reduce spark plug fouling and carbon buildup inside the engine. Aggressively leaning is defined as leaning to the point where any additional leaning or increased throttle movement will cause the engine to sputter from lack of fuel. Aggressive leaning created a fail-safe situation where it is impossible to attempt a takeoff with a partially leaned mixture. Should a takeoff be attempted while aggressively leaned, the engine will sputter and instantly remind the pilot of the leaned mixture.

Take Off and Climb

Takeoffs should generally be conducted at full throttle, using the full rich setting. This allows the full required fuel flow to reach the engine, and is important to achieving full power as well as proper cooling. When the AeroCarb is properly adjusted, takeoff EGTs should be approximately 675-730°C. Under certain conditions, including high Density Altitude or very hot outside air conditions, it may be desirable or necessary to lean for takeoff. The recommended procedure is to lean the engine while on the ground so that full throttle EGTs are between 675-730°C, or until the engine runs smoothly. Temperatures should be monitored throughout the takeoff roll and initial climb out, and the mixture adjusted as needed to remain within limits.

Cruise

Cruise flight is typically conducted at 3000-3200 rpm, however, this may vary with DA and temperature. Significant reductions in fuel flow can be achieved by properly leaning the engine during cruise flight. Additionally, proper leaning in cruise helps reduce carbon buildup inside the engine and prolong engine life.

Prior to leaning for cruise, the engine should be allowed to stabilize in rpm and temperature for a few minutes. Once stabilized, the engine should be leaned according to the following procedures, with minor modifications as needed to keep the engine running smoothly and within temperature limits. The engine may be operated in the following 3 modes: Rich of Peak, whereby more fuel is consumed for the sake of cooler temperatures, near peak, producing maximum power, but at greater heat and strain on the engine, or Lean of Peak, resulting in the lowest fuel flow. Peak EGT is approximately 775°C - 805° C. When operating Lean of Peak, EGTs will peak, then fall somewhat. The engine will not be damaged as long as CHTs are stable and within limits (194° C or less).

Rich of Peak (ROP): 675-730°C EGT

When leaning to ROP, the recommended procedure is to gradually move the mixture lever while watching EGT readings, stopping at the desired setting.

Peak Power: 730° -745°C

Gradually reduce the mixture setting until EGTs on the hottest cylinders reach 730° -745°C. Continue to monitor CHTs to ensure they remain within limits. This setting will generally produce the best power.

Lean of Peak (LOP): 745° -770°C EGT

For LOP operation, it is preferable to lean quickly and drastically to reduce the time spent at peak EGT settings. This can be described as “the big mixture pull”, whereby the mixture knob is pulled out 1”-1.5” over the course of 5-10 seconds, while observing EGTs. Due to imbalances in the induction system, it may not always be possible to lean all 4 cylinders to LOP operation without causing engine roughness and/or vibration. If roughness occurs, richen the mixture slightly until the engine runs smooth again. Continue to monitor CHT to ensure they remain within limits. In some cases, the front cylinders may be running near peak EGT while the rear are LOP. This poses no problem as long as the CHTs are stable and within limits. If a suitable setting cannot be found, it may be necessary to richen the mixture enough to return to ROP operation on all cylinders to control CHTs.

Maximum Engine Stress: 750° -805°C EGT





The engine is under maximum stress when EGTs are approximately 10-35°C rich of peak. This generally corresponds to EGTs of approximately 750° -805°C. High power settings should be avoided in this mixture range.

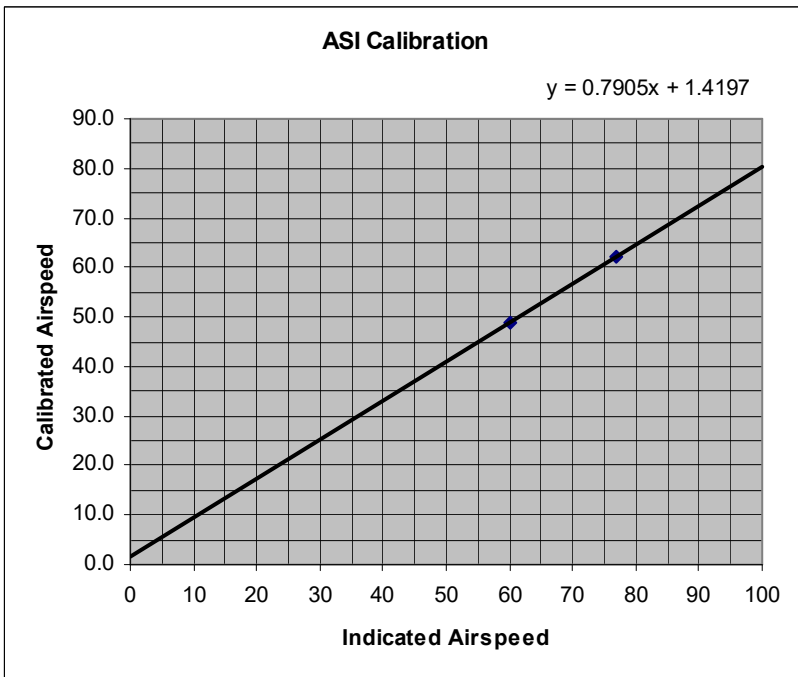
Descent

Descent may be initiated by simply reducing the throttle to the desired rpm, while leaving the mixture setting leaned as in cruise. This will help prevent cooling the engine excessively during the descent and low power operation. Prior to resuming application of cruise power setting, as in entering the traffic pattern, the mixture should be adjusted or richened accordingly. In the event of a touch-and-go landing, or go-around, the mixture should be returned to the takeoff setting (full rich, or leaned as appropriate) before advancing the throttle to full.

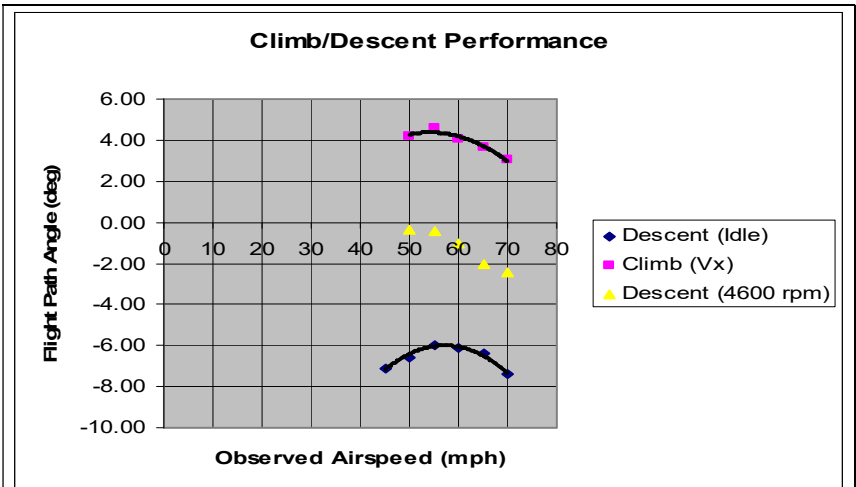
8. Operational Data

Operational Data from Phase 1 Flight Testing is included here. This is advisory in nature and may be subject to refinement. Conservative judgement for take off and landing minimums should be exercised at all times.

| STALL SPEEDS - POWER OFF, KIAS | | | | |
|---------------------------------------|--|---|---|---|
| Gross Wt. Condition | Angle of Bank | | | |
| |  0° |  20° |  40° |  60° |
| 1100 lbs | | | | |
| 0° Flaps | 35 | 39 | 41 | 50 |
| 10° Flaps | | | | |
| 30° Flaps | 31 | 33 | 36 | 44 |



CAS = 80% IAS



CRUISE PERFORMANCE (Full Fuel 16.7 Gal)

| Altitude (Feet) | RPM | % BHP | TAS (KIAS) | Fuel Flow (GPH) | Endurance (Hours) | Range (NMiles) |
|-----------------|------|-------|------------|-----------------|-------------------|----------------|
| S.L. | 3300 | 100 | 113 | 5.7 | 2.8 | 316 |
| | 3200 | 87 | 109 | 5.0 | 3.2 | 348 |
| | 3100 | 77 | 104 | 4.4 | 3.6 | 374 |
| | 3000 | 70 | 100 | 4.0 | 4.0 | 400 |
| | 2900 | 60 | 96 | 3.4 | 4.7 | 451 |
| | 2800 | 55 | 91 | 3.1 | 5.1 | 464 |
| 4000 | 3300 | 87 | 122 | 5.0 | 3.2 | 390 |
| | 3200 | 76 | 117 | 4.3 | 3.7 | 433 |
| | 3100 | 67 | 113 | 3.8 | 4.2 | 475 |
| | 3000 | 61 | 108 | 3.5 | 4.6 | 497 |
| | 2900 | 52 | 103 | 3.0 | 5.4 | 556 |
| | 2800 | 48 | 98 | 2.7 | 5.9 | 578 |
| 8000 | 3300 | 77 | 131 | 4.4 | 3.6 | 471 |
| | 3200 | 67 | 126 | 3.8 | 4.2 | 529 |
| | 3100 | 59 | 121 | 3.4 | 4.7 | 569 |
| | 3000 | 54 | 116 | 3.1 | 5.2 | 603 |
| | 2900 | 46 | 111 | 2.6 | 6.1 | 677 |
| | 2800 | 42 | 106 | 2.4 | 6.6 | 699 |

1. Maximum Cruise is normally limited to 75% power.
2. Endurance and Range are for **No-Wind, No Reserve** conditions.
3. Figures do not include take off, landing, or reserve.
4. Cruise RPM for AeroVee is 2800-3200 RPM.

Carson Airspeed

Maximum Endurance. It has been shown that, while the speed for maximum L/D yields the least fuel consumed per unit of distance, there is also a speed for the least fuel per unit of velocity, essentially, the best compromise between speed and fuel economy.

If using Carson airspeeds – care should be taken when flying into a headwind component where the extra time spent in the headwind may more than offset or even negatively impact the fuel savings.

The rule of thumb calculations are:

$V_{\text{max endurance}} = \text{Best Glide Speed} / 1.316$

For this aircraft this is 53 KIAS (61 mph)

$V_{\text{max range}} = \text{Best Glide Speed}$

For this aircraft this is 70 KIAS (81 mph)

Blending these numbers:

$V_{\text{optimum cruise}} = (\text{Best Glide Speed}) * 1.316$

For this aircraft this is 92 KIAS (106 mph)

TIME, DISTANCE, & FUEL TO CLIMB

| Weight (lbs) | DA (Feet) | Climb Speed (KIAS) | ROC (FPM) | From Sea Level | | |
|-----------------|--------------|--------------------------|------------------|----------------|---------------|----------------------|
| | | | | Time (Min) | Fuel (Gal) | Distance (NMiles) |
| 950 | S.L. | 70 | 620 | 0 | 0 | 0 |
| | 1000 | 70 | 585 | 2 | 0.2 | 1.7 |
| | 2000 | 70 | 550 | 3 | 0.3 | 4.3 |
| | 3000 | 70 | 515 | 5 | 0.5 | 6 |
| | 4000 | 68 | 480 | 7 | 0.7 | 9.6 |
| | 5000 | 68 | 445 | 9 | 0.9 | 12 |
| | 6000 | 68 | 410 | 12 | 1.1 | 14.8 |
| | 7000 | 67 | 375 | 14 | 1.3 | 18.2 |
| | 8000 | 66 | 335 | 17 | 1.6 | 22.6 |
| | 9000 | 65 | 300 | 20 | 1.9 | 27 |
| | 10000 | 65 | 265 | 24 | 2.2 | 31.3 |
| 1100 | S.L. | 70 | 495 | 0 | 0 | 0 |
| | 1000 | 70 | 460 | 2 | 0.2 | 2.6 |
| | 2000 | 70 | 425 | 4 | 0.4 | 5.2 |
| | 3000 | 70 | 390 | 7 | 0.6 | 8.7 |
| | 4000 | 68 | 355 | 10 | 0.9 | 12.1 |
| | 5000 | 68 | 315 | 12 | 1.1 | 15.6 |
| | 6000 | 68 | 285 | 16 | 1.4 | 20 |
| | 7000 | 67 | 250 | 20 | 1.8 | 25.2 |
| | 8000 | 66 | 210 | 24 | 2.2 | 31.3 |
| | 9000 | 65 | 175 | 29 | 2.7 | 38.2 |
| | 10000 | 65 | 140 | 35 | 3.2 | 47 |

TAKE OFF DISTANCE

| Elevation and Temperature | 950 lbs | | 1100 lbs | |
|---|-------------------------|----------------------------------|-------------------------|----------------------------------|
| | Ground Run (Feet) | Over 50-ft Obstacle (Feet) | Ground Run (Feet) | Over 50-ft Obstacle (Feet) |
| Sea Level @ 15° C | 550 | 1020 | 1000 | 1715 |
| 2500 ft @ 10° C | 670 | 1385 | 1190 | 2150 |
| 5000 ft @ 5° C | 780 | 1735 | 1430 | 2860 |
| 8000 ft @ 0° C | 950 | 3815 | 1650 | 7380 |
| <ol style="list-style-type: none"> Figures for clean, level, hard surface runway. Increase distance 10% for each 18° C increase in temperature above standard day temperature. Increase distance by 10% for dry grass runway, 25% for wet grass. | | | | |

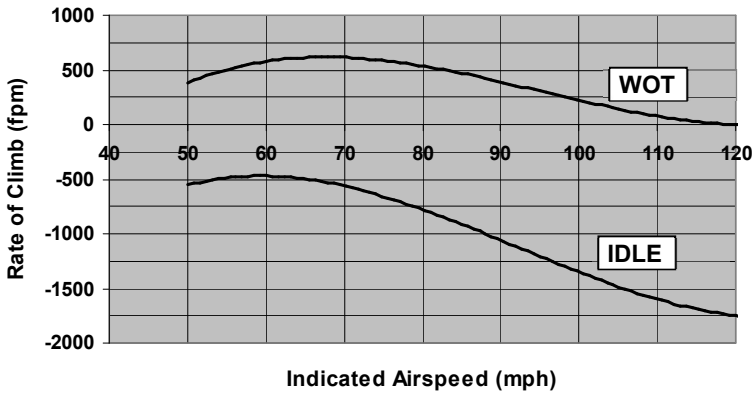
LANDING DISTANCE

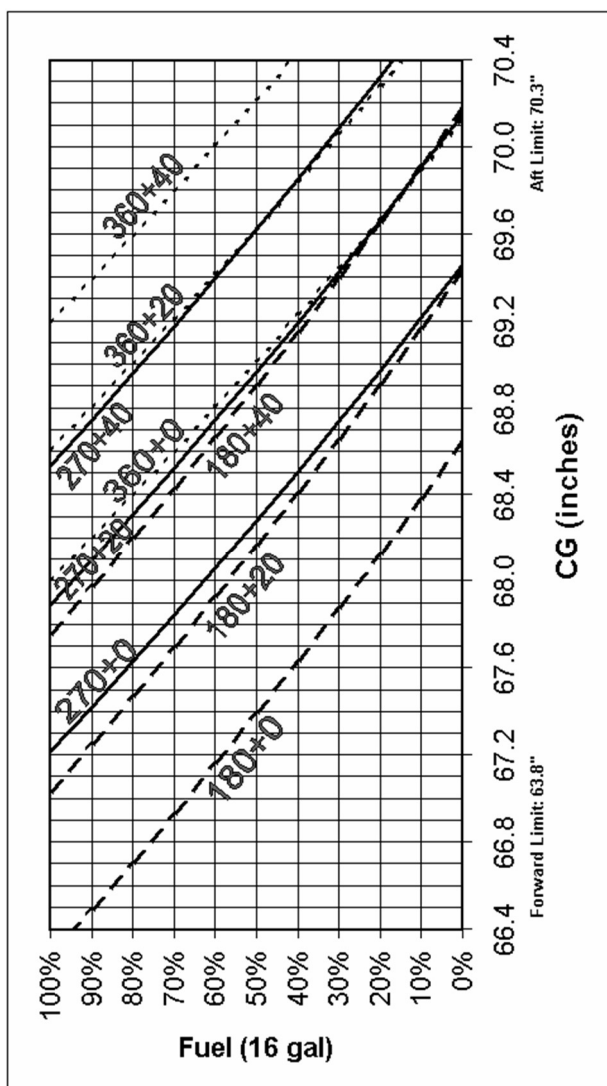
| Elevation and Temperature | 950 lbs | | 1100 lbs | |
|--|-------------------------|----------------------------------|-------------------------|----------------------------------|
| | Ground Run (Feet) | Over 50-ft Obstacle (Feet) | Ground Run (Feet) | Over 50-ft Obstacle (Feet) |
| Sea Level @ 15° C | 450 | 1045 | 650 | 1245 |
| 2500 ft @ 10° C | 500 | 1095 | 705 | 1300 |
| 5000 ft @ 5° C | 550 | 1145 | 765 | 1360 |
| 8000 ft @ 0° C | 600 | 1195 | 830 | 1425 |
| <ol style="list-style-type: none"> Figures for full flap, no wind conditions, on clean, level, hard surface runway. Decrease distance by 30% for each 10 mph of head wind. Increase distance by 50% for each 10 mph of tail wind. Increase distance 10% for each 18° C increase in temperature above standard day temperature. Increase distance by 10% for dry grass runway. | | | | |

Rate of Climb at Vy



Power Required Curves





Occupants (lbs) + Baggage (lbs)

MAXIMUM GLIDE

Propeller Windmilling 70 KIAS (81 mph)

Glide Ratio is dependent on strictly maintaining V_g . A knot either side of 70 KIAS makes an appreciable difference to the glide ratio as does loading. Though considered an imperfect Rule of Thumb - visually – keeping the wing chord level to the horizon will assist in achieving an airspeed close to V_g in the event of instrumentation failure.

At 950lb a glide ratio of 10.5:1 was measured.

At 1,100 a glide ratio of 8.8:1 was measured.

A conservative and “safe” value to use in calculations that allows for piloting errors is 8:1 in all loading states.

Minimum Maneuvering Airspeed –

At a maximum 45 degrees bank – 60 KIAS

180 degree turn after engine failure

Use minimum maneuvering speed and bank angle and apply 10 degrees of flaps as you roll into the turn into wind and back to flaps zero as you roll out. (This is a variation of back country emergency canyon turn)

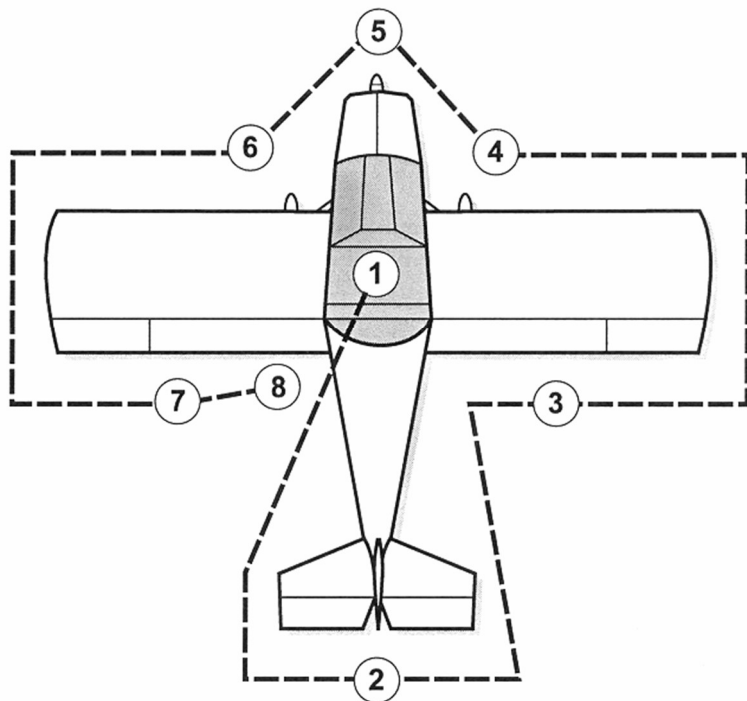
With a three second delay then executing the turn an altitude loss of just 300ft has been demonstrated when completely proficient. 500ft is safer for planning purposes.

9. Operating Checklists

Detailed Procedures are on the Checklist cards aboard the aircraft. The checklists are considered part of this manual and must be carried aboard the aircraft

Currently v9 Jan 2023

WALK AROUND INSPECTION



10. Care of the Airplane

Exterior Care

N360GS is polished, with fiberglass parts painted with Rustoleum “rattle can” enamel color paint, with Rustoleum clear gloss top coat. The aluminum can be washed with mild soap and polished with Nuvite C-grade polish. The paint may be washed with mild soap and waxed with automotive waxes as desired.

Windshield and Canopy Care

The windshield and canopy are standard Plexiglass acrylic. Care must be taken to keep the plexiglass clean and unscratched. Flush away grit with water to prevent scratching, then wash with water with mild detergent or commercial plexiglass cleaner, such as Novus or Plexus. Never use benzene, gasoline, alcohol, acetone, carbon tetrachloride, lacquer thinner or glass cleaner to clean plastic. These materials, as well as Lok-Tite, will damage the plastic and may cause severe crazing.

Brakes

N360GS uses cable brakes manufactured and purchased through Sonex Aircraft. A machined drum with cooling fins bolts on to the standard Azusa-1137 wheels. The shoes can only be removed through disassembly. Shoes should be checked for wear annually and replaced as needed. Normal brake pad life is estimated at 500 hours.

Propeller

The Price P Tip propeller is a fixed pitch wood/composite propeller with reinforced leading edges. The propeller has a nominal pitch of 44” but under load it will flex and pitch across the range 44”-48” as appropriate to load. It should be moved to a horizontal position after running. Re-torque propeller bolts every year. Proper torque is 140 inch-lbs. Routine cleaning can be accomplished with mild detergents.

Tires

Nankang/Shin 11-400x5 6-ply tires and tubes are used. Tires should be replaced when the remaining tread depth reaches 1/16”. Inflate tires to a pressure of 50 PSI. Use of higher tire pressures is not recommended due to loss of shock absorption and increased wear of the tires. Clean and repack the main wheel bearings after the first 100 hours, then every 200 hours thereafter. Hydroplane Speed – 61 knots (70 mph)

OPTIONAL 500x5 tubed tires can be fitted for soft field operation - 45PSI
Hydroplane Speed – 57 knots (66 mph)

Battery

The Earth-X ETX900 battery is a high performance, sealed Lithium Iron Phosphate 13.2 volt battery. It is rated at 15.6 amp-hours, and 400 cranking amps for 3 seconds. Under normal conditions, no servicing or maintenance is required. The battery cable terminals, lugs, and wires should be inspected annually for security and corrosion.

The PowerQueen 12A BMS backup battery is located under the seat pan. It is charged by the Alternator or Solar Panel but if needed must be manually turned on by operating the rightmost switch on the panel. The Backup will allow approx. 1 hour of EFIS and Ignition operation ONLY. All other electrical loads should be turned off.

An SAE charging port is provided at the bottom right exit cooling slot. The port is connected to a PowMr Solar 20 Amp Charge Controller which prevents over voltage. The Solar charger allows for battery maintenance while the plane is tied down. (See electrical schematic).

Battery chargers must not be connected to the Solar port.

Fuel and Oil Requirements

The engine is rated for aviation grade 100LL fuel. Addition of TCP lead scavenger is recommended when using 100LL fuel.

WARNING - Automotive fuel – even ethanol free “Mo-Gas” may NOT be used as the timing and compression will not accept this fuel.

20W-50 multi-grade oil (Valvoline VR-1, or Brad Pennzoil) is used year round, Full synthetic oils must NOT be used as they adversely react with the lead in 100LL. In extreme cold temperatures, 20W-40 multi-grade oil may be substituted. Lighter weight oils may be used in colder climates if hard starting occurs. Engine pre-heat is recommended when temperature is below 20° Fahrenheit to save unnecessary wear and tear. Oil change is recommended every 25 hours of operation, or every 3 months. Clean the Oil Filter at change.

Use of AUTOMOTIVE CamGuard is permitted on this aircraft.

The aircraft is equipped with a fine-mesh wire screen fuel filter INSIDE the Gascolator on the firewall-engine side, designed to filter out debris and contaminants. This screen should be inspected and cleaned every 25 hours. Replace screen as needed.

Spark Plugs

Spark plugs (Autolite MP4163 or Champion RA6HC) should be cleaned, tested, and re-gapped every 100 hours, or annually. Apply anti-seize lubricant and re-torque plugs to 240 in-lbs. 100LL avgas may result in lead deposits forming on the plug electrodes. Replace plugs as needed, or every 200 hours.

Carburetor Air Filter

Replace the carburetor air filter every 50 hours, or as needed. To remove the air filter, remove the engine cowl and unscrew the carburetor filter retaining bolt. K&N E-3120 High Performance filter is used.

Oil Filter

A user serviceable Peterson Fluid Systems 400 Series 60 micron Oil Filter is fitted under the front of the engine. The unit incorporates a bypass in the event the filter becomes saturated and clogged.

This should be disassembled, inspected and cleaned at each oil change. Care should be taken to ensure the O rings that seal the filter body are not damaged during this cleaning

The Element can be replaced when no longer cleanable.

Sump Gasket

For a 1970 Volkswagen Beetle; NAPA part number: ATM113198031; Advance Auto and Autozone part number: felpro OS21625

11. Inspection and Service

Inspection Periods

Federal Aviation regulations require that all airplanes have a periodic (annual) condition inspection as prescribed by the administrator, and performed by a person designated by the administrator

A log sheet showing current state of maintenance and next interval due is kept in the aircraft “flight box” with the Hobbs, fuel and oil log and carried aboard the aircraft during flight. Prior to flight – a check should be made to ensure the aircraft is “in maintenance” for the intended flight.

A maintenance schedule has been developed for this aircraft as well as a checklist for the annual “Condition Inspection”. These and manufacturer recommended install and maintenance procedures for equipment are kept in a master file with the aircraft logbooks.

To be carried aboard the aircraft:

- Special Airworthiness Certificate
- Registration Certificate
- This Flight Manual
- Weight and Balance Information

To be available for Inspection:

- Aircraft Logbook
- Engine Logbook
- Propeller Logbook
- Form 337's (if filed)

FAR Part 43 - Maintenance, Preventive Maintenance, Rebuilding and Alterations is recommended as a reference. While it does not apply to amateur built aircraft, it does provide worthwhile guidance in recommended practices.

Maintenance Intervals

Daily

Service fuel tank with 100LL grade fuel.

Oil – When oil is at the low mark on dipstick, add 0.5 quarts of oil to bring it to the high mark.

25 Hours (or 4 months)

Change Engine Oil

Clean Air Filter

Check head torque

Adjust Valves

Adjust Brakes

Retorque and track the propeller

100 Hours:

All 25 hour items and:

Spark Plugs – Clean, test and adjust gap (or just replace with newly gapped plugs)

Fuel Strainer – Disassemble and clean

Main Wheel Bearings – disassemble, clean and repack

Annual or 500 hours

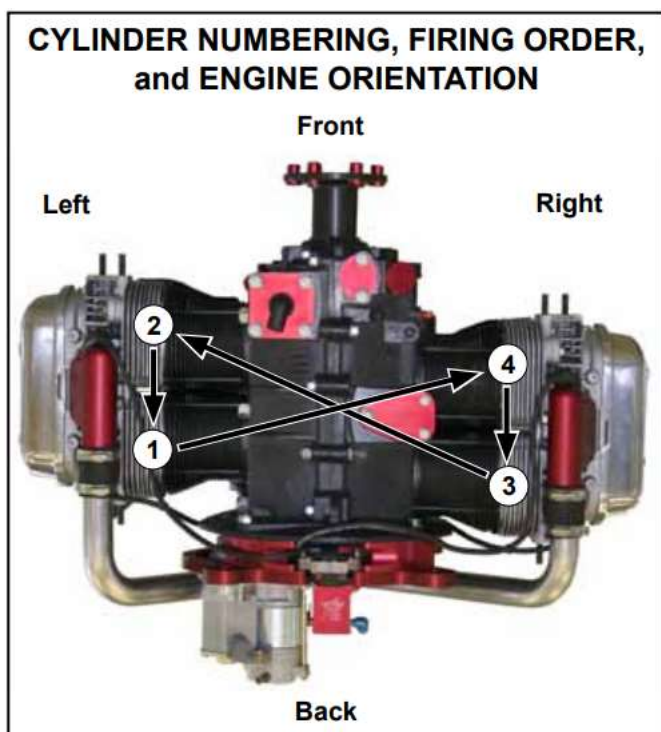
100 hour items

Moveable Bearing Points – Check for wear, adjust, lubricate and check safety wiring

Leak Down Test (80psi normal; <60psi bad)

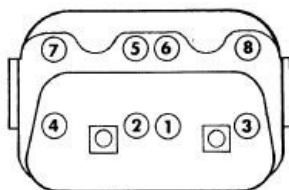
Torque Values

| Item | Socket | Ft. lbs. | In. lbs. |
|-----------------------------|--------------|---------------|---------------|
| Large Case Nuts | 19mm | 25 | 300 |
| Cam Case Nuts | | 10 | 120 |
| Small Case Nuts | 13mm | 14 | 168 |
| Cylinder Head Nuts | 15mm | 18 | 216 |
| Rocker Arm Nuts | 13mm | 14 | 168 |
| Prop Hub Nuts | 30mm | 70-80 | 840-960 |
| Flywheel Gland Nut | 36mm | 227 | 2724 |
| Connecting Rod Nuts | 14mm | 30 | 360 |
| Oil Pump Cover | 13mm | 14 | 168 |
| Valve Cover Bolts | 13mm | 10 | 120 |
| Oil Pump Cover | 13mm | 14 | 168 |
| Oil Pan Cover Nuts | 10mm | 5 | 60 |
| Rear Unit Mount Bolts | 17mm | 25 | 300 |
| Prop Bolts/Nuts* | 1/2" | 11 | 132 |
| Spark Plugs | 11/16" | 12 | 144 |

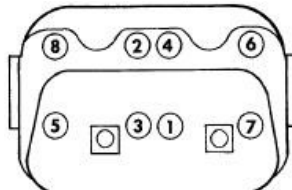


The following “quick reference” sizes and values are included for use in the field but where there is any doubt or variance between these figures and the manuals – the figures and settings in the manuals shall prevail.

Head tightening sequence



7-10 Ft-Lbs / 84-120 In-Lbs



18 Ft-Lbs / 216 In-Lbs

Rocker Arm Nuts 14 Ft-Lbs / 168 In-Lbs

Valve Gap: 0.006"

Spark Plug Gaps: Top = 0.018" Bottom = 0.032"

AeroInjector Carburetor

3/16" Ball Hex Wrench

RICHEN: counter clockwise in 1/8th turn increments

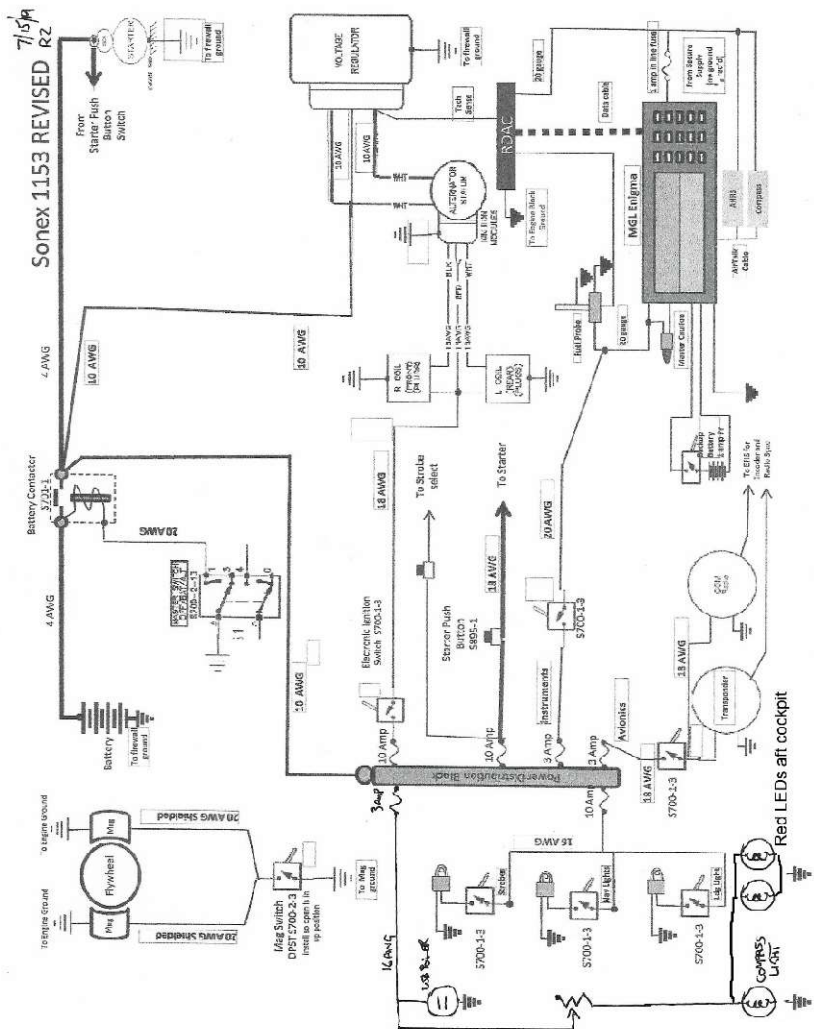
LEAN: clockwise

Propeller

Track - +/- 1/8th inch

Bolt Torques: 140 in-lbs

12. Electrical Schematic



Solar Battery Charging

A port is provided on the bottom of the right-side cowl by the negative pressure vent cooling slot.

Any Solar Cell with a nominal 12v rating (under load) and up to 16 amps current may be utilized. So nominally up to a 200w Solar Cell. The solar cell input is managed by a charge controller described on the next page.

On no account should a battery charger be plugged into the solar charging circuit as it will destroy the Solar Controller.

It is vital that the connections and disconnections are made in accordance with the information on the next page.

The third “consumer load” circuit on the controller is wired to a USB port in the cockpit on the right side of the panel. It is active when there is an excess of power available from the Solar Panel after battery charge needs are met. It may also be turned on when in flight and will be fed by the Alternator/Main battery.

A small 50w solar panel is available to carry in the aircraft to keep the battery trickle charged/maintained when away from base.

PowMr Solar Charge - 20A Charge Controller

Located on the bottom of the battery box.



TECHNICAL PARAMETER

| MODEL | IR-A210-C | IR-A220-C | IR-A210-L | IR-A220-L |
|-----------------------------|--|-----------|-----------|-----------|
| Rated Charge current | 10A | 20A | 10A | 20A |
| Rated Discharge current | 10A | 20A | 10A | 20A |
| Battery voltage | 12V/24V auto-adapt | | | |
| Battery type | Lead-acid (Sealed/flooded/AGM/GEL) | | | |
| Max Solar input | 50V | | | |
| Equalization charge voltage | 14.4V | | | |
| Bulk charge voltage | 14.2V | | | |
| Fast charge voltage | 13.8V | | | |
| Discharge stop voltage | 13.2V | | | |
| Discharge reconnect voltage | 13.6V | | | |
| Self-consume | <10mA | | | |
| Voltage to open the load | PV panel <4V (delay 10s) | | | |
| Voltage to close the load | PV panel >4V (delay 10s) | | | |
| Operating temperature | -20~+60 °C | | | |
| Size/Weight | 89*45*23mm/126g | | | |
| Wire size | 16AWG ,silicone rubber (insulation wire) | | | |
| Installing hole size | 74.5mm | | | |

*All above voltage in red color multiply 2 while used for 24V system

*Product specifications are subject to change without prior notice

Any question, pls kindly contact us via email:howie.1210@163.com

Step 3: Connect your solar panel to the controller through indicated positive and negative poles.
The reverse order applies when uninstalling!
An improper connecting sequence order can damage the controller!

SYSTEM WORKING MODE

| Model/Working mode | Description |
|--|---|
| IR-A210-C IR-A220-C Under 24 hours working mode | That means your solar system will support your load to work continuously until battery is too low. That means sunlight controls your load to work, when it turns dark at night, your load starts to work. |
| IR-A210-L IR-A220-L Under light control working mode | |

Indicators

- Constant on: bulk/equalization charge
- Slow flash: float charge
- Green on: battery high
- Yellow on: battery medium
- Red on: battery low
- Red flash: battery very low
- Red on: output normal
- Slow flash: over-load
- Fast flash: short-circuit

TROUBLE SHOOTING

| Situation | Probable causes | Solution |
|---------------------------------------|---|--|
| Sun Charging LED is not on when sunny | Solar panel not or reversely connect | Reconnect rightly |
| Load LED slow flashing | Battery too low | Recharge battery |
| Load LED fast flashing | Over load | Reduce load wait |
| Power off | Short circuit protection Battery too low/Reverse | Reconnect rightly Check battery and reconnect |

User Manual

SAFETY INSTRUCTIONS

1. Make sure your battery has enough voltage for the controller to recognize the battery type and activate the controller before first installation. Too low voltage or dead battery will not activate the solar charge controller.
2. The battery cable should be as short as possible to minimize loss.
3. This controller is suitable for all kinds of lead-acid batteries (including Sealed, Flooded, AGM, GEL), but it is not suitable for nickel metal hydride, lithium ions or other batteries. (If need, you can choose our other models to charge for Lithium ions and LifePO4 type battery.)
4. The charge controller is only suitable for regulating solar modules. Never connect another charging source to the charge controller.

PRODUCT FEATURES

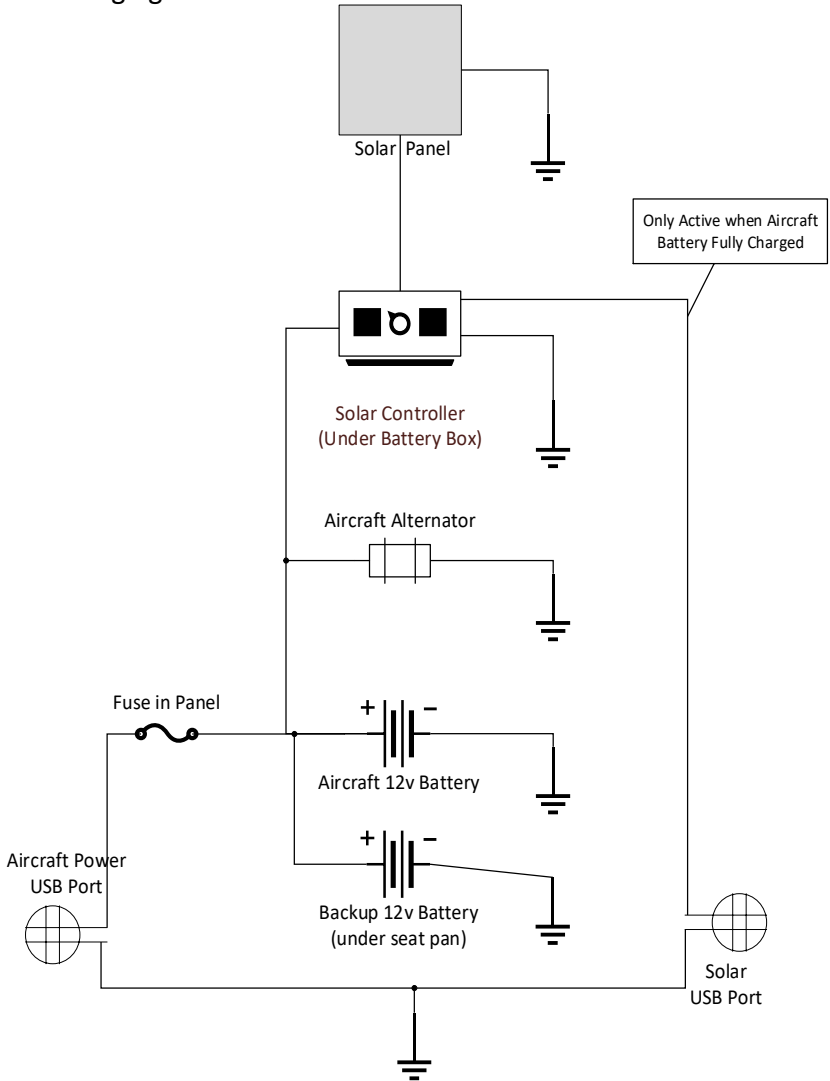
1. IP68 waterproof grade, suitable for outdoor use.
2. With built-in short circuit, reverse connect, over-load, over-charge and dual MOSFET reverse current protection, with low heat production.
3. Can identify battery type to be 12V or 24V automatically, with power-off memory function.
4. With 3 LED lights to show status of charging and loading.
5. Fully 4-stage PWM charge management.
5. Compact size, high quality aluminum alloy shell with 20pcs mounting holes and potted cables.

SYSTEM CONNECTION

- Step 1:** Connect your battery to the controller through indicated positive and negative poles, and it will identify your battery type to be 12V or 24V automatically.
- Step 2:** Connect your loads to the controller through indicated positive and negative poles.

Sonex Serial 1153

Solar Charging Schematic



13. Build Specifications

Aircraft Type

Sonex

(Since the introduction of the “B” model also known as the Sonex “A” or “Legacy”)

Plans Source:

Sonex Ltd

PO Box 2521

Oshkosh, WI 54903-2521

Aircraft Serial Number: 1153

Engine Type: AeroVee 2.1, 2180cc, 80hp - VW Conversion

Major Construction Materials:

6061-T6 Aluminium, Fiberglass, Titanium Rod, Chrome-Moly tubing.

Aircraft Registration Number:

N360GS (originally registered as N581DW)

Constructed by

Wright, Dennis H

3238 Foxcroft Road

Charlotte, NC 28211

Construction Commenced: May 2008

Construction Complete: November 2015

FAA Approval by:

Robert W Reynolds Jr

Date Approved for Flight: November 24, 2015

First Flight: December 6th, 2015

At: KAFP – Anson County

Pilot: Dennis Wright

Date Phase 1 Flight Testing Complete: April 29, 2016

Engine Information**Powerplant Specifications**

| | |
|-----------------------------|--|
| Serial #: | 512 |
| Carburetor: | AeroCarb ACV-C07 |
| Serial #: | 954 |
| Type: | 4 cylinder, 4 stroke, horizontally opposed, normally aspirated |
| Cooling: | Air cooled, with external oil cooler |
| Drive: | Direct drive |
| Weight (complete, less oil) | 168 lbs |
| Rated HP: | 80 |
| Rated RPM: | 3400 |
| Maximum RPM: | 4000 |
| Cruise RPM: | 2,900-3,100 |
| Idle RPM: | 900-1000 |
| Bore: | 92mm |
| Stroke: | 82mm |
| Compression Ratio: | 8:1 |
| Firing Order: | 1-4-3-2 |
| Valve Gap Adjustment: | .006" |
| Alternator: | 20 amp |

Ignition

| | |
|----------------------|-----------------------------------|
| Timing: | Fixed @ 28° BTDC |
| Ignition Module Gap: | .010 - .014" |
| Spark Plugs: | Autolite MP4163 or Champion RA6HC |
| Plug Gap: | Top: .018" Bottom: .032" |

Ignition System: "Right" Setting

| | |
|-------------------|-----------------|
| - Upper Magnatron | Top Front Plugs |
| - Lower Magnatron | Top Rear Plugs |

Ignition System: "Left" Setting

| | |
|-----------------------|--------------------|
| - Right Ignition Coil | Bottom Front Plugs |
| - Left Ignition Coil | Bottom Rear Plugs |

| Parameter | HI | LO |
|------------------|--------|--------|
| Oil Pressure | 80 psi | 20 psi |
| Oil Temp | 220F | 120F |
| Voltage | 14.0 | 12.4 |
| Fuel Qty | ---- | 0 gal |
| RPM | 3400 | ---- |
| EGT | 1400 | ---- |
| CHT | 420 | ---- |
| Tach EMP setting | 5 | |

Lubricant**CAUTION****Do NOT use Aviation Lubricant!**

The oil passages in the AeroVee engine are quite small, and unsuitable for the larger molecular size of aviation oil.

Use only brand name multi-grade oil marked "SL" or "SJ" in accordance with the API system.

| | |
|----------------------------|-----------------------------|
| Type: | SAE 20W-50 (Valvoline VR-1) |
| Oil Sump Capacity: | 2 $\frac{3}{4}$ Quarts |
| Oil Cooler Capacity: | $\frac{1}{2}$ Quart |
| Oil Minimum Safe Quantity: | 2 $\frac{1}{4}$ Quarts |

Operating Conditions

| | |
|----------------------|--|
| Oil Temp: | 70° C (160° F) min, 110° C (230° F) Max |
| Oil Pressure (psi): | 20 min, 100 max, 30-40 cruise |
| Fuel Pressure (psi): | 1 psi min, 4 psi max |
| Cylinder Head Temp: | 176-190° C (350-375° F) desired 216° C (420° F) max |
| Exhaust Gas Temp: | 760° C (1400° F) max |

Fuel

| | |
|-----------------------|-------------------------|
| Approved Fuel Grades: | 100LL Avgas |
| Total Fuel Capacity: | 16 Gallons (US) |
| Usable Fuel: | 15 Gallons 7 Pints (US) |

Propeller

Prince Wood Carbon P-Tip 54" diameter
x 44" pitch

14. Equipment List

| | |
|----------------------------------|---|
| <u>Engine:</u> | <u>AeroVee 2180</u> Version: 2.1 SN: 512 |
| <u>Starter:</u> | <u>Sky-Tech</u> Model: 122-12AV SN: |
| <u>Oil Filter:</u> | <u>Peterson Fluid Systems</u> 09-0452 60 micron with bypass |
| <u>Carburetor:</u> | <u>AeroInjector</u> Model: ACV-C03 SN: 957 |
| <u>Air Filter:</u> | <u>K&N</u> E-3120 High Performance Replacement |
| <u>Air-Oil Separator:</u> | <u>Custom Made</u> |
| <u>Propeller:</u> | <u>Prince</u> P-Tip 54" x 44" S/N 8031 |
| <u>Battery:</u> | <u>Earth-X ETX 900</u> |
| <u>Backup Battery</u> | <u>PowerQueen 12A BMS</u> |
| <u>Radio</u> | <u>Garmin GTR 220</u> S/N 5JC000317 |
| <u>ELT</u> | <u>Artex ELT 345</u> 406MHz |
| <u>GPS</u> | <u>MGL to Enigma EFIS</u> <u>SkyFx to echoUAT ADSB</u> |
| <u>ADSB-OUT/IN</u> | <u>UAVIONIX ECHO UAT / SKYFY</u> |

EIFS: **MGL ENIGMA**

Transponder: **Sandia STX 165**

EFIS Magnetometer / Compass: **MGL SP6**

EFIS AHRS **MGL SP7**

Strobe and Nav Lights **Aveo Engineering Powerburst NG**
Daylite

Magnetic Compass **Falcon MCVC-2L**
S/N: 180110060

15. Smoke System (when fitted)

A smoke system injects smoke oil into the exhaust system to create a visible trail of oxidized smoke.

Smoke Oil is stored in a 1 gall tank in the passenger compartment. When the system is actuated by a switch next to the mixture control an electric pump under the seat pan pumps oil through a needle valve to a manifold on the firewall. Stainless armored lines deliver the oil to injectors installed on the No 2 and 4 exhaust pipes to be burned.

The burned smoke exists the aircraft by the exhaust tail pipes.

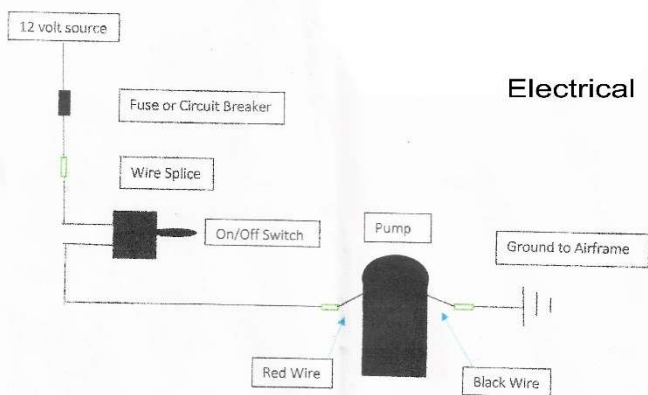
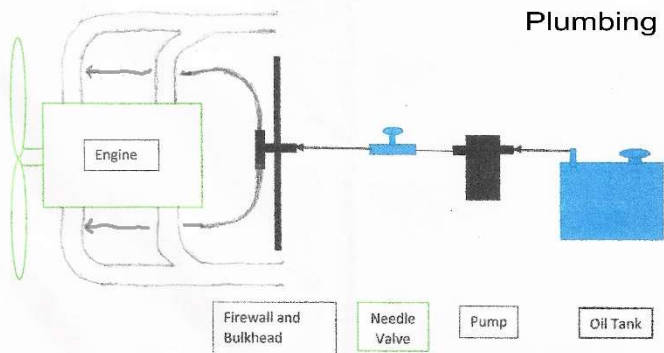
In general:

- The system needs maximum EGT's to fully vaporize the oil in the area of 700 C
- Oil should have a flash point of 250-300 C
- Oil should be delivered at a rate of approximately 0.5 gall / min, controlled by the needle valve. This gives an endurance of approximately 2 mins of smoke.

Full procedures are on the checklist in the aircraft

Weight and Balance – 1 Gall of Smoke oil weight approximate 7lb and the tank is at an arm of 110 inches

Smoke System Schematic



Smoke System Equipment - Locations



Injector right Exhaust



Oil Tank



Fuse

Needle Valve

Firewall Aft



Firewall Forward



On/Off Switch by Mixture

16. Abandon Aircraft

In the event the aircraft becomes uncontrollable for any reason a prompt decision must be made to abandon the aircraft.

Assuming a parachute is worn - the suggested abandon aircraft drill in this order is:

- Mixture CUT OFF
- Master and Mags OFF
- Headset FLICK BACK INTO BAGGAGE COMPARTMENT
- Canopy Lock Pin – PULL
- Canopy Latch – LIFT AND PUSH UP INTO SLIPSTREAM
- 4 point harness – UNBUCKLE AND THROW TO SIDES
- Crouch on seat pan and SPRING CLEAR OF AIRCRAFT

Outside Aircraft

- Right / Both hand(s) in to D Ring OUT AND BACK PULL
- D Ring THROW AWAY
- Steering IDENTIFY TOGGLES
- Landing INTO WIND
- Posture PARACHUTE LANDING FALL

NOTES

-

Assuming a “Softie” type Emergency Rig. A fully developed canopy takes 2-3 seconds while travelling at terminal velocity and uses 300-500ft

An Aerobatic Safety Floor of 1,500ft will barely give time to successfully abandon the aircraft, get turned into wind and adopt a landing posture.

Parachute Landing Fall – Feet and knees tight together and flex knees and ankles into a slight bend. While steering with hands - clamp elbows tightly either side of head. On contact with ground allow body to “break” across ankles, knees, hips, back and shoulders to dissipate energy - rolling in direction of travel.

After landing collapse parachute by hauling in on ONE riser only. Even if being dragged across ground – keep pulling in on one riser till chute collapses.

17. Passenger Disclaimer Form

[To be read and signed by all passengers before flight]

I, _____ acknowledge having been informed that:

1. The Sonex aircraft, N360GS, is an Experimental aircraft; Airworthiness of this aircraft cannot be certified. However, maintained by the owner to the best of his knowledge and ability.
2. The aircraft is for recreational use only, and may not be operated for remuneration. Passengers are taken as an act of friendship and courtesy, and at their own risks.
3. Risks are inherent to experimental aircraft operation.

I hereby:

4. Indemnify the owner/operator and his next of kin for any loss or damage occurred during operation.
5. Declare that I have not made any financial arrangement with the owner/operator with regards to payment of the flight, except for voluntary sharing of the aircraft operating cost, which is limited to fuel, oil costs and airport fees.

Made at _____, this _____ day of _____

[Signed]

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