Sonex Aircraft

19-8656

Pilot's Operating Handbook

Revision 1
Updated 8/May/2016

Pilot's Operating Handbook

Make:	Sport Aircraft Club
Model:	Sonex
Serial Number:	1631
Registration Number:	19-8656
Date of Certification:	Nov 12, 2015
First Flight:	Nov 21, 2015

Owner Information

Name:	Sport Aircraft Club of SA
Address:	c/o 21 Wilsden Street Walkerville SA 5081
Telephone:	0411196232
Email Address:	cpmoore@internode.on.net

Kit Manufacturer:	Sonex Aircraft LLC
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I. Introduction and Description

The Sonex is a high-performance, homebuilt aircraft. Its compact external size and extremely efficient design results in superb performance and unequaled fuel economy using a relatively low horsepower engine. Even though the Sonex has relatively low horsepower, it can outperform many general aviation aircraft while retaining unequaled fuel economy. Typical cruise speed is 105 knots, burning under 15 litres per hour, yielding fuel economy in excess of 10 litres per 100km.

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

The engine that powers the Sonex is an AeroVee 2180 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, offering superior operation, power, and efficiency in all modes of operation.

Flight Controls

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

An in-flight cockpit adjustable pitch trim system is provided. A rotating wheel in the lower centre of the panel pulls or releases a cable which via a spring pulls on the main pitch operating rod. The primary pitch control system (i.e. the stick) can override any position of the trim system.

Engine Controls

The throttle, identified with a black handle, is located in the left of the instrument panel. It is a lever style cable actuator with an adjustable friction nut to hold the position set. A push pull mixture control is located to the front of the throttle, and is identified by a red handle.

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 steerable nose wheel swivel tube is welded to the engine mount. 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.

Brakes

The braking system consists of mechanical drum brakes on each main tyre, cable actuated by an aluminum lever in along the left hand cockpit sidewall. A catch bracket serves as a parking brake.

Fuel System

The 60 litre main fuel tank is located just aft of the firewall above the occupant's legs. Unusable fuel quantity is less than 2 litres. Fuel is delivered by gravity feed. A fuel shutoff valve is located inside the cockpit at the tank outlet, consisting of a ¼ turn ball valve. The fuel valve is closed by pulling the actuating knob mounted to the right of the trim wheel on the lower part of the panel. A capacitance fuel probe is installed to measure fuel quantity. Fuel level should be checked while in level, balanced flight to avoid inaccurate fuel quantity measurements. The fuel filler cap is located on the upper forward fuselage, accessible from the outside of the aircraft through the fuel filler door in the cowling. Approved fuel is 100LL aviation fuel. Care needs to be taken not to spill fuel onto the windscreen during refueling.

Engine Cowling

The cowling is split into right and left sections. To remove the cowling, loosen the screw fasteners along the upper firewall, in addition to a single screw located just below the engine air intake. Next, remove the upper and lower piano hinge pins, thereby separating the right and left cowling sections. Next the three hinge pins at the bottom of the lower cowl are removed. Lastly, the hinge pins connecting the cowl section to the fuselage may be removed, and the cowling detached from the fuselage.

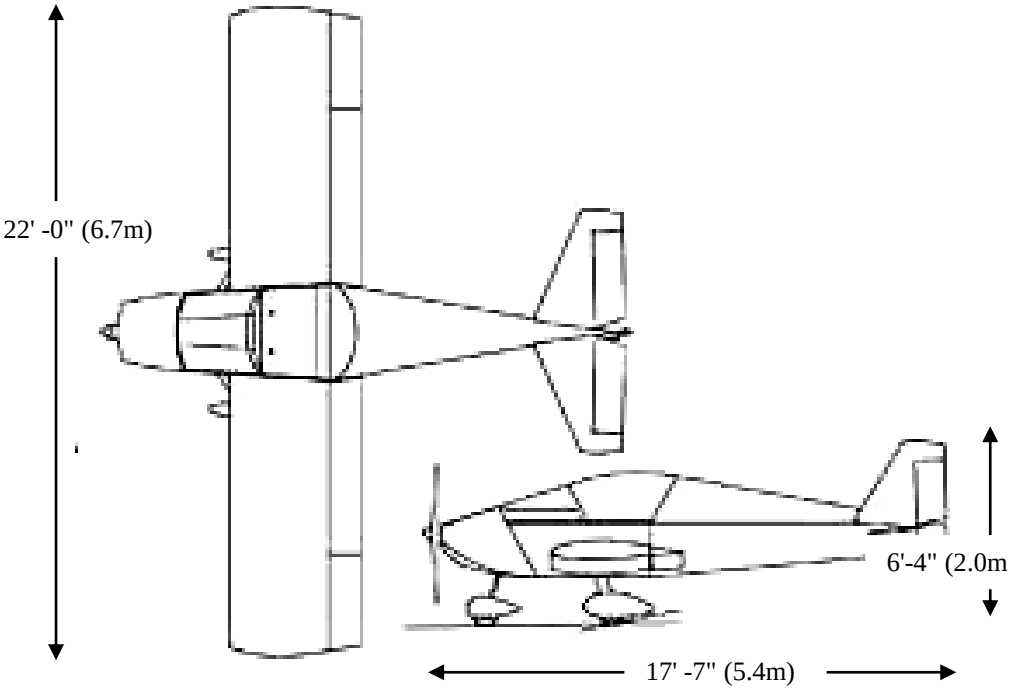
Baggage Compartment

A baggage compartment is provided aft of the occupants' seats. The baggage limit is 18kg. Depending on the pilot, passenger, and fuel loads to be carried, baggage may have to be limited to remain within gross weight and/or center-of-gravity (CG) limits.

Ventilation and Heating

NACA scoops on the forward fuselage sides provide fresh air ventilation. These scoops feed into rotating eyeball vents mounted in the corners of the instrument panel. The flow of air can be directed and controlled by adjusting the vent opening. No cabin heat is installed.

II. Aircraft Specifications



2 View Diagram

Exterior Dimensions

Span:	22 ft (6.7m)
Length:	17 ft, 7 in (5.4m)
Height:	6 ft, 4 in (2.0m)
Wing Area:	98 sq ft (9.1m^2)

Weights

Empty Weight:	307kg
Gross Weight:	500Kg
Aerobatic Gross Weight:	N/A
Useful Load:	193Kg
Fuel (60 litre):	46kg
Full Fuel Payload:	147kg
Max Baggage:	18kg

CG Limitations

Datum	Front of Spinner
Mean Aerodynamic Cord:	54"
Forward CG Limit:	1620mm aft of datum
Aft CG Limit:	1786mm aft of datum
Acro CG Limits:	N/A

Loadings

Wing Loading:	59.5kg/m^2
Power Loading:	15 kg/hp
Load Factor Limit	
- 950 lbs	N/A
- 1200 lbs	+4.0, -2.0

Powerplant

Engine:	AeroVee 2180cc, 80 HP
Prop:	Sensenich 54x44 (W54JV5L44G) AH1067

Control Surface Deflections

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

Engine Information

Specifications

Model:	AeroVee 2180cc VW Conversion
Serial #:	0850
Carburetor:	AeroInjector ACV-C03-32mm
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 (76 Kg)
Rated HP:	80
Rated RPM:	3400
Maximum RPM:	4000
Cruise RPM:	3000 +/- 200

Idle RPM:	1000-1200
Bore:	92mm
Stroke:	82mm
Compression Ratio:	8.2:1
Firing Order:	1-4-3-2
Valve Gap Adjustment:	.006-.008" (0.15-0.2mm)
Alternator:	20 amp

Ignition

Timing:	Fixed @ 28° BTDC
Ignition Module Gap:	.010 - .014" (0.25-0.35mm)
Spark Plugs:	Autolite MP4163
Plug Gap:	Top: .018" (0.45mm) Bottom: .032" (0.80mm)

Ignition System: "Primary" Switch

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

Ignition System: "Secondary" Switch

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

Fuel

Approved Fuel Grades:	100LL Avgas
Total Fuel Capacity:	16 US Gallons (60.5 litres)
Usable Fuel:	Approximately 15.8 US Gallons (60.0 litres)

Lubricant

CAUTION
Do <u>not</u> 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.

Type:	SAE 20W-50
Oil Sump Capacity:	2 ¾ Quarts (2.60 litre)

Oil Cooler Capacity:	½ Quart (0.47 litre)
Oil Filter Capacity (approx)	½ Quarts (0.47 litre)

Operating Conditions

Cylinder Head Temp:	330ºF-380°F desired, 450°F max (166ºC-193ºC desired, 232ºC max)
Exhaust Gas Temp:	1200ºF-1350°F desired, 1400°F max (649ºC-732ºC desired, 760ºC max)
Oil Temp:	160°F min, 230°F max (71ºC min, 110ºC max)
Oil Pressure (psi):	20psi min, 100psi max, 30psi-40psi cruise
Fuel Pressure (psi):	Gravity feed (approx) 1.0psi

Airspeed Limitations

	Speed	IAS	Remarks
V_{NE}	Never Exceed Speed	**171 Knts**	Do not exceed this speed in any operations
V_{NO}	Maximum Structural Cruising Speed	**109 Knts**	Exceed this speed only in smooth air
V_A	Maneuvering Speed	**109 Knots**	Do not make full control movements above this speed. Full elevator deflection will result in a 6 G load at this speed
V_{FE}	Maximum Flap Extended Speed	**87 Knots**	Do not exceed this speed with flaps down
V_y	Best Rate of Climb	**70 Knots**	
V_x	Best Angle of Climb	**68 knots**	
V_S	Stall Speed Clean	**40 Knots**	
V_{SO}	Stall Speed Landing Configuration	**35 Knots**	

Airspeed Indicator Markings

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

Maneuvers – Aerobatic Category

Aerobatic operations are not permitted

Inverted Flight

Aerobatic maneuvers are not permitted

Required Placards

The following placards must be in full view of passengers:

WARNING

This aircraft is not required to comply with the safety regulations for standard aircraft.

PERSONS FLY THIS AIRCRAFT AT THEIR OWN RISK

III. Performance

Speed	**500kg**
Top Speed:	122 knots
Cruise: 75% power @ 8000 ft	113 knots
Cruise: 55% power @ 8000 ft	104 knots
Stall Speed:	37 knots

Ground Performance	**500kg**
Takeoff Distance:	1000 ft (305m)
Landing Distance:	850 ft (259m)

Climb / Ceiling	**500kg**
Rate of Climb:	480 fpm
Ceiling:	10,500 ft

Endurance	
Fuel Quantity:	60 litres
Fuel Consumption: 100%	22 lt/hr
Fuel Consumption: 75%	16 lt/hr
Fuel Consumption: 55%	12 lt/hr
Range: 75% @ 4000 ft	434 nautical miles
Range: 55% @ 8000 ft	603 nautical miles

Note: Performance values are stated at Sea Level, Standard Temperature and Pressure, unless otherwise noted.

CALCULATED CRUISE PERFORMANCE
(Full Fuel 60 litres)

Altitude (Feet)	RPM	% BHP	TAS (Knots)	Fuel Flow (litre/hr)	Endurance (Hours)	Range (Nautical Miles)
S.L.	3300	100	113	22	2.8	316
	3200	87	109	19	3.2	348
	3100	77	104	17	3.6	374
	3000	70	100	15	4.0	400
	2900	60	96	13	4.7	451
	2800	55	91	12	5.1	464
4000	3300	87	122	19	3.2	390
	3200	76	117	16	3.7	433
	3100	67	113	14	4.2	475
	3000	61	108	13	4.6	497
	2900	52	103	11	5.4	556
	2800	48	98	10	5.9	578
8000	3300	77	131	17	3.6	471
	3200	67	126	14	4.2	529
	3100	59	121	13	4.7	569
	3000	54	116	12	5.2	603
	2900	46	111	10	6.1	677
	2800	42	106	9	6.6	700

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.

TIME, DISTANCE, & FUEL TO CLIMB

Weight (kg)	DA (Feet)	Climb Speed (Knt)	ROC (FPM)	From Sea Level		
				Time (Min)	Fuel (Litre)	Distance (Nautical Miles)
431	S.L.	70	480	0	0	0
	1000	70	460	2	3	1.7
	2000	70	425	4	4	1.7
	3000	70	390	7	7	4.3
	4000	69	355	10	10	6.1
	5000	69	315	12	13	12.2
	6000	68	285	16	16	14.8
	7000	67	250	20	19	18.2
	8000	66	210	24	23	22.6
	9000	65	175	29	27	27
	10000	65	140	35	31	31.3

TAKE OFF DISTANCE

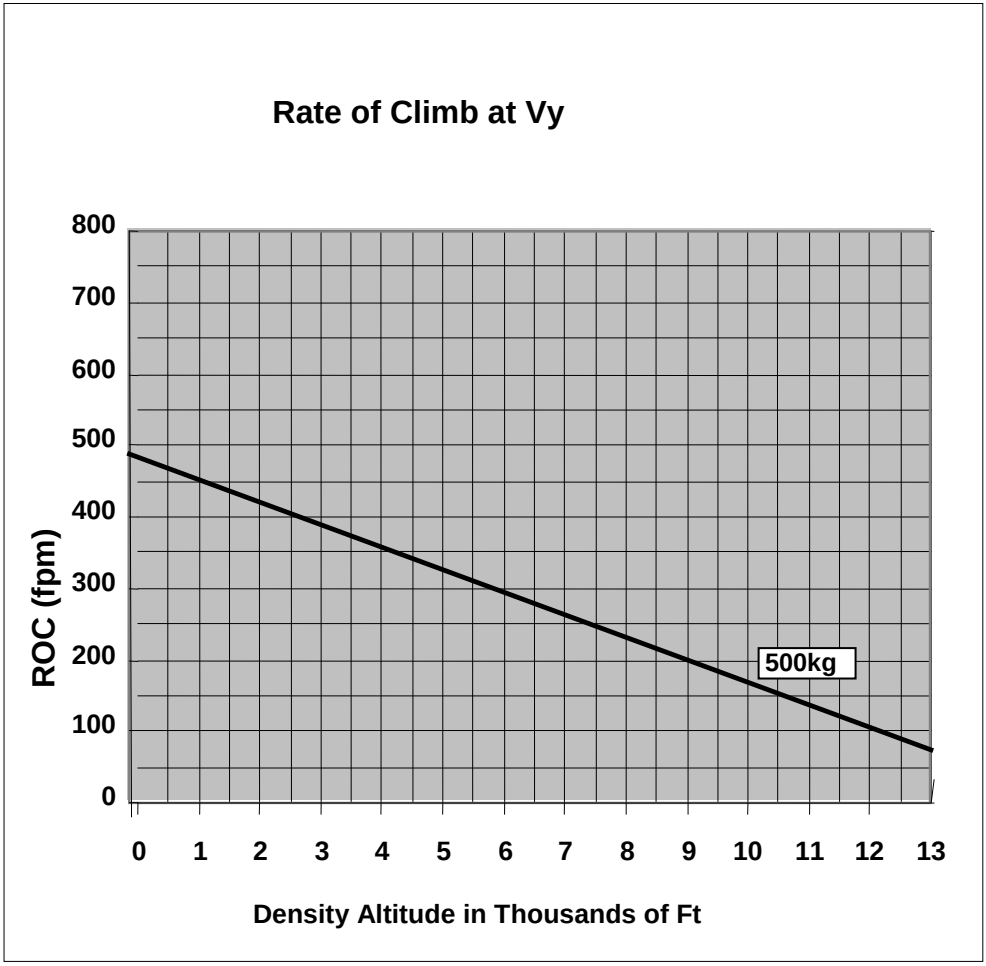
Elevation and Temperature	500 kg	
	Ground Run (Feet)	Over 50-ft Obstacle (Feet)
Sea Level @ 15° C	1000	1715
2500 ft @ 10° C	1190	2150
5000 ft @ 5° C	1430	2860
8000 ft @ 1° C	1650	7380

1. Figures for clean, level, hard surface runway.
2. Increase distance 10% for each 35° F increase in temperature above standard day temperature.
3. Increase distance by 10% for dry grass runway, 25% for wet grass.

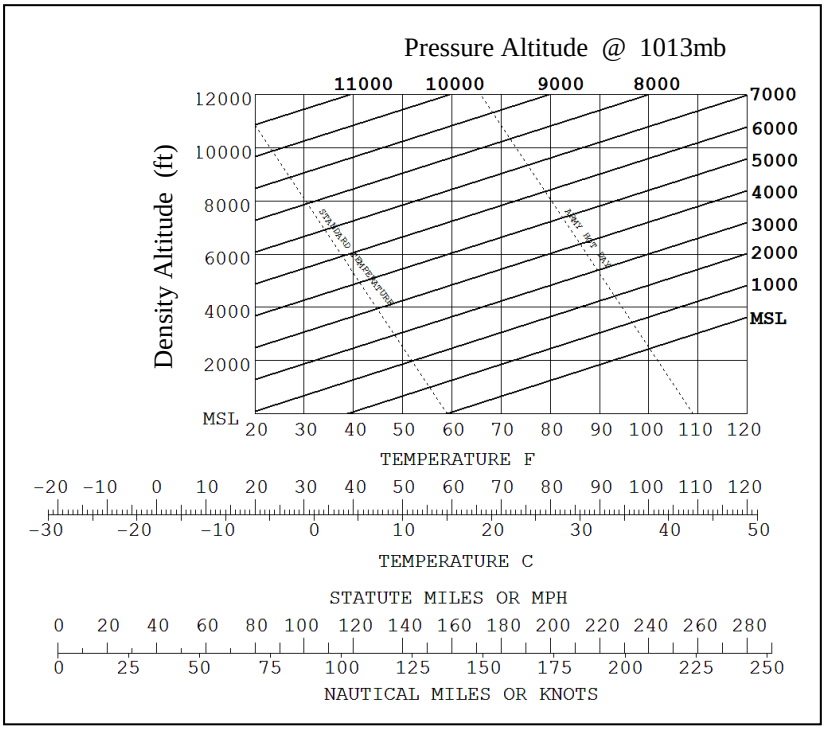
LANDING DISTANCE

Elevation and Temperature	500 kg	
	Ground Run (Feet)	Over 50-ft Obstacle (Feet)
Sea Level @ 15° C	650	1245
2500 ft @ 10° C	705	1300
5000 ft @ 5° C	765	1360
8000 ft @ 1° C	830	1425

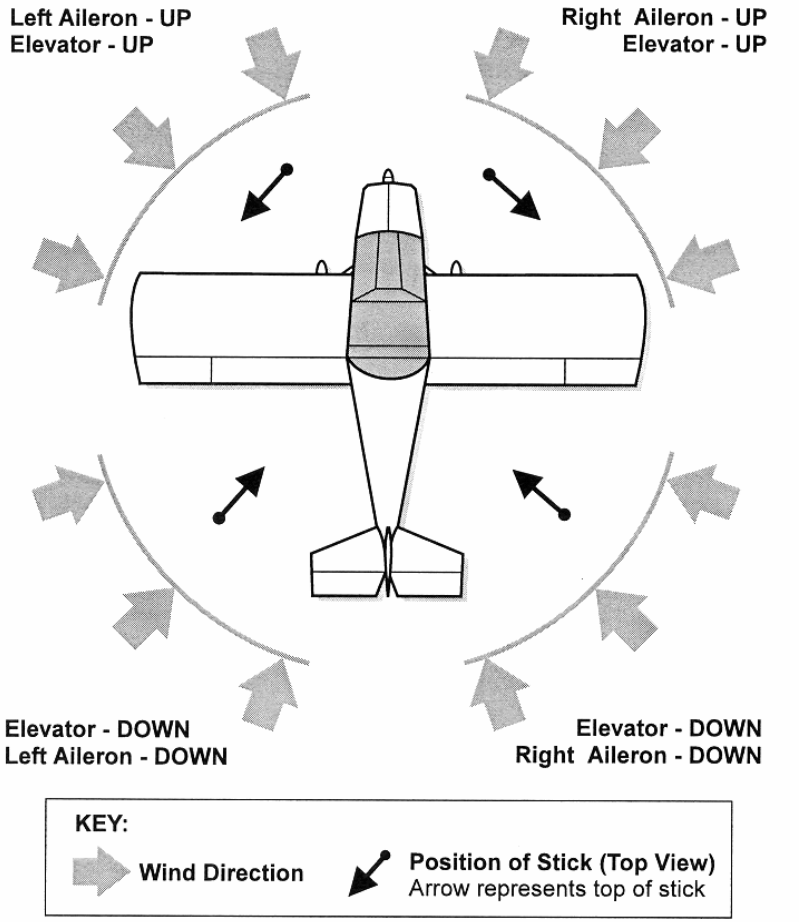
1. Figures for full flap, no wind conditions, on clean, level, hard surface runway.
2. Decrease distance by 30% for each 10 mph of head wind.
3. Increase distance by 50% for each 10 mph of tail wind.
4. Increase distance 10% for each 35° F increase in temperature above standard day temperature.
5. Increase distance by 10% for dry grass runway.


Rate of Climb at Vy
800
700
600
500
400
300
200
100
0
ROC (fpm)
500kg
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Density Altitude in Thousands of Ft

Estimating Density Altitude



CONTROL POSITIONS while TAXIING



IV. Engine Operation

The AeroVee 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 38º-66º 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 677-732º 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 677º -732º 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 stabilise in rpm and temperature for a few minutes. Once stabilised, 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 774º C – 804º 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 (193º C or less).

Rich of Peak (ROP): *691º C – 718º 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: *732º C – 746º C EGT*

Gradually reduce the mixture setting until EGTs on the hottest cylinders reach 732º C – 746ºC. Continue to monitor CHTs to ensure they remain within limits. This setting will generally produce the best power.

Lean of Peak (LOP): *746º C – 771º 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: *750º C - 800º C EGT*

The engine is under maximum stress when EGTs are approximately 25º C - 50º C rich of peak. This generally corresponds to EGTs of approximately 750º C - 800º 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.

V. Weight and Balance

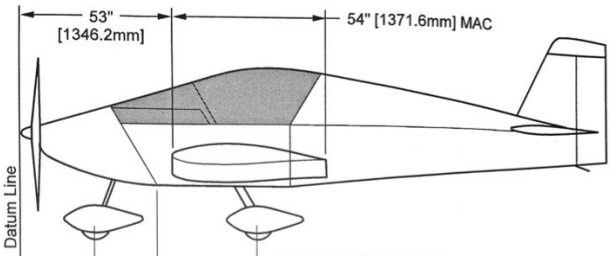
Weight and Balance Report

Make: Sonex **Model: Trigear** **Serial #: 1631** **Registration #: 19 - 8656**

Datum: Front Tip of Spinner
Aircraft Leveled by placing bubble level on top fuselage longitudinal at cabin

Maximum Gross Weight: 500 kg

Forward CG Limit: **1620mm** (20% MAC)
Aft CG Limit: **1786mm** (32% MAC)



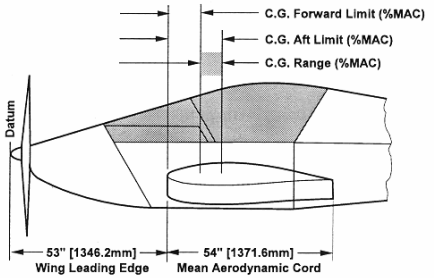
EMPTY WEIGHT			Wt. X Arm
Weighing Point	**Weight (kg)**	**Arm (in)**	**Moment**
Right Main	118.9	1985.0	236016.5
Left Main	118.8	1985.0	235818.0
Nose Wheel	69.3	620.0	42966.0
Equipment added or removed after weighing aircraft:			
			0.0
			0.0
			0.0
TOTAL	307		514800.5
MOMENT / WEIGHT = EMPTY WEIGHT CG (in)			**1676.9**

Installed Equipment
MGL Comm Radio
MGL iEFIS Dicovery Lite
UMA Airspeed Indicator
Seat Cushions

	MOST AFT C of G		
Item	**Weight (kg)**	**Arm (mm)**	**Moment**
Aircraft Empty	307.0	1676.9	514800.5
Pilot	95.5	1953.0	186511.5
Passenger	0.0	1953.0	0.0
Fuel	0.0	1162.0	0.0
Baggage (max 20 kg)	20.0	2590.0	51800.0
TOTAL	422.5		753112.0
MOMENT/WEIGHT		Most Aft CG	**1782.5**
		% MAC:	31.8
		Limit:	32

MOST FOREWARD C of G		
Weight (kg)	**Arm (mm)**	**Moment**
307.0	1676.9	514800.5
6.0	1953.0	11718.0
0.0	1953.0	0.0
42.0	1162.0	48804.0
0.0	2590.0	0.0
355.0		575322.5
Most forward CG		**1620.6**
% MAC:		20.0
Limit:		20

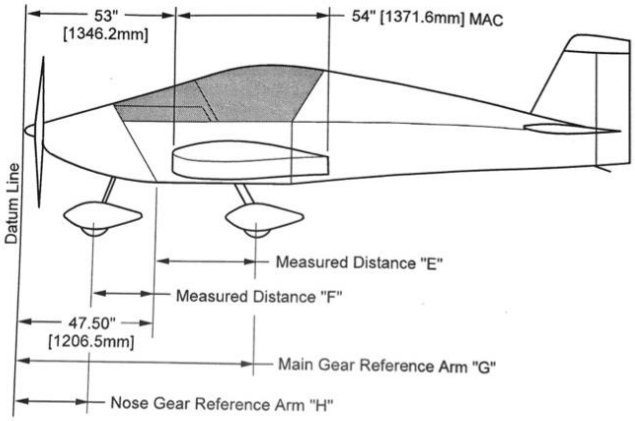
ALLOWABLE CENTER OF GRAVITY RANGE



Utility Category

Maximum Forward C.G. ..... 20% MAC
Maximum Aft C.G. ..... 32% MAC

ARM DIAGRAM - TRICYCLE GEAR



Datum = Tip of Spinner

Measured Distance "E" = 778.5mm

Measured Distance "F" = 586.5mm

Main Gear Reference Arm "G" = 47.50" [1206.5mm] + "E" = 1985mm

Nose Wheel Reference Arm "H" = 47.50" [1206.5mm] - "F" = 620mm

Right Hand Main Gear Weight = 118.9 kg

Left Hand Main Gear Weight = 118.8 kg

Nose Wheel Weight = 69.3 kg

Blank Weight and Balance Worksheet

The following table can be used to determine the aircraft's weight and center of gravity for any loading situation. Complete the weight column in the table below using the fuel, baggage, and pilot/passenger weights for the situation being considered. Next, using the moment charts on the following pages, record the appropriate moments into the table. Use the Total Weight and Total Moment from the table to find the aircraft's loaded center of gravity using the Allowable Weight and Balance chart.

Weight x Arm = Moment

Item	**Weight** (kg)	**Arm** (mm)	**Moment** (mm-kg)
Aircraft, Empty	307	1677	514,839
Fuel		1162	
Pilot & Passenger		1953	
Baggage		2590	
Total		---	

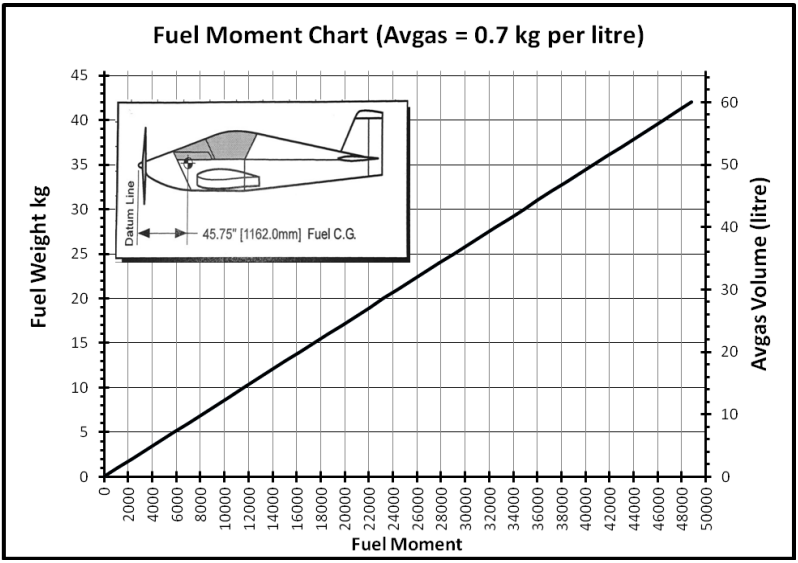
$$\text{CG (mm)} = \frac{\text{Total Moment}}{\text{Total Weight}} = \frac{\quad}{\quad}$$

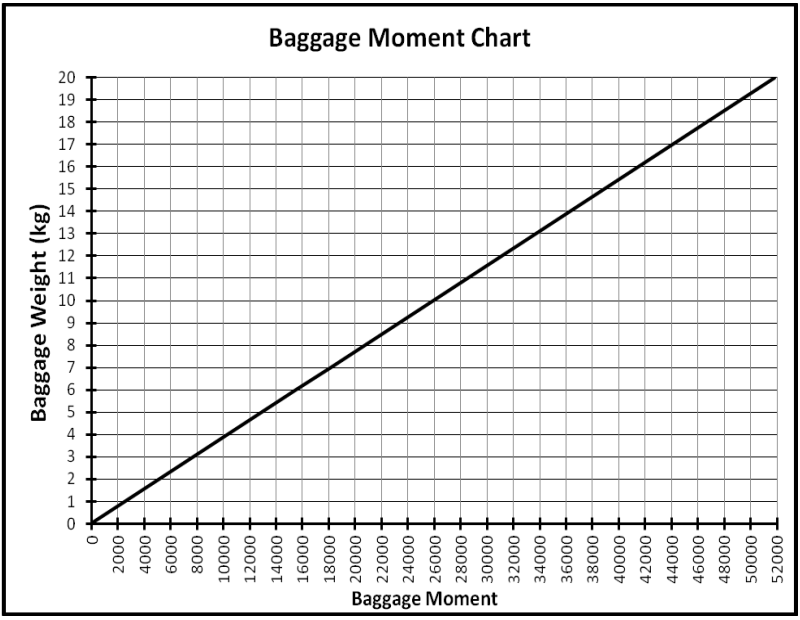
CG (mm) = _____

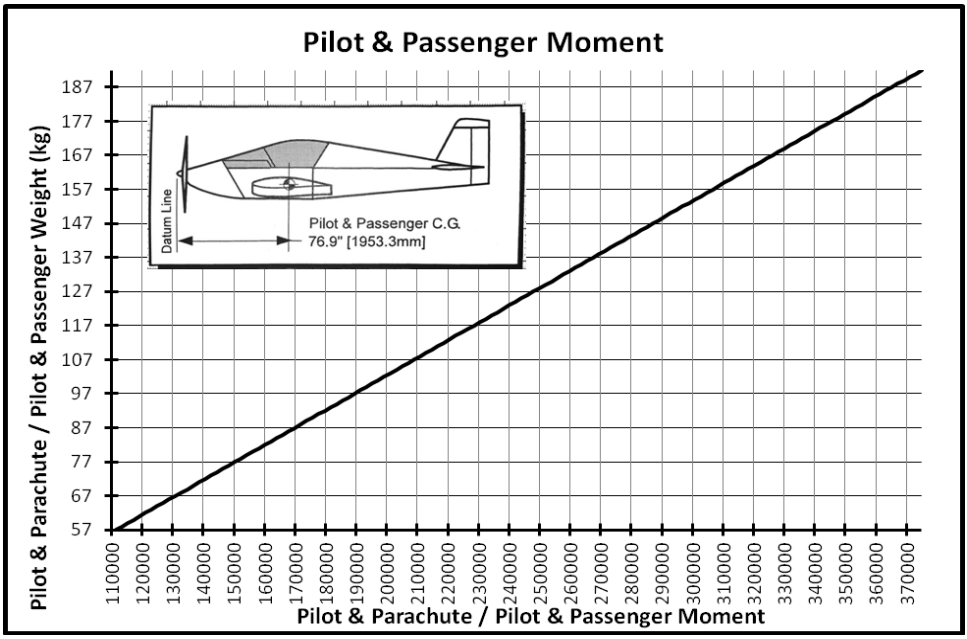
Safe to Fly? YES ☐ / NO ☐

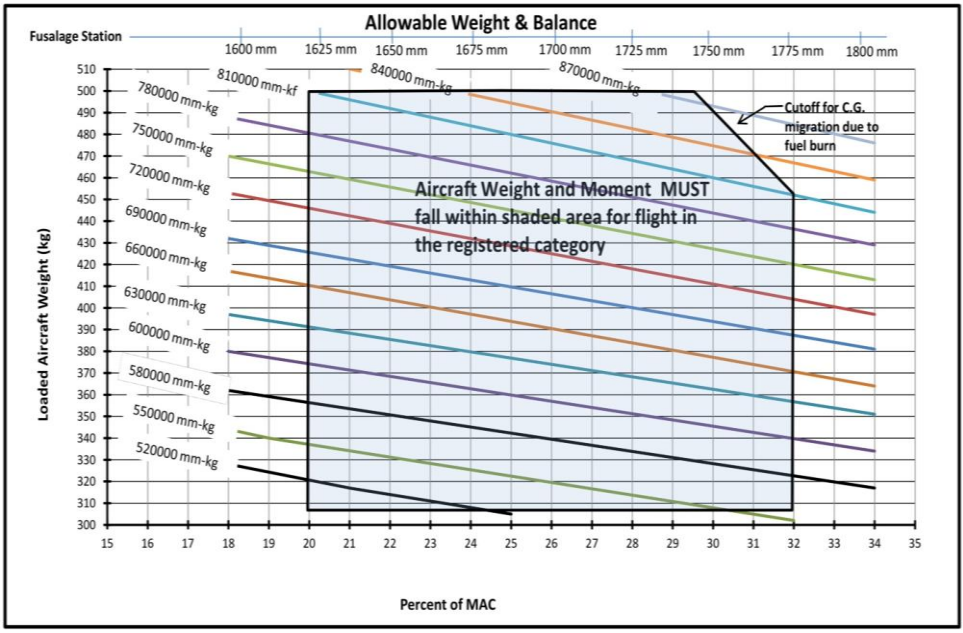
Note: Pitch stability is significantly reduced at C.G. conditions aft of 1775.5mm. Exercise caution when operating from 1778mm – 1786mm.

Moments


Fuel Moment Chart (Avgas = 0.7 kg per litre)
Fuel Weight kg
Avgas Volume (litre)
Fuel Moment
Datum Line
45.75" [1162.0mm] Fuel C.G.


Baggage Moment Chart
Baggage Weight (kg)
Baggage Moment


Pilot & Passenger Moment
Pilot & Parachute / Pilot & Passenger Weight (kg)
187
177
167
157
147
137
127
117
107
97
87
77
67
57
Datum Line
Pilot & Passenger C.G.
76.9" [1953.3mm]
110000
120000
130000
140000
150000
160000
170000
180000
190000
200000
210000
220000
230000
240000
250000
260000
270000
280000
290000
300000
310000
320000
330000
340000
350000
360000
370000
Pilot & Parachute / Pilot & Passenger Moment


Allowable Weight & Balance
Fusalage Station
1600 mm
1625 mm
1650 mm
1675 mm
1700 mm
1725 mm
1750 mm
1775 mm
1800 mm
Loaded Aircraft Weight (kg)
510
500
490
480
470
460
450
440
430
420
410
400
390
380
370
360
350
340
330
320
310
300
810000 mm-kf
840000 mm-kg
870000 mm-kg
780000 mm-kg
750000 mm-kg
720000 mm-kg
690000 mm-kg
660000 mm-kg
630000 mm-kg
600000 mm-kg
580000 mm-kg
550000 mm-kg
520000 mm-kg
Cutoff for C.G. migration due to fuel burn
Aircraft Weight and Moment MUST fall within shaded area for flight in the registered category
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
Percent of MAC

VI. Systems

Engine Information System (iEFIS)

The iEFIS integrates all engine and flight data into a single instrument. Information is displayed in a series of "Pages", each providing the pilot specific information **Display Pages**

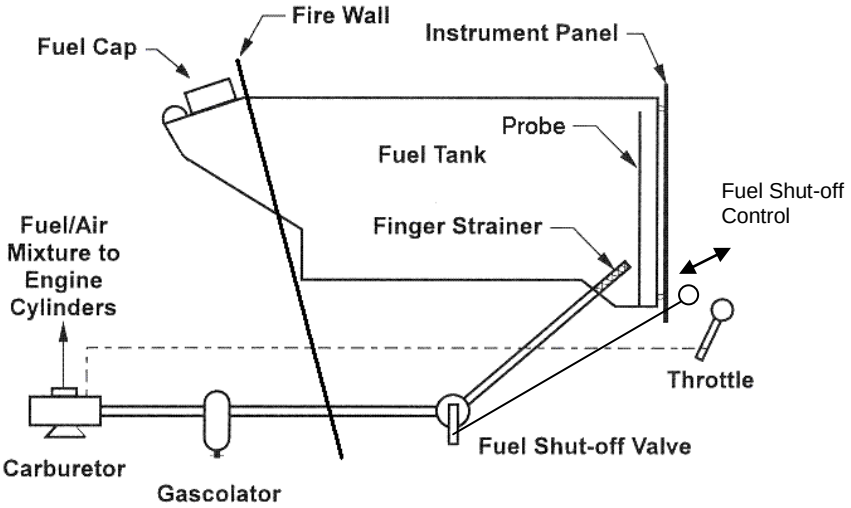
iEFIS

Details of the iEFIS are contained in the equipment section of the manual.

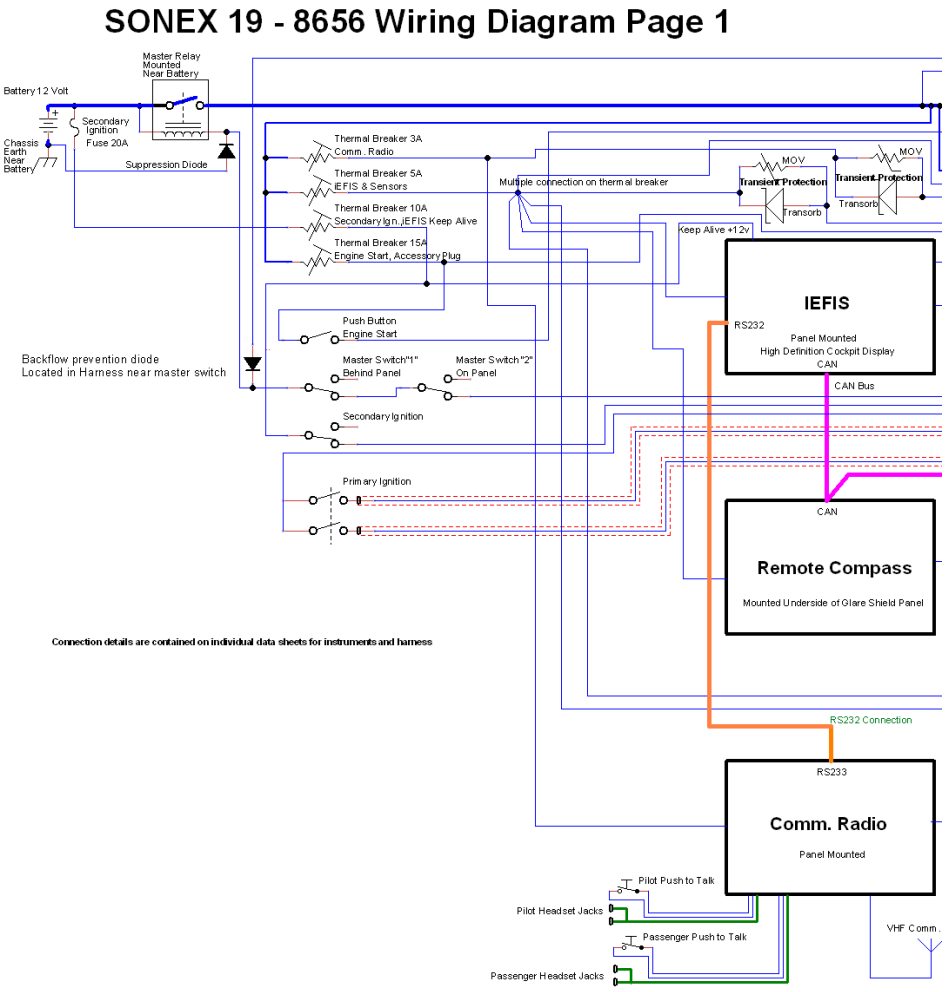
Engine information available on the 1st iEFIS screen

Fuel volume remaining (determined from a capacitor probe in the fuel tank)
Fuel volume remaining (determined by calculation from the fuel flow meter)
Fuel flow (litres per hour)
Tachometer RPM
Cylinder head temperature CHT (1 to 4 cylinders displayed from left to right) cº
Exhaust gas temperature EGT (1 to 4 cylinders displayed from left to right) Cº
Engine oil pressure PSI
Engine oil temperature cº
System voltage (Volts)
Alternator output current (Amps)
Air switch time
Tachometer Engine time

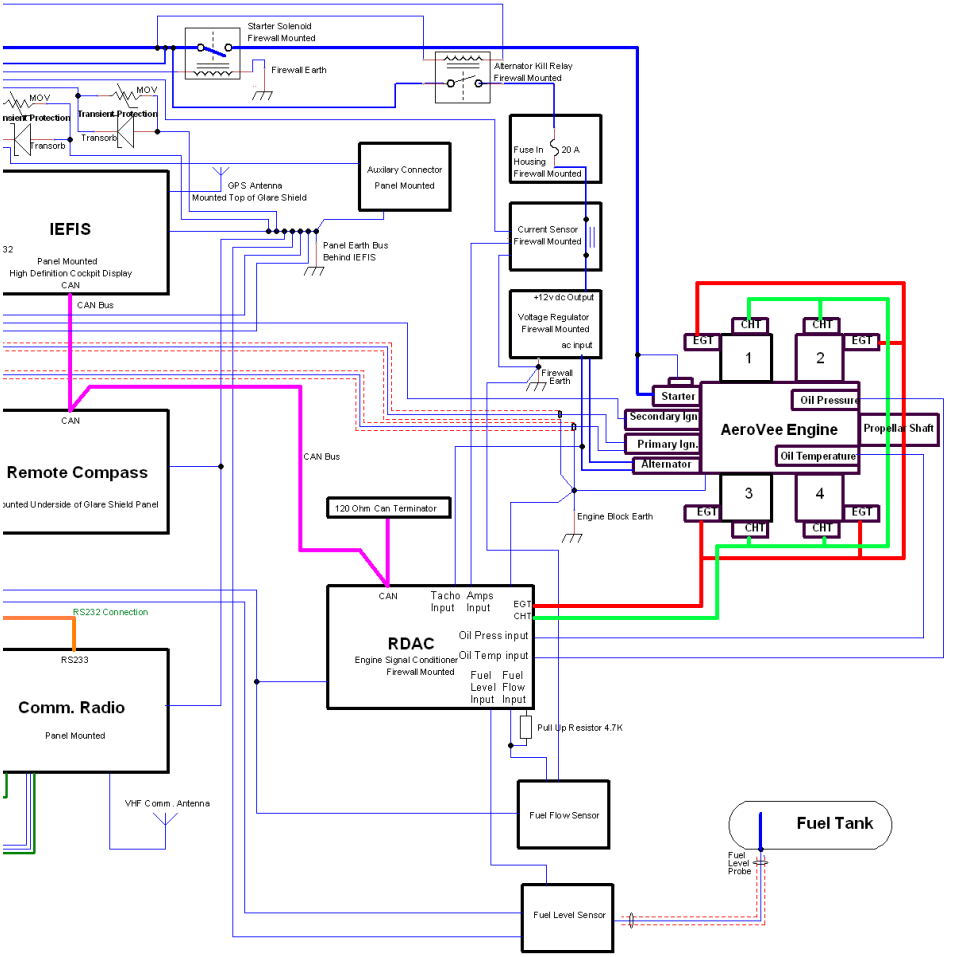
Fuel System Diagram



Electrical System Diagram



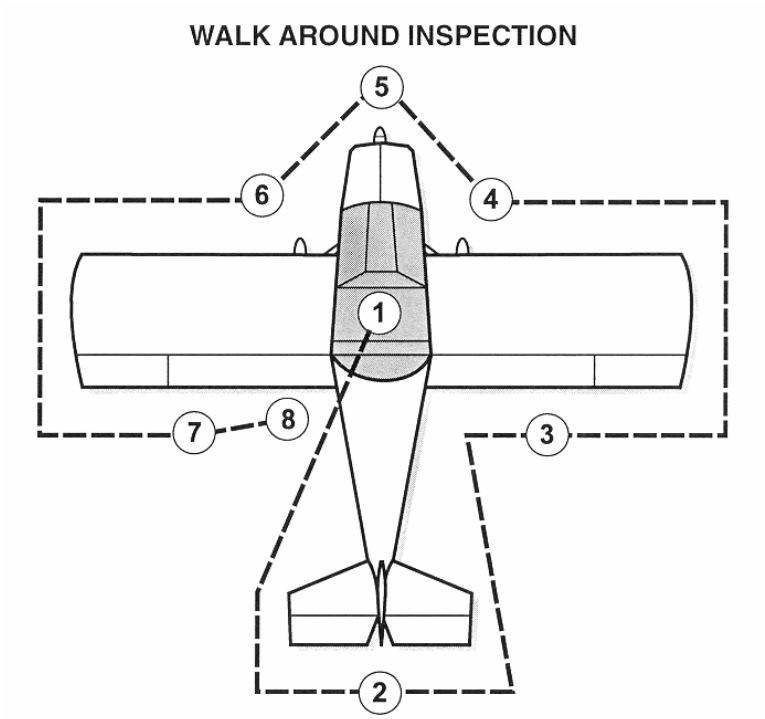
SONEX 19 - 8656 Wiring Diagram Page 2



Revision		
Date	Rev. No.	Details
19/1/16	1.1	Add alternator kill relay

Title		
Sonex Wiring		
Author		
Chris Moore Sport Aircraft Club		
File		Document
craft\Sonex Wiring manual page Version 1_1.dsn		
Revision	Date	Sheets
1.1	19th Jan 2016	1 of 1

VII. Pre-Flight Inspection / Checklist



1. CABIN

- Aeronautical Charts – **CURRENT & APPROPRIATE**
- Seat Belt Securing Control Stick - **RELEASE**
- Ignition Switches – **OFF**
- Master Switch – **ON** Check hidden security switch behind panel is up **ON**
- Fuel Gauges (iEFIS probe) – **CHECK** quantity visually against tank level
- Fuel Gauge (Calculated) – **SET** quantity using iEFIS "Action Menu"
- Flight Instruments – **SET** – iEFIS Altimeter
- Flaps – **DOWN**
- Master Switch – **OFF**
- Fuel Lock - **REMOVE**
- Fuel Knob- **ON** (pushed in - for checking gascolator valve)

2. EMPENNAGE

- Control surfaces – **REMOVE** Rudder **LOCK** - **CHECK** for movement & security
- Empennage fairing – **CHECK** for security
- Elevator trim – **CHECK** for movement & security
- Rudder cables – **CHECK** for condition & security
- Tail tie-down – **REMOVE**

3. RIGHT WING

- Aileron – **CHECK** for movement & security
- Flap – **CHECK** for security

4. RIGHT FRONT

- Wing Tie-Down – **REMOVE**
- Wheel Chock – **REMOVE**
- Pitot/Static Tube – **REMOVE** cover – **CHECK** for obstruction
- Main Wheel Tyre – **CHECK** for proper inflation
- Gear Leg Fairing – **CHECK** for security

5. NOSE

- Engine Oil Level – **CHECK** – 2 quarts minimum
- Propeller & Spinner – **CHECK** for nicks & security
- Cowl Fasteners & Hinge Pins – **CHECK** for security
- Cooling Inlets – **CHECK** for obstructions
- Fuel Tank Cap – **CHECK** for security
- Fuel Tank Vent – **REMOVE COVER** & **CHECK** for obstruction
- Gascolator Sump – **DRAIN** sump 4 seconds
- Exhaust – **CHECK** for security
- Nose Wheel Fairing **CHECK** for security
- Nose Wheel **CHECK** for proper inflation

6. LEFT FRONT

- Wing Tie-Down – **REMOVE**
- Wheel Chock – **REMOVE**
- Main Wheel Tyre – **CHECK** for proper inflation
- Gear Leg Fairing – **CHECK** for security

7. LEFT WING

- Aileron – **CHECK** for movement & security
- Flap – **CHECK** for security

8. COCKPIT

- Canopy – **CHECK** for condition
- Canopy Latch – **CHECK** for operation and security
- Fuel Knob – **OFF** (pulled out) closed after checking gascolator

VIII. Normal Procedures

BEFORE STARTING ENGINE

- Preflight Inspection – **COMPLETE**
- Passenger Briefing – **COMPLETE**
- Seat Belts & Shoulder Harnesses – **ADJUST & LOCK**

STARTING ENGINE

- Flaps – **UP**
- Brakes – **ENGAGED** to "park"
- Fuel Shutoff Valve – **ON**
- Master Switch **On**
- Throttle – **CRACKED OPEN** approx. 6mm
- Mixture – Push **RICH;** Wait 2-3 seconds to prime
- Propeller Area – "**CLEAR PROP"**
- Ignition Switches – **ON**
- iEFIS – **CHECK** for alerts
- Press **START**
- Oil Pressure – **CHECK**
- Throttle – **1600 RPM** for engine warm up

BEFORE TAKE-OFF

- Fuel Shutoff Valve – **ON**
- Flight Controls – **FREE & CORRECT**
- Elevator Trim – **NEUTRAL**
- Throttle – 2**000 RPM**
- Engine Run-up – **CHECK MAGS** – 100 RPM drop on each
- Mixture – **FULL RICH** (forward)
- Engine Instruments – **CHECK**
- Throttle – **1000 RPM**
- Flight Instruments – **SET**
- Radio – **SET**
- Seat Belts – **ADJUST & SECURED**
- Canopy – **CLOSED & LATCHED**

NORMAL TAKE-OFF

- Brakes – **RELEASE**
- Throttle – **FULL "OPEN"**
- Engine RPM – **3100 RPM** minimum
- Climb Speed – **70-80 MPH**

MAXIMUM PERFORMANCE TAKE-OFF

- Throttle – **FULL "OPEN"**
- Airspeed – **ROTATE** at 52 knots* * 56 knots with 2 people on board
- Engine RPM – **3100 RPM** minimum
- Climb Speed – **68 knots** (Vx)

CRUISE CLIMB

- Airspeed – **87-95 knots**
- Throttle – **3300 RPM** or full throttle
- Mixture – **LEAN** for best power
- Engine Instruments – **MONITOR** Temperatures

CRUISE

- Throttle – **3000 RPM**
- Trim – **ADJUST**
- Mixture – **LEAN** to 25° C rich of peak

BEFORE LANDING

- Mixture – **FULL RICH**
- Airspeed – **REDUCE** to 87 knots or less
- Flaps – **AS DESIRED**
- Airspeed – **61 knots***
- Throttle – **AS NEEDED** to maintain 61 knots*
  * 68 knots with 2 people on board

BALKED LANDING (GO AROUND)

- Throttle – **FULL OPEN**
- Flaps – **RETRACT** slowly
- Climb Speed - **68 knots**
- Climb out and re-enter traffic pattern

NORMAL LANDING

- Throttle – **CLOSED**
- Flaps – **AS NEEDED**
- Touchdown – Full stall with stick full back
- Landing Roll – Maintain straight line down runway
- Brakes – Minimum required

AFTER LANDING

- Flaps – **UP**
- Taxi – At slow walking speed, observe other traffic

ENGINE SHUTDOWN

- Throttle – **1000 RPM** for engine cool down
- Ignition Switches – **CHECK** for cut-off
- Mixture – **IDLE CUT-OFF** (pulled full out)

After Engine Stops

- Ignition Switches – **"OFF"**
- Fuel Shutoff Valve – **"OFF"**
- Master Switch – **"OFF"**

Note: Failure to close fuel shutoff valve may result in fuel flowing from the AeroCarb after shut-down.

SECURE AIRCRAFT

- Brakes – **ENGAGED** to "park" as required
- Master & Ignition Switches – **CHECK OFF**
- Fuel Shutoff Valve – **CHECK "OFF" & INSTALL LOCK**
- Throttle – **FULL CLOSED**
- Mixture – **IDLE CUT-OFF** (pulled full out)
- Cockpit – **CLEAN & SECURE**
- Seat Belt – **SECURED** around control stick
- Canopy – **LATCHED AND LOCKED**
- Pitot Tube & Fuel Vent – **INSTALL COVERS** as required
- Rudder Lock – **INSTALL** as required
- Wheel Chocks – **INSTALL** as required
- Wing & Tail Tie-Downs – **INSTALL** as required

IX. EMERGENCY PROCEDURES

POWER LOSS ON TAKEOFF

- Stick – **FORWARD**
- Airspeed – **68 knots**
- Throttle – **CLOSE**
- Mixture – **IDLE CUT-OFF**
- Fuel Valve – **OFF**
- Master & MAG Switches – **OFF**
- Flaps – **AS REQUIRED**
- Land and/or Stop Straight Ahead
- Brakes – **AS REQUIRED**

POWER LOSS IN FLIGHT

- **TRIM FOR BEST GLIDE – 68 knots**
- Note Wind Direction & Velocity
- PICK A LANDING SPOT
- Mixture – **FULL RICH**
- Fuel Valve – **ON**
- MAGS – **ON**
- Master – **ON**
- Engine – **CHECK iEFIS**

If Power Not Restored & Time Permits

- Maintain Best Glide – **68 knots**
- Radio – **121.5** – CALL MAYDAY
- Mixture – **IDLE CUT-OFF**
- Fuel Selector – **OFF**
- Master – **OFF**
- Flaps – **AS NEEDED**
- Canopy – **Remove Lock Pin**
- Seat Belts & Shoulder Harnesses – **PULLED TIGHT**

ROUGH ENGINE

- Mixture – **ADJUST**
- Fuel Selector – **ON**
- MAGS – **CYCLE SWITCHES in sequence**
- Run On Best Settings
- Locate Suitable Landing Site & Land ASAP
- Prepare For Off Field Landing If Necessary

OIL PRESSURE LOSS

- Locate Suitable Landing Site & Land ASAP
- Prepare For Off Field Landing If Necessary

HIGH OIL TEMPURATURE

- Reduce Power
- Increase Airspeed
- Observe Trend

  If Oil Temperature Cannot Be Stabilized
- Locate Suitable Landing Site & Land ASAP
- Prepare For Off Field Landing If Necessary

ENGINE FIRE DURING START-UP

- Throttle – **FULLY OPEN**
- Starter – **CRANK**
- Mixture – **IDLE CUT-OFF**
- Fuel Selector – **OFF**
- Master and MAG Switches – **OFF**

ENGINE FIRE IN FLIGHT

- Fuel Selector – **OFF**
- Throttle – **CLOSED**
- Mixture – **IDLE CUT-OFF**
- Master & MAG Switches – **OFF**
- Locate Suitable Landing Site & Land ASAP

X. SERVICING REQUIREMENTS

Exterior Care

The paint may be washed with mild soap and waxed with automotive waxes as desired. Polished aluminium may be wiped with alcohol based cleaners and re-polished with Nuvite system as required.

Windshield and Canopy Care

The windshield and canopy are polycarbonate. Care must be taken to keep the plexiglas clean and unscratched. Flush away grit with water to prevent scratching, then wash with water with mild detergent or commercial plexiglas cleaner, such as Windex or similar. Never use benzene, gasoline, acetone, carbon tetrachloride, lacquer thinner or glass cleaner to clean plastic. These materials will damage the plastic and may cause severe crazing.

Brakes

19 – 8656 uses Azusa mechanical drum brakes, purchased through Sonex Aircraft. The brake shoes are integral to the unit, and can only be removed through disassembly. Shoes should be checked for wear annually. Normal brake shoe life is estimated at 500 hours.

Propeller

The Sensenich propeller is a composite coated, laminated wood propeller. It is extremely durable, and resistant to corrosion and damage. Re-torque propeller bolts every 50 flight hours, every 6 months, or with drastic seasonal changes. Proper torque is 145 inch-lbs, +/-15 inch lbs. Place the propeller in a horizontal position when not in use. Routine cleaning can be accomplished with mild detergents.

Tyres

Nankang/Shin 11-400x5 6-ply tyres and tubes are used. Tyres should be replaced when the remaining tread depth reaches 1/16". Inflate tyres 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.

Battery

The Odyssey PC625 battery is a high performance, sealed lead-acid 12 volt battery. It is rated at 16 amp-hours, and 625 cranking amps for 5 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.

Fuel and Oil Requirements

The AeroVee engine is rated for 100LL Octane Avgas. Do not use automotive fuel

Automotive 20W-60 multi-grade oil (Penrite or Castrol Magnetec) is used year round, although fully synthetic (Mobile 1 15W-50) or synthetic blends may be substituted. Oil change is recommended every 25 to 30 hours of operation, or every 4 months. An oil filter is used and it is recommended to change it at each oil change of the AeroVee engine. Oil filter part number is Ryco Z103 or Mahle OC51.

The aircraft is equipped with a fuel gascolator attached to the lower right side of the firewall. Inside the gascolator is a fine-mesh wire screen designed to filter out debris and contaminants. This screen should be inspected and cleaned every 100 hours, or annually. Replace screen as needed.

Spark Plugs

Spark plugs (Autolite MP4163) should be cleaned, tested, and re-gapped every 100 hours, or annually. Ensure CHT probe ring terminals are secured by a separate screw not under the spark plugs. Apply anti-seize lubricant and re-torque plugs to 240 in-lbs. Using 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 retaining bolt on the filter housing. Replacement filter elements are available from Sonex Aircraft (PN ACV-C10-33). Alternately, a K&N high performance filter (PN E-3120) may be directly substituted.

XI. Equipment List

Updated September 29, 2006

Engine: **AeroVee 2180**
SN: 850

Starter: **Sky-Tech**
Model: 122-12AV
SN: A2X-140524

Oil Cooler: **B&M Supercooler**
Model: 15K GVW
Jegs PN: 130-70265

Carburetor: **AeroCarb**
Model: ACV-C03
SN:850

Air Filter: **K&N**
Model: E-3120

Propeller: **Sensenich 55x44**
Model: W54LVG-44G
SN: AG-1605

Battery: **Odyssey PC625**
Catalogue Number: 0768-0001

Airspeed Indicator: **UMA**
UMA 2 -1/4 ASI, Serial #A6015
20 – 200 knots with custom markings

Comm: **MGL V6**

Engine Info System: **MGL Iefis**
Model: Discovery Lite

XII. Passenger Disclaimer Form

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

I, _____ acknowledge having been informed that:

1. The Sonex aircraft, 19-8656, is an Experimental aircraft; Airworthiness of this aircraft cannot be certified, however it is maintained by the owner to the best of his/her/their 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 cost and airport fees.

Made at_____, this _____ day of _____

_____

[Signed]

XII. Revisions List

Rev #	Description	Date