PILOT OPERATING MANUAL

KEA/S51D/G-CGOI/PM

STEWART S51D MUSTANG

Registration: G-CGOI
Serial No: 144
E2S

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SECTION 0

NOTES TO READERS

0.1 Revision Record

0.1 Revision Record

Revision:	Subject	Pages affected	date
1	Document introduced	1 to 47	14 Sept 14

SECTION 1

GENERAL

1.1 INTRODUCTION

1.2 DESCRIPTION OF AIRCRAFT

1.3 3 PLAN VIEW

1.1 INTRODUCTION

This Flight Manual has been printed to supply the pilot information for the correct, safe and efficient use of the aircraft. The Pilot must possess and know the contents of this manual.

1.2 DESCRIPTION OF AIRCRAFT

A. DESCRIPTION

The S-51 Mustang is an all-metal monoplane with two seats (one usable), and designed mostly for pleasure flying. It is built from a kit and has a single engine with a low wing. It has electric/hydraulic retractable landing gear and electric (screw jack) flap action.

B. SPECIFICATIONS

Number of seats : Originally designed for 2 seats but limited to single seat based on emergency egress

DIMENSIONS

Wing span	: 26 ft.9 inches / 8.15 Metres
Length	: 22 ft 4 inches / 6.70 Metres
Height	: 9 ft 4 inches / 2.84 Metres
Wing area	: 123 Sq ft / 11.4 Sq Metres

WEIGHT

Empty	: 2645lbs / 1200kg
Maximum at take-off	: 3400lbs / 1542kg

ENGINE

General Motors Big Block Chevy 509 cu in V8---500hp fuel injected.
Triple ignition, gear box dry sump 500HP at 4700 RPM at sea level.
Team 38 Marathon 509 Serial C509A040001

C. GEAR BOX

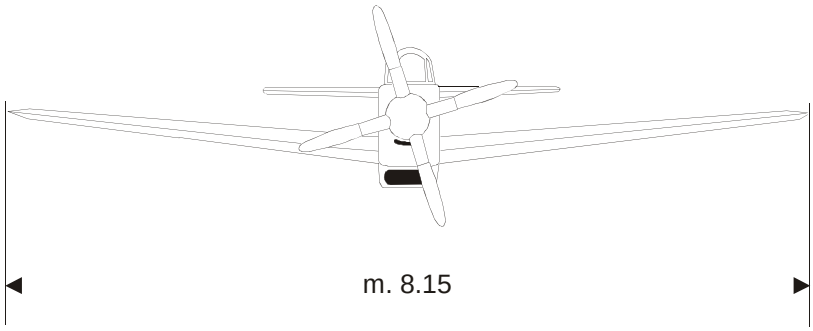
Reduction ratio: 2.13 to 1

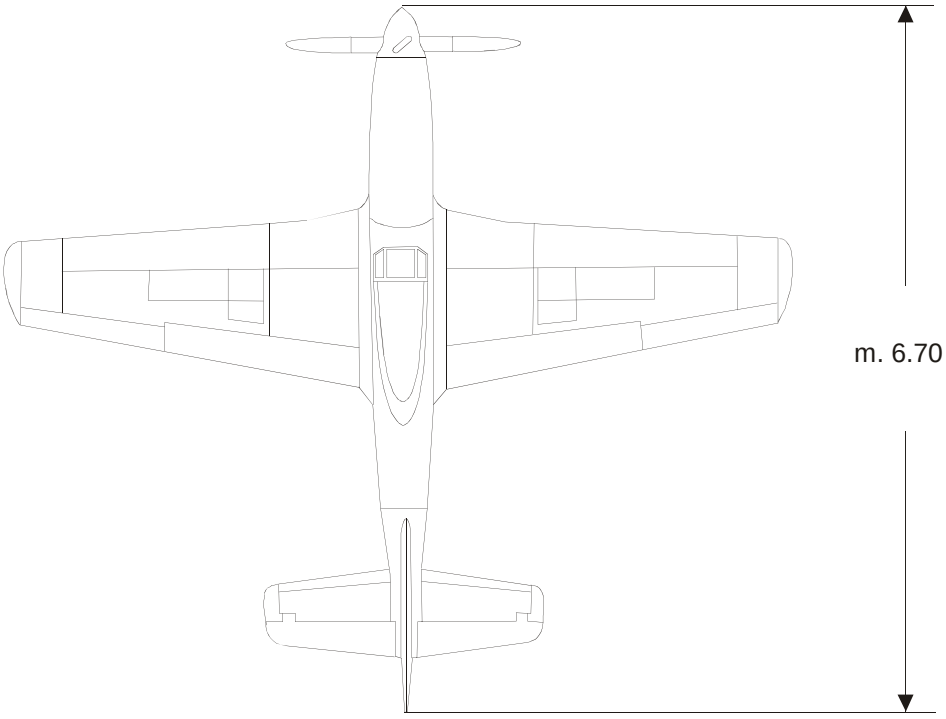
PROPELLER

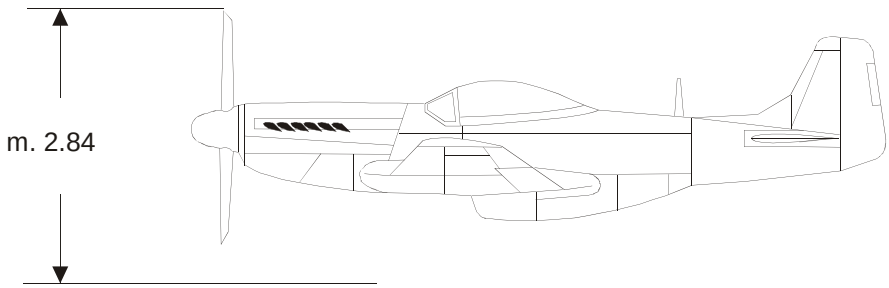
Four blades variable pitch Hartzell HC-B4TN-1AX2 Diameter 91".

1.3 3 PLAN VIEW

Mustang S 51D







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2.5 LOAD CENTER

2.6 MANOEUVRES

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2.8 HYDRAULIC SYSTEM

2.9 PILOT AND PASSENGER POSITION

2.10 TERMS OF USE

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2.12 PRESSURE ERROR CORRECTION

2 LIMITATIONS

2.1 INTRODUCTION

Section 2 includes usage, flight restrictions and instrument markings with placards that are needed for safe operation of the aircraft, engine, facilities and equipment standards.

2.2 SPEEDS

A SPEEDS – LIMIT at Maximum Take Off Weight

V_1: with not more than 20Deg. Flaps	90 KIAS
V_{NE}: never exceed speed	250 KIAS [288 for permit to test]
V_{NO}: normal operating:	200 KIAS
(Moderate turbulence)	190 KIAS
V_B: variable turbulence	150-190 KIAS
V_C: normal cruise	200 KIAS
V_{BR}: Best range speed @ 3500RPM	170 KIAS
V_A: manoeuvring speed	197 KIAS
V_{FE}: full flaps down	130 KIAS
V_{LO} / V_{LE}: gear down	115 KIAS
V_Y: Best rate of climb/sea level	108 KIAS
V_{BG}: Best power-off glide speed ROD 1995 fpm	95 KIAS
V_{AT}: Approach speed	95 KIAS
Touchdown speed	80 KIAS
V_S: Stall	
0 degrees flaps @ 3400lbs	77 KIAS
20 degrees flaps @ 3400lbs	73 KIAS
Full (40 degrees) flaps @ 3400lbs	69 KIAS

AIR SPEED MARKINGS

- Radial red line at 250 KIAS
- Yellow arc from red line to upper limit of the green line
- Green line from 77 to 200 KIAS
- White arc 69 to 130 KIAS
- Yellow triangle for recommended approach speed 95KIAS

2.3 LOAD FACTOR

LOAD FACTOR LIMIT
At maximum take-off weight +4.4G (plus) / -2.2G (negative)

2.4 MAXIMUM WEIGHTS

Take off	3400 lbs / 1542kg
Maximum baggage weight	75 lbs / 34kg

2.5 LOAD CENTER

Levelling: Longitudinal spar upper fuselage
Transverse: roof rails
Frame Station FS0.00 (datum) **3 inches aft** of tip of spinner

-Distance to the leading edge	77.70 inches
-Distance to the tail wheel	215.90 inches
-Distance to the main wheel	74.75 inches
-Distance to the pilot	114.90 inches
-Distance to the fuel	106.54 inches
-Distance to the passenger	145.10 inches
-Distance to the baggage	164.30 inches
-Distance to the MAC	56 inches

CG LIMITS

Forward:	85.1 inches aft of datum
Aft:	91.8 inches aft of datum

2.6 OPERATIONAL LIMITATIONS

- Aerobatics including flick manoeuvre, spins and deliberate negative G manoeuvres are prohibited.
- Aircraft not to be flown with canopy open.
- Day/VMC only

2.7 ENGINE

A. COOLANT

Mixture:
50% water 50% glycol

Quantity:

Minimum	20 Quarts / 22.7 Litres
Maximum	27 Quarts / 30.6 Litres

Temperature:

Minimum	160 °F
Maximum	225 °F
Normal operation	180 °F / 220 °F

B. OIL

TYPE: MOBIL 1, 10W50 Synthetic or equivalent

Quantity:

Minimum	5 Quarts / 5.6 Litres
Maximum	9 Quarts / 10.2 Litres

Temperatures:

Minimum	180 °F
Maximum	250 °F
Normal operation	200 °F / 240 °F

Pressure:

Minimum	40PSI
Maximum	70PSI
Normal operation	40PSI

Filter: Champion P/N CH48109-1

C. FUEL

Type:

AVGAS 100LL - DIN 51600,
Petroleum, unleaded DIN 51603, 91 Octane

Quantity:

Main tanks hold	35 USG each side 70 total
Useable	31 USG each side 62 total

Pressure:

Minimum	27 PSI

Starboard (right) tank has fuel return and is also aerobatic tank.

D. ELECTRICAL SYSTEM

Power

Minimum	10 Volts
Maximum	14 Volts
Normal operation	12 Volts

System

Batteries	2 Off
Rating	20 amps each 40 amps total

E. RPM

Rating	Max RPM	Manifold Pressure (psi)	Max Engine Exhaust Gas Temperture EGT °F	Duration
Take-off	4700	30	1350	5 min
Max continuous	4400	22	1350	N/A
Economy cruise	3500	20	1300	N/A

2.8 HYDRAULIC SYSTEM

Oil type	Mineral oil HF585B
Quantity:	
Minimum	7 Quarts / 8 Litres
Maximum	Indicated
Pressure:	
Minimum	800 PSI
Maximum	1200 PSI

2.9 FLIGHT CREW

Single occupant only.

2.10 FLIGHT CONDITIONS

- THIS AIRCRAFT IS HOMEBUILT approved for day operations only VMC.
- Its compliance with airworthiness Regulations has never been proved.
- Aerobatics including flick manoeuvre, spins and deliberate negative G manoeuvres are prohibited.
- Aircraft not to be flown with canopy open.
- The Aircraft must be operated in compliance with Regulations.

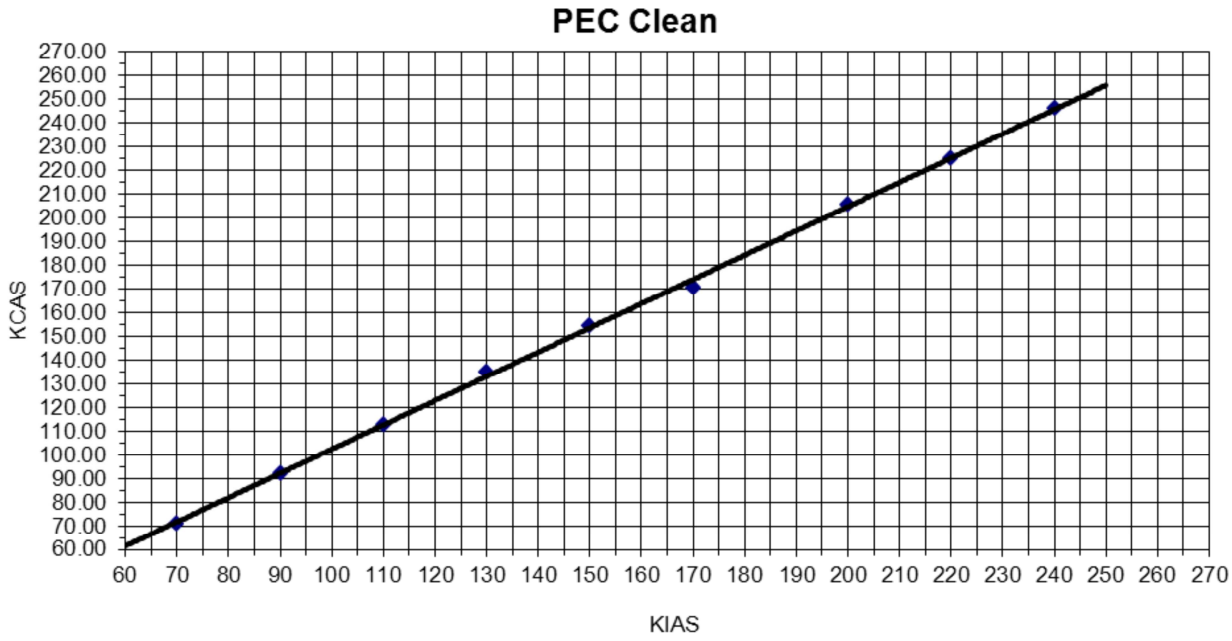
2.11 LIMITATION MARKINGS

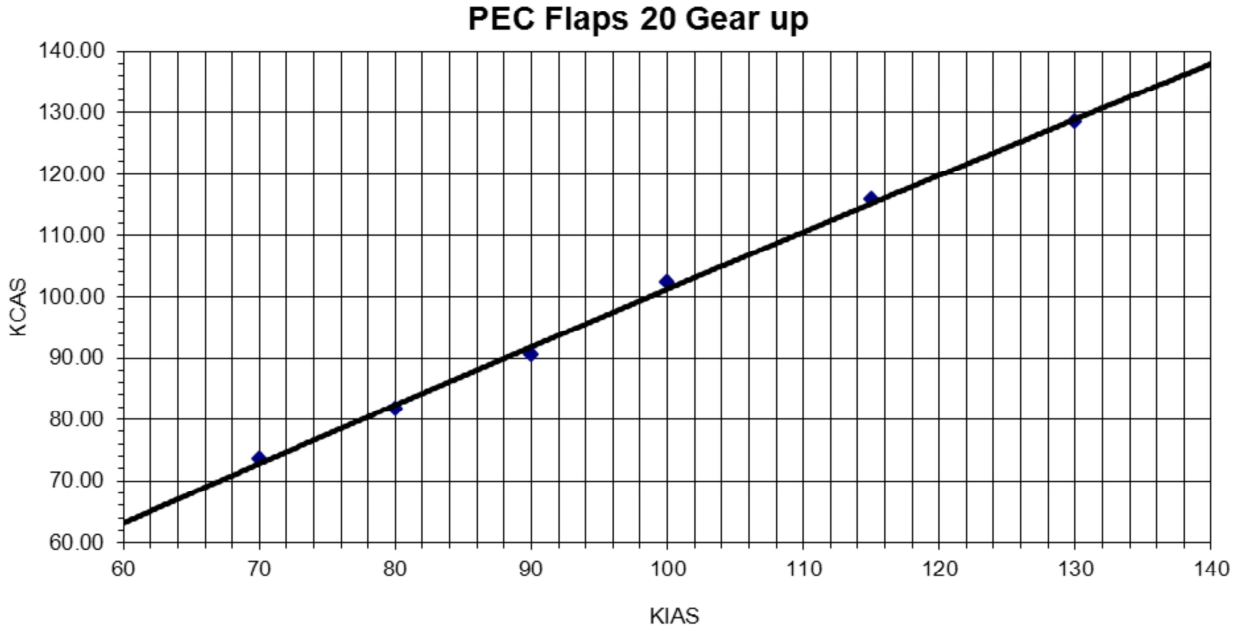
SPEEDS	
V_{FE}	130 KASI
V_{AC}	105 KASI
V_B	150 -190 KASI

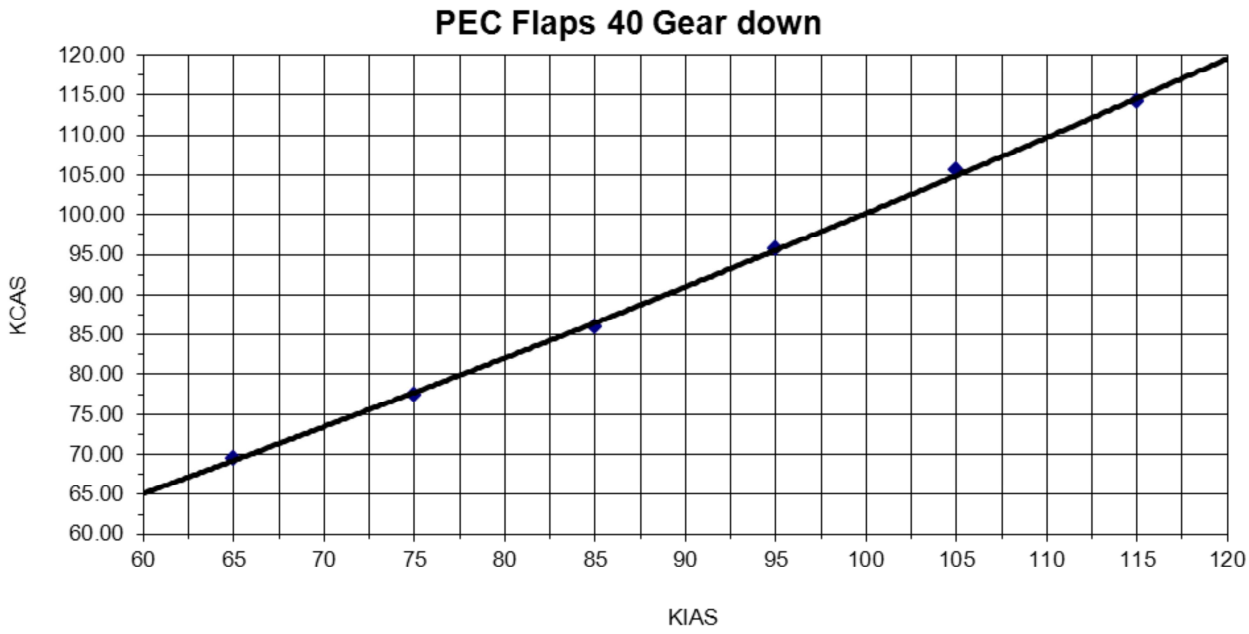
PROHIBITED MANOEUVRES

- **Intentional Spinning**
- **Flick Manoeuvres**
- **Intentional Negative G Manoeuvres**

2.12 PRESSURE ERROR CORRECTION






PEC Flaps 40 Gear down
KCAS
KIAS
120.00
115.00
110.00
105.00
100.00
95.00
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85.00
80.00
75.00
70.00
65.00
60.00
60
65
70
75
80
85
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95
100
105
110
115
120

SECTION 3

EMERGENCY PROCEDURES

3. 1 INTRODUCTION

3. 2 INFLIGHT FIRE

3. 3 ENGINE FAILURE

3. 4 INFLIGHT RESTART

3. 5 MECHANICAL FUEL PUMP FAILURE

3. 6 LANDING GEAR FAILURE

3.6.1 FAILURE OF ONE MAIN GEAR

3. 7 FLAP FAILURE

3.8 ELECTRICAL FAILURE (LVW LIGHT)

3.9 WATER DITCHING

3.10 ELECTRIC TRIM RUNAWAY

3.11 INADVERTENT SPIN RECOVERY

3.1 Introduction

Section 3 includes checklists and procedures to deal with emergencies that may arise during the use of the aircraft.

In an emergency, in addition to the provisions in this chapter, shall be used common sense, wisdom and experience available to deal with situations which may not be resolved with the procedures below.

3.2 INFLIGHT FIRE

Shut off fuel
Throttle full forward
After engine stops, ignition switches to off position
Shut off all electrical switches (master switch)
Speed – maintain 95 KASI or faster (best glide rate 1995 ft/min
If fire does not extinguish, bail out.

3.3 ENGINE FAILURE

Speed – maintain 95 KASI or faster (best glide rate 1995 ft/min)
Search for suitable landing area
Booster pump - ON
Fuel selector - change tank
Ignitions - 1 & 2 ON
Mixture - Full rich
Throttle - Change position

3. 3.1 ENGINE FAILURE EMERGENCY LANDING

Speed – maintain 95 KASI or faster (best glide rate 1995 ft/min)
Fuel - Shut off
Harness tight
Landing Gear – configuration:
Down for road or flat landing area (3 green lights)
Up for water (3 red lights)
Radio emergency call
Lower flaps when landing area is assured only
Speed – low and maintain 75-80KASI
Electrical power master off
Canopy - unlatch and partially open

3.3.2 CANOPY EJECTION

Unlatch - partially open.
Pull pins and remove sliding holds.

Note:

Duck to avoid being hit by canopy.

3.4 INFLIGHT RESTART

Fuel selector - on fullest tank
Electrical fuel pumps - both on
Master switch - on
Ignitions - 1 & 2
Throttle - half forward
Mixture - full rich
Propeller - full forward
Speed - 150 KIAS or faster.

Note:

If at low altitude, crank engine with starter

3.5 MECHANICAL FUEL PUMP FAILURE

Electrical pump – on for tank selected
Fuel Pressure - Check 30 PSI.
In case of engine failure apply **in-flight restart** procedures

3.6 LANDING GEAR FAILURE

In case of hydraulic pump failure, pull hydraulic pump CIRCUIT BREAKER (50 AMP top right hand side).
Position LANDING GEAR LEAVER DOWN and pull emergency hydraulic dump valve (right hand side floor), side slip to lock it in position and get 3 green lights.
If necessary execute a 2g turn to help main and rear gear extension. Dump valve lever is just forward of fuel valve selector.

3.6.1 FAILURE OF ONE MAIN GEAR

In case of only one main gear extension, try to land tilted toward extended gear.

Note:

After emergency landing, abandon area immediately.

3.7 FLAP FAILURE

Flaps have no redundancy. In case of asymmetrical extension, retract to regain symmetry and observe speed INCREASE required for configuration. Consider runway length required.

3.8 ELECTRICAL FAILURE (LVW LIGHT)

In case of generator failure (signalled by the LVW light (Low Voltage Light), tune Transponder on A7700.

Switch off all electrical apparatus not required, according to electrical load assessment there should be 89 minutes of power if both batteries are charged and 44 if one battery is out.

Turn off one ignition and land as soon as possible at next airport.

Limit the use of radios and navigation equipment.

3.9 WATER DITCHING

Apply the same procedures for emergency landing, wear and secure life vest, knife ready to cut harness or anything that might hold, if necessary. Try to land parallel to the swell on the top of it. Before contact unlatch canopy.

Exit the floating aircraft immediately as time is very limited.

3.10 ELECTRIC TRIM RUNAWAY

In the event of electric trim runaway

Pull trim circuit breaker (bottom row left hand end)

Note: That the rate is slow enough not to over power control surfaces.

3.11 INADVERTENT SPIN RECOVERY

Controls to central

Note: should this technique not recover within one turn, the Standard recovery technique should be used.

SECTION 4

NORMAL PROCEDURES

SECTION 4

4.1 INTRODUCTION

4.2 DAILY / PRE-FLIGHT INSPECTION

4.3 START CHECK LIST

4.4 TAXY CHECK LIST

4.5 ENGINE RUN UP CHECK

4.6 TAKE OFF CHECK LIST

4.7 AFTER TAKE-OFF CHECK LIST

4.8 DOWNWIND CHECK LIST

4.9 BASE TURN AND FINAL CHECK LIST

4.10 AFTER LANDING CHECK LIST

4.11 ENGINE STOP CHECK LIST

4. 1 Introduction

Section 4 contains operating check lists and normal operating procedures.

4.2 INSPECTION DAILY / PRE FLIGHT

In the cabin

MASTER switch	OFF
Ignitions	OFF
Fuel selector	the fullest
Fuel level	minimum 1/4
E.L.T.	ARM

External

Left Flap	levers and control, hinges
Left aileron	levers and control, hinges
Left navigation lights	intact
Left main landing gear	tire pressure and oil leaks, brakes, creep marks, tailgate set
Antenna	intact
Purge left fuel tank	Check for water
Left wing fuel cap	Check fuel level Gasoline and replace
Left tank vent	Unobstructed
Propeller	Check
Spinner	Check Fixing screws
Engine air intakes	Clean and unobstructed
Oil level	Check level
Engine cowling	Closed and secured
Right tank vent	Unobstructed
Right wing fuel cap	Check level Gasoline and replace
Purge right fuel tank	Check for water

Right main landing gear	tire pressure and oil leaks, brakes, creep marks, tailgate set
Transponder	intact
Pitot tube	Unobstructed
Right navigation lights	intact
Right aileron	Levers and control, Hinges
Right Flap	Levers and control, Hinges
Fuselage	Undamaged
Right Static port	Unobstructed
Left Static port	Unobstructed
Plans fixed and mobile	Hinges, race trim
VHF NAV, COM,	Intact
Rail canopy	Set and clean

Pre-start-up

Perform instrument centralizing

Instruments	correct condition
Flaps	retracted
Flight Controls	Full, free and correct movement
Electrical switches	OFF
Avionics	OFF
Circuit breakers	inserted
Radio	OFF

4.3 STARTING

Fuel selector	lowest tank
Master	ON

- COLD -

Mixture	rich
Fuel Pump	ON to prime engine
Throttle	1 cm Forward
Fuel Pump	OFF
Ignitions	Both ON
Prop fully fine	(fully forward)

"CLEAR PROP!!"

Starter Switch	starter switch under right

side of instrument panel and leave fuel pump on till running smoothly

Starter motor light	**ensure goes out**
Throttle to	1000 RPM
Oil pressure	**within 30 seconds**

- HOT-

Mixture	rich
Throttle	2 cm. Forward
Fuel Pump	ON for 3 seconds
Ignitions	BOTH ON

"CLEAR PROP!!"

Starter switch	START
Starter motor light	**ensure goes out**
Throttle to	1000 RPM
Oil pressure	**within 30 seconds**

Note: If Starter motor warning light fails to **go out** after starter toggle switch is released SHUT DOWN ENGINE as per below:

- Mixture to lean
- OFF-ignitions
- Master OFF

Note: If the oil pressure does not rise within 30 seconds:

- Mixture to lean
- OFF-ignitions
- Master OFF

4.4 PRE-TAXI

Harness	Secure
Canopy	Closed
Landing gear lights	3 GREEN lights
Throttle	1000-1200 RPM
Radio	ON, Tune to frequency
Intercom	ON
Instrument panel	Instruments green arc
Coolant door	open
Fuel selector on fullest tank	
Radio call	
Move off	
Test brakes before picking up momentum.	
Brakes are on top of rudder pedals	

4.5 ENGINE TESTING

Nose to wind	Engage brakes
Circuit breakers	All engaged
Fuel selector	highest tank
Throttle to	RPM 3000
Mixture control	
Ignition drop	Maximum 125 RPM, No more 50 RPM between the three ignitions
Throttle to	1200 RPM
Oil Temperature and Pressures	Check

4.6 FOR TAKE OFF

Propeller lever	Fine
Mixture	Rich - full forward
Radiator door	Open
Fuel Pump	ON
Electrical switches	ON
Canopy	Closed / pin inserted
Trims	Positioned neutral
Flaps	Max 20 °

4.7 AFTER TAKE OFF

ASI positive	RETRACT landing gear
Speed given rise	110 KIAS
Landing gear lights	3 REDS lights
At 400 ft	retract flaps @ 110KIAS
At 1000 ft	Booster pump off, Control pressure.
Coolant radiator door	As required.

4.8 DOWNWIND CHECK LIST

Belts		Full tight
Mixture		Fully rich
Propeller		Full forward (Fine pitch)
Fuel		Fullest tank
Flaps		10 °
Trim		as required
Fuel Pump		ON
Coolant radiator door	170-190 deg	Open
Radio call		make
Landing gear		down
Landing gear lights		3 GREEN lights

4.9 BASE AND FINAL

Base	speed 115 KIAS Landing gear
Approach	Flaps: full: 40° Speed 95 KIAS
Touchdown	Speed 80 KIAS

4:10 POST-FLIGHT SETINGS

Clear the runway	
Flaps	up
Trim	neutral

4.11 ENGINE SHUT DOWN

Radio equipment and utilities	OFF
Flaps	Full up
Coolant radiator door	close
Mixture	fully back.
RPM 1000	lean
With the engine stopped	ignitions OFF
All Switches	OFF
Fuel	OFF
Master	OFF
ELT	OFF

SECTION 5

PERFORMANCES

5. 1 INTRODUCTION

5. 2 STALL SPEED

5. 3 TAKE OFF DISTANCES

5. 4 LANDING DISTANCES

5. 5 CLIMB PERFORMANCE

5.6 CRUISE

5. 1 Introduction

Section 5 contains the performance data for the aircraft.
Being an airplane homebuilt data were collected in an empirical way, with real experimentation in some cases for calculating mathematically as a function of engine performance based on the rated power.
In any case, the data in this section can be a solid value and performance to ensure the same, therefore, to operate safely, you should always add a margin of 10%.

5. 2 Stall speeds

Flaps 0° (clean)
Weight 3400lbs 77 KIAS (indicated airspeed)

Flaps 20°
Weight 3400lbs 73 KIAS (indicated airspeed)

Flaps 40° (Full)
Weight 3400lbs 69 KIAS (indicated airspeed)

The stall speeds can be reduced by 1 KIAS/100 lbs reduction in aircraft weight.

5. 3 TAKE OFF distance

Take off power MP 30 "4700 RPM

Field elevation	Distance m.
S.L.	313
1000 ft	338
2000 ft	366
3000 ft	396
4000 ft	428
5000 ft	465
6000 ft	504

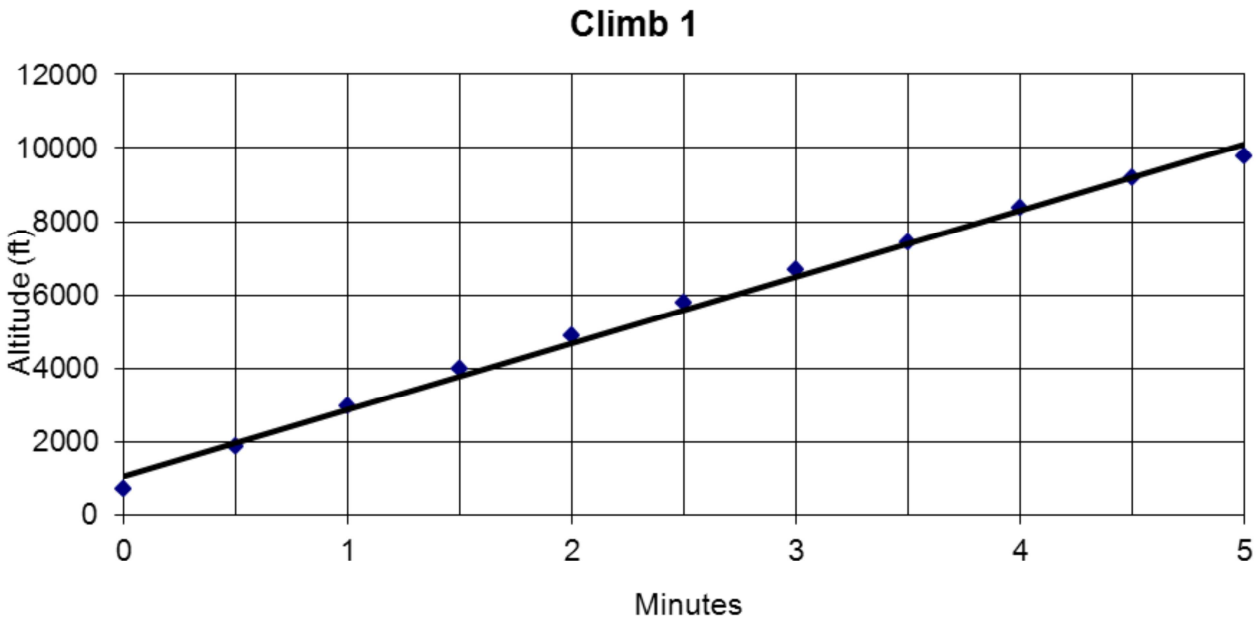
5. 4 Landing distance

Rwy Threshold speed 80 KIAS

Elevation (ft)	Runway length (m)	Distance to land (m).
S.L.	606	297
1000 ft	623	305
2000 ft	643	315
3000 ft	660	323
4000 ft	682	334
5000 ft	703	344
6000 ft	723	354

5. 5 Climb performance

Climb power MP 30 "4700 RPM 3375lbs



5. 6 Cruise

Power Setting	RPM	Manifold Pressure (PSI)	Air speed (KIAS)	Fuel flow (usg/hour)	Range (Usable 62usg)
Take off	4700	28	220	23.0	5 minutes
Max Continuous	4400	22	Not known	Not known	Not Known
Normal Cruise	4000	25	200	15.6	795 Nm including reserve
Economy Cruise	3500	20	170	11.0	958 Nm including reserve

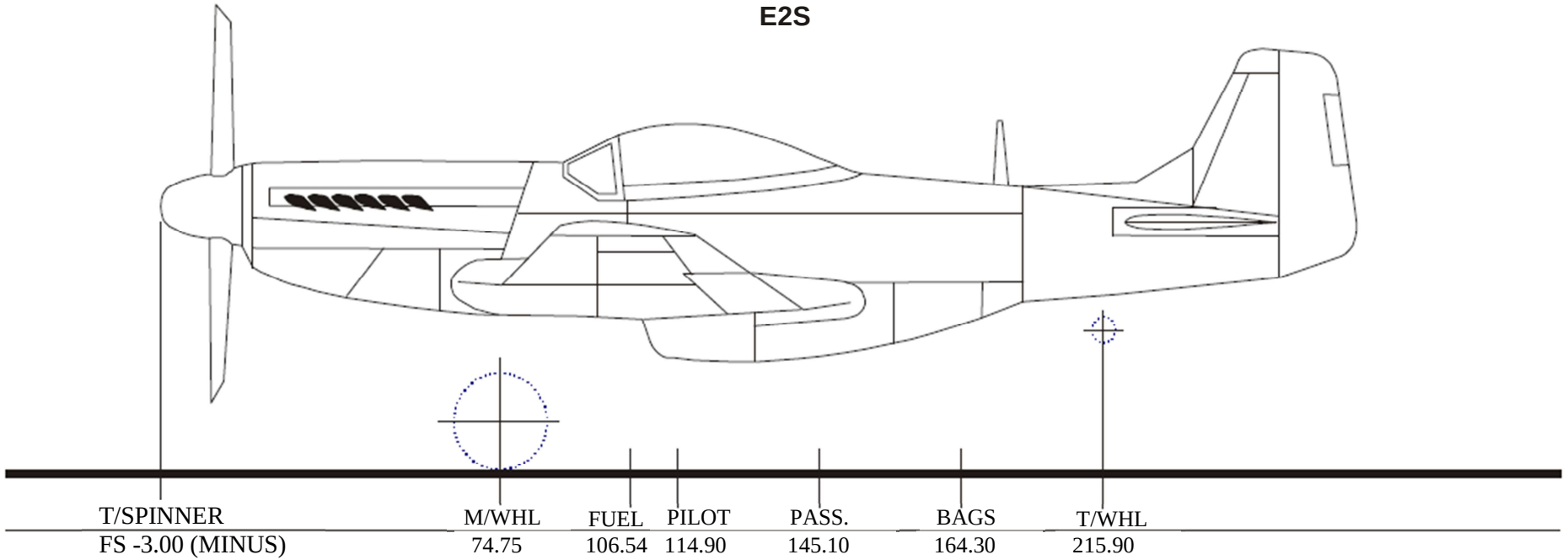
SECTION 6

WEIGHT AND BALANCE

WEIGHT & BALANCE DIAGRAM

STEWART S 51 D

AIRCRAFT SERIAL NO. 144
REGISTRATION NO. G-CGOI
E2S



Leading Edge OF MAC	**FS 77.70**
MAC	**FS 56.00**
FWD CG LIMIT	**85.1”**
REAR CG LIMIT	**91.8”**
EMPTY WT. INCLUDES	**16 QTS OF OIL**
	27 QTS OF COOLANT

C OF G
CALCULATION

EXAMPLE

Column designation letter	**A**	**B**	**C**
	MASS (lbs)	DISTANCE FROM DATUM (inches)	MOMENT (lbs.inches) (columns A x B)
EMPTY	2645	83.23"	220156.6
PILOT	220	114.90"	25278
FUEL ONBOARD (lbs)	301	106.54"	32068.54
PASSENGER	Not certified	145.10"	0
BAGS	20	164.30"	3286
Total Mass onboard (column **A** addition)	3186		

Total Moment (Column **C** addition) =	280789.14	Lbs.inches
Current C.G = Total Moment / Total Mass	280789.14 / 3186	= 88.13
Is this in limits?		
NO LESS THAN	**85.1 inches**	✓
NO GREATER THAN	**91.8 inches**	✓

TEMPLATE

FILL IN GREY SQUARES

Column designation letter	**A**	**B**	**C**
	MASS (lbs)	DISTANCE FROM DATUM (inches)	MOMENT (lbs.inches) (columns A x B)
EMPTY	2645	83.23"	220156.6
PILOT		114.90"	
FUEL ONBOARD (lbs)		106.54"	
PASSENGER	Not certified	145.10"	0
BAGS		164.30"	
Total Mass onboard (column **A** addition)			

Total Moment (Column **C** addition) =		Lbs.inches
Current C.G = Total Moment / Total Mass	/	
Is this in limits?		
NO LESS THAN	**85.1 inches**	
NO GREATER THAN	**91.8 inches**	

SECTION 7

AIRCRAFT DESCRIPTION

7.1 INTRODUCTION

7.2 POWERPLANT

7.3 AIRCRAFT STRUCTURE AND FLIGHT CONTROLS

7.4 LANDING GEAR

7.5 FLAP SYSTEM

7.6 HYDRAULIC SYSTEM AND BRAKES

7.7 FUEL SYSTEM

7.8 ELECTRICAL SYSTEM

7.9 PITOT AND STATIC SYSTEMS

7.10 INSTRUMENT PANEL

7.11 CONSOLES

7.12 RADIOS AND NAVIGATION EQUIPMENT

7.13 ELT

7.14 VENTILLATION

7.15 SEAT BELTS AND HARNESSES

7.16 INADVERTENT SPIN RECOVERY

7.17 POWER OUT LANDING (EMERGENCY)

7.1 INTRODUCTION

Section 7 describes the physical components of this aircraft, their location and their function in relation to other components of the aircraft.

7.2 POWER PLANT

THIS ENGINE IS A REVERSE DRIVE ENGINE.

A- ENGINE GENERAL **This aircraft is equipped with an aftermarket aluminium MOTORS DESIGNED "big block" CHEVROLET V8 engine of 509 cu.in. The engine is liquid cooled using 50/50 mix of ethylene glycol and distilled water. This engine produces 500hp at sea level, showing 30 psi M.P. @4700 RPM. Fuel is supplied to the engine through a modified Bendix fuel injection system available from Airflow Performance Inc. The engine mounts in the airframe backwards. Rear (transmission end) points forward.**

Air enters the chinscoop, passes through ducting under the engine, up the back of the engine and through the injection system into the intake manifold. An air filter is installed in this ducting for use during taxying. This engine runs in REVERSE direction so that a standard Hartzell propeller can be used

B-IGNITION

The ignition is provided by three independent systems.

The ignitions are activated by a switch each. The three systems are served by two batteries of 20 Amps each. Two are electronic systems and one distributer.

Two systems run at all times and feed individual dual plugs (Two spark plugs for each cylinder) for ignition redundancy.

C - START SYSTEM

This consists of a starter motor powered by the batteries of 12 volts through a relay that is powered by the ignition switch in ON position. This switch is under the right side of the instrument panel and is spring loaded to the off position.

The on-board battery can be, supported by an external battery, through an outlet located within an inspection door on the bottom left hand side of the engine cowl. The connection unit of Cessna type, is located in the luggage bay, and is part of the fixed equipment on board.

D - OIL SYSTEM

Lubrication is pressurised by means of an oil pump, located in the engine accessories, which draws oil from the dry sump reservoir. From the pump the oil passes to the filter and then to the various parts to be lubricated (engine, gearbox...) and the propeller speed governor. In the return to the tank the oil passes into a heat exchanger.

The oil pressure (during operation 40/70 PSI) is regulated by a spring with ball.

The supply of oil is done by opening the door at the top of the engine cowling and removing the oil cap.

It is connected to the oil dipstick indicated in 4 quarts quantities up to 12 quarts.

The types of oil recommended by the engine builder are the following:

-	for all temperatures	Mobil 1	SAE 10W50

The amount of engine oil is the following:

-	maximum	9 U.S. quarts
-	minimum quantity	5 U.S. quarts
-	consumption per hour maximum allowable at 75% power.	1 US pint

E - COOLING

The engine is equipped with a system of liquid cooling, glycol/water based. The liquid is cooled by passing through a radiator placed in the belly of the airplane(chin scoop), equipped with an electric controlled door that regulates the flow of air through the radiator The system also has an expansion tank fitted with a thermostatic cap for its supply and a recovery tank. The door is controlled by a switch on the right hand side upright in the cockpit.

The amount of liquid is recommended to be 27 US quarts.

F - PROPELLER

The propeller is a four blade Hartzell HC-B4TN-1AX2 and is variable pitch. Pitch adjustments are automatic when power changes are made and the same RPM is desired. Propeller speed may be manually changed through movement of the BLUE knob on the throttle console.

Propeller speed is reduced below engine speed by a ratio of 2.13 to 1 for prop efficiency. Take off engine speed of 4700 RPM results in a prop speed of 2206 RPM.

This is considered the maximum prop speed, however this may be preset at any speed desired using the BLUE knob on the throttle console.

G - ENGINE CONTROLS

The control of the power unit is made by using the following three levers:

- Power lever throttle: BLACK cylindrical lever
- Fuel mixture lever is: RED knob
- Propeller pitch lever RPM.BLUE knob

1) Throttle

Movement of the throttle lever varies the fuel pressure and air flow at the air flow sensor section of the injection system. Since the aircraft is equipped with a variable pitch propeller, the performance values are transmitted and correlated through the prop rpm and fuel flow systems.

2) Fuel mixture

The position "full forward" corresponds to the mixture rich, while the position "full back" corresponds to the STOP position, thereby closing the flow of fuel to the engine.

Fuel mixture lever is used for start procedure and engine shut down. The full forward position keeps the engine (and in particular the valves) cool during all running conditions. During cruise the fuel mixture may be leaned by moving this lever partially to the rear while watching for a moderate cylinder head and exhaust temperature increase. Using this procedure will increase flight range and duration.

3) Propeller RPM

The fully forward position provides the maximum number of revolutions in fine pitch, move back the lever, into the intermediate position, gives the number of revolutions necessary for course pitch.

H - ENGINE INSTRUMENTS

These instruments are positioned mainly on the left side of the dashboard and in part on the bottom:

- Main panel:
- 1. Tachometer: top right
- 2. Supply pressure / flow meter: bottom right
- 3. Temperature cooling liquid: right of tachometer
- 4. Oil pressure: bottom right
- 5. Oil temperature: bottom right
- 6. EGT& fuel flow: right
- 7. Fuel quantity indicators both tanks: bottom instrument panel

7.3 AIRCRAFT STRUCTURE AND FLIGHT CONTROLS

A - STRUCTURE OF THE AIRCRAFT

The fuselage of the aircraft consists of an aluminium frame with neat, stringers and skin overlay. Staying in the cabin at the front, the instrument panel, joysticks and pedals. The pilot seats are an integral part of the frame and therefore are not adjustable; backrests are tilting forward. The rear seat is also equipped with flight controls. Behind the rear seat is the luggage compartment.

The canopy slides on rails and can be actuated by an inner handle located at the top front right side. There is an outside release (PUSH HOLD SLIDE BACK), button located at lower right side windscreen bow for emergency canopy release.

B - FLIGHT CONTROLS

Flight controls include:

- Ailerons
- Rudder
- Elevator
- Trim
- Flaps

Flight controls can be operated from both the two seat positions and both have joysticks to operate the ailerons and elevator and pedals to operate the rudder. The pedals only controls the rudder and brakes for the wheels on the main landing gear, while the rear wheel is free to rotate independently from the pedal when unlocked.

The trim tab on the rudder and elevator are electric and are operated from the coolie hat switch on top of the joystick.

All controls are statically balanced to 100%.

		Maximum Up / Down
-	Elevator	27 ° / 18 °
-	Ailerons	DS27 ° to 20 ° down, 21 ° Sn of 28 ° down
-	Rudder	30 ° / 30 ° left / right
-	Flaps	0 ° of 40 ° down

The movement of the Rudder is by steel cables from the rudder pedals to a cross bar in the tail cone. This cross bar steers the tail wheel via cables 3 deg. right or left while taxiing, and via tube to rudder for inflight control. Tail wheel may be unlocked for 360 deg. Rotation by moving the control stick full forward.

The movement of the ailerons and elevator is transmitted by rigid rods of steel and brackets, supported with bearings. All connections are made with adjustable bearings.

7.4 LANDING GEAR

The main landing gear and the small rear wheel, are fully retractable, driven by hydraulic pressure supplied by an electro-hydraulic pump.

The main undercarriage is of the telescopic steel alloy type, retracts into a housing formed in the wings and the centre of the fuselage. Mount 6.5x8.00 tires. The inflation pressure of the main wheels is 3 bars.

The rear wheel is 8x4.00 4 ply fairing. The support leg is alloy steel hinged at the rear underside of the fuselage. The fork is installed on the leg so that it can rotate to allow 360 °of steering to the direction of steering of the main undercarriage. The rear bogie is controlled by the pedal when locked, but free when unlocked. The locking and unlocking occur with moving the joystick full forward.

The rear carriage retracts forward into a slot in the fuselage, the doors are closed mechanically by means of rods carried by the wheel itself.

The undercarriage can be extended by gravity in the event of failure of the hydraulic system or for lack of electrical power. The displacement of the dump valve lever in the DOWN position, unlocks the main undercarriage and releases pressure from the system to allow the three undercarriage legs to fall into place. The rear carriage is also equipped with a spring that helps the stroke in the extended position.

There are two sets of three micro switches which are triggered when undercarriage is either in the up position or down position. These are only activated when the mechanical locks that hold the gear in position are engaged, ie uplocks and downlocks. The micro switches trigger a set of three green or red LED lights that are positioned on the upper left of the instrument panel. The green LED lights indicated that the gear is fully locked down and the red lights indicate the gear is fully locked up.

The S 51 has a hydraulic undercarriage system, which is driven by an electric motor, and powers the extension and retraction of the undercarriage. This system has its own reservoir and filling takes place by unscrewing the cap of the tank installed in the lower part of the electric pump. The pump is housed behind the rear seat on the right side. Undercarriage system pressure is adjusted at the regulating solenoids located adjacent to the pump and is set at 1100psi. Gauge is on the left on the bottom console.

7.5 FLAP SYSTEM

The flaps are of the traditional type, hinge mounted to the inner end of the rear wing spar with brackets and mounting bearings. Flap extension is done through an electric motorised screwjack referred to as a linear positioner. An up/down

Switch located on the rear end of the gear console activates this motor. The linear positioner directs 1500lbs of force through levers and linkage rods to the flaps and is located under the right armrest of the rear seat.

7.6 HYDRAULIC SYSTEM - BRAKES

The hydraulic brakes are operated by the pressure exerted on the brake pedals. To refill the brake reservoir, open the top left hand panel by the front windscreen, remove the cap of the oil tank and add hydraulic fluid until it reaches at least 2/3 of the tank capacity.

The two main wheels are equipped with 2 single disc brakes. The braking action is obtained by adjusting the hydraulic brake pedals. Down, with the tip of the foot, the left pedal, breaking the left wheel and the right wheel to the right.

Each pedal is equipped with a hydraulic actuator which transmits hydraulic pressure to the brake pads, the consumption of which is automatically compensated, thus obviating the need to periodically adjusting the brakes.

7.7 FUEL SYSTEM

The fuel system of the aircraft S51 is made up of two tanks integrated in the two wings in an inner position, between the longitudinal members and in the outer position towards the leading edge.
The total capacity of the two main tanks is as follows:

- Left tank: 132 litres / 35 Usg
- Right tank: 132 litres / 35 Usg

While the usable fuel is:

- Left tank: 117 litres / 31 Usg
- Right tank: 117 litres / 31 Usg

The line of the feed pumps is provided with a drain cock located under each wing at the lowest point of the reservoir. They are used to remove water and sediment deposited at the bottom of the tanks.

Drainage should be performed before moving the aircraft and before the first flight of the day or after every refuelling.

The tanks are connected to a three-way selector valve located on the right hand side of the front floor in front of the pilots seat. The valve is actuated by a selector lever, arranged on the floor right in front of the pilots seat, through which you can select the left or right main tanks. To stop the flow of fuel to the engine, it is necessary to move the lever hard right by lifting the nob on the fuel selector.

The fuel from the tank, reaches the selector valve through rigid aluminium tubes from the electric pumps placed inside the wing. From the electric pump, fuel passes through rigid tubes to a baffle plate and then through a filter with wire mesh. From the filter the fuel reaches the mechanical pump driven by the engine; to the injector.

The electric pump must be switched on, before starting the engine (for a few seconds) until there is an increase of the fuel pressure, in take-off, landing and during the change of tank. During the cruise flight it must be switched on in the event of a failure in the mechanical pump or insufficient pressure.

A fuel level, transmitter is mounted inside each tank and consists of a potentiometer, actuated by an arm with a float: when the fuel level changes, there is a variation of the voltage given by the potentiometer, this gives a change of reading on the instrument placed on the dashboard (one for each tank), there is a corresponding reading of quantity. The indicators are on the right on the lower console. The pump switches for left and right tanks are on the bottom right side of main instrument panel. Fuel not needed by the engine is returned to the starboard tank and also the starboard tank has a flop tube pick up for aerobatics.

The vents of the tanks, are in the lower part by wing panels, one for the reservoir.

7.8 ELECTRICAL SYSTEM

The power necessary for the services, is provided by a 90amp alternator / battery DC negative ground.

A - BATTERY

The batteries are of a dry type maintenance-free, 12 volt 40 amp / hour and starting current. Provides the energy for starting and a reserve of energy in the event of failure of the alternator during the flight.

The two batteries, fully sealed, are located in the engine compartment.

B - ALTERNATOR

An alternator, driven by the motor via a rubber belt with a trapezoidal section, the capacity of 90 amperes, provides the electricity during the flight and keeps charging the batteries.

The electrical system comprises:

- a battery master relay
- an alternator with regulator
- a master switch
- electric-starter
- two electric fuel pumps
- liquid temperature
- oil pressure
- oil temperature
- Fuel pressure
- fuel gauge left and right
- radio and intercom
- transponder
- GPS,VOR, ILS, gyro
- rev counter
- ELT
- Electric flaps
- Electric hydraulic pump
- Strobe Lights
- Navigation lights
- artificial horizon
- EGT and fuel flow gauge
- heated pitot
- Clock

All main circuits are protected by "breakers". The breakers are installed on the console at the top, they automatically break the circuit in the electrical system that were going to short-circuit failure.

The master switches, alternator and utilities radio, are positioned on the dashboard and on the devices themselves.

C - LIGHT SYSTEM

Includes:

1. Two points of light placed at the wingtips consist of:
   - left: Red light (navigation)
     Strobe Light (collision)
   - right: Green light (navigation)
     Strobe Light (collision)

2 - The white light position is located on the bottom of the rudder.

7.9 PITOT - STATIC AIR SYSTEM

The facility to bring the air static and dynamic instruments is provided by the Pitot tube, with the only outlet for the air dynamics, and two static ports and related connection pipes.

The pitot tube is installed under the right wing tip and is equipped with heating system.

The static ports, wall type, are mounted, one on each side, at the rear of the fuselage and connected in parallel with each other.

A pressure-error-correction (PEC) evaluation was completed during the flight testing stage. This showed that the indicated airspeed was generally slightly below the Calibrated airspeed for all configurations tested by between 1-6 knots. During the Vdf and stalling exercises, the flight-test PECs were used to accurately give a Vne value and the correct approach speeds.

ATTITUDE AND NAVIGATION INSTRUMENTS

A - ATTITUDE AND NAVIGATION INSTRUMENTS

All flight instruments and navigation, including ignition switch are installed on the dashboard.

1. The Vertical **compass**, Front reading, is installed centrally on the dashboard

2. The **Turn & bank** is of the type 12 volts electric with built-in ball
3. **Airspeed indicator** is the classical type-compensated density; scale in KIAS.
4. **Attitude indicator**, Electric, with reference that can be moved in the vertical direction - depending on the height of the ground.
5. The **Altimeters** are one of the type with two hands, calibrated in feet (ft), with adjustable window and scale in inches.
6. The **vertical speed**, In feet per minute, with the full scale value of 6000 ft / min.

7:10 PANELS

On the left side console, you will find the following controls:

1. Throttle power
2. Fuel mixture of engine
3. Propeller pitch lever Fine/Course
4. flap control switch
5. breakers hydraulic pump, motor and engine flaps
6. Rudder electric trim control (on top of joystick)
7. Elevator electric trim control (on top of joystick)
8. Lever for operating undercarriage.

7.11 CONCOLES

MAIN PANEL - FROM LEFT TO RIGHT -

1. 5amp NAV/COM
2. 2Amp TRANSPONER
3. 1 Amp Instrument Dimmer
4. 3Amp Turn & Bank
5. 25AmpFlap Motor
6. 5Amp Flap Control
7. 50Amp Hydraulic Pump
8. 5Amp Hydraulic Control
9. 1Amp Trim Control
10. 1Amp Gear Position
11. 1Amp Engine Instrument
12. 1Amp Tachometer
13. 10Amp Coolant Door
14. 2Amp JPI 700 Instrument
15. 2Amp Fuel Gauge
16. 3Amp HH Radio AMP

7.12 RADIO/ NAVIGATION EQUIPMENT

The equipment for ground-air-ground consists of:

1. Garmin GPS 430 NAV/VOR/Localizer indicator. Garmin GTX 327 Transponder.
2. for communication between the Pilot and Passenger an intercom is installed mc connected with headphones. In the vicinity of the headphone jacks of the rear seat there is also a power supply to 12 volts for the use of utilities (GPS).

The apparatus for navigation include:

2. A GPS Garmin 430 VOR and a VOR / ILS Garmin type installed on the dashboard
3. Garmin transponder type GTX 327 model installed on the centre panel of the dashboard

7:13 E.L.T.

In the fuselage, in the luggage compartment on the left side behind the rear seat, there is installed the ELT with autonomous power and antenna installed inside the passenger compartment on the left side of the fuselage behind the rear seat. To check the status of the batteries should be checked that the date on the plate on the apparatus is not before one year.

7:14 VENTILATION

The ventilation system in the cabin is provided by an air intake located inside the scoop of the radiator. The outside air is conveyed to four vents. These openings are adjustable and can be altered for the amount of airflow required and are positioned on the left and right of both seats.

7.15 SEAT BELTS AND HARNESSES

The aircraft originally was designed for 2 seats but limited to single seat based on emergency egress the straps are of grey colour with five points made by Hooker Harnesses.

The pilot has two straps or shoulder straps and a waist strap consists of two semi-belts ventral and a fifth centre point, between the legs. All five belts (two shoulder straps, two ventral and fifth) converge in a quick coupling and release. All five belts have the possibility of adjustment in length.

7.16 INADVERTENT SPIN RECOVERY

As centralizing the controls almost works as well as the ‘Standard’ and Muller recovery techniques, it is recommended that in the case of an accidental spin (when someone might be so disoriented) that the first recovery action should be to centralise the controls.

Should this technique not recover within one turn, the Standard recovery technique should be used.

7.17 POWER OUT LANDING (EMERGENCY)

During all simulated gliding operations, the aircraft remains very controllable. At the recommended glide speed, there is plenty of elevator authority to produce a good flare, where the rate of descent can be reduced to zero, if required. Although the descent rate is reasonably high, the good handling qualities of the Stewart Mustang means that the descent rate is considered manageable and therefore is acceptable for this class of aircraft. At no time was manoeuvring during a simulated engine failure considered difficult during the test flight phase. To allow a managed descent, it is recommended that the flaps are lowered only when landing is assured and used to ‘bleed’ the speed from the clean glide speed down to the full-flap touchdown speed.