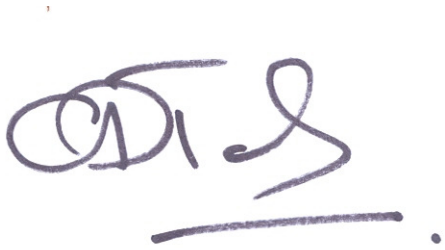
Title:- **Flight Test Report –** Certification Compliance Testing of TLAC Scout Aircraft G-A2-001 Empennage (TSS01) & Powerplant (TSS02) Modification



Written …… ……. Chris Taylor

ISSUE RECORD

ISSUE	DATE	REASON FOR RE-ISSUE	WRTN	
1	21 Oct 17	Initial issue.	CT	

Note. This document is updated as a whole and not as individual pages.

1 INTRODUCTION

The Light Aircraft Company purchased the Escapade2 Aircraft from Reality Aircraft some 4 years ago. The Escapade was a successful home built aircraft, however TLAC intend to offer a factory built improved microlight version of the aircraft. The original design had been modified with increased tail fin area to improve directional stability and the elevators had been modified to increase control power, particularly at slow speed for take-off and landing. The aircraft powerplant had been changed to a Rotax 912 ULS 100hp driving a Kiev 283 propeller.

Although operating under a company A8-9 approval the oversight of the flight testing lay with the UK Civil Aviation Authority. This FTR documents the flight testing conducted iaw the Flight Test Plan that was accepted by the CAA.

2 ABBREVIATIONS USED

AC	Advisory Circular
agl	above ground level
AMC	Acceptable Means of Compliance
ATSU	Air Traffic Service Unit
BMAA	British Microlight Aircraft Association
CAA	UK Civil Aviation Authority
C of g	Centre of Gravity
CS	Certification Specifications
EASA	European Aviation Safety Agency
ETPS	Empire Test Pilots School
FAA	Federal Aviation Administration
FBS	Full Back Stick

FTP	Flight Test Plan
FTS	Flight Test Schedule
HQ	Handling Qualities
LSS	Longitudinal Static stability
NTPS	National Test Pilot School
PFLF	Power for Level Flight
SHSS	Steady Heading Sideslip
VMC	Visual Meteorological Conditions
Vs	Stall Speed
Vs0	Stall Speed Landing Config
Vs1	Stall Speed other than Vs0

3 AIRCRAFT & MODIFICATION DESCRIPTION

The Sherwood Scout was previously sold as a home build kit aircraft under the name Escapade 2. The Escapade 2 was, itself, an evolution of a single seat microlight aircraft called the Easy Raider. The Escapade 2 was developed to meet a niche in the UK aviation market for a microlight that looked and handled like a conventional aircraft, but which conformed to the lower weight and license requirements of microlights and was easily towable and stowable. In addition to this, it had side-by-side seating and full dual controls. The Sherwood Scout was a factory built aircraft which incorporated further refinements to the Escapade 2 design and which was constructed and finished to a standard in excess of that typically achievable during home build construction. The fuselage was a welded tubular steel construction, covered with heat-shrunk self-coloured Oratex UL600. The wings consisted of parallel tubular aluminium spars with wooden ribs bonded to them, aluminium trailing edges and fibreglass tips. The wings also supported both flaps and ailerons. All surfaces were again covered in Oratex UL600 as per the fuselage. The tail surfaces were also made of tubular steel construction, and were wire and tubing braced. The surfaces were finished as per the rest of the aircraft. The windscreen, windows and doors were made from thin transparent polycarbonate sheet.

Pitch control was through a conventional elevator controlled by dual control sticks in the cockpit. The linkage between them consisted of a series of levers and push rods. Pitch trimming was through a trim tab fitted to the left side of the elevator. This was operated using a mechanical system operated via a cable. Roll control was through conventional ailerons, controlled by dual control sticks in the cockpit. The sticks were linked to the ailerons by a series of levers, cables and pulleys. Yaw control was through a conventional rudder, both pilot and passenger had a set of pedals which were interlinked and controlled the rudder. Connection was by a series of levers, cables and pulleys. The rudder tended to self-centre aerodynamically however spring capsules had been fitted to assist with rudder centring. The aircraft was equipped with hydraulic disc brakes operated by toe brake pedals connected to master cylinders. The tail wheel was steerable and connected to the rudder mechanism in the same sense (push right, yaw right, turn right). Low speed steering was achieved by differential braking. Flaps were fitted to the aircraft and were operated by a central push button lever in the cockpit. Connection to the flaps was via cables. The flaps were not mechanically interconnected so that in the event of a cable failure a different flap setting on each wing could occur; however, previous flight-testing had shown this does not

cause severe handling difficulties and is easily controlled by use of the rudder and stick.

Modification TSS01 increased the strength of the rear of the aircraft to support a larger rudder (fitted with spring capsules to aid centring) increasing the fin area and larger elevator control surfaces with a greater control throw than the original Escapade aircraft.

Modification TSS02 replaced the Jabiru engine with a more common Rotax 912 ULS 100 hp engine fitted with a Kiev 283 propeller.

4 PURPOSE

The flight testing was to complete formal certification compliance testing following successful completion of development testing outlined in Flight Test Plan 01-2017. Testing was conducted against

- CAP 482 British Civil Airworthiness Requirements - Section S - Small Light Aeroplanes Issue 6 dated:31 May 2013.

5 CATEGORY OF FLIGHT TEST

A national rather than EASA flight test programme however this flight trial was determined to be a Category 1 Flight Test.

6 STATEMENTS

The aircraft tested was:

A/C Reg : G-A2-001 **C/N** : TLAC-2-001

7 PHILOSOPHY

7.1 Objective

The objective of the Flight Test Programme was to conduct a standard certification flight test programme gathering the required data to demonstrate compliance with BCAR Section S Issue 6.

7.2 Philosophy of Flight Testing

Generally the flight testing of the modified aircraft fell into three categories

- Handling Qualities/Stability and Control
- Performance including stalling
- The aircraft was tested only in the tail wheel configuration. Ballast was added to obtain a c of g at the required c of g envelope limit.

7.3 Test Criteria

Handling Qualities/Stability and Control: Testing was conducted 500-8000ft Hp.

Performance: Performance testing was predominantly conducted 500-6000ft Hp. Stall speeds and climb performance was obtained at full forward c of g and as close to MAUW as possible.

Test Envelope: The aircraft was tested at up to 8,000 ft Hp and up to the forward and aft limits of c of g.

7.4 HQ and Performance Assessment Methodology

No novel test techniques were required. Performance testing was conducted where relevant iaw CAP 1038 CAA Check Flight Handbook and AC 23-8C Flight Test Guide for the Certification of Part 23 Airplanes. Handling Qualities testing was conducted iaw the above documents and ETPS standard test techniques as previously employed by the CAA Flight Test Department. Pressure Error data was gathered using the 3 leg (Triangle Method) provided by NTPS or by flying into and downwind legs at the same altitude and noting ground speed. Additionally the company had previously gathered PE data and used the BMAA technical procedure to analyse the results

7.5 Data Analysis

Climb performance data was gathered using reciprocal climbs and the data averaged to provide a mean ROC. Weight effects were negligible as the climbs were conducted within 2-3 kg of each other. The loss of performance resulting in testing not being conducted at Sea Level will not be factored and will be used to provide conservatism in the results. PE data was analysed using the NTPS spreadsheet where relevant. Stick force per g has been plotted.

Flight Tes

8 FLIGHT TESTS

8.1 Test Instrumentation

A temporary g meter was fitted to the instrument panel. Forces were measured using a hand held force gauge from ETPS) and spring balances. GPS Navigation devices including Garmin & IPad will be used to provide GPS ground speed.

No spin testing was required within this programme –.

8.2 Objective

The objective of the Flight Test Programme was to address specific concerns raised during previous flight testing achieved to date. Those concerns related to manoeuvre stability (stick force per g) and the change of power plant. The objective was to ensure these aspects of the aircraft comply with the certification requirement and conduct sufficient further testing to demonstrate that the aircraft remains compliant with BCAR Section S.

8.3 Section S requirements

In combination with previous and subsequent testing the following Section S requirements are being assessed:

S 21	Proof of Compliance
S23	Load Distribution Limits
S45	Performance General
S49	Stalling Speed
S51	Take-off
S65	Climb
S71	Rate of Descent
S75	Landing
S143	Controllability and manoeuvrability
S145	Longitudinal Control
S147	Lateral and Directional Control
S155	Pitch Force in manoeuvres

S161	Trim
S171	Stability General
S173	Static longitudinal stability
S175	Demonstration of static longitudinal stability
S177	Static directional stability
S181	Dynamic Stability
S201	Stalls
S203	Turning Flight Stalls
S207	Recovery From the Stall
S221	Spinning – NB – Not required
S233	Directional Stability & Control
S235	Take-off in Cross Winds
S251	Vibration and buffeting

Flight Test Programme

An initial shakedown and data gathering flight was flown with mid c of g followed by both full aft and full forward c of g flights. Testing was conducted out of Little Snoring Airfield(Norfolk) on 17 & 18 October in suitable weather conditions which included a very light wind day which allowed good take-off and landing performance data to be gathered.

Pressure Error data had been gathered previously which had led to the decision for the Pitot Static system to have the static vent within the cockpit rather than externally. The company testing was confirmed by further testing using a different method which produced the same result – namely a nil error at slow speed 30-40 KIAS increasing linearly to a 15 KIAS error at 110 KIAS. This 15kt error was applied for all the high speed Vdf testing noting that the analogue ASI read up to 140 KIAS. The aircraft was fitted with an analogue primary ASI and Bar Alt which were used throughout for the flight testing. An MGL EFIS was installed which indicated identical airspeeds and altitudes to the analogue instruments but was not assessed.

Scout Testing								
Serial	Date	T/O	Ldg	Time	T/OAUW	CG mm AoD	Fuel	Ldg Fuel
1	17/10/17	1450	1540	0:50	450 Kg	Mid	70 Lts	61 Lts
2	17/10/17	1620	1745	1:25	440	393.9 Aft	61	47
3	18/10/17	1030	1115	0:45	450	228.2 Fwd	70	60
4	18/10/17	1145	1245	1:00	450	228 Fwd	70	57
			Total	4:00				

Results

The flight test results presented in this report are to support an application for certification against BCAR Section S. This report aims to address the requirements of Sub-Section B Flight Paras S21 –S251. A cockpit assessment was completed which allowed aspects of Sub-Section F Equipment to be addressed.

Sub-Section F

The cockpit of the aircraft was simple but functional. The seat had good fore and aft adjustment. Rudder pedals were fixed. The joystick was conventional and fitted with a radio PTT switch. The instrument panel was functional with all fitted gauges being easy to read and all switches easy to reach and operate. Some of the gauges were incorrectly marked but were to be replaced on the production version.

The aircraft complied with Section S as follows:

S1301 Function and Installation

1. Each item of equipment fitted in the cockpit was of a kind/design appropriate to its intended function.

Complied with S1301.a. 1

S1301 a) 3. The installed equipment functioned properly throughout the test programme. Ambient temperatures of +17℃ to +8℃ were experienced without difficulty. The aircraft was tested in rain.

Complied with S1301.a. 3

S1301 b) The instruments and other equipment did not constitute a hazard to the safe operation of the aircraft throughout the test programme.

Complied with S1301.b

S1303 1 & 2

The aircraft was fitted with fully functioning ASI calibrated to read in KIAS and an altimeter with a Hp/Mb subscale.

Complied with S 1303 1&2

S1305 a) Powerplant Instruments

The aircraft was fitted with an EFIS giving engine rpm, and conventional analogue gauges which allowed the engine manufacturer's limitations to be complied with.

S1305 b)

The aircraft was fitted with a fuel contents sight glass. Satisfactory

S1305 c)

The a/c engine was conventional Rotax 912 with oil tank dip stick.

Complied with S 1305

S1307 a/b Safety Harness

The aircraft was fitted with a 4 point harness with a quick release mechanism. The lap straps gave good torso restraint. The shoulder straps were fitted to the rear bulkhead of the cabin. The harness was assessed as fit for purpose in that it gave good occupant restraint when tight.

The harness was not sufficiently long to contact the propeller even when unsecured.

Complied with S1307.

S1321 Instruments Arrangement and Visibility

The flight instruments were clearly visible to the pilot and easy to read.

Complied with S1321

S1323 Airspeed Indicator

a) The ASI was calibrated by TLAC and again during this test campaign. (See separate report) In order to confirm the required stall speed of 35 Kts was met additional testing was done at the slow end of the speed range. The aircraft was stalled into and down wind at 1500 ft agl – with a mean GPS ground speed of 33 kts Complied with S1323.

Sub Section B – Flight

General

S21 Proof of Compliance

a) The aircraft was tested with a full forward c of g by adding ballast forward of the passenger seat. It was tested at an extreme aft c of g by adding ballast at the rear of the baggage compartment. The aircraft was tested at 450 Kg for the heavy test points, and tested as light as possible with one POB and minimal fuel.
b) The aircraft was tested in all possible configurations. With fixed gear and a fixed pitch prop the only configuration variation possible was applying flap. All flap configurations were comprehensively tested.

Complied with S21

S23 Load Distribution Limits

The ranges of c of g have been selected to be the worst possible fwd and aft c of g possibilities likely to be encountered.

Complied with S23

Weight Limits

The maximum weight had been established as 450 kg which was the highest weight selected by the applicant and was below the design maximum weight. 450 kg was more than (not less than) the weight of the a/c + 86 kg. And was more than a/c weight + 86 kg + max fuel.

Complied with S25

S29 Empty Weight and Corresponding c.g.

The empty weight of the test a/c was determined by weighing with fixed ballast, min equipment, unusable fuel, max oil.

Summary of CG Limits and Test Points

The aircraft was designed to have a MAUW of 450 KG with a cg range of 9” (228 mm) – 15.5” (393mm) aft of datum. The aircraft was tested at MAUW from 450 Kg – 430 Kg and c of g from 9-15.5”.

Performance

S45 General

All performance testing was done out of Little Snoring at 196 ft above Sea Level. Temperatures for submitted performance data was ISA or above.

Complied with S45

Summary of Design Speeds

	V_{s0}	V_{s1}	Vx (Best angle)	(Best glide)	Vy (Best climb)	V_F (Flap limit)
Kn CAS (calibrated)	33	35	45	50	50	59
	V_A	Vh	V_{ne}	Vd		
Kn CAS (calibrated)			114	126		

S49 Stalling Speed

a) Vso was tested predominantly with idle power set (throttle closed). The landing configuration was identified as being with full flap applied. Testing was conducted at 430-450 kg (MAUW)
b) Vs1 was tested predominantly with idle power set (throttle closed). Testing was conducted at 430-450 kg (MAUW)
c) The procedure from S201 was used.
d) Initial testing (Sortie 1) with a full forward c of g stall speeds were as below.

Vs1 Clean = 38 KIAS
Vs1 First Stage of Flap = 36 KIAS
Vso Third Stage of Flap = 30 KIAS

PE testing indicated that the PE was nil at the stall giving a Vso of 30 Kts.

Complied with S 49

S51 Take-Off

Good take off performance – 100 m

Complied with S51

S65 Climb

A series of saw tooth climbs and descents were flown to determine the best ROC climb speed. This data led to the conclusion that an indicated airspeed of 60 KIAS gave the best rate of climb. Four climbs were then conducted at or close to MAUW at 60 KIAS. The aircraft was established at full throttle at the targeted airspeed and climbed for a full 5 mins with the height noted every 30 seconds. The results were then plotted graphically. Approx 1000 ft/min was achieved each time. The best rate of climb reduced with increasing altitude and temperature but was always consistently better than 250 ft/min at Sea Level allowing a climb to 1000 ft to be achieved in less than 4 mins. No temperature limits were exceeded even when climbing on days of ISA+1.

Complied with S65

S71 Rate of Descent

The saw tooth climbs/descents flown led to the conclusion that the best glide speed was 50-60 KIAS which gave a rate of decent consistently less than 800 ft/min

Complied with S71

S75 Landing

A series of landings were flown to the grass & concrete runway 25 at Little Snoring and Runway 09 Grass. Full flap was applied and initially approx. 3800 rpm used on approach maintaining 50 KIAS. Once at 15m/50 ft agl power was progressively reduced to idle and speed reduced to 45 KIAS. At approx. 1-2m the aircraft was gently flared using up to full back stick eventually to plant the aircraft onto the ground in the 3 point (stalled) attitude. Landing distances appeared consistent with previously published data.

Complied with S75

Controllability and Manoeuvrability

S143 General

a) The aeroplane was safely controllable and manoeuvrable during a max power take-off, climbs, level flight, descents, landing power on & off and following throttle chops to simulate engine failure.
b) It was easy to make smooth transitions between all tested flight conditions with no more than average piloting skill. No unsafe flight conditions were experienced during testing. Tests were conducted at all permissible/possible power settings.
c) No unusual flying characteristics were observed during testing. Flight in rain was assessed and was satisfactory.
d) No marginal conditions existed with regard to pilot limits.

Complied with S143.

S145 Longitudinal Control

a) It was possible at any speed below 1.3Vs1 to pitch the nose downwards so that a speed equal to Vs1 could be reached promptly. All configurations were tested at all power settings at fwd and aft c.g.
b) The only configuration changes were the application of flap. The flap was easy to apply for all stages.
c) Vdf was tested at fwd and aft c.g and recoveries flown with idle power and up to max rpm applied. It was easy to pitch the nose up and recover from the Vdf dive.

Complied with S145.

S147 Lateral and Directional Control

Tested in same conditions as LSS = sat.

Complied with S147.

S155 Pitch Control Force

The Pitch control force during turns/when recovering from manoeuvres was tested at forward and full aft c of g using wind up turns and pull ups. The stick force per g had been a concern but in both turns to the left and right 7daN was pulled at approx. 2.6 g well below the 4g limit. It was very hard to get close to 3 g as the speed washed off quickly and large aft stick input was required. Stick forcer per g was very benign with good force & tactile cues throughout.

Complied with S155.

S161 Trim

Longitudinal trim could be adjusted to cope with speed and power changes and even at Idle power with full flap a trim condition was achieved.

Complied with S161.

Stability

S171 General

The aeroplane was tested and met S173 to 181 Inclusive. In addition throughout the flight test programme the aircraft showed suitable stability and control “feel” and no additional condition was expected to be encountered in service.

Complied with S171

S173 Static Longitudinal Stability

Throughout the LSS testing at speeds from 1.4 Vs1 to Vne the slope of the curve of control force versus speed was consistently positive and any significant speed change introduced a variation in control force that was always plainly perceptible to the pilot. Additionally where the aircraft could be trimmed to a given speed it tended to return to within 10% of that speed after being disturbed from the condition.

Complied with S173

S175 Demonstration of Static Longitudinal Stability (LSS)

LSS was tested in the conditions required as follows:

a) Climb – The full power climb at 60KIAS was weakly stable. As speed was increased the stability became more positive. Holding a given airspeed was easy and the aircraft demonstrated positive stability at the recommended climb speed of 60 KIAS.

b) Cruise –Positive static stability in all required configurations 5500 Rpm Max Continuous power used. Static stability assessed up to Vdf.

c) Approach The recommended approach speed was 50 KIAS with normal approach power being defined as 3500 rpm. Again positive stability was evident.

Complied with S175

S177 Lateral and Directional Stability

With the aeroplane in steady flight and when the roll and yaw controls were gradually applied in opposite directions any increase in sideslip angle corresponded to an increased deflection in joystick. In all sideslips the lateral stick force increased progressively with the amount of sideslip and did not reverse.

Complied with S177

S181 Dynamic Stability

The following requirements were met with the engine running at Idle, Cruise PFLF and full power.

a) Short Period Oscillations between Vs and Vne were heavily damped with the controls fixed and free.

b) The Lateral Directional Oscillations (LDO) were damped.

c) The phugoid was well damped and did not cause an unacceptable increase in pilot workload or otherwise endanger the aeroplane. When the conditions of S175 were tested and the controls released from the trim speed by 15% the response of the aircraft was benign and not excessive in relation to the magnitude of the control force released.
Complied with S181

S201 Stalls

Stalling behaviour was investigated at full fwd and full aft c.g and at MAUW and as light as possible with 1 POB and minimal fuel.

a) Stalls were conducted by reducing the speed at approx. 1 KIAS per second from Straight and Level flight until a stall was noted by a downward pitching moment and/or full back stick. No uncontrollable rolling motion was observed and roll and yaw could be produced with unreversed use of the controls until the stall occurred.
b) There was no tendency to spin at the stall. Minimal wing drop could be contained within 20° AOB with normal use of the controls.
c) The loss of altitude from the beginning of the stall to regaining level flight by achieving applying normal procedures and the max nose down pitch attitude below the horizon was noted. The typical height loss was approx. 20-50 ft and no more than 10-15 degrees nose down was required for recovery.
d) Testing was conducted in all flap configurations, trimmed at 1.4 Vs and with Idle power and at the throttle setting for 4800 rpm in the cruise.

Complied with S201

S203 Turning Flight Stalls

a) When stalled during a co-ordinated 30°AOB turn it was possible to regain normal level flight without encountering uncontrollable rolling or spinning tendencies.
b) The loss of altitude from the beginning of the stall until regaining level flight by applying normal procedures was determined and found to be approx. 30 ft. The testing was conducted with flaps in all configurations and power idle and at the throttle setting for 4800 rpm in the cruise.

Complied with S203

S207 recovery from the Stall

a) It was possible to control the roll attitude of the aircraft up to the stall using the joystick alone and any tendency for wing drop at the stall could be prevented.

b) The aircraft met the requirement of S207. a. “clear and distinctive stall warning with the flaps in any position in both straight and turning flight was evident” in that the pre-stall buffet occurred approx 5 KIAS above the stall.

Complied with S207

S221 Spinning

Given the heritage of the aircraft as a derivative of the Escapade the UK CAA and previously BMAA had agreed that no further spin testing was required.

Ground Handling Characteristics

S233 Directional Stability and Control

Testing was conducted on dry and wet grass and concrete with wind speeds to 15 kts. There was no uncontrollable ground-loop tendency at any speed at which the aeroplane could be expected to operate on the ground and it had adequate directional control during taxiing. The brakes were effective in stopping the aircraft quickly and were easy to use.

Complied with S 233

S235 Take-Off and Landing in Cross Winds

During the period of testing cross wind components up to and including 10 kts were experienced. The take –off was flown conventionally with into wind aileron applied at the start of the take-off roll. The landing could be accomplished using either the “kick off for drift” or “wing down” technique. The latter was used due to personal preference by the test

pilot but both techniques allowed safe and controllable landings. The aircraft coped well with the cross wind.

S251 Vibration and Buffeting

There was no excessive vibration at all airspeeds up to and including Vdf, nor was there any buffeting severe enough to interfere with the satisfactory control of the aeroplane, cause fatigue to the crew or result in structural damage. The testing included the engine running at all powers from idle to full throttle and included start up and shut down.

Conclusion

The Scout was a very pleasant small aeroplane to fly. It had a simple but well laid out cockpit with the minimal instrumentation being easy to read and use. The flying controls were well harmonised and it demonstrated appropriate static and dynamic stability. The performance for such a small engine was excellent. The aircraft was satisfactory to manoeuvre on the ground and the take-off and landings were all easy to fly with short take-off and landing distances evident. The aircraft fully met the requirements of BCAR Section S Issue 6.

9 TEST DATA

Flight Number / Configuration	Sortie 1 – Mid c of g
Date	17 October 2017
Overview	Shakedown flight – Pressure Errors – Qualitative Assessment of LSS, Lat Dir & Stick Force/g plus Phugoid & Dutch Roll. Idle Power Stalls Engine & prop handling – and flight to V_{DF} Take-off & landings
Handling Pilot/P1	Chris Taylor
Safety Pilot P2	N/A
FTE	N/A
AUW	450kg
cg	mid
Fuel T/O	70 Lts
Fuel Ldg	61
ZFW	400 kg

Airfield Altitude	196	ft	QFE	1008	mb
Wind	Lt/Vrb	knots	OAT	15	℃
Weather (test area)	Good – Nil cloud minimal turbulence				

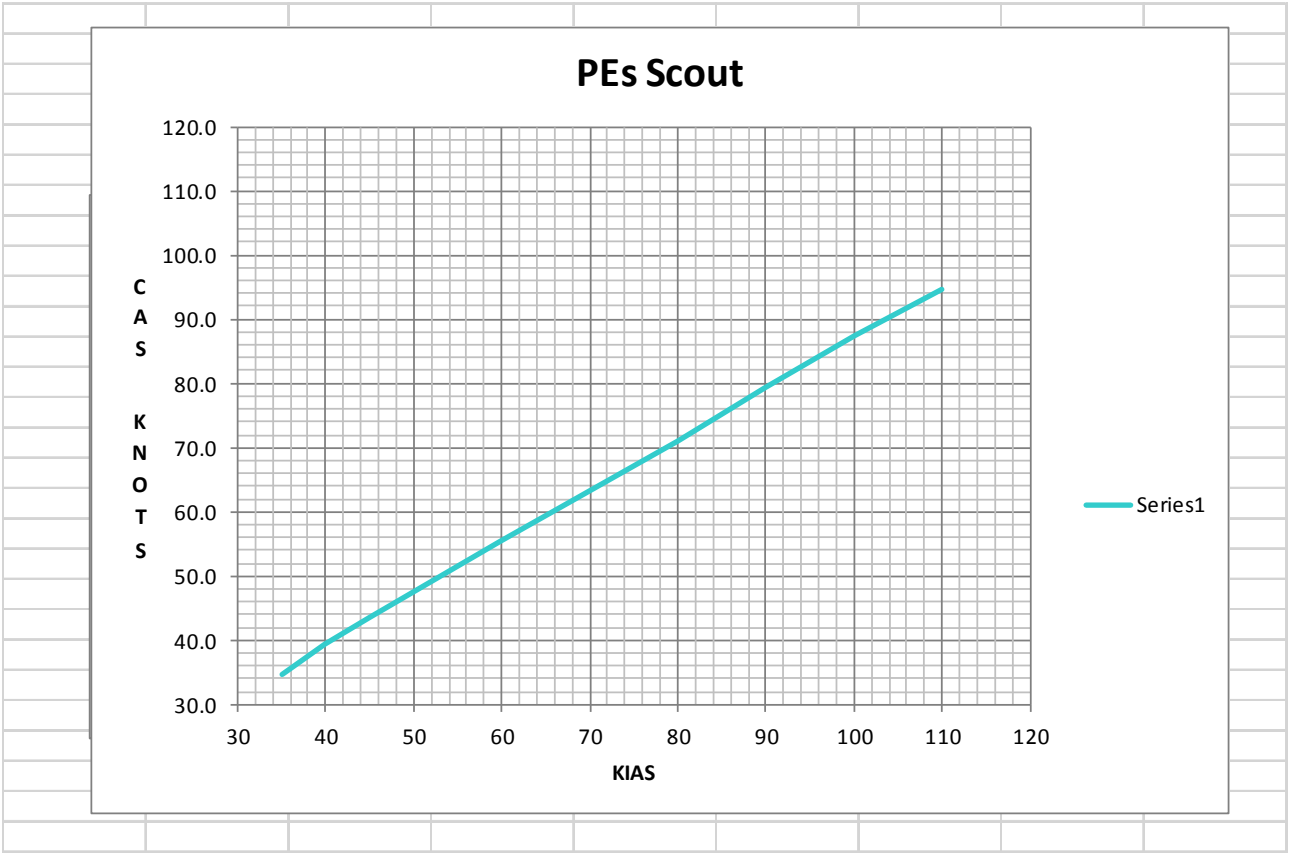
Test Timings			
Off Chocks	1450	Landing	1535
Take-Off	1455	On Chocks	1540

Ground Handling						
Test	Fuel	Wt				
Start	70	450				
End	69	449				
All OK – Brakes worked well –Could 180 turn easily by braking inner wheel. Tail wheel connected to rudder – rudder without brake could be used for normal taxi and aircraft could be kept straight – more twitchy on concrete than grass. = sat						

Sawtooth climbs to determine Vy				
	ht	T		Remarks
Fuel=	69			
	Time (mins	℃		
50KIAS	52			Uncomfortable high nose up attitude – but good for best angle
55KIAS	48			Approx Best Rate of Climb Speed
60 KIAS	51			Good rate of climb with good external view - recommended

Pressure Error data - Clean Config En Route Config — Clear Air – No turbulence						
Speed	Hdg	Track	G/S	Ht	OAT	Comment
35	000	325	35	1500	12	Full Flap
	120	155	25			
	240	243	57			
40	000	330	37			Full Flap
	120	150	28			
	240	243	64			
45	000	335	39			Full Flap
	120	145	35			
	240	243	66			
60	000	340	56			
	120	140	44			
	240	242	76			
80	000	345	75			
	120	133	59			
	240	242	87			
90	000	347	83			
	120	132	66			
	240	242	97			
100	000	349	85			
	120	130	76			
	240	241	109			
110	000	350	90			
	120	129	84			
	240	241	118			

	Vg 1 (kts)	Track 1 (deg)	Vg 2 (kts)	Track 2 (deg)	Vg 3 (kts)	Track 3 (deg)	Vwind (kts)	Wind dir (deg)	1500/12C root Sigma		CAS	Vtrue (kts)
35	35	325	25	155	57	243	22.1	72.3	0.9800		34.7	35.4
40	37	330	28	150	64	243	24.1	70.7	0.9800		39.4	40.2
45	39	335	35	145	66	243	21.6	65.6	0.9800		43.5	44.4
60	56	340	44	140	76	242	20.5	78.5	0.9800		55.6	56.7
80	75	345	59	133	87	242	17.0	90.2	0.9800		71.0	72.4
90	83	347	66	132	97	242	18.8	89.9	0.9800		79.3	80.9
100	85	349	76	130	109	241	20.5	74.1	0.9800		87.4	89.1
110	90	350	84	129	118	241	21.7	68.7	0.9800		94.7	96.6



Basic/idle Stalling
49 Stall speed
201 Stall demonstration Wings Level
203 Stall characteristics Turning Flight
207 Stall Recovery & warning
NB: Full back Stick 2 secs, G Break

Straight (thrust levers closed). Trim the aeroplane above 3000 ft AGL in the required configuration at 1.4 Vs with the throttle closed. Approach the stall in straight flight while decreasing speed at 1 knot/second. Recovery is to be completed by 3000 ft agl.

Test	Fuel	Wt	Time	Pwr	Trim	Buffet	Stall	Wing Drop
Flaps 0	65	445	1515	Idle				
Flaps T/O	65	445		Idle				
Flaps Full	65	445		Idle			30	

Controllability and Manoeuvrability
143 General

S 143 General
a) The aeroplane must be safely controllable and manoeuvrable during;
1) take-off at maximum take-off power;
2) any steady climb condition;
3) level flight;
4) descent;
5) landing, power on and off; and
6) with sudden engine failure.
b) It must be possible to make a smooth transition from one flight condition to another (including turns, reversal of turns and slips) with no more than average piloting skill, alertness or strength, and without danger of exceeding the limit load factor, under any probable operating condition, with the engine running at all allowable power settings, including the effect of power changes and sudden engine failure. Modest departures from any recommended techniques must not cause unsafe flight conditions
c) Any unusual flying characteristics observed during the flight tests required to determine compliance with the flight requirements and any significant variations in flight characteristics caused by rain must be determined with the engine running at all allowable powers.
d) If marginal conditions exist with regard to pilot effort the 'pilot effort' limits must be shown by quantitative tests for a minimum weight pilot. In no case may the limits exceed those prescribed in the table shown in S.143. This requirement must be met with the engine running at all allowable powers. Values in pounds of force as applied to the control wheel or rudder pedals.

(a) For temporary application:	P	R	Y
Stick----------	20	10	--------
Wheel (applied to rim)----------	25	20	--------
Rudder Pedal--------	-------	-------	40
(b) For prolonged application.	2	1.5	10

Amdt 23-0 & Amdt. 23-14, Eff. 12/20/73

Condition of Note	Comment
	All sat including response to throttle chop on climb out – gentle nose drop

S 161 Trim
The speeds to achieve lateral, longitudinal and directional trim must lie within 1.3 VS1 and 2.0 VS1 at all engine powers and the extreme c.g. positions.

Test	Fuel	Wt	Time	KIAS	Pwr	Considerations
Flap Up	64	444		1.3Vs1	PFLF	Assess Long & Directional Trim
Flap Up				2.0 Vs1	PFLF	Assess Long & Directional Trim
Flap Up				1.3Vs1	Idle	Assess Long & Directional Trim
Flap Up				2.0 Vs1	Idle	Assess Long & Directional Trim
Flap Up				1.3Vs1	Full	Assess Long & Directional Trim
Flap Up				2.0 Vs1	Full	Assess Long & Directional Trim
Flap Full				1.3Vs1	PFLF	Assess Long & Directional Trim
Flap Full				2.0 Vs1	PFLF	Assess Long & Directional Trim
Flap Full				1.3Vs1	Idle	Assess Long & Directional Trim
Flap Full				2.0 Vs1	Idle	Assess Long & Directional Trim
Flap Full				1.3Vs1	Full	Assess Long & Directional Trim
Flap Full				2.0 Vs1	Full	Assess Long & Directional Trim

All satisfactory – no concerns regarding future test points.

Stick Force per G

S 155 Pitch control force in manoeuvres
The pitch control force during turns or when recovering from manoeuvres must be such that at a constant speed an increase in load factor is associated with an increase in control force. In addition:
a) For conventional control systems the minimum value of this force to apply to the aeroplane a normal acceleration which would impose limit load on the structure must not be less than 7 daN from a trimmed 1 g condition at all speeds up to VNE at which the required normal acceleration can be achieved without stalling, with wing-flaps and, where applicable, landing gear retracted.

Test	Fuel	Wt	Time	KIAS	Pwr	Considerations
The wind Up turns to 3G						
Flaps 0 Gear Up	63	443		80	MCP	
Flaps 0 Gear Up				80	MCP	
Flaps 0 Gear Up				Vne	MCP	
Flaps 0 Gear Up				Vne	MCP	
Large control throw to pull g with speed quickly washing off – difficult to reach 2g -2.5g max reached – no concerns regarding further data gathering						

75 Normal Landing – Power Off

Test	CG	Wt	Ht	KIAS	Pwr	Considerations
2	Mid	440Kg		50	Idle	(1) A steady gliding approach with a calibrated airspeed of at least [1.3] V_{S1} must be maintained down to the 50 foot height. (2) The landing may not require exceptional piloting skill or exceptionally favourable conditions. (3) The landing must be made without excessive vertical acceleration or tendency to bounce, nose over, ground loop, porpoise, or water loop.

Satisfactory – easy to round out

75 Simulated Emergency Condition Flapless Landing – Touch & Go						
Test	CG	Wt	Ht	KIAS	Pwr	Considerations
4	A	L		55	Idle	Note change in pitch attitude at touch down
Easy – could land on main wheels or three point - satisfactory						

51 Flapless Take-Off – from Touch & Go						
Test	CG	Wt	Ht	KIAS	Pwr	Considerations
5	A	L			Idle	Note change in pitch attitude at rotate
Easy – tail could be raised by forward movement of the stick – aircraft flying off at 40-45KIAS.						

75 Vref-5 Landing –						
Test	CG	Wt	Ht	KIAS	Pwr	Considerations
6	A	L		45	Idle	
A 45 KIAS approach still gave a good margin above the stall and for a very short field landing 40 KIAS could be used over the threshold – easy to round out – good elevator control power.						

Flight Number / Configuration	Sortie 2 – Full Forward c of g
Date	18 Oct 17
Overview	Forward c of g = performance Climbs,. Idle Power Stalls and flight to V_{DF} Take-off & landings
Handling Pilot/P1	Chris Taylor
Safety Pilot P2	None
FTE	None
AUW	450 kg
cg	228mm
Fuel T/O	70 lts
Fuel Ldg	57 lts
ZFW	400 kg

Airfield Altitude	196	ft	QFE	1008	mb
Wind	Light/Vrb	knots	OAT	15	℃
Weather (test area)	Overcast – light winds from NE at altitude – no sig turbulence – rain later				

Test Timings			
Off Chocks	1145	Landing	1240
Take-Off	1150	On Chocks	1245

Ground Handling						
Test	Fuel	Wt				
Start	70	450				
End	70	450				
Satisfactory – Steering OK with mainwheel brakes & tail wheel – Tailwheel could easily be broken out of rudder steering –more twitchy on concrete that grass – so landing easier on grass in light winds.						

Climb data							
	ht	T			ht	T	Remarks
Fuel=	70			Fuel=	69		
Time (mins)		℃		Time (mins)		℃	
0	500	13		0	500	13	
0.5	1100			0.5	1100		
1	1700	11		1	1700	11	
1.5	2200			1.5	2200		
2	2700	9		2	2700	9	
2.5	3150			2.5	3150		
3	3600	7		3	3600	7	
3.5	4100			3.5	4150		
4	4550	5		4	4550	5	
4.5	5000			4.5	5050		
5	5400	3		5	5450	3	

Basic/idle Stalling
49 Stall speed
201 Stall demonstration Wings Level
203 Stall characteristics Turning Flight
207 Stall Recovery & warning
NB: Full back Stick 2 secs, G Break

Straight (thrust levers closed). Trim the aeroplane above 3000 ft AGL in the required configuration at 1.4 Vs with the throttle closed. Approach the stall in straight flight while decreasing speed at 1 knot/second. Recovery is to be completed by 3000 ft agl.

Test	Fuel	Wt	Time	Pwr	Trim	Buffet	Stall	Wing Drop
Flaps 0	69	448	1210	Idle	54	Light	38	Wing Rock +/- 10 degrees
Flaps T/O	69	448	1211	Idle	50	Light	36	No
Flaps Full	68	447	1212	Idle	42	Light	30	No sig

Advanced Stalling Forward C of G & Heavy
49 Stall speed
201 Stall demonstration Wings Level
207 Stall Recovery & warning
NB: Full back Stick 2 secs, G Break

4) Power :
i) Engine idling; and
ii) Maximum continuous power, or, if the power-to-weight ratio at maximum continuous power results in extreme nose-up attitudes, demonstration may be carried out with the power not less than that required for level flight in the landing configuration at maximum landing weight and a speed of 1·4 VS0, except that the power may not be less than 75% maximum continuous power.
Note 4800 rpm used to give 75% of MCP

Test	Fuel	Wt	Time	Pwr	Trim	Buffet	Stall	Wing Drop
Flaps 0	68	447	1213	4800	49	Light	35	No
Flaps T/O	68	447	1214	4800	42	Light	30	10°AOB
Flaps Full	67	446	1215	4800	35	Light	25	No

Advanced Stalling
49 Stall speed
203 Stall characteristics Turning Flight
207 Stall Recovery & warning
NB: Full back Stick 2 secs, G Break

4) Power :
i) Engine idling; and
ii) Maximum continuous power, or, if the power-to-weight ratio at maximum continuous power results in extreme nose-up attitudes, demonstration may be carried out with the power not less than that required for level flight in the landing configuration at maximum landing weight and a speed of 1·4 VS0, except that the power may not be less than 75% maximum continuous power.

Test	Fuel	Wt	Time	Pwr	Trim	Buffet	Stall	Wing Drop
Flaps 0 Left	67	446	1215	Idle	45	Light	38	Nil
Flaps 0 Right	67	446		Idle	45	Light	40	Rolled level
Flaps T/O Left	67	446		Idle	45	Light	38	Nil
Flaps T/O Right	66	446		Idle	45	Light	40	Rolled level
Flaps Full Left	66	446		Idle	45	Light	32	Nil
Flaps Full Right	66	446		Idle	45	Light	32	Rolled level
Flaps 0 Left	66	446		4800	45	Light	34	Nil
Flaps 0 Right	66	446		4800	45	Light	35	Rolled level
Flaps T/O Left	66	446		4800	45	Light	40	Nil
Flaps T/O Right	66	446		4800	45	Light	35	Rolled level
Flaps Full Left	66	446		4800	45	Light	25	Nil
Flaps Full Right	66	446		4800	45	Light	30	Rolled level

Controllability and Manoeuvrability
143 General

S 143 General
a) The aeroplane must be safely controllable and manoeuvrable during;
1) take-off at maximum take-off power;
2) any steady climb condition;
3) level flight;
4) descent;
5) landing, power on and off; and
6) with sudden engine failure.
b) It must be possible to make a smooth transition from one flight condition to another (including turns, reversal of turns and slips) with no more than average piloting skill, alertness or strength, and without danger of exceeding the limit load factor, under any probable operating condition, with the engine running at all allowable power settings, including the effect of power changes and sudden engine failure. Modest departures from any recommended techniques must not cause unsafe flight conditions
c) Any unusual flying characteristics observed during the flight tests required to determine compliance with the flight requirements and any significant variations in flight characteristics caused by rain must be determined with the engine running at all allowable powers.
d) If marginal conditions exist with regard to pilot effort the 'pilot effort' limits must be shown by quantitative tests for a minimum weight pilot. In no case may the limits exceed those prescribed in the table shown in S.143. This requirement must be met with the engine running at all allowable powers. Values in pounds of force as applied to the control wheel or rudder pedals.

(a) For temporary application:	P	R	Y
Stick----------	20	10	--------
Wheel (applied to rim)----------	25	20	--------
Rudder Pedal--------	-------	-------	40
(b) For prolonged application.	2	1.5	10

Amdt 23-0 & Amdt. 23-14, Eff. 12/20/73

Condition of Note	Comment
Nil	All sat – Throttle chop on take-off benign – Gentle pitch nose down.

S 161 Trim
The speeds to achieve lateral, longitudinal and directional trim must lie within 1.3 VS1 and 2.0 VS1 at all engine powers and the extreme c.g. positions.

Test	Fuel	Wt	Time	KIAS	Pwr	Considerations
Flap Up	65	445	1220	1.3Vs1	PFLF	Assess Long & Directional Trim
Flap Up	65	445		2.0 Vs1	PFLF	Assess Long & Directional Trim

Flap Up	65	445		1.3Vs1	Idle	Assess Long & Directional Trim
Flap Up	65	445		2.0 Vs1	Idle	Assess Long & Directional Trim
Flap Up	65	445		1.3Vs1	Full	Assess Long & Directional Trim
Flap Up	65	445		2.0 Vs1	Full	Assess Long & Directional Trim
Flap Full	65	445		1.3Vs1	PFLF	Assess Long & Directional Trim
Flap Full	65	445		2.0 Vs1	PFLF	Assess Long & Directional Trim
Flap Full	65	445		1.3Vs1	Idle	Assess Long & Directional Trim
Flap Full	64	445		2.0 Vs1	Idle	Assess Long & Directional Trim
Flap Full	64	445		1.3Vs1	Full	Assess Long & Directional Trim
Flap Full	64	445		2.0 Vs1	Full	Assess Long & Directional Trim

All satisfactory – aircraft could easily be trimmed in all required conditions – worst case idle power full flap where full NU trim = 48KIAS – very light forces = all easy to fly

Longitudinal Control
S 145 Longitudinal Control
a) It must be possible at any speed below 1.3 VS1 to pitch the nose downwards so that a speed equal to 1.3 VS1 can be reached promptly.
1) **Test conditions.** All possible configurations and engine powers when trimmed at 1.3 VS1 (where trim control is fitted).
b) It must be possible throughout the appropriate flight envelope to change the configuration (landing gear, wing flaps etc.) without exceptional piloting skill and without exceeding the control forces defined in S 143 d).
c) It must be possible to raise the nose at VDF at all permitted c.g. positions and engine powers.

Test	Fuel	Wt	Time	KIAS	Pwr	Considerations
Flap Up	63	445	1225		Idle	Extend Flaps
Flap T/O					Idle	Extend – then retract Flaps
Flap Full					idle	Extend – then retract Flaps

Flap Up					Full	Apply Full Power – maintain speed
Flap T/O					Full	Apply Full Power – maintain speed
Flap Full					Full	Fly 1.1 – 1.7 Vs
All satisfactory – all test points easy to fly – easy to maintain level flight						

S 147 Lateral and directional control
a) Using an appropriate combination of controls, it must be possible to roll the aeroplane from a steady 30° banked turn through an angle of 60°, so as to reverse the direction of the turn within 5 seconds when the turns are made at speeds of 1.3 VS1 and at VNE.
b) N/A - (Applicable only if control is effected by weight shift
c) The tests required by a) and b) must be performed:
1) where applicable, with the landing gear and wing-flaps retracted and with the landing gear and wing-flaps extended;
2) without encountering uncontrollable rolling tendencies or uncommanded high roll rates; and
3) with any uncommanded pitching during the manoeuvre being readily controllable.

Test	Fuel	Wt	Time	KIAS	Pwr	Time to Roll
Flap Up	62	444	1228	1.3Vs1	4000	3 secs L-R
Flap Up				1.3Vs1	4000	3 secs R-L
Flap Full				1.3Vs1	4000	3 secs L-R
Flap Full				1.3Vs1	4000	3 secs R-L
Flap Up				Vne	5500	3 secs L-R
Flap Up				Vne	5500	3 secs R-L

Stick Force per G

S 155 Pitch control force in manoeuvres
The pitch control force during turns or when recovering from manoeuvres must be such that at a constant speed an increase in load factor is associated with an increase in control force. In addition:
a) For conventional control systems the minimum value of this force to apply to the aeroplane a normal acceleration which would impose limit load on the structure must not be less than 7 daN from a trimmed 1 g condition at all speeds up to VNE at which the required normal acceleration can be achieved without stalling, with wing-flaps and, where applicable, landing gear retracted.

Test	Fuel	Wt	Time	KIAS	Pwr	Considerations
The wind Up turns to 3G						
Flaps 0 Gear Up	61	443	1230	80	MCP	Pull to 2.5g = 7DaN Pull to 3 g
Flaps 0 Gear Up	A	L	5k+	80	MCP	Pull to 2.5g = 7DaN Pull to 3g
Flaps 0 Gear Up	A	L	5k+	Vne	MCP	Pull to 2.5g = 7DaN Pull to 3 g
Flaps 0 Gear Up	A	L	5k+	Vne	MCP	Pull to 2.5g =7DaN Pull to 3g

23.251 Vibration and buffeting
23.253 High speed characteristics
Dive to Vdf

Test	Fuel	Wt	Time	KIAS	Pwr	Considerations
Clean	60	443	1235	140	MCP	

NOTE: This test must not be carried out in turbulent conditions.

Start Altitude	3000 ft	IOAT	11 C	Scheduled Vdf	140 kts
End Altitude	2000 ft	PEs	15 kt	Vdf KIAS Achieved?	140 kts

Left	Right

Any buffet or unusual vibrations ACC
Weight and Response of flying Controls ACC
Engine/Propeller behaviour ACC

It must be possible to recover from an overspeed condition at Vd using the primary longitudinal control alone – yes it was

Assess LSS = Statically stable – very positive

Assess LDO = Well damped – not excited

S 181 Dynamic stability
a) Any short period oscillations not including combined lateral-directional oscillations occurring between the stalling speed and VDF must be heavily damped with the primary controls:
1) Free;
2) Fixed.
b) Any combined lateral-directional oscillations occurring between the stalling speed and VDF must be damped with the primary controls:
1) Free;
2) Fixed.
c) Any long period oscillation of the flight path (phugoid) must not be so unstable as to cause an unacceptable increase in pilot workload or otherwise endanger the aeroplane. When, in the conditions of S 175, the longitudinal control force required to maintain speeds differing from the trimmed speed by at least ±15% is suddenly released, the response of the aeroplane must not exhibit any dangerous characteristics nor be excessive in relation to the magnitude of the control force released. These requirements must be met with the engine running at all allowable powers

Test	Fuel	Wt	Ht Hp	Power	OAT	LDO		Phugoid
Climb Vyi	59	442	3000	Full	11	Well damped		Convergent 20 sec
Cruise 0.9Hh				MCP		Well damped		Convergent 24 sec
Slow Cruise				PFLF		Well damped		Convergent 22 sec
App				Idle		Well damped		Convergent 20 sec
App Full Flap						Well damped		Convergent 20 sec

75 Normal Landing – Power Off						
Test	CG	Wt	Ht	KIAS	Pwr	Considerations
2	Fwd	440			Idle	(1) A steady gliding approach with a calibrated airspeed of at least [1.3] V_{S1} must be maintained down to the 50 foot height. (2) The landing may not require exceptional piloting skill or exceptionally favourable conditions. (3) The landing must be made without excessive vertical acceleration or tendency to bounce, nose over, ground loop, porpoise, or water loop.
Easy to fly – 50KIAS approach – 45 KIAS over threshold – good elevator authority – full back stick not reached/required						

75 Simulated Emergency Condition Flapless Landing – Touch & Go						
Test	CG	Wt	Ht	KIAS	Pwr	Considerations
4	F	440			Idle	Note change in pitch attitude at touch down
Sat – no issues						

51 Flapless Take-Off – from Touch & Go						
Test	CG	Wt	Ht	KIAS	Pwr	Considerations
5	F	440			Idle	Note change in pitch attitude at rotate
Easy – no issues						

75 Vref-5 Landing –						
Test	CG	Wt	Ht	KIAS	Pwr	Considerations
6	F	440			Idle	
Short field technique 40 KIAS at threshold – good control – good elevator authority – good field of view - sat						

Flight Number / Configuration	Sortie 3 – Full Aft c of g
Date	17 October 2017
Overview	Full Aft cg = HQ –LSS, Lat Dir & Stick Force/g plus Phugoid & Dutch Roll. Stalls– and flight to V_{DF} Take-off & landings
Handling Pilot/P1	Chris Taylor
Safety Pilot P2	None
FTE	None
AUW	440 kg
cg	394
Fuel T/O	61
Fuel Ldg	47
ZFW	400

Airfield Altitude	196	ft	QFE	1010	mb
Wind	250/10-12	knots	OAT	17	℃
Weather (test area)	Excellent – light westerly winds no turbulence				

Test Timings			
Off Chocks	1620	Landing	1740
Take-Off	1625	On Chocks	1745

Ground Handling						
Test	Fuel	Wt				
Start	60	440				
End						
Satisfactory – tendency to weather cock into wind due to larger fin/rudder – needed yaw pedal activity to keep straight o concrete – easier						

Climb data						
	ht	T		ht	T	Remarks
Fuel=	60		Fuel=	60		
Time (mins)		℃	Time (mins)		℃	
0	500	15	0	500	15	
0.5	1200		0.5	1150		
1	1600	13	1	1600	13	
1.5	2200		1.5	2250		
2	2650	10	2	2700	10	
2.5	3200		2.5	3250		
3	3600	8	3	3600	8	
3.5	4100		3.5	4140		
4	4500	7	4	4550	7	
4.5	4950		4.5	5000		
5	5350	5	5	5400	5	

Basic/idle Stalling
49 Stall speed
201 Stall demonstration Wings Level
203 Stall characteristics Turning Flight
207 Stall Recovery & warning
NB: Full back Stick 2 secs, G Break

Straight (thrust levers closed). Trim the aeroplane above 3000 ft AGL in the required configuration at 1.4 Vs with the throttle closed. Approach the stall in straight flight while decreasing speed at 1 knot/second. Recovery is to be completed by 3000 ft agl.

Test	Fuel	Wt	Time	Pwr	Trim	Buffet	Stall	Wing Drop
Flaps 0	59	439	1640	Idle		light	38 Full Back Stick FBS	Wing rock

Flaps T/O	59	439		Idle		light	32 FBS	no
Flaps Full	59	439		Idle		light	30 FBS	Wing Rock

Advanced Stalling
49 Stall speed
201 Stall demonstration Wings Level
207 Stall Recovery & warning
NB: Full back Stick 2 secs, G Break

4) Power :
i) Engine idling; and
ii) Maximum continuous power, or, if the power-to-weight ratio at maximum continuous power results in extreme nose-up attitudes, demonstration may be carried out with the power not less than that required for level flight in the landing configuration at maximum landing weight and a speed of 1·4 VS0, except that the power may not be less than 75% maximum continuous power.

Test	Fuel	Wt	Time	Pwr	Trim	Buffet	Stall	Wing Drop
Flaps 0	58	438	1645	MCP+		Light	30	No
Flaps T/O				MCP+		Light	30	No
Flaps Full				MCP+		Heavy	30	No

Advanced Stalling
49 Stall speed
203 Stall characteristics Turning Flight
207 Stall Recovery & warning
NB: Full back Stick 2 secs, G Break

4) Power :
i) Engine idling; and
ii) Maximum continuous power, or, if the power-to-weight ratio at maximum continuous power results in extreme nose-up attitudes, demonstration may be carried out with the power not less than that required for level flight in the landing configuration at maximum landing weight and a speed of 1·4 VS0, except that the power may not be less than 75% maximum continuous power.
Power used = 4800 rpm

Test	Fuel	Wt	Time	Pwr	Trim	Buffet	Stall	Wing Drop
Flaps 0 Left	56	437	1650	Idle	50	Light	40	no
Flaps 0 Right				Idle	50	Light	40	Wings Levelled
Flaps T/O Left				Idle	40	Light	35	no
Flaps T/O Right				Idle	40	Light	35	Wings Levelled
Flaps Full Left				Idle	35	Light	30 FBS	no
Flaps Full Right				Idle	35	Light	30 FBS	Wings Levelled
Flaps 0 Left				MCP+	40	Light	35	no
Flaps 0 Right				MCP+	40	Light	35	Wings Levelled
Flaps T/O Left				MCP+	38	Light	30	no
Flaps T/O Right				MCP+	38	Light	30	Wings Levelled
Flaps Full Left				MCP+	38	Light	30	no
Flaps Full Right	55	436	1653	MCP+	38	Light	30	Wings Levelled

Controllability and Manoeuvrability
143 General

S 143 General
a) The aeroplane must be safely controllable and manoeuvrable during;
1) take-off at maximum take-off power;
2) any steady climb condition;
3) level flight;
4) descent;
5) landing, power on and off; and
6) with sudden engine failure.
b) It must be possible to make a smooth transition from one flight condition to another (including turns, reversal of turns and slips) with no more than average piloting skill, alertness or strength, and without danger of exceeding the limit load factor, under any probable operating condition, with the engine running at all allowable power settings, including the effect of power changes and sudden engine failure. Modest departures from any recommended techniques must not cause unsafe flight conditions
c) Any unusual flying characteristics observed during the flight tests required to determine compliance with the flight requirements and any significant variations in flight characteristics caused by rain must be determined with the engine running at all allowable powers.
d) If marginal conditions exist with regard to pilot effort the 'pilot effort' limits must be shown by quantitative tests for a minimum weight pilot. In no case may the limits exceed those prescribed in the table shown in S.143. This requirement must be met with the engine running at all allowable powers. Values in pounds of force as applied to the control wheel or rudder pedals.

(a) For temporary application:	P	R	Y
Stick----------	20	10	--------
Wheel (applied to rim)----------	25	20	--------
Rudder Pedal--------	-------	-------	40
(b) For prolonged application.	2	1.5	10

Amdt 23-0 & Amdt. 23-14, Eff. 12/20/73

Condition of Note	Comment
None	All sat

S 161 Trim
The speeds to achieve lateral, longitudinal and directional trim must lie within 1.3 VS1 and 2.0 VS1 at all engine powers and the extreme c.g. positions.

Test	Fuel	Wt	Time	KIAS	Pwr	Considerations
Flap Up	55	436	1655	1.3Vs1	PFLF	Assess Long & Directional Trim
Flap Up				2.0 Vs1	PFLF	Assess Long & Directional Trim
Flap Up				1.3Vs1	Idle	Assess Long & Directional Trim
Flap Up				2.0 Vs1	Idle	Assess Long & Directional Trim
Flap Up				1.3Vs1	Full	Assess Long & Directional Trim
Flap Up				2.0 Vs1	Full	Assess Long & Directional Trim

Flap Full				1.3Vs1	PFLF	Assess Long & Directional Trim
Flap Full				2.0 Vs1	PFLF	Assess Long & Directional Trim
Flap Full				1.3Vs1	Idle	Assess Long & Directional Trim
Flap Full				2.0 Vs1	Idle	Assess Long & Directional Trim
Flap Full				1.3Vs1	Full	Assess Long & Directional Trim
Flap Full				2.0 Vs1	Full	Assess Long & Directional Trim
All sat – no issues						

Test	Fuel	Wt	Time	Pwr	Considerations
Flap Up	54	435	1700	Idle	Extend Flaps
Flap T/O				Idle	Extend – then retract Flaps
Flap Full				idle	Extend – then retract Flaps
Flap Up				Full	Apply Full Power – maintain speed
Flap T/O				Full	Apply Full Power – maintain speed
Flap Full				Full	Fly 1.1 – 1.7 Vs

S 147 Lateral and directional control
a) Using an appropriate combination of controls, it must be possible to roll the aeroplane from a steady 30° banked turn through an angle of 60°, so as to reverse the direction of the turn within 5 seconds when the turns are made at speeds of 1.3 VS1 and at VNE.
b) N/A - (Applicable only if control is effected by weight shift
c) The tests required by a) and b) must be performed:
1) where applicable, with the landing gear and wing-flaps retracted and with the landing gear and wing-flaps extended;
2) without encountering uncontrollable rolling tendencies or uncommanded high roll rates; and
3) with any uncommanded pitching during the manoeuvre being readily controllable.

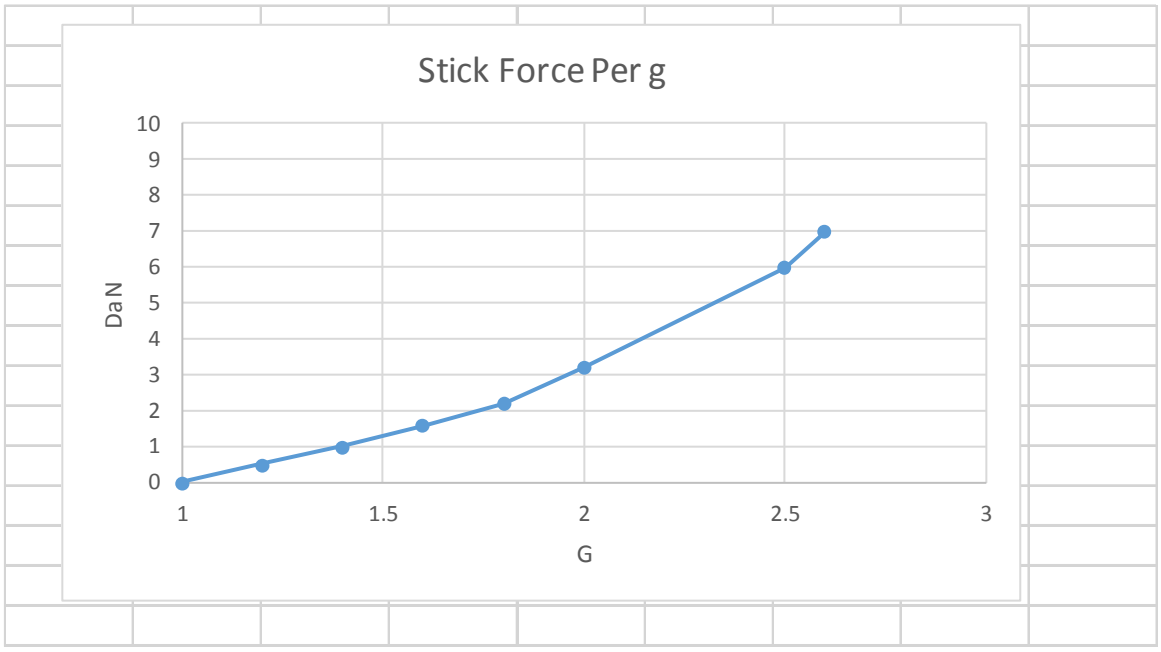
Test	Fuel	Wt	Time	KIAS	Pwr	Time to Roll
Flap Up	53	435	1705	1.3Vs1	4000	3 secs L-R
Flap Up				1.3Vs1	4000	3 secs R-L
Flap Full				1.3Vs1	4000	2 secs L-R
Flap Full				1.3Vs1	4000	2 secs R-L

Flap Up				Vne	5500	3 secs L-R
Flap Up				Vne	5500	3 secs R-L

Stick Force per G

S 155 Pitch control force in manoeuvres
The pitch control force during turns or when recovering from manoeuvres must be such that at a constant speed an increase in load factor is associated with an increase in control force. In addition:
a) For conventional control systems the minimum value of this force to apply to the aeroplane a normal acceleration which would impose limit load on the structure must not be less than 7 daN from a trimmed 1 g condition at all speeds up to VNE at which the required normal acceleration can be achieved without stalling, with wing-flaps and, where applicable, landing gear retracted.

Test	Fuel	Wt	Time	KIAS	G	DaN
The wind Up turns to 3G						
	50	430	1710	120	1	0
					1.2	0.5
					1.4	1
					1.6	1.6
					1.8	2.2
					2	3.2
					2.5	6
					2.6	7
Note – Turns left and right at MCP at 80 KIAS and Vne approx. 120 KIAS – speed washed off very quickly – large aft stick displacement required – very obvious tactile cues – forces left and right the same – 7daN reached at 2.6 2.7 g – well below 4g limit – compliant with Section S & satisfactory						



23.251 Vibration and buffeting
23.253 High speed characteristics
Dive to Vdf

Test	Fuel	Wt	Time	KIAS	Pwr	Considerations
Clean	49	430	1715	140	MCP	

NOTE: This test must not be carried out in turbulent conditions.

Start Altitude	5000 ft	IOAT	7 ºC	Scheduled Vdf	140 kts
End Altitude	2000 ft	PEs	15 kt	Vdf KIAS Achieved?	140 kts

Left	Right

Any buffet or unusual vibrations ACC
Weight and Response of flying Controls ACC
Engine/Propeller behavior ACC

It must be possible to recover from an overspeed condition at Vd using the primary longitudinal control alone

Assess LSS = Very Stable

Assess LDO = Heavily damped

S 173 Static longitudinal stability
a) Under the conditions and throughout the speed range specified in S 175 the slope of the curve, control force versus speed, must be positive and have a value such that any significant speed change will cause a variation in control force plainly perceptible to the pilot.
b) 1) Where the aeroplane can be trimmed longitudinally the airspeed must return to within 10% of the original trim speed when the aeroplane is disturbed from the trimmed condition.
2) Where the aeroplane has no longitudinal trimmer the airspeed must return to within 10% of the trim speed required by S 161 in each configuration, when the aeroplane is disturbed from the trimmed condition.

S 175 **Demonstration of static longitudinal stability** The control force/speed curve must have a stable slope in the following conditions:
a) Climb:
1) At 1.4 VS1;
2) Landing gear retracted;
3) Wing-flaps in the position for climb; and
4) Maximum power.
b) Cruise:
1) At maximum level flight speed and VDF;
2) Landing gear retracted;
3) Wing-flaps retracted.
c) Approach:
1) At the recommended approach speed;
2) Wing-flaps in the landing position;
3) Landing gear extended; and
4) Engine at normal approach power and with engine off.

Test	Fuel	Wt	Time	Power	OAT	-20kts	Trim Speed	+20kts
Climb 1.4Vs1	48	430	1720	Full	13		60	
Cruise				MCP	13		110	
Vdf				MCP	13		140	XXXXXXX
App Full Flap				App	13		50	
App Full Flap				Idle	13		50	

Aircraft – positive static stability in all cases – weak in full power climb as typical

S 177 Lateral and directional stability
a) With the aeroplane in straight steady flight, and when the roll and yaw controls are gradually applied in opposite directions, any increase in sideslip angle must correspond to an increased deflection of the lateral control. This behaviour need not follow a linear law.
b) In a sideslip any control force must increase progressively with sideslip; it need not be linear but must not reverse.

Test	Fuel	Wt	Time	Power	OAT	-10°	Trim	+10°
	48		1725					
Cruise 0.9Vh				PFLF	13			
Tested in cruise & same conditions as LSS – directionally and laterally stable throughout								

S 181 Dynamic stability
a) Any short period oscillations not including combined lateral-directional oscillations occurring between the stalling speed and VDF must be heavily damped with the primary controls:
1) Free;
2) Fixed.
b) Any combined lateral-directional oscillations occurring between the stalling speed and VDF must be damped with the primary controls:
1) Free;
2) Fixed.
c) Any long period oscillation of the flight path (phugoid) must not be so unstable as to cause an unacceptable increase in pilot workload or otherwise endanger the aeroplane. When, in the conditions of S 175, the longitudinal control force required to maintain speeds differing from the trimmed speed by at least ±15% is suddenly released, the response of the aeroplane must not exhibit any dangerous characteristics nor be excessive in relation to the magnitude of the control force released. These requirements must be met with the engine running at all allowable powers

Test	Fuel	Wt	Ht Hp	Power	OAT	LDO		Phugoid
Climb Vyi	47	340	3000	Full	13	Well damped		20 secs
Cruise 0.9Hh				MCP				24 secs
Slow Cruise				PFLF				22 secs
App				Idle				20 secs
App Full Flap								20 secs

75 Normal Landing – Power Off						
Test	CG	Wt	Ht	KIAS	Pwr	Considerations
2	A	L		50	Idle	(1) A steady gliding approach with a calibrated airspeed of at least [1.3] V_{S1} must be maintained down to the 50 foot height. (2) The landing may not require exceptional piloting skill or exceptionally favourable conditions. (3) The landing must be made without excessive vertical acceleration or tendency to bounce, nose over, ground loop, porpoise, or water loop.
Easy to land – good elevator control response						

75 Simulated Emergency Condition Flapless Landing – Touch & Go						
Test	CG	Wt	Ht	KIAS	Pwr	Considerations
4	A	L			Idle	Note change in pitch attitude at touch down
Sat – no issues						

51 Flapless Take-Off – from Touch & Go						
Test	CG	Wt	Ht	KIAS	Pwr	Considerations
5	A	L			Idle	Note change in pitch attitude at rotate
Sat – no issues						

75 Vref-5 Landing –						
Test	CG	Wt	Ht	KIAS	Pwr	Considerations
6	A	L		45	Idle	
All OK						

Flight Number / Configuration	Sortie 4 – MAUW Mid c of g
Date	18 Oct 17
Overview	Take-off & Landing Perf
Handling Pilot/P1	Chris Taylor
Safety Pilot P2	None
FTE	None
AUW	450 kg
cg	228
Fuel T/O	70
Fuel Ldg	60
ZFW	400 kg

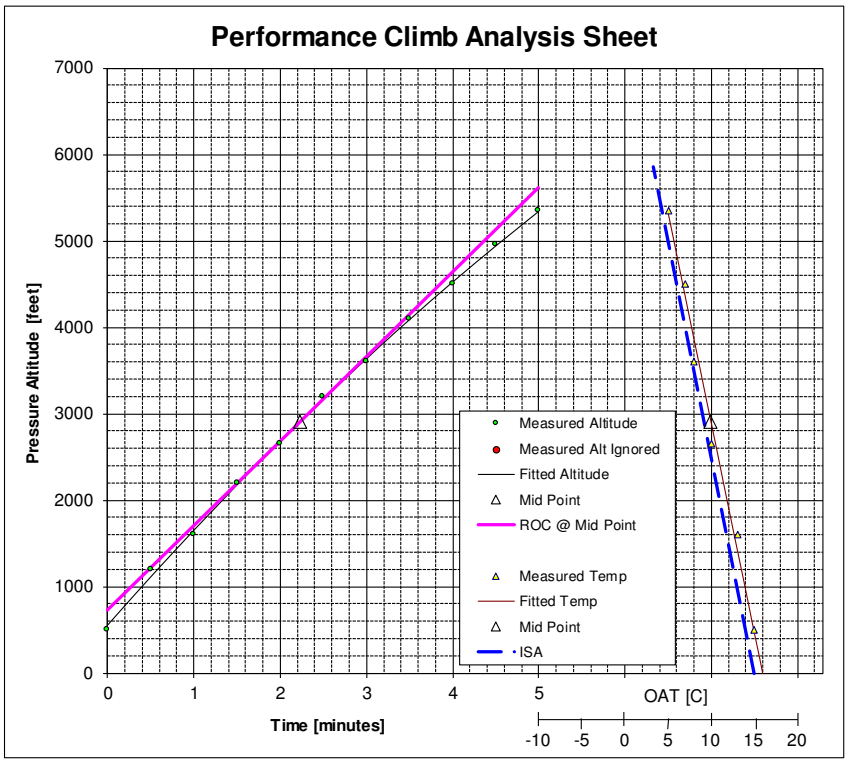
Airfield Altitude	196	ft	QFE	1008	mb
Wind	Light/Vrb	knots	OAT	15	℃
Weather (test area)	Overcast – light winds from NE at altitude – no sig turbulence – rain				

Test Timings			
Off Chocks	1030	Landing	1110
Take-Off	1035	On Chocks	1115

	Direction	Distance	Comment
Take-Off	090	100	
Landing	090	105	
Take-Off	090	95	
Landing	090	100	
Take-Off	090	100	
Landing	090	90	
Take-Off	090	100	
Landing	090	105	
Take-Off	090	95	
Landing	090	100	

Take-Off	090	100	
Landing	090	90	
Take-Off	090	100	
Landing	090	105	
Take-Off	090	95	
Ops were conducted on soft uneven grass which was wet increasing both take-off and landing distances over the optimum. Take off performance was excellent with the aircraft leaping off the ground in less than 100m – Equally with full flap and a threshold speed of 45 KIAS the aircraft was easily landed and brought to a halt in 100 m –brakes were efficient and undercarriage suitable – no handling issues.			

Climb Performance Data



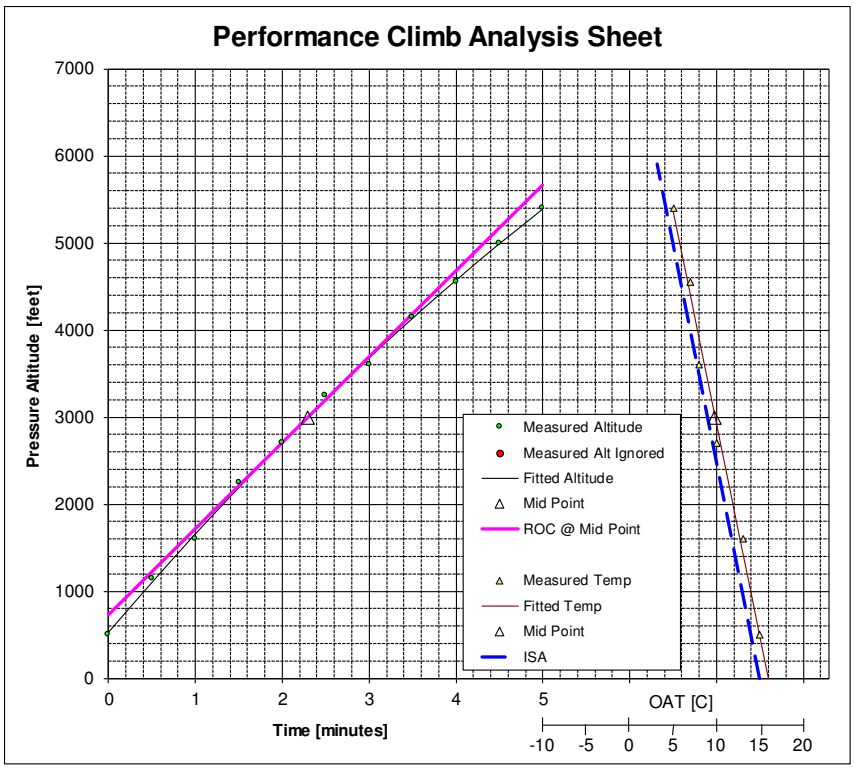
Aircraft Type
Scout
Registration
G-A2-001
Date of Test
17 Oct 2017

Mean Weight	Kg/Lbs
440 Kg	
Mid Altitude	**[feet]**
2900	
Mid OAT	**[C]**
9.9	
(ISA 1)	

Scheduled ROC	[ft/min]
Basic	
Correction	0
Correction	0
Final SROC	

Observed ROC	[ft/min]
977	
Difference	**[ft/min]**
977	
(Observed ROC - Final SROC)	

© Gerard Geurts, Version 2, November 2001 Curve Fit Quality: 97



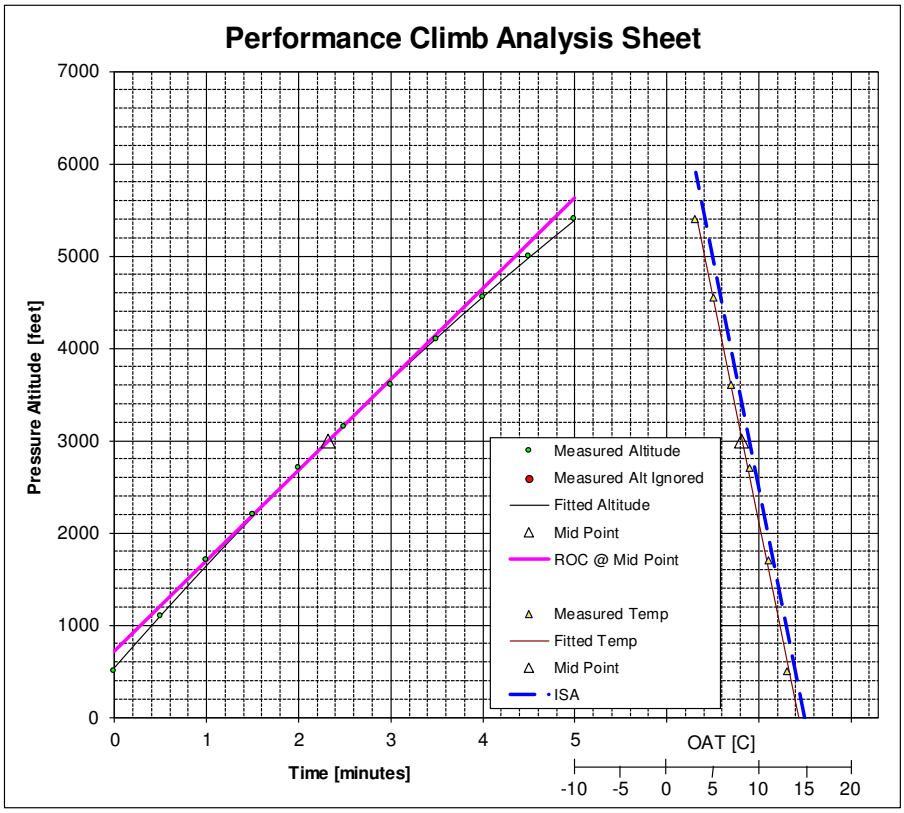
Aircraft Type
Scout 2
Registration
G-A2-001
Date of Test
17 Oct 2017

Mean Weight	Kg/Lbs
440 Kg	
Mid Altitude	**[feet]**
3000	
Mid OAT	**[C]**
9.8	
(ISA 1)	

Scheduled ROC	[ft/min]
Basic	
Correction	0
Correction	0
Final SROC	

Observed ROC	[ft/min]
987	
Difference	**[ft/min]**
987	
(Observed ROC - Final SROC)	

© Gerard Geurts, Version 2, November 2001 Curve Fit Quality: 97



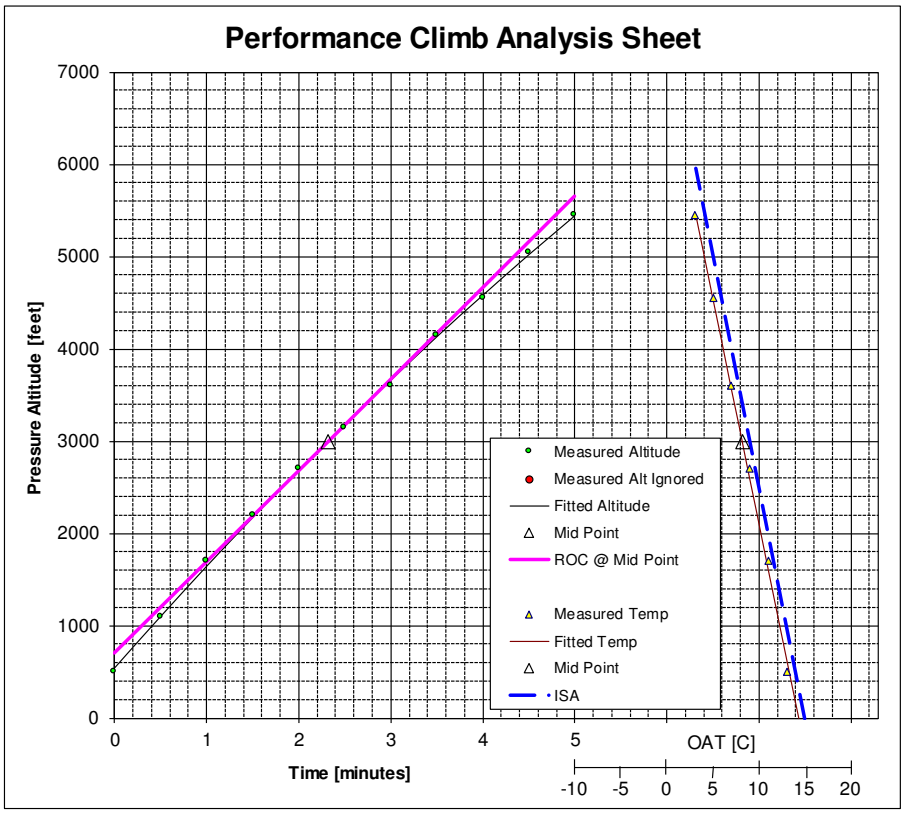
 Curve Fit Quality: 98

Aircraft Type
Scout 3
Registration
G-A2-001
Date of Test
18 Oct 2017

Mean Weight	Kg/Lbs
450 Kg	
Mid Altitude	**[feet]**
3000	
Mid OAT	**[C]**
8.2	
(ISA -1)	

Scheduled ROC	[ft/min]
Basic	
Correction	0
Correction	0
Final SROC	

Observed ROC	[ft/min]
982	
Difference	**[ft/min]**
982	
(Observed ROC - Final SROC)	



 Curve Fit Quality: 98

Aircraft Type
Scout 4
Registration
G-A2-001
Date of Test
18 Oct 2017

Mean Weight	Kg/Lbs
445 Kg	
Mid Altitude	**[feet]**
3000	
Mid OAT	**[C]**
8.2	
(ISA -1)	

Scheduled ROC	[ft/min]
Basic	
Correction	0
Correction	0
Final SROC	

Observed ROC	[ft/min]
991	
Difference	**[ft/min]**
991	
(Observed ROC - Final SROC)	