AIRWORTHINESS APPROVAL NOTE NO: 26000

APPLICANT:	Mr S W Talbot		
AIRCRAFT TYPE:	CEA DR221 (Modified)		
REGISTRATION NO:	G-STEV	CONSTRUCTOR'S NO:	61
OPERATOR:	Mr S W Talbot		
CERTIFICATE CATEGORY:	Private		
MODIFICATION NO:	RAE(B)-1 (G-STEV)		
MODIFICATION TITLE:	**Removal of Lycoming O-235-C2A and Replacement with Lycoming O-320-B2C**		

1.0 Introduction

This modification involves the replacement of the original engine and an alteration to the limitations of the basic DR 221. This modification RAE(B)-1 (G-STEV) is essentially similar to modification RAE(B)-1 approved on DR220 G-BLCT and approved by AAN 23425. It introduces an increase in All Up Weight, an altered CG envelope, and revised design speeds. Substantiation of these changes was achieved on modification RAE)B)-1 with the support of the aircraft's original designer, M. J. J. Delemontez, the current Type Certificate holder, Avions Pierre Robin, not being involved.

This change of engine from the standard 115 bhp Avco Lycoming 0-235-C2A to a 160 bhp Avco Lycoming 0-320-B2C relies upon the structure of the DR 221 being identical to that of the DR 250/160 which has the larger engine as standard equipment. Details of the UK approval of the basic DR220 in the Private category appear in AAN 16160 Issue 2. There is currently no AAN for the DR250, although there are six on the UK register, in Private Category. Approval of this variant is by precedent.

In addition three minor modifications are approved.

Application of this modification results in a change of designation to DR 221 (modified).

2.0 Description

2.1 General

The DR 221 was produced by Centre Est Aeronautique (C.E.A.) as a touring version of the DR 200 series with less installed power that the DR 250. It followed shortly after the DR 250 and was developed in parallel.

It is cleared in France in both the Normal and Utility Categories. Due to validation of the type's spinning characteristics not having been carried out by the CAA, it has yet to be cleared for Utility Category operation in the UK.

2.2 Airframe and Limitations

Unlike the DR220, the DR 221 and the DR 220A, have an airframe identical to the DR 250. The DR 221 performance and limitations are restricted due to the installation of the less powerful 0-235 C2A engine. M. J.J Delemontez has confirmed (in letter dated 19/11/90) that the DR 221 is structurally and aerodynamically identical to the DR 250 and that when an 0-320 engine is installed it may be operated to the limitations applicable to a DR 250.

Modification: The standard DR 221 has a maximum take off weight of 840 kg and a landing weight of 780 kg (both limited by available engine power). This modifications results in revised figures of 960 kg and 920 kg respectively and a revised CG range.

The main undercarriage, wheels, brakes and axles on G-STEV are the original build standard and identical to those fitted to the DR250.

2.3 Powerplant

The standard DR 221 is fitted with the 115 bhp Lycoming 0-235 C2A engine and the EVRA 88-75-34-F propeller. The design standard DR 250 is fitted with either a 150 bhp or a 160 bhp Lycoming 0-320-D or -E engine respectively and has a large range of propeller options, one of which is the EVRA 91-78-34.

G-STEV, as modified is fitted with a 160 bhp Lycoming 0-320 B2C engine and an EVRA 91-86-34 F propeller, but any of the propellers listed in Fiche No. 100 for the DR 250/160 are equally applicable. When fitted with the EVRA 91-86-34 F propeller, it shall be determined that the static full throttle rpm is at least 2250 rpm.

The fuel system on G-STEV remains the original build standard.

2.4 Minor Modifications

In addition, the following minor modifications are installed:

a) Introduction of Slick 4251 impulse magneto in lieu of Slick 4247 retard magneto.

b) Introduction of Airwolf AFC-K007 full flow oil filter.

c) Introduction of 60 amp alternator in lieu of 35 amp DC generator system.

3.0 Basis for Approval

The DR 221 was formally Type Certificated in France by the DGAC to AIR 2052 (May 1965). Type Certificate No. 40/2 was issued 25/4/67. Certification details appear in Fiche de Naigabilité No. 111.

The DR 250 was granted Type Certificate 34/1 (an extension to that issued for the Dr 200) dated 25/5/65. Certification details appear in Fiche de Navigabilité No. 100.

3.1 The powerplant change, and the changes to the DR 221 limitations, are based upon the confirmation from the designer of the DR200 series aircraft. M J J Delemontez of Avions Jodel, that a DR 220A or a DR 221 airframe is structurally and aerodynamically identical to the DR250 and can therefore be operated to the limitations for the DR 250 contained in Fiche de Navigabilité No. 100 with an 0-320 of 150 hp or 160 hp with any of the propellers listed in Fiche de Navigabilité No. 100, provided that specified physical checks are carried out on the fuselage and mainplanes to verify that the original build standard has not been changed. (Letters HWJ/JJD dated 14/2/94 and JJD/HWJ dated 16/3/94 refers) The physical checks that are required on the mainplanes and fuselage to confirm the common DR220A/221/250 structural build standard are contained in letter JJD/HWJ dated 19/11/90. G-STEV has been checked and found to conform to its original build standard.

3.2 The engine fitted on G-STEV is slightly different to that fitted as original on the DR 250. The difference has been identified by reference to the relevant Type Certificate Data Sheets and is covered in paragraph 4.1 below

4.0 Technical Investigation

4.1 Powerplant installation

4.1.1 Engine differences G-STEV vs DR 250/160: Reference to FAA Type Certificate Data Sheet E-274 (Revision 14) for the O-320 range of engines shows this aircraft's 0-320 B2C engine has cone rubber mounts rather than the dynafocal mounts fitted to the -D2A, which is the standard engine fit on DR250/160. The justification for the continued use of the existing engine mount is based upon confirmation of it's suitability from the designer of the DR200 series aircraft, by M. J J Delemontez (JJD/HWJ letter dated 19/11/90 refers).

4.1.2. There are no propeller differences between G-STEV as modified and a DR250 equipped as per Fiche de Navigabilité No. 100.

4.1.3 Modified parts/New drawings: All new items introduced as part of this modification are detailed in RAE drawing No 1-600-3-56844 (3 sheets) at issue C, less items 1, 7, 8, 9, 10, 15, 16, 17, 20, 21, 22 and 23, all of which are standard fit items on a DR 221. The O-320 A2B engine, item 11, is replaced with an O-320 B2C.

Compliance with relevant design requirements has been demonstrated for the following specific aspects of the powerplant modification.

4.1.4 Propeller ground clearance [FAR 23.925]: Satisfactory: Reference H.W.Jemmett submission dated 22.6.93, and a configuration identical to the DR250.

4.1.5 Engine cooling [FAR 23.1047]: The retained DR221 engine cooling baffles are identical to those of the DR250 except for the addition of the aperture introduced by RAE(B)-1 for oil cooler air supply (AAN 24325).

4.1.6. Fuel Flows [FAR 23.955]: The fuel system is identical in all aspects to that fitted to the DR250.

Other aspects of the powerplant design and construction are as for the DR 250 installation. The local structural implications of the heavier engine are cleared on the basis of inspection of the area concerned in addition to assurances from M. Delemontez, the aircraft's designer. The cowlings, spinner, air intake, oil cooler, etc. are all DR 250 components.

4.2 Performance Information

The data presented below is justified by the confirmation given by M J J Delemontez (see paragraph 3.1 above***)*** and is abstracted from Fiche de Navigabilité No. 100 for the DR 250/160 and from the DR250/160 Flight Manual. This information is provided as the aircraft operates on a Certificate of Airworthiness with Limitations and the information derived from the DR250 Flight Manual, does not appear elsewhere:

4.2.1 Stall speeds, level flight, max. takeoff weight, ISA, sea level:

Clean	53 kt (61 mph)
20 deg flap	52 kt (60 mph)
60 deg flap	49 kt (56 mph)

4.2.2 Performance at max takeoff weight, ISA, Sea Level:

Take-off ground roll, dry concrete	300 m (954 ft)
Rate of climb at sea level.	650 ft/min
Landing performance, dry concrete	293 m (963 ft)

4.2.3 Speeds at max take-of weight

Takeoff unstick speed 20 degs flap	58 kts (66.8 mph)
Best Climb Speed	92 kts (106 mph)
Best gliding speed	83 kts (96 mph)
Approach speed	70 kts (81 mph)

4.3 Design Speeds

Established from Fiche de Navigabilité No. 100 for the DR 250/160:

Never exceed speed, V_{ne}	159 kt (183 mph)*
Max. Normal operation speed, V_{no}	140 kt (161 mph)
Design cruise speed, V_c	140 kt (161 mph)
Max manoeuvre speed, Va	100 kt (115 mph)
Flap limit speed, V_f	91 kt (105 mph)

* reduced voluntarily by applicant to 156 kt (180 mph)

4.4 Weight & Centre of Gravity Envelope

M.Delemontez letter dated 14.2.94 states that a revised maximum rear seat load of 154 kg is allowable for this modified aircraft. This is confirmed by Fiche de Navigabilité 100.

The Weight and Centre of Gravity envelope derived from the Fiche de Navigabilité 100 and modified in accordance with revised aft limit proposed by M.Delemontez [Ref. letters of 5/5/94 and 14.2.95] is as follows:

Forward CG:	920 kg (2028 lb) at +0.29m (11.4 ins) aft of datum
Aft CG:	960 kg (2116 lb) at +0.565m (22.24 ins) aft of datum
	895 kg (1973 lb) at +0.58m (22.8 ins) aft of datum
	linear variation between these points

The resulting envelope has the same forward limit as the DR250 and the same aft limit as the DR220 G-BLCT, at a slightly reduced weight, previously approved in AAN 23425.

As this aircraft is fitted with three fuel tanks (two in the wings and a supplementary tank aft), there is the potential for exceeding the aft CG limit if the wing tanks are used first when the aircraft is loaded close to its aft CG position. As there is no approved Flight Manual for this aircraft, a placard instructs the captain to use the fuel in the supplementary tank first when this tank is fitted.

4.5 Airworthiness Notices

4.5.1. Airworthiness Notice 33 [Unprotected Starter Circuits]: Complied with within Modification RAE (B)-1.

4.5.2. Airworthiness Notice 98 [Use of MOGAS]: Complied with by Minor M9/214/1038 on original aircraft. No significant changes result from RAE (B)-1.

4.5.3 Airworthiness notice No 88 is complied with.

4.6 Minor Modifications

4.6.1 Introduction of Slick 4251 impulse magneto in left-hand position in lieu of Slick 4247 retard magneto to improve starting. The Slick 4247 has been removed and replaced with a Slick 4251 25 degree mechanical retard impulse unit to suit the existing airframe wiring and ignition switch. The engine now conforms to O-320-B2B configuration; Avco Lycoming SSP-387 refers.

4.6.2 Introduction of Airwolf AFC-K007 full flow oil filter in lieu of standard oil screen filter. This is FAA-Approved for single and multi-engined Lycoming powered aircraft (450 HP or less) via STC SA00024NY dated 22 July 1993. The earlier AFC-K005 has been previously CAA approved by Minor Modification. The unit is installed in accordance with Airwolf installation instructions AFC-K007-A-11. Airwolf maintenance instructions AFC-K07-M1 apply.

4.6.3 Introduction of 60 amp alternator in lieu of 35 amp DC generator system to provide a high capacity charging system. The installed engine (O-320-B2C) was supplied with a 60 amp 14V alternator. This unit has been retained and the airframe charging system adapted to suit. 60 amp (output) and 5 amp (field) circuit breakers are fitted to provide protection. The generator voltage regulator has been replaced with a modern solid state Lamar DGR6 unit. Over-volt protection is provided by an Electro Systems OS60 sensor. Wire gauges and capacities have been assessed as being adequate; the existing 60 amp ammeter is retained. Circuit diagram LAS/G-STEV/E/01A refers.

5.0 Weight And Balance

Weight Schedule Ref LAS/G-STEV/W dated 16 Dec 98 refers to this modified aircraft.

The maximum take-off weight is 960 kg and the maximum landing weight is 920 kg. The CG range is as detailed in paragraph 4.4.

6.0 Noise

DR221(Modified) G-STEV has the same engine, airframe, performance and exhaust system as the DR250/160 of which there are examples already on the UK register. The Evra propeller (91-86-34-F) has been approved through the DGAC DR250 Airworthiness Data Sheet No 100 Ed 7-8/85 The aircraft is considered to comply with the relevant noise certification requirements of BCAR Section N, Issue 5 (Paragraph N3-4). Accordingly, Noise Certificate 8404 has been issued to this aircraft. All aircraft of this type will require a noise certificate when joining the UK register.

7.0 Flight Testing

A handling assessment of this modification is required to be carried out in accordance with Flight Test Schedule No 2 by the applicant or the applicant's nominated pilot, who must be acceptable to the CAA. The applicant's flight test report must be submitted to CAA. A separate CAA handling assessment is not required.

8.0 Limitations and Placards

8.1 Limitations

Limitations to appear in the Certificate of Airworthiness (numbers refer to existing item numbers). Those items asterisked shall be placarded or instruments shall be marked accordingly:

(4) Maximum weight authorised 960 kg take-off
920 kg landing

(5) Distribution of the load
The aircraft must always be loaded such that the centre of gravity position is:

Forward CG: 920 kg (2028 lb) at +0.29m (11.4 ins) aft of datum
Aft CG:960 kg (2116 lb) at +0.565m (22.24 ins) aft of datum
895 kg (1973 lb) at +0.58m (22.8 ins) aft of datum
linear variation between these points

The datum point is defined as the leading edge of the rectangular part of the mainplane.

(6)* The engine revolutions per minute shall not exceed 2700 at any time.

(7)* The aircraft shall not be flown at an airspeed in excess of 156 kts (180 mph)

(8)* The flaps must not be extended at air speed indicator readings in excess of 91 kt (105 mph)

( )* The design manoeuvring airspeed is 100 kts (115 mph). Full application of controls must not be made above this speed.

( ) The minimum static full throttle rpm when fitted with the EVRA 91-78-34 propeller is 2250.

8.2 Additional Placards

The following placards or instrument markings shall be provided:

(a) either the clean stall speed of 53 kts (61 mph) shall be placarded, or the airspeed indicator shall be marked with a green arc from 53 kts (61 mph) to 140 kts (161 mph).

(b) either the full flap stall speed of 49 kts (56 mph) shall be placarded, or the airspeed indicator shall be marked with a white arc from 49 kts (56 mph) to 91 kts (105 mph).

If placarding is chosen, the instruments shall not display any conflicting coloured arcs or limits. The placards shall be located as close as is practically possible to the appropriate instrument.

(c) Close to fuel tank selector:

"Take off and land on main tanks. If rear seats occupied, use rear fuel first in cruise".

9.0 Flight Manual

There is no CAA approved flight manual for this aircraft. The current Certificate of Airworthiness is amended to show the revised limitations detailed in paragraph 8.

10.0 Maintenance

This aircraft must be maintained to the CAA LAMS schedule, as amended and to the manufacturers recommended practices.

11.0 Continued Airworthiness

The influence of the modification to this aircraft on Airworthiness Directive, Service Bulletin etc. eligibility must be considered and the publications monitored accordingly. The maintenance schedule for the aircraft should include reference to this material additional to that applicable to the original design.

12.0 Approval

This aeroplane, G-STEV, constructors number 61, as modified in accordance with Modification RAE(B)-1 (G-STEV) is approved for certification in the Private or Aerial Work Categories provided it is operated and maintained in accordance with the limitations and procedures contained in this AAN.

R J Hardy
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For the Civil Aviation Authority

Date 13 January 1998