AIRWORTHINESS APPROVAL NOTE NO: 24967

APPLICANT:	AJE Smith, The Real Aeroplane Company		
AIRCRAFT TYPE:	Aero Vodochody L-39ZO Albatros		
REGISTRATION NO:	G-OTAF	CONSTRUCTOR'S NO:	2337
OPERATOR:	The Real Aeroplane Company		
CERTIFICATE CATEGORY:	Permit to Fly		

To Approve Aero L-39 Albatros Registered G-OTAF for the Issue of a Permit to Fly

1. Introduction

First flight of the L-39 was made on 4th November 1968. This aircraft was built by Aero Vodochody at Kunovice in Czechoslovakia and first flew in 1982. This aircraft, No. 2337 was delivered in 1982 to Libya, as a basic jet trainer. In 1989, the aircraft was purchased by R Lamplough of the British Aerial Museum. Subsequently, the aeroplane was ferried to UK (under N marks) and then it was then acquired by the applicant who requires a Permit to Fly for demonstration and exhibition purposes.

2. Description

The L-39 Albatros is a two seat tandem low-wing combat/trainer aircraft powered by an Ivchenko A1-25TL turbofan engine. It was designed and manufactured by Aero Vodochody at Kunovice, Czechoslovakia, and the type is still supported by the manufacturer. The engine is also manufactured in Czechoslovakia, by Ivchenko at it's Motorlet works, Ninoice. Engine type is a twin shaft 'bypass' turbo fan of 3790 lb s.t.

Numerous variants of this basic trainer have been exported around the World to Eastern aligned countries, resulting in sales-to-date of about 2000 aircraft. This aircraft, the L-39ZO is an improved basic trainer/ground attack variant with reinforced wings and four underwing hardpoints.

A detailed description of the aircraft may be obtained by reference to the publications listed in Section 6 below.

3. Approval Basis

The aircraft was designed to Russian military requirements. CAA approval is based on the satisfactory service history of the type and investigation carried out in accordance with policies agreed by ARB during the meeting of 23 April 1992, appropriate to its classification in the *Intermediate* category.

4. Technical Investigation

The manufacturer has submitted information on the type safety record in accordance with BCAR A3-7 Appendix 1 para 2.1, and this record was acceptable to CAA. The applicant engaged JS Chillingworth (Aircraft Engineering Services) to establish conformity to type (BCAR A3-7 Appendix 1 para 2.2) and support submission of this aircraft to CAA for Permit issue. The aircraft was reviewed for potentially hazardous features in accordance with BCAR Section B3-7 para 3 (d) and results are as described below.

Designed for training in severe conditions, the L-39 was designed to be capable of operation in temperatures between -50°C and 60°C and to be capable of operation from grass airfields.

Unusual features include simulated failure modes selectable from the rear (instructor's) cockpit. This was intended as a training aid but this facility is not accepted for Permit issue as the pilot in command must be sure of retaining full authority throughout flight. These modes have been disabled under applicant's modification action - see below.

Immediately prior to the ferry flights in April 1991, when airframe life was 521 hours, Aero Vodochody's factory's engineers fitted a serviceable replacement engine, which had consumed 217 of its operational life at the time of fitment. Under N registration the aircraft flew 17 hours and 45 minutes to position at North Weald, and an additional 1 hour 48 minutes was flown to position at Breighton, Yorkshire. At the time of this permit application, airframe and engine hours are:

Airframe	521 + 17:45 + 1:48 = 540:33 hours
Engine	217 + 17:45 + 1:48 = 236:33 hours

4.1 Modification State

Mr JS Chillingworth has ascertained that no alterations have been made, damage incurred or significant repairs to the main structure of the aeroplane. Unlike Western aircraft which have ongoing modification programmes, Aero Vodochody 'freeze' the modifications at build standard. The manufacturers statement dated 5 March 1996 confirms that all modifications required for airworthiness are embodied and that the applicant will be provided will any service bulletins required in future.

Applicants Modifications

Applicants modifications have been carried out, as follows:

a) Avionics Installation: see Radio section below.

b) Inhibiting of Simulated Failure Modes from Rear Seat
Selection of all simulated failure modes from the rear cockpit has been disabled by the applicant as follows:

	Simulated Failure	**How Inhibited**
i)	Pitot static: Failure by switch	Wire Lock 18 SWG to on position
ii)	Total cabin pressure: Failure by switch	Wire Lock 18 SWG to non fail position
iii)	Artificial horizon: Failure by switch	Wire Lock to non fail position
iv)	Jet pipe temperature: Failure by switch	Wire Lock to front position
v)	Engine shut down: Failure by switch	Wire lock to inhibit switch operation via tell tale guard

c) UK standard altimeter and ASI
The applicant has replaced these instruments with instruments reading standard UK units of ft/mb and knots.

The above modifications are reflected in the applicants Flight Reference Cards, to which the aircraft will be flown.

d) Ballast Mods
The applicant has added ballast in the nose to maintain cg in the correct range. Wherever such ballast has been added it is within the weight of original military equipment removed from that location.

4.2 Structure - Fatigue State

The manufacturers statement MP/544/96 dated 5 March 1996 states that:

The in service structural life is 3000 flying hours provided overhauls are carried out by the producing factory upon completion of 1000 flying hours and 2000 flying hours. Any extension to the 3000 flying hours life being granted only by the producing factory. These figures are based on the aircraft being operated within the flight limitations and a record of such is kept for each flight.

This philosophy is similar to that of other aircraft produced in Czechoslovakia. A flight data recorder feedback may be installed to provide assurance that the aircraft is being operated within the proper limitations but this is optional. The applicant has elected to use a manual recording system and has agreed to provide the manufacturer with information on sortie profiles every 3 months and CAA are to be kept informed of the manufacturers responses to this feedback.

Remaining airframe fatigue life at permit application is therefore:
3000 - 539:40 = 2460 hours:20 minutes

Remaining life prior to manufacturers overhaul:
1000 - 539:40 = 460:20 hours

Load factor limits are up to +8/-4 g and a warning tone is heard in the headset when these limits are reached. A 'g' meter is installed in each cockpit and load factor limitations are also listed against AUW's, as shown in section 8 below.

4.3 Engine

The aircraft is powered by an Ivchenko A1-25TL twin shaft turbo-fan engine (comparable with Garrett 731 but with entirely mechanical controls), serial 905 2522200010 which prior to flight test had completed a total of 236:33 hours since overhaul, including allowances for ground running and ferry flight. Time between overhauls (TBO) is 750 hours with a service life of 4000 hours and overhaul is to be completed by the engine manufacturer. The limitations as they appeared in the Technical Manuals entitled "Instruction for Pilots" were confusing and these have been simplified for presentation in applicants FRCs. The manufacturers statement of 5 March 1996 confirms that these are acceptable.

Fire warning and extinguisher systems are provided and operational. The high pressure fuel system includes an HP fuel pump type 4001 and fuel control governor type 4000. The engine is started (either on ground or in flight) by a Sapphire 5 air starting unit whose life is 15 years/3000 starts/1800 flight hours whichever occurs first according to manufacturers statement date 5 March 1996. Number of starts is to be recorded and the unit replaced at limit life.

4.4 Controls

All primary flight controls are mechanically operated through control rods. The elevator system incorporates a spring loaded booster system to alleviate control loads in extreme elevator up position (during take-off).

Elevator trim is electrical and although there is no back-up actuator, flight test assessment was that in the event of failure/runaway trim forces are light enough that a pilot could still be expected to land the aircraft.

The airbrake automatically deploys if both Machmeters indicate over Mach 0.78. That both Machmeters have to indicate ≥ 0.78 provides some protection against inappropriate deployment due to a single failure. Trim change due to deployment at low speed was assessed during flight test with conclusion that the pilot should be capable of coping with undemanded deployment in the circuit.

The double slotted flaps automatically raise above 170 knots.

4.5 Systems - General

The applicant has overhauled/functioned all systems prior to ferry flight North Weald to Breighton and re-activated all systems during subsequent work at Breighton. All aircraft systems are operational although the applicant has elected to operate the aircraft not above 10,000 feet, without pressurisation. Engine bleed air taken from the ninth stage of the high pressure compressor is used for cabin air conditioning and pressurisation, de-icing and de-misting, anti G suits and fuel transfer from the tip external tanks. The hydraulic system powers undercarriage, flaps, airbrake, ram air turbine, and wheel brakes, and an emergency accumulator provides hydraulic power to systems in the event of main hydraulic system failure. Dual (selectable) pitot-static systems are provided.

The hydraulic override in the rear cockpit has been wire locked so that the occupant of the rear cockpit may not render the system unusable by the pilot in the front.

4.6 Ejection Seats

Ejection seats fitted on Czech designed VSI-BRI/L rocket seats (with leg restraints), serial numbers 2506-8U2 and 2511-8U2 which can operate at zero altitude with speeds above 80 knots (procedures and envelopes are given in the Instructions for Pilots). It is possible to eject through the canopies. To eject, a twin firing handle of the seat pan is squeezed and pulled upwards. From ejection to parachute, the process is automatic but manual over-ride is provided if seat separation does not take place.

Pilots have to be weighed prior to flight and 'dial in' their weight in Kg on the seat. The sitting height of the pilot is not to exceed 98 cm.Ground crew have to adjust to seat head height on strap-in for the pilot eye level. A separate canopy jettison handle is provided in each cockpit, in the event of automatic jettison failure.

Seat vital and independent checks must be identified during seat annual inspections and must be carried out after each installation. Seat locking to the airframe will be identified and also independently checked during installation. Rocket and cartridge lives are: rocket pack - 9 years, harness restraint - canopy explosive - seat gun cartridges - 5 years and drogue explosive cartridges (2 off) - 1 year.

4.7 Fuel System and Drop Tanks

The fuel system includes 5 rubber bladder bag tanks in the fuselage (1100 litres) and wing tip tanks (2 x 100 litres) which are not jettisonable. The applicant has elected not to use the underwing pylon mounted tanks. Total capacity is thus 1300 litres.

A fuel low warning light illuminates at 150 kg fuel remaining. A fuel booster pump is fitted at the base of No. 5 tank. Tip tank transfer is by engine bleed air pressure. An inverted flight reservoir provides fuel for 20 seconds. In the event of a Fuel Control Unit (FCU) failure, a switch located on the pilot's left console (both cockpits), will bypass the FCU to allow fuel supply. Re-selection is only possible as a 'Ground' function.

4.8 Weight and Balance

The aircraft is accepted by the CAA at 5670 kg (12474 lb) MTWA. Zero fuel weight is 3304 kg (7617 lb.). A weight report reference Planeweigh Ltd Ref 232337 dated 14 February 1996 and balance schedule dated 10 March 1996 has been prepared and appended to the pilot's notes. C of G range is determined by the manufacturer as 20.7% to 25.5.0% of mean aerodynamic chord which is 2.15 meters and the datum is at station 129:72 inch forward of the nose jacking point.

4.9 Electrical System

The 28 volt DC system for the aircraft is supplied by 2 x Sonnenschein 24 amp hour batteries and an engine driven generator 9 kW type VG-7500 JAL. A volt/ammeter is fitted in the front cockpit. AC power for instruments and previous weapon installations comes form 5 invertors: (1 x 115V, 1 x 26V, 3 x 36V). In the event of power failure, a RAT (Ram Air Turbine), is extended hydraulically to supply power to operate essential services. When the aircraft weight is on wheels, the RAT automatically retracts if previously extended in flight.

4.10 Radio

The original military equipment has been rendered inoperative or replaced with modern equipment. Radio fit (all in front cockpit) is as follows:

Qty	Function	Manufacturer	Type	CAA Approval
1	VHF COMM 1	Collins	VHF 22B (760 Channel)	VC 399
1	VHF COMM 2	Dittel	FSG-70	LA 331
1	GPS	Sky Force	Skymap	LA 301031
1	VOR/ILS/Mk R	Collins	VIR.32	VC 413

4.11 Operational Aspects

The operators Organisational Control Manual (OCM) has been submitted to CAA Sport Recreational Department for approval to CAP 632 and approved by CAA Letter 102/13/015/G-OTAF dated 23 April 1996.

Maximum duration for inverted and negative 'g' flight is 20 seconds following which positive g must be applied for 20 seconds to allow fuel system to recuperate.

The aircraft may take-off/land on grass surfaces provided weight is less than 4600 kg.

5. Flight Test

The aircraft was flight tested on 17 April 1996 (FTR 9782 refers) concludes that the aircraft is acceptable for issue of a Permit to Fly. The Technical Books include recommended speeds for aerobatic manoeuvres.

6. Manuals

The applicant has a complete set of technical manuals entitled Technical Documentation L39 Albatros aircraft which were produced in English by Aero Vodochody. The following are included:

Technical Book 1 Instructions for Pilot (Part I and Part II)
Technical Book 2 Airframe/engine installation (includes servicing schedule)
Technical Book 3 Electrical diagrams/instruments
Technical Book 5 Engine Manual
Book 17 Part 2 Servicing ejection seats + Book 6
Book 17 Part 3 Parachutes and oxygen
Spares Manuals Books 12, 4, 7

The applicant has complied a set of Flight Reference Cards based on information in the Instructions for Pilot referred above. The aircraft will be flown in accordance with this summary document reference RAC/FRC/1/96 Issue 1/96.

7. Noise Certification

A noise certificate is not required for this aircraft as it operates on a Permit to Fly.

8. Limitations and Concessions

Airframe and Engine limitations are given in the above referenced Instructions for Pilot and applicant's Flight Reference Cards - in the event of a discrepancy those shown below are to be employed different (* - to be placarded or otherwise marked on instruments):

*1. Aerobatics are permitted in accordance with the Pilots Notes, but flick manoeuvres and intentional stalling and spinning (maximum 3 turns is quoted) are prohibited.

*2. Load factor: (g) +5/-2.5 +6/-3 +7/-3.5 +8/-4
At weight: (kg) 5600 5000 4500 4200
Negative 'g' is limited to 20 seconds duration only.

3. C of G to be between 17.5% and 25.5% MAC. MAC is 2.15 metres and datum is at station 5548.8 (ie at wing leading edge 2.008 m outboard from centreline).

4. Weights:
Maximum take-off (hard runways only)	5600 kg
Maximum Landing	4800 kg
Max weight for use of grass runways	4600 kg

5. Airspeed Limitations (see Instructions for Pilot Book I Part II) summary follows:

*	Max speed	(910 kph) IAS	490 knots IAS
*	Max Mach number indicated	0.8 Mach	
*	Minimum speed	(200 kph) IAS	108 knots IAS
	Undercarriage operation/deployed	(340 kph)	183 knots IAS
*	Flaps 25° or 44°	(310 kph)	167 knots IAS
*	Max speed for use of elevator tab	(700 kph)	378 knots IAS
	Max crosswind	(10 m/s)	19 knots

*6. Engine limitations (see Instructions for Pilot Book I Part II) summary follows:

Condition	**RPM %**	**JPT(°C)**	**Duration**
Maximum (max height 26000 ft) * - de-icing OFF	106.8	685/715*	20 mins
"Rated" (Max.continuous up to 6500 ft)	103.2	650	-
"0.85 rated" (max continuous 6500 ft to 26000 ft)	99.6	615	-
Idle (✸duration limited on ground)	56	600	(✸30 mins)

Oil pressure 3:0 - 4.5 kg/cm^2 (2:0 kg/cm^2 for start/idle)
Oil temperature -5ºC to 90ºC (-40ºC to 90ºC for start)

*7. Day VMC only.

*8. No smoking.

9. Fatigue is to be accounted in accordance with section 4.2 above after each days flight. At 1000 hrs, the aircraft has to be returned to the manufacturer for major overhaul/re-life.

9. Approval

This aircraft G-OTAF Constructors Number 2337 is approved for issue of a Permit to Fly provided that it is operated in accordance with the limitations and procedures in documentation referred to in Section 6 above, and in Section 8 above, and the conditions of the Permit to Fly and that it is maintained in accordance with all appropriate manuals and schedules including publications referred in Section 6 above.

A C Love
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For the Civil Aviation Authority

Date 26 April 1996

10. Maintenance

The manufacturers servicing schedule for the L-39 is defined in Technical Book 2, and includes inspections at 100 hours, 200, 400 and multiples thereof up to the 1000 hour overhaul. Due to the expected low utilisation under the Permit to Fly, the applicant has proposed the following calendar maintenance check cycle:

Permit to Fly issue	200 hr inspection
First year Permit renewal	100 hr inspection
Second year Permit renewal	400 hr inspection
Third year Permit renewal	100 hr inspection
Fourth year Permit renewal	200 hr inspection

with the inspection cycle being repeated for subsequent years. This maintenance check cycle is acceptable to the CAA provided the flying hours called up in the manufacturers servicing cycle are not exceeded.

This aircraft must be maintained by a company approved under BCAR A8-20 with a rating for the aircraft type and experience in the maintenance of the ejection seats. The aircraft is to be kept hangared and inhibiting/short term care and maintenance procedures observed.

This aircraft has been inspected and found to conform to the requirements of this AAN, and to be in a satisfactory and airworthy condition.