

RAF 2000, RAF 2000 GTX-SE

Issue 6 MPD 2009-001 and 2009-003 added 15.1.10

1. UK contact

Mike Goldring, Newtonair (Gyroplanes), 6 Coombeshead Road, Highweek, Newton Abbot, Devon TQ12 1PY Tel: 01626 353717

Manufacturer: Rotary Air Force Marketing, INC. Box 1236, 1107 – 9th Street West, Kindersley, SK Canada. Tel: (306) 4636030. Website: www.raf2000.com

2. Description

The RAF 2000 and its variants are two seat gyroplanes with an enclosed cockpit, powered by a converted Subaru EA22 or EJ22 'flat four' liquid cooled automotive engine. A three bladed Warp Drive propeller is fitted as standard. The RAF 2000 model was fitted with the EA22 engine. The later RAF2000 GTX-SE model has a revised cabin and the slightly more powerful EJ22 type engine.

3. Fast Build Kit 51% Compliance

Not applicable – the aircraft is built from a slow-build kit.

4. Build Manual

RAF 2000 Build manual

5. Maintenance Manual

TBD

6. Flight Manual

RAF 2000 Operator's Manual. Note supplemental operating procedures as follows:

a. In "cabin check" add "Check joystick cross tube for fretting from gust lock".

b. In section 2 under operations/limitations: -

Add – "Doors must be removed for flight".

Add - "maximum crosswind component for take off and landing : 7 knots"

Airspeed limitations - amend Vne to 70 mph.

Add - "Flight when surface winds exceeds 15 kt is prohibited. Flight when surface wind gust spread exceed 10 kts is prohibited. Continued flight in moderate, severe or extreme turbulence is prohibited. Maximum airspeed, should such conditions turbulence be encountered, is 60 mph".

"Note: Moderate turbulence is turbulence which causes a) changes in altitude or attitude, b) variations of indicated airspeed or c) aircraft occupants to feel definite

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strains against the seat harnesses or any tendency to a reduction in positive g forces "

(POH changes referred to under b. above can be accomplished by stapling a copy of MPD 2006-013 into the Operating Limitations section of the POH)

7. Mandatory Permit Directives

MPD: 1998-019-R1 Flexible Fuel Tubing (applies to all permit aircraft)
Immediate replacement of any PVC fuel tubing by tubing of an alternative type which will not harden and shrink with age.

MPD: 2003-001 (Replaced by MPD 2006-013)

MPD: 2003-007 Rotor Blade Inspection for Cracks This MPD required initial immediate inspection of the rotor blades for cracks and thereafter requires repeat inspections prior to the first flight of the day. The MPD permits the pilot to perform these 'daily' inspections.

MPD: 2004-011 Door Placard This MPD requires application of certain external placards adjacent to cabin door handles and latches. Compliance was required no later than 13th September 2004. Placards not required while cabin doors are not permitted to be fitted following MPD 2006-013.

MPD: 2006-003 Reinforcements of control system. This MPD mandates fitting RAF 2000 retro-fit kit to increase strength of control system where it has been shown not to meet Section T requirements.

MPD 2006-013 Handling Qualities. Replaced by MPD 2009-001

MPD 2009-001 This AAN prohibits flight with doors fitted, except when the LAA approved tailplane modification is fitted, and reduces Vne to 70 mph, and imposes other operating restrictions.

MPD 2009-003 Inspection of rudder cables

8. LAA Mandatory Modifications

The terms of the LAA's CAA approval do not extend to investigating the design of complete gyroplanes and the overall type design investigation and approval is carried out by the CAA. As a consequence of the CAA's investigation into the RAF 2000 the following list of modifications and placards is mandatory for all examples on the UK register. This list is supplied to all builders but for the purposes of ongoing inspections the list is provided here. Inspectors should check that any RAF 2000 they inspect either at first issue or Permit renewal inspection is compliant with the following list. Mods are obtainable from the UK agent, details above.

- a) If the original type of driveshaft pre-rotator is fitted, the rotor spin up drive shaft roll pin connections must be wire locked. Applicants mod. No. RAF/UK/1.
- b) The engine cam belt drive cover attachment bolts must be wire locked. Applicants mod No. RAF/UK/2.
- c) The threaded rudder hinge pin must be replaced by a plain stainless steel rod threaded at either end and fitted with castle nuts and split pins for retention. Applicants mod No. RAF/UK/3.

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- d) Lower mast cheek plate spacer block assembly rivets must be removed and replaced with through-bolts with spacers. Applicants mod No. RAF/UK/4.
- e) Bungee elastic or locking wire must be fitted through the trim springs to ensure that a failed spring is retained. Applicants mod. No. RAF/UK/S3.
- f) The bolts through the mast at the hinge point must be fitted with castle nuts and split pins, as they may be removed routinely for transport or storage of the gyroplane. The rotor brake pivot bolt must also be fitted with a castle nut and split pin. Applicants mod. no. RAF/UK/5.
- g) Witness holes must be checked in the control rods to ensure that there is adequate length of thread on the rod ends engaged. Applicants mod No. RAF/UK/12.
- h) Stops must be fitted to the rudder control system at the rudder pedals. Applicant's mod. No. RAF/UK/S1 shows the details.
- i) The trim wheels must be marked to indicate the direction of rotation for the trim function. A device must be fitted to indicate the fore and aft trim position. Applicant's mod. No. RAF/UK/6 & RAF/UK/7.
- j) The gust lock must be modified to prevent fretting on the control cross rod, Applicant's mod No. RAF/UK/8. Additional plastic sleeves fitted over the control cross rod. Mod No. RAF/UK/S4.
- k) The fuel filler pipe to the seat tank must be padded and the head set bracket removed to prevent a head strike hazard. Applicant's mod. No. RAF/UK/9.
- l) The side ventilators supplied as optional equipment by RAF must be fitted.
- m) Additional venting must be provided in the fuel filler cap. Applicants mod. No. RAF/UK/10.
- n) A fuel level gauge must be fitted, visible to the pilot when strapped in the left seat, either a sight. tube per applicant's mod. No. RAF/UK/S5 or the optional electric fuel sender with gauge on the panel.

9. Service Bulletins

RAF service bulletins to be sourced from RAF.

10. Standard Options

RAF Alternative seat tank

RAF Weighted rotor tips and stiffened rotor head (but note, not including centrifugal teeter stops)

RAF fuel injection system (note when the fuel injection system is used, problems have been experienced with engine failure with low fuel levels in the tank – refer to section 14 below.

Note the RAF optional 'stabiliser' tab is NOT accepted by LAA or CAA.

11. Special Inspection Points

The aircraft and engine should be maintained in accordance with the servicing schedule published by RAF. Owners should ensure they obtain this information, including RAF service bulletins, from the UK agent and make this information available to their inspector. Maintenance and inspection should also be in accordance with the checklist in the LAA's gyroplane Permit renewal form

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(LAA/GR-1) and in accordance with instructions and guidance contained in the LAA Owners Handbook for Ultralight Gyroplanes.

The following is a list of specific items to watch closely on the RAF 2000, provided by the UK agent:

- a) Check the two eyebolts acting as mounts for the alternator as these can fracture, particularly if the spacing between them has not been set correctly and they have been placed in lateral tension.
- b) The battery should have some form of secure connections to the terminals as the screw-on type supplied are not really sufficient for the job.
- c) Check for any run-off on the prerotator belt – black rubber marking on the crankcase is a give-away.
- d) Check for cracks where the prerotator mounting bracket is attached to the crankcase.
- e) Check security of the small eyebolts at each end of the lower main control rod.

Following any roll-over accident, contact LAA to discuss repair proposals and mandatory replacement of highly stressed components, pushrod rod-ends etc which may have been over-stressed in the accident. Refer to RAF service information.

Note that in addition to standard flight instrumentation, the ANO requires that a slip indicator is fitted to all gyroplanes. On pusher gyroplanes this is usually accomplished with a simple yaw string on the aircraft centreline in view of the pilot.

In some cases there has been wear of the base of the lower cyclic control rods due to their rubbing on the trim springs. Inspectors should check that excessive wear has not occurred. To avoid wear occurring, a short length of protective tape can be fitted over the affected area at the bottom ends of the pushrods such as proprietary propeller leading edge anti-chafing tape.

In one case it was found that at extreme nose-down trim setting, there was potential for the safety chain connected to the pitch trim springs to interfere with the control system and it is possible that this could slightly limit the extreme range of travel of the roll control. In order to prevent this possibility, any surplus links at the free end of the chain must be either cut off or restrained clear of the moving parts. A suitable restraint method is to insert the free end of the chain down the centre of the pitch trim spring.

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12. Operating Limitations and Placards (unless tailplane modification fitted in which case see see MPD 2009-001)

Maximum number of occupants authorised to be carried: Two

The aircraft must be operated in compliance with the following operating limitations, which shall be displayed in the cockpit by means of placards or instrument markings:

Aerobatic Limitations

Aerobatic manoeuvres are prohibited

Minimum sustained load factor: 1g.

Manoeuvres involving a deliberate reduction in normal 'g' shall be avoided.

Loading Limitations

Maximum Total weight Authorised: RAF 2000: 1125 Lbs

GTX-SE model: 1225 lbs

cg limits - refer to hang check limits

minimum solo pilot weight 100 lbs

solo flight from left seat only

Engine Limitations

Maximum Engine RPM: RAF 2000: 6000 GTX-SE model: 5500

Airspeed Limitations

Maximum Indicated Airspeed: 70 mph

Other Limitations

Gyroplane to be operated in accordance with the RAF Flight Manual including UK Supplement.

Minimum rotor rpm before start of take-off: 150 rpm

The aircraft shall be flown by day and under Visual Flight Rules only.

Smoking in the aircraft is prohibited.

The aircraft shall not fly closer than 110 m to any assembly of persons.

Flight with doors fitted is prohibited.

Flight when surface winds exceeds 15 kt is prohibited.

Flight when surface wind gust spread exceed 10 kts is prohibited.

Continued Flight in moderate, severe or extreme turbulence is prohibited.

Maximum airspeed, should such conditions turbulence be encountered, is 60 mph."

Additional Placard

"Occupant Warning - This Aircraft has not been Certificated to an International Requirement"

Additional Placard (located adjacent to ASI)

"Maximum permitted airspeed 70 mph, reference MPD 2006-013"

The following placards must also be fitted in addition to all placards recommended by RAF:

1. The inside of the door must be placarded to indicate the procedure to be used to enable the doors to be forced open from the inside in an emergency. "In emergency - release". Applicant's mod. No. RAF/UK/S6 refers.
2. A placard, indicating that switching the ignition switch off ensures that the fuel is cut off, must be located adjacent to the ignition switch "Ignition/fuel/on off". Applicant's mod. No. RAF/UK/S6.
3. A placard must be fitted adjacent to the fuel filler indicating the fuel grade must be installed as standard. A placard indicating the oil grade and whether

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the oil is detergent or non detergent is installed adjacent to the oil filler. Applicant's modification No. RAF/UK/11 refers.

- 4. A Placard must be displayed in the cabin "check c of g position before take off" and on the mast to warn that the mast adjustment must be set correctly prior to flight to ensure that the gyroplane is in trim for the cabin loading being flown. MOD RAF/UK/S6.
- 5. The outside of the cabin must be placarded to indicate where to pull on the doors in an emergency to gain access to the cabin.' In emergency, lift here'. in full view of the pilot and crew - "Occupant Warning - this aircraft has not been certificated to an international requirement".

Refer also MPD 2004-011 re door placard requirement.

Fireproof identification plate must be fitted to fuselage, engraved or stamped with aircraft's registration letters.

13. Maximum Permitted Empty Weight

Not applicable

14. Special Test Flying Issues

Gyroplane flight test schedule.

When the fuel injection system system is used, problems have been experienced with the engine stopping prematurely with low fuel level in the tank, due to the return feed from the injector to the tank causing swirling of the fuel in the tank and allowing air to be injected into the feed line from the bottom of the vortex which forms in the tank. This in effect results in a greatly increased 'unusable fuel' level. A LAA mod (mod11836) re-routes the return fuel and avoids the problem.

15. Significant Airworthiness Approval Notes

LAA-G/13-370 issue 2	RAF 2000 GTX-SE
23911 issue 3	RAF 2000

16. Control deflections

Cyclic	Forward	TBD degrees
Cyclic	Aft	TBD degrees
Cyclic	Stbd	TBD degrees
Cyclic	Port	TBD degrees
Rudder	Left	TBD degrees
	Right	TBD degrees

Approved :

F.R. Donaldson
Chief Engineer

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