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DAILY INSPECTOR'S HANDBOOK - POWERED SAILPLANES

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1. Introduction

1.1 General

This appendix to the GFA Daily Inspector's Handbook specifically covers gliders with all types of power systems – sailplanes, motorgliders and power assisted gliders. You are expected to be an experienced Daily Inspector of unpowered sailplanes before you embark on this much more complex subject.

The checks described in this handbook are general in nature. It is important when inspecting a glider for the first time, that the manufacturer's flight and/or technical manuals are studied. These manuals contain specific checks that must be complied with – every daily inspection must comply with the requirements of the manufacturer's manuals.

This handbook is intended to guide you in the general principles and level of care required that may not be detailed in specific manuals and specifically to appraise you of Australian/ GFA requirements.

At the time of writing, 2012, motorgliders are the subject of most of the insurance claims and defects, for both operational and airworthiness faults! This needs to be corrected. There are reasons for this situation; they are much more complex than normal gliders. We should be under no misguided assumption that a motorglider is a simple power plane – it is not and we need to establish and maintain high standards. Motor gliders are all more complex by orders of magnitude than gliders. Just because it has a simple looking pop-up two-stroke automated engine does little to make it fool proof. It still has FUEL, an engine, fuel lines, drive system, propeller, cooling, and an exhaust. Even electric motorgliders have high current wires, controllers, batteries, power-cables, electric motor drive, electronics, cooling, and a propeller. If it has a fire at 2,000ft you are in a lot of trouble – prevent it and prepare for it. They are more complex – it is worth putting in the effort to learn about it and do the right thing to make it as safe as possible.

Even if you fly a powered glider and don't use the motor there are still items you must check. Is the weight and balance correct, has it got fuel in it, will the fuel leak, do you know the operational requirements? Or if you have a non-self launcher will you maybe use the motor to prevent an outlanding? Is it going to be reliable? Will it work? How can you be sure? What will you do in the event of fire?

Having a motor can save you from an outlanding - but historically it is shown to have got pilots into trouble. They are more likely to lead you into a corner, too low, over bad country and then don't work when needed. So they make you more unsafe unless you take much more care of it.

The main message concerning motorgliders is they are more complex than pure gliders and you have a lot more to learn and do to be safe. You are moving from simple gliders to essentially a power plane.

This handbook has made reference to the General Aviation, "maintenance guide for PILOTS", CASA, 2005, available for download from the CASA website. It is worth a read to broaden your perspective and is available for more detailed information. This handbook will put the requirements into a gliding context.

GFA members are subject to the same regulations, Civil Aviation Regulations (CARs and Civil Aviation Safety Regulations (CASRs), concerning airworthiness as any other General Aviation VH registered aircraft. Except we have some exemptions to CAR Part 4 and 4a. See the GFA MOSP Part 3 for guidance.

1.2 The Purpose of a Daily Inspection

The daily inspection is one of the most important inspections carried out on an aircraft in service. The daily inspection is the only thorough inspection carried out between periodic inspections and is the last real opportunity to inspect the aircraft to ensure that:

a. The aircraft is airworthy and “fit to fly”

b. All periodic inspections have been completed (as listed in the MR)

c. The aircraft equipment is serviceable and suitable for the particular operation.

Please note that a daily inspection is maintenance and therefore must be:

d. a. Certified for (Refer to CAR (1988) 42ZE);

e. b. Certified for by an authorised person

f. c. Carried out in accordance with approved data (Refer to CAR (1988) 42V).

1.3 Daily Inspector Requirements

To hold a DI rating on a motorglider you need to be an experienced DI of standard gliders and be a current GFA member. You will apply the same principles but to many more and complex systems.

You need to be meticulous and thorough, every time. Remember the basic difference between a car and an aeroplane is if a car fails you can usually pull over and fix it – an aeroplane has to get you back on the ground. The most dangerous time for a motorglider is at takeoff at the end of the runway, they are going to be in more trouble than a glider on aerotow if the engine fails. Another high risk is re-starting in flight. You need to be sure on all your systems.

You must have and study all the manuals.

Don’t just get a quick conversion by your mate, hop in and give it a try. Rather do the inspections with an inspector who knows that motorglider, fly it with a co-pilot, or fly it without the motor a few times until you know it all well. Progress carefully and get to know it safely. As your knowledge increases you will become safer and be able to check it quicker and better. Also you will be able to handle difficulties; what if the motor falters on the runway? Does it sound and act right on startup and runup? Do you have enough runway to stop, how will you handle it?

Know your limitations on what you can check and fix. Get an expert if required.

You should not require any special tools for a DI. Just knowledge and the manuals, a good bright torch, a screwdriver or two, a rag, a fuel-draining tool.

Have the time to do the DI adequately. Don’t rush or miss things. Over time and with familiarity you can get quicker. But don’t assume anything – know it is correct! It is your last chance to make sure the glider is airworthy for your or the next pilots safety. You are certifying it is safe!

1.4 How to Train as a Daily Inspector

A person wishing to get a rating to Daily Inspect a motorglider goes about it as follows :-

a. You will get a rating for a specific motorglider and can add more types over time. Once you are rated on a number of types you can get an unrestricted rating to DI any motorglider. But beware there are many varieties and you need to be sure you can check it fully. Only work within your experience.

b. Study the manuals, get the checklists and understand the systems.

c. Check the aircraft with a DI experienced on type. Once you are confident in your knowledge and experience, ask for a rating from a Daily Examiner.

A person receiving a Daily Inspector rating is authorized to carry out DIs only on motorglider types listed on the logbook sticker.

1.5 What Tasks may a Daily Inspector Perform

Daily Inspectors are authorised to perform daily inspections, inspect gliders after heavy landings and perform independent inspections following maintenance. Daily Inspectors may certify the following maintenance in addition to what you can do on a plain glider, if you have received training and are proficient:

a. Replacement of bulbs, reflectors, glasses, lenses or lights.

b. Replacement, cleaning, or setting gaps of spark plugs.

c. Service and replacement of batteries.

d. Changing oil filters or air filters.

e. Changing or replenishing engine oil or fuel.

f. Lubrication not requiring disassembly or requiring only the removal of non-structural parts, or of cover plates, cowlings and fairings.

g. Replenishment of hydraulic fluid.

Application of preservative or protective materials, but only if no disassembly of the primary structure or operating system of the aircraft is involved.

Removal or replacement of glider tow hooks on tow planes or motorgliders.

There is useful guidance on some of the above in the “maintenance guide for PILOTS”, CASA, 2005.

Annual Inspectors rated on motors can do all maintenance within their rating authority. A rating on motors will initially be restricted to periodic maintenance and can be extended with experience and training to cover various types, replacement of components, propellers, top end overhauls and major overhauls. Don’t go beyond your ratings or experience, it is illegal and dangerous to you and others.

All parts used in Australian aircraft must be approved for use in aircraft, except as detailed in the MOSP Part 3. GFA recognise that many parts used in gliders are automotive and where sensible these can be procured locally. However sense must prevail and quality control is required – only an Annual Inspector can approve parts as detailed in MOSP Part 3. This ensures they are quality controlled and are not cheap copies. Make sure it is the correct part with its release note if it is a critical part – this paper trail proves its origin and quality control.

2. DAILY INSPECTION

The aircraft inspection must be a systematic and thorough look at the aircraft in accordance with the appropriate approved schedule. Make sure you have studied the manuals and have the required knowledge and checklists. It makes little difference where you begin your inspection provided that all areas of the schedule are performed. Remember that you will be certifying for the inspection, which means that you are signing that you are taking responsibility for completing ALL of it.

2.1 Table of Checks Included in a Daily Inspection

2.1.1 Normal Sailplane Inspection.

Do this as you would for any glider, we are used to this procedure.

2.1.2 The Power System Inspection

Check that the ignition switches are off, the mixture control is lean or cut off, the throttle is closed and the fuel selector is on. Make sure you understand and know the switches and are certain the ignition is off, there are odd systems of multiple switches. Even so, work as though it is live as ignition switches in aircraft are designed to fail “LIVE”. Meaning the prop may kick and hurt someone if faulty.

When you check the MR, check for total, engine, and prop times of service required. It will all be in the MR. For this you will need the hours to date. Check for maintenance required during your planned flight and will the MR expire during the flight. The flight can be more prolonged than a simple glider flight especially in the case of cruising motorgliders that may be going away for days or weeks. Plan how you will get your maintenance done.

Turn on all fuel pumps to pressurise the system and to look for leaks. Also listen for correct pump operation.

Check that the propeller blades are free from cracks, bends and detrimental nicks, that the propeller spinner is secure and free from cracks, that there is no evidence of oil or grease leakage from the propeller hub or actuating cylinder and that the propeller hub, where visible, has no evidence of any defect which would prevent safe operation. Check the seals at the root of Hoffman props are undamaged.

Motorgliders have many systems of folding, retraction, furling and feathering. Understand these and check to make sure all is working properly and freely.

Make sure all drive systems; belts, pulleys, gearboxes are operating correctly. In the case of electric make sure the electric drive system has no risks of shorts or overheating, it is charged and correct.

Check that the induction system and all cooling air inlets are free from obstruction.

Check that the engine, where visible, has no fuel or oil leaks and that the exhaust system is secure and free from cracks. Remove cowls as required.

Check that the oil quantity is within the limits specified by the manufacturer for safe operation and that the oil filler cap, dipstick and inspection panels are secure. Refill only with the specified oil using the correct procedures. (There are often tricks.) Makes sure you check all the oil levels as some engines have multiple oil systems.

Check that all electrical connections are secure and all wiring insulation is complete. Where wiring passes through bulkheads or baffles that there is adequate insulation and grommets to prevent electrical shorting.

Check that the engine cowlings and cowl flaps are secure and work.

Check the instrumentation for the engine system.

Check the engine and drive system controls are fully functional.

Check that each tank sump and fuel filter is free from water and foreign matter by draining a suitable quantity of fuel into a clean transparent container. Some systems require a large quantity is removed to move the water out.

Make sure you have enough fuel, the fuel gauges are reading correctly and that you know how much fuel is onboard.

Remember the Daily Inspection:

a. IS MAINTENANCE

b. IS PERFORMED BEFORE THE FIRST FLIGHT OF EACH DAY THE A/C FLIES

c. CAN ONLY BE PERFORMED BY A SUITABLY RATED DI PILOT

d. IS THE LAST CHANCE TO DETERMINE AIRWORTHINESS OF THE AIRCRAFT

e. APPROVED MAINTENANCE DATA MUST BE USED

f. A CHECKLIST IS USED FROM THE GLIDER MAINTENANCE MANUAL

g. MUST BE SIGNED OFF (certified) IN THE MAINTENANCE RELEASE. THE INSPECTOR IS RESPONSIBLE.

3. REFUELLING

Most fuel accidents happen on the ground while working in the workshop or hangar or when refuelling. Be careful and follow protocol for fuel in drums, open fuel containers, storage, and finally refuelling. Be very aware of what you and others around you are doing and don't take chances.

There are regulations and good practice to try to avoid fire and to minimize damage if a fire starts.

During refuelling operations, the aircraft and ground refuelling equipment shall be located so that no fuel tank filling points or vent outlets lie:

a. Within 5 metres of any sealed building

b. Within 6 metres of other stationary aircraft

c. Within 15 metres of any exposed public area

d. Within 9 metres of any unsealed building.

For the above a "sealed building" is one for which all the external parts within 15 metres of an aircraft's fuel tank filling points or vent outlets or ground refuelling equipment is of non-flammable materials and has no openings or all openings are closed.

The area in which fuelling operations are carried out shall be clearly placarded as a 'No Smoking' area and the limits of this area shall be a sealed building or at least 15 metres from the aircraft or ground fuelling equipment.

Where mobile fuelling equipment is used, the equipment shall be so placed that it can be rapidly moved in the event of fire.

A person shall not, and the pilot-in-command and the operator shall take reasonable steps to ensure that a person does not, during fuelling operations:

e. Smoke or use a naked flame within 15 metres of the aircraft and ground fuelling equipment;

f. Operate an internal combustion engine or any electrical switch, battery, generator, motor or other electrical apparatus (mobile phones included) within 15 metres of the aircraft's fuel tank filling points or vent outlets, and ground fuelling equipment unless these comply with the provisions of Appendix 1 to CAO 20.9 and has been inspected (ie it is approved refuelling equipment);

g. Two or more fire extinguishers of approved type and capacity shall be positioned within 15 metres, but not less than 6 metres, from the aircraft and the fuelling equipment except where two or more fire extinguishers are carried on the fuelling equipment. Where so carried the fire extinguishers shall be fitted with quick release brackets, be readily available from either side of the equipment and be located as far as is practicable from the vehicle fuel tanks and fuelling points.

h. Ground the aircraft to the fuelling equipment and allow static to dissipate by touching the nozzle before exposing fuel.

4. Other Useful Information

Motorgliders allow you to extend your normal sphere of operations for gliders and so you need to be aware of the following:

a. Special Flight Permits

b. Carburettor Icing

c. Minimum Additional Equipment for Motorgliders

4.1 Special Flight Permits

The GFA can issue a Special Flight Permit for specific purposes when the motorglider is otherwise grounded by maintenance requirements, damage or other regulatory requirements concerning the aircraft which would normally render it un-airworthy. This does not imply that the aircraft is unsafe. If it could be considered unsafe then the permit should not be issued.

The usual reason would be to ferry a glider to maintenance or a test flight.

4.2 Carburettor Icing

Some aircraft motors are prone to carburettor icing although most motorgliders are generally not. Understand that icing is caused by the air humidity and cooling caused by pressure reduction in the carburettor. It can occur at air temperatures as high as 40oC. Ensure you understand this and check on warnings in the aircraft manuals.

4.3 Minimum Additional Equipment for Motorgliders

In the case of a motorglider, the minimum glider items must be supplemented with:

a. An engine tachometer

b. A carbon monoxide detector for engine installations fixed into the fuselage

c. A cylinder head temperature or water temperature gauge. (Not required if the motorglider type was originally Type Approved without, but strongly recommended)

d. An oil pressure and temperature gauge if applicable

e. A fuel contents gauge or dip stick

f. Static earthing point for re-fuelling purposes

g. And the minimum placarding given in MOSP Part 3.

Carbon monoxide detectors are not all equal but if it indicates carbon monoxide believe it and fix the problem before further flight. In flight open all vents and get down pronto. There will be a reason and you must find it. Carbon monoxide is insidious and the occupant's faculties will be reduced and they could die. Rather get a good detector and be sure how it works.

Suggested reading: http://www.avweb.com/news/aeromed/186016-1.html

5. GLOSSARY OF ACRONYMS AND TERMS

AA	Airservices Australia, the regulatory body responsible for Air Traffic Services and aviation administration at Federal level.
AA	Airservices Australia, the regulatory body responsible for Air Traffic Services and aviation administration at Federal level.
AAF	Airworthiness Administration Fee, payable to the GFA for the issue of the paperwork associated with the annual "Form 2" inspection.
AC	Aerodynamic Centre, the point on a wing about which the sum of the aerodynamic forces act.
AD	Airworthiness Directive (Mandatory).
AN	Airworthiness Advice Notice (non-mandatory).
AIP	Aeronautical Information Publication.
ASI	Air Speed Indicator.
ATSB	Air Transport Safety Bureau, a division of the Department of Transport and Communications and the body responsible for accident investigation.
BCAR	British Civil Airworthiness Requirements, the standard to which British gliders are certificated and to which Australian gliders used to be certificated.
Boom	The term used to describe the spanwise beams of a glider main spar and which carries the main bending loads of the wing.
Box spar	A spar constructed of two booms, top and bottom, joined together by shear webs (q.v.) at front and rear of the booms.
CASA	Civil Aviation Safety Authority.
CAR	Civil Aviation Regulation.
CAO	Civil Aviation Order.
Chord	The distance between the leading and trailing edges of a flying surface such as a wing or tailplane, etc.
C of A	Certificate of Airworthiness.
Control circuit friction	The friction present in a control circuit resulting from the cumulative friction of all the components in the circuit.
Control circuit stiffness	The flexibility of a control circuit, resulting from components deforming under load.
CG	The point on the aircraft through which the total weight acts at right angles to the earth's surface.
CP	Centre of Pressure, the point on a wing through which the lift acts at right angles to the airflow.
CRP	Carbon Reinforced Plastic
CTOA	Chief Technical Officer, Airworthiness, the GFA Officer delegated by the CAA to supervise the airworthiness functions of the GFA
DI	Daily Inspection
D-nose	The D-shaped front section of a wing, forward of the main spar and consisting of a load-bearing skin and numerous internal ribs. Resists the torsional or twisting loads exerted on a wing.
DoTC	Department of Transport and Communications
FRP	Fibre Reinforced Plastic, a generic term for all forms of plastic structures
GFA	Gliding Federation of Australia
GRP	Glass Reinforced Plastic
"I" spar	A spar constructed of two booms, top and bottom, joined together by a single shear web equidistant between front and rear of the booms.

JARs	Joint Airworthiness Requirements, a European standard, Section 22 of which applies to gliders. Hence "JAR 22 requirements".
MAC	Mean Aerodynamic Chord, the average chord of a flying surface, taking into account taper of the surface.
MAR	Mandatory Airworthiness Requirements, a set of GFA requirements for new glider types
MOSP	The GFA Manual of Standard Procedures
MR	Maintenance Release, the document which annually validates the Certificate of Airworthiness or Permit to Fly. Must be kept in the aircraft at all times.
OSTIV	A French acronym which translates into "Scientific and Technical Organisation for Gliding".
OSTIVAS	Airworthiness standards according to OSTIV.
RTOA	Regional Technical Officer, Airworthiness.
Shear	A load tending to deform a structure by sliding one section against another
Shear web	The vertical facing used to join together the top and bottom booms of a glider spar and carrying shear loads when the spar is deflected up and down. A single or double shear web may be used, usually the latter in the thicker part of the wing toward the root and possibly reducing to a single web outboard.
Torque tube	A metal tube which transmits a force to a control surface (e.g. flaps) by means of twisting the tube.
Torsion box	A structure designed to resist torsional (twisting) loads.