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DAILY INSPECTOR'S HANDBOOK

Airworthiness

UNCONTROLLED WHEN PRINTED

Revision 4.3

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Précis of changes Section 8.15 updated to include risk management of Lithium Ferrous Phosphate batteries.			

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1. INTRODUCTION

1.1 The Daily Inspector's Handbook

This handbook details the requirements, procedures and knowledge required of a Daily Inspector in carrying out a DI of a sailplane as mandated in MOSP Part 3 Sections 9.3 and 10.7. Where there are any discrepancies between this handbook and MOSP 3, MOSP 3 has precedence.

The information contained in this handbook is directed to sailplanes. A separate handbook AIRW-M04 DI Handbook Powered Sailplanes is applicable to powered sailplanes including 'sustainer' or 'turbo' sailplanes.

1.2 Pilot Maintenance

A Daily Inspection authority forms the foundation skill set for pilot maintenance activities. Further training is available to extend that skill set to include a range of practical maintenance tasks which pilots may face from time to time in keeping the sailplane serviceable for daily flying. Basic Sailplane Engineering provides the technical theory supporting that training. The range of pilot maintenance activities is defined in Section 10.7 of MOSP 3.

1.3 Daily Inspection

The check items for Steps 1 and 2 of the Daily Inspection process are laid out in the Maintenance Release with specific actions which are mandatory and proven good practice. However, it is difficult to cover all subsequent check items at the detail level because of the huge range of variation amongst the different sailplane types.

It is important when inspecting a sailplane for the first time, where the sailplane or sailplane type is not familiar to the inspector, that they read the manufacturer's flight and/or technical manuals. These manuals will contain specific checks that must be complied with. All daily inspections must observe the specific daily inspection checks in the manufacturer's manuals, which are authoritative sources of information on the daily inspection and technical aspects of the particular sailplane. You need to have access to these manuals, either as a club member or as sailplane owner (sole owner or syndicate).

It was possible in the past with simple sailplane types to inspect them on the basis of experience and without reference to manuals. However, the continuing trend is towards increasing complexity, for example with water ballast in the rear fin, sophisticated instrumentation, competition sealing, sprung retractable undercarriages, etc. All this elevates the importance of knowledge of the manufacturer's manuals.

The most important attributes for a Daily Inspector are experience, adherence to competent inspection process and a good eye for detail. The important key at the detail level is to know what you are looking at, and to be able to compare that with what the equipment or feature should look like. This comes from experience developed with time. If you are not sure what you are doing, then do not undertake the DI on your own. Rather take the initiative and find competent assistance so that you have appropriate supervision while conducting the DI.

Productive ways to increase your knowledge and experience of sailplanes and the DI process are:

a. Take every opportunity to undertake daily inspections, initially under supervision as part of DI training, and subsequently when issued with a DI authority;

b. Take the opportunity with the help of a mentor to inspect all the different sailplanes operated by your club to gain familiarity with different features and systems in different sailplanes;

c. Actively participate in sailplane reassembly and rigging after trailer storage or after workshop overhaul; and

d. Get involved with assisting with Annual Inspections.

2. DAILY INSPECTION

2.1 The Purpose of a Daily Inspection

The purpose of a Daily Inspection is to establish that the sailplane is fit for flight for that day's flying operations and for the DI Inspector to certify that by signature in the Maintenance Release.

A Daily Inspection is required:

a. Before the first flight of the day; and

b. After any assembly and rigging of the sailplane prior to flight.

The Daily Inspection clears the sailplane to fly for one day's operations, unless other factors intervene, such as a retrieve from a paddock landing or disassembly to complete a hard landing inspection.

A good Daily Inspection helps in avoiding incidents and accidents, by finding faults in or issues with the sailplane before it flies. A person holding Daily Inspector authorisation therefore plays a front line role in incident and accident prevention, and in continuing to keep the sailplane airworthy.

Beyond the fit for flight consideration which emphasises safety, there is a subsidiary task which is to set the sailplane up for flying operations on that day, refer Section 10.

A sailplane daily inspection has a major difference to powered aircraft daily inspection because sailplane pilots regularly have to assemble the sailplane out of the trailer or workshop. This involves assembling and safetying structure and connecting and safetying the controls, which are serious critical tasks. These are generally excluded from power pilot practice except in rare specific circumstances.

2.2 The Five Key Aspects of Daily Inspection

All sailplanes receive an in-depth inspection at least every twelve months - the so-called Annual Inspection or "Form 2". The Maintenance Release (MR) records the date that the Annual Inspection was last completed. As a result, you do not need to disassemble the sailplane as part of a DI unless there are specific instructions spelled out in Part 1 of the MR.

The DI involves five key aspects to proving fitness for flight for that day:

a. Checking that the sailplane is correctly assembled and safetyed including the control circuits. Ensure the independent second or 'duplicate' checks of structure and control system assembly and safetying has been signed off.

b. Checking for progressive deterioration caused by fair wear and tear.

c. Checking for unserviceabilities or sudden deterioration which fall outside the range of fair wear and tear such that they constitute defects – major and minor.

d. Checking for unreported or undetected damage.

e. Checking for unwanted loose objects (e.g. tools).

When carrying out a DI, it is sometimes difficult to decide how far to go, how deep an inspection to do. Using the above five points as a guide, the answer is to go deep enough to satisfy your curiosity as to whether the sailplane can safely fly, without going to the extent of starting to take it apart. However, there may be circumstances where disassembly is required eg evidence of a hard landing. If in any doubt, seek a second opinion from a more experienced inspector.

A DI is basically a visual inspection, using only those tools which are necessary to gain access to essential parts of the structure, such as wing roots or underneath nose fairings where the sailplane manufacturer intends there to be access for DI.

Inspectors will need glasses if they wear them, a torch and occasionally a mirror on a stick. It is a great help if a club provides any particular tools which an individual sailplane type might need, either for use at the home base or for expeditions, etc.

2.3 Progressive Deterioration and Fair Wear and Tear Issues

The sailplane will never be in the pristine ex-factory condition. Usage creates progressive deterioration, wear and tear. DI people are constantly assessing whether wear and tear is either “fair” ie reasonably expected, or signs of rapid deterioration that could cause failure.

The last annual inspection should have brought the sailplane to such an overhauled condition that it is fit for a further 12 months operation without unforeseen hassles. But subsequent usage can, and does, lead to issues.

Typical items on a sailplane which can deteriorate slowly over a twelve-month period are:

a. Control cables – wear and/or corrosion and/or broken wires;

b. Excessive free play in hinges and bearings, often due to lack of lubrication or the ingress of dirt;

c. Signs of small fatigue cracks or small patches of corrosion in metal structures;

d. Cracking at stress points in all structures; or

e. Frayed or worn harnesses.

This list is not exhaustive, but gives some ideas in regard to wear and tear issues which need to be assessed for continuing acceptance. Much of the above should develop slowly. Damage that is growing rapidly will need to be assessed by an Annual Inspector.

2.4 Daily Inspector Requirements

The requirements to be a Daily Inspector are listed in Section 10.7 of MOSP 3.

2.5 Daily Inspector Qualities

A Daily Inspector will need to demonstrate the following qualities:

a. Adherence to competent inspection procedures;

b. Curiosity and a willingness to ask questions and seek further information when in doubt or confronted with something new;

c. Attention to and an eye for detail;

d. Being thorough and rigorous;

e. Have knowledge of safe maintenance and workshop practices;

f. Legible handwriting, otherwise the information written in the maintenance release will be of **no use to anyone**; and

g. Physical dexterity as needed to inspect a sailplane.

Note that where it is difficult or impossible for an individual with mobility limitations to inspect there can be procedures or problem ‘work arounds’ developed for the issue at hand.

2.6 How to Train as a Daily Inspector

A person wishing to become a Daily Inspector can receive training from Annual Inspectors, and Gliding Instructors of Level 1. The primary references for the training are AIRW-M007 Sailplane Inspector Training Syllabus and this Daily Inspector’s Handbook. A further good source of training materials are the Daily Inspection training videos available from the Gliding Australia website or via the Gliding Australia channel on YouTube.

When the training has been carried out, the person is tested by an Annual Inspector or Daily Inspector Examiner.

If the DI Examiner is satisfied, the person's logbook is appropriately endorsed. If not satisfied, the person shall be provided with guidance as to appropriate skill and experience development needed towards gaining the authority.

2.7 What Tasks May a Daily Inspector Perform?

Daily Inspectors are authorised to:

a. Prepare a sailplane for daily operations, including relevant tasks listed below;

b. Perform daily inspections and certify, ie. 'sign off', in the Daily Inspection Record within the Maintenance Release;

c. Assemble a sailplane, connecting and safetying the structure and the controls, ie. 'rig the sailplane', following the completion of maintenance, or following transport or storage in a trailer. This includes lubrication of mating surfaces on assembly of sailplane components and controls and applying simple gap tapes across fixed surface to fixed surface, eg. wing roots.

d. Perform second person independent inspections for correct assembly and safetying of structure or controls as precautionary checks on the work conducted by another inspector with prime responsibility. This includes the reconnection of control circuits and reinstallation of control surfaces where these have been disturbed during maintenance, including at annual inspection or following repair.

   This includes certifying the second inspection by signing their name:

   i. in the Daily Inspection record within the MR in the case of second inspections following rigging the sailplane, and recording the signature as 'Second inspection' or 'Duplicate inspection' to avoid confusing it with a 'DI completed' signature; or

   ii. in the sailplane logbook record in the case of maintenance, repair or annual inspection activities.

e. Install serviceable batteries and connect via simple plug and socket;

f. Inflation of tyres;

g. Fitment of removable ballast;

h. Filling of water ballast; and

i. Wash and clean canopies.

Daily Inspectors are authorised to carry out DIs on any sailplane type of the construction category(s) they are endorsed on by pilot logbook entry or sticker; i.e. metal, wood, composite materials (FRP) or steel tube construction category(s); powered sailplane; etc. Authorisation for additional construction category(s) may be added later as examples of the construction category become available for practical training.

Daily Inspectors are not permitted to carry out hard landing inspections. Such hard landing events require an Annual Inspector to inspect and evaluate. The term 'hard landing' includes ground-loops. Refer to Section 9.

Daily Inspectors can extend their capability to include carrying out and certifying significant 'pilot maintenance' tasks. With specific training the 'pilot maintenance' person can carry out and sign-off for the tasks they have been trained for as recorded in the logbook sign-off page.

a. Change main wheels, tyres, tubes;

b. Change nose- and tail-wheels, tyres and tubes;

c. Adjust cable actuated wheel brakes for better braking;

d. Replenish brake fluids (except where removal of structure is needed);

e. Change worn skid shoes and plates;

f. Remove or replace instruments (other than the ASI and altimeter) where this does not affect the pitot-static system, e.g. TE driven variometer; g meter, navigation display;

g. Perform periodic lubrication in accordance with manufacturers schedule;

h. Remove and replace external control seals;

i. Replace broken canopy window rails;

j. Polish small scratches to canopies;

k. Repair chips, gouges and scratches to gelcoat;

l. Update instrument software eg FLARM, digital varios; excluding digital ASI and altimeter;

m. Replace and refill oxygen bottles.

You undertake training for the maintenance activity above and when performing the task you certify for the task at completion. You need to maintain competency with the particular tasks above that you are rated to perform. Show initiative and review the reference information on these topics.

The principle here again is: If you are unsure of what you are doing, then do not undertake the matter on your own. Rather take the initiative and find competent assistance so that you have appropriate supervision while conducting the task, or that the other person carries out the task while you observe, assist them and learn from them.

3. GFA MAINTENANCE RELEASE

3.1 GFA Form 1 Daily Inspection Schedule and Record

The Maintenance Release records the completion of the annual "Form 2" inspection thereby releasing the sailplane from maintenance and into service. The Maintenance Release with its parts 1, 2 and 3 is combined in booklet form with the GFA Form 1 - Daily Inspection Schedule and Record.

WARNING

IF A MAINTENANCE RELEASE IS NOT IN THE SAILPLANE AND IT CANNOT BE LOCATED AROUND THE CLUB AND PLACED IN THE SAILPLANE, THEN IT IS **ILLEGAL** TO FLY THE SAILPLANE.

At the very start of the DI, it is essential to check the Maintenance Release thoroughly.

a. The registration on the Maintenance Release cover must correspond with the sailplane registration on the cockpit registration plate or fuselage / fin markings, ie. the booklet is for the correct sailplane. The booklets are numbered and specific to each sailplane registration. It is not permitted to swap booklets between sailplanes.

b. The Maintenance Release is within date. Check the inside cover for the date that the Maintenance Release is valid from and valid to.

WARNING

IF A MAINTENANCE RELEASE IS OUT OF DATE, THEN IT IS **ILLEGAL** TO FLY THE SAILPLANE.

Next check the following in Parts 1 and 2 of the Maintenance Release:

c. The annual inspection must have been completed and signed on the inside cover page.

d. Check that the post-inspection evaluation flight has been signed off, unless the first flight is intended to be the post-inspection evaluation flight following the completion of the annual inspection.

e. Any scheduled maintenance, either recurring or one time maintenance, in Part 1 due for completion by a date or number of landings which has now past, must have been completed and signed off for the sailplane to fly. If the maintenance is overdue, or now due, but not yet undertaken, then organise the maintenance to be carried out this day by an appropriate person and certified before then conducting the DI and release the sailplane for flying. Scheduled maintenance, if not completed as required, keeps the sailplane on the ground until completed;

f. All Major Defects must have been rectified. Any Major Defect NOT rectified prevents flight until rectified; and

g. All Minor Defect entries are read through, understood and checked where necessary.

MAINTENANCE RELEASE PART 1	Aircraft Type: G102 ASTIR		Registration Marks: VH - ABC

In accordance with the GFA Manual of Standard Procedures this Maintenance Release is issued following the completion of an inspection certified on the GFA Form 2:

Issued by: BUNGALUP GLIDING CLUB (Registered Operator / Organisation)		Valid from First Light on	10 / 09 / 2022
Signed by: James Biggleswoth (Annual Inspector)	MA No. 11767	Valid until Last Light on	09 / 09 / 2023

RETURN TO SERVICE — *FLIGHT REPORT*

Before return to general service an experienced pilot must conduct a check flight and sign below that the flight characteristics are normal. Check for general handling, trim, abnormal buffeting within the flight envelope.

LOW SPEED: √ Stalls, Spins, Trim Abnormal wing drop etc.
HIGH SPEED: √ Handling, Trim etc Up to V_{NE}
AIR SPEED: √ Record max. air speed flight tested 130 KTS

Pilot's signature: Ned Seagall Date: 10 / 09 / 2022

MAINTENANCE RELEASE No: 12345

This Maintenance Release is issued subject to the following conditions:

1. *A Daily Inspection as detailed in the GFA Manual of Standard Procedures shall be performed on the aircraft each day before flight and following any re-rigging occurring at any time.*
2. *Maintenance required during the validity period of the Maintenance Release shall be performed.*

Item No	Maintenance to be Performed. Items which may be performed by Daily Inspectors must be marked 'DI'		Due Date or Time in Service	Maintenance Certified by: (with member no)	Date Completed
1	REPLACE NOSE TOST MAIN SPRING		4542 LAUNCHES		
2	CHECK RUDDER CABLES EVERY 200 HRS		2402 HOURS		
3	CLEAN AND LUBRICATE L'HOTELLIERS		03 APR 2022 OR 2252 HRS OR NEXT RIGGING	ABradshaw 2250 HOURS	21 FEB 2022
4	CLEAN AND LUBRICATE L'HOTELLIERS		21 AUG 2022 OR 2300 HRS OR NEXT RIGGING		

Maintenance Authority is your signature, name and membership number

3.2 Maintenance Release Part 2 Major Defects

The next section of the booklet provides a place for recording Major Defects. A GFA member must record a Major Defect and ground the sailplane if they find a problem which renders the sailplane not safe to fly. If there is a Major Defect which has not been cleared by an appropriately rated person eg Annual Inspector, or a Replacement of Components Inspector (if the matter was within the rectification capacity of such inspector rating), the sailplane must not be flown until the rectification work has been done and the entry cleared. Take the initiative and organise for the defect to be rectified by bringing the matter to the attention of the relevant person.

MAINTENANCE RELEASE PART 2			
MAJOR DEFECTS **THESE DEFECTS PREVENT FLIGHT UNTIL CLEARED** Major defect other than accidental damage and Fair Wear and Tear must be reported to an RTOA or the CTOA	**Found By:** Signature Date	**Cleared By:** Signature 1109 No. Date	**Clearance action taken**
USE REPORT FORM FROM CENTRE PAGES			

If you find a major defect during the Daily Inspection:

a. It is mandatory that an entry is written in the Major Defects section of the Maintenance Release. Additionally, as a practical measure, place a large notice in the cockpit (or taped to the wing) warning of the defect.

b. Report the defect to either the club Airworthiness Administration Officer (if a club sailplane) or the Registered Operator (if privately owned) to ensure that the rectification or repair work gets organised.

c. Report the problem to the GFA. If it is accidental damage during operations, enter a SOAR report. If it is a defect with the sailplane, enter a Service Defect Report. For serious defects, GFA has a legal obligation to report these to CASA. The problem may extend to other sailplanes in Australia and worldwide and require issue of an Airworthiness Directive (AD) and notification to the manufacturer. Refer to MOSP 3 Section 12.3.

If you are in doubt as to whether a significant defect is Major or Minor, then locate an experienced Annual Inspector and get their view on the matter. There is usually such a person on the gliding site. You should seek out such person(s) to get the matter assessed and, if possible on the day, rectified so the sailplane may resume flying.

If the assessment is entirely up to you and uncertainty exists with a significant defect, then under the precautionary principle, you should err on the side of caution and safety and enter it in the "Major Defects" section. Then follow up to see that it gets inspected and assessed as soon as practical and rectified by a qualified inspector, ie. Annual Inspector, or a Replacement of Components Inspector with relevant capability.

3.3 Maintenance Release Part 2 Minor Defects

The next section is for recording Minor Defects. Such defects do not prevent the sailplane from flying, but they do need monitoring at each Daily Inspection.

The sailplane will always show deterioration as a result of flight and ground operations. The daily inspector needs to assess "Is the sailplane fit for flight today?" and minor defects are assessed each day from that viewpoint. However, that is not an excuse for letting deteriorations slide into becoming trouble. Minor defects must be fixed at some time. Therefore, it is better to show initiative and contribute to fixing minor defects earlier rather than later.

MINOR DEFECTS THESE DEFECTS MUST BE CHECKED AT EACH DAILY INSPECTION UNTIL CLEARED	Found by: Signature Date	Cleared by: Signature 1109 No. Date	Clearance Action taken

If on inspection a minor defect is found to have become a threat to the safety for flying that day, it must be elevated to a major defect preventing flight until rectified. In this case make a note in the 'Clearance Action Taken' column that the defect has been moved to and recorded in the Major Defect section and enter the date. Remember that you can usually find someone on site for a second opinion or ring someone knowledgeable and send a picture from your phone.

On occasion, sailplanes will have unserviceable equipment and/or items remaining installed that are not essential and where the equipment or item's presence or absence does not alter the safe operation of the sailplane. GFA document AIRW-M015 – Permissible Unserviceabilities lists conditions where it is legal to operate the sailplane with unserviceable or removed equipment. In all cases, the permissible unserviceability must be listed in the minor defects section of the Maintenance Release.

Always start recording minor defects on the first page. If recording of defects has started on the second or third page, the earlier blank page should have a diagonal line ruled across it so that the minor defect list follows date order.

In all cases, please write legibly, as the information will be of no use to anyone if they cannot read it.

If a minor defect is considered relevant to other similar sailplanes, a defect report needs to be completed and forwarded to the GFA either via the club Airworthiness Administration Officer or via the Registered Operator (private sailplane). Report the matter via a Service Difficulty Report (SDR) online via the GFA website, or as a backup defect report forms are found in the centre of the Maintenance Release booklet.

3.4 Maintenance Release Part 3 Flight Time Recording

Part 3 of the Maintenance Release is where the sailplane flight hours and landings are recorded. This is essential for tracking the sailplane's hours and landings in relation to any scheduled maintenance in Part 1 of the Maintenance Release.

Each page is divided into two sets of columns which include the date, the hours flown since last entry, the progressive hours total, and the total number of landings. These should be updated at the end of each day's operations. Take care when adding up the hours and landings as it is a very common to find arithmetic errors. Another common source of errors is when transferring total hours and landings from the end of one page to the top of the next.

The increasing fitment of flight computers leads to daily flight times being readily accessible via the 'logbook' function for transfer to the Maintenance Release.

Part 3 need not be filled out if an alternate system for tracking hours and landings that is approved by GFA under Advice Notice AN-150 is being used.

MAINTENANCE RELEASE PART 3

NOTE: Part 3 need not be used if a GFA approved alternative exists. Refer AN-150

DATE	Since last entry		Progressive total		Total landings	DATE	Since last entry		Progressive total		Total landings
	Hrs	Mins	Hrs	Mins			Hrs	Mins	Hrs	Mins	
Brought Forward						Brought Forward					
Carried Forward						Carried Forward					

3.5 GFA Form 1 Schedule

When carrying out the DI, follow the daily inspection schedule (GFA Form 1) included within the Maintenance Release booklet.

Step 1, checking the Maintenance Release records, and Step 2, check the rigging and controls, are the **mandatory** starting points of the process.

Steps 3 to 9 which are the detail inspection presents **guidelines**. These guidelines are applicable to sailplanes constructed of all materials and are reproduced below. These do not supersede any detail requirements listed in the sailplane's flight or maintenance manuals.

DAILY INSPECTION SCHEDULE GFA FORM 1

STEP 1 **Maintenance Release must be valid and in date! No unrectified major defects!**
Check Pt 1 and Pt 2 of the Maint Release for outstanding maintenance. Review all minor defects.

STEP 2 **CRITICAL SAFETY CHECKS. Is it rigged correctly?**

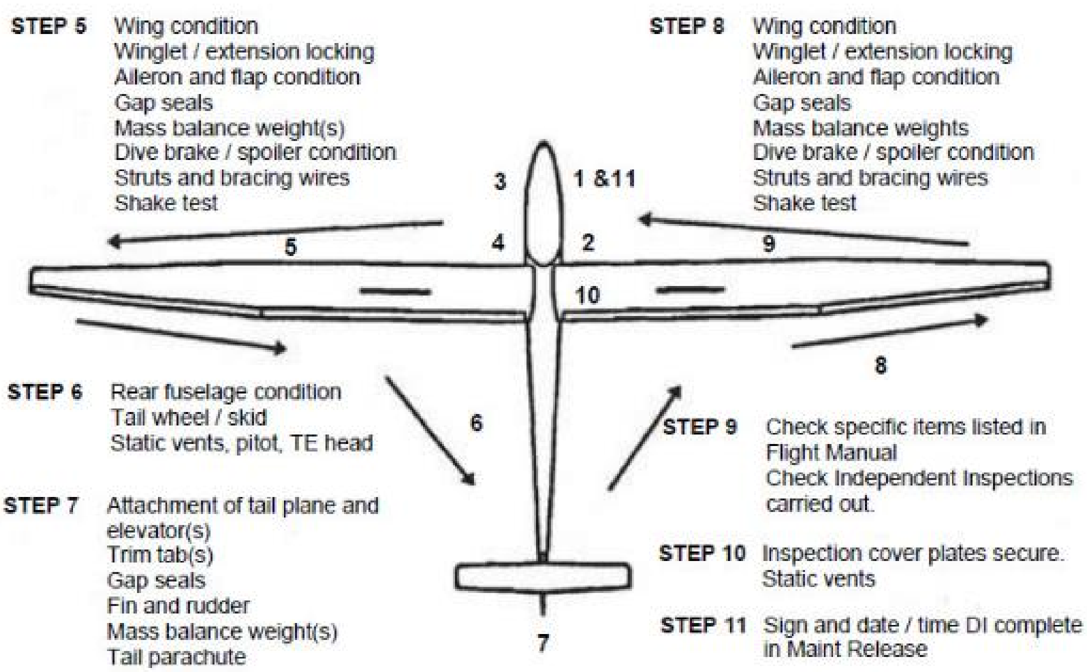
a. *Check assembly & safetying of wing-fuselage-wing, tail plane-fin, etc structural connections.*
b. *Check assembly and safetying of the flight and secondary controls.*
c. *Check the unrestrained behaviour of the controls — full deflections & freedom of movement.*
d. *Check controls by restraint — prove connection, correct control sense & lack of free play.*

STEP 3 **Other two person checks:**

a. Pitot, static and TE system. Puff and check system.
b. Release checks using tow rope under load
c. Wheel brake check under load

STEP 4 **Cockpit:**

a. Battery(s) installation
b. Harness(s) webbing and buckles – Test under load. Seat(s), cushions & headrest(s)
c. Instruments & radio
d. Placards, cockpit cleanliness
e. Tyre(s) condition, pressure & clearance, undercarriage & suspension / bungies, doors
f. Tail Parachute
g. Oxygen bottle, regulator and system
h. Parachute(s), maps, equipment, security and storage
i. Forward fuselage condition



3.6 What to Inspect at Detail Inspection Level?

The check list from Step 3 to Step 9 in the booklet with the associated diagram showing a typical walk around daily inspection. After an initial period of building experience with the DI activity, you must be able to complete the DI without carrying that list and referring to it each and every minute. You should progress to the stage where you only use it at the end as a final checklist if you need to.

Think of the "What to inspect?" issue this way. You can only inspect that which is in front of you and that which you can reasonably access, e.g. open the airbrakes and look into the airbrake box. You are not expected to take the sailplane apart to inspect it or to remove screw secured inspection panels. Inspection panels that you may be expected to access are typically held by a spring latch mechanism for finger activation.

The physical sailplane in front of you forms its own checklist. This works particularly well if you break the task into sections and work your way around the sailplane in a consistent and orderly manner. You then inspect that section of the sailplane in front of you and then move on to the next section.

For example, with a wide wing chord, you may only be able to reach and inspect the wing upper surface from Leading Edge back to the main spar. So, starting at the wing root work along to the wing tip looking at what is in front of you – the upper surface of the front half of the wing. You have then covered that section, that part of the checklist. You then do the upper surface from main spar back to the Trailing Edge, working wing tip to wing root. Next inspect the wing under surface root to tip. Then the detail inspection of that wing is complete.

By way of another example; in the cockpit, break the front cockpit into the starboard wall section, the port wall section and then the middle seating area and inspect each of those sections from rear to the front. What is in front of you is what has to be checked, and it is what forms its own checklist.

3.7 Completing the DI – Sign only when completed!

Do not, under any circumstances, sign the MR knowing that you intend to come back later and complete part of the task such as a release check or a pitot-static check. Incidents have occurred where the Daily Inspector arrived back 20 minutes later to complete the DI check only to find that the sailplane had been launched based on the signature in the MR.

Never sign the MR until you have completed all the requirements of the inspection.

4. STRUCTURE AND CONTROLS

After checking the Maintenance Release at Step 1, always follow with checking the sailplane for correct structural assembly and safetying (Step 2a), and then correct control connection and safetying (Step 2b).

There is no point to going any further and fussing over detail if the big picture safety issues of correct assembly and correct rigging have been overlooked at the start. Particular attention must be paid to this aspect if the sailplane has just been assembled, such as following an annual inspection or after retrieve from a cross-country outlanding.

As the DI person performing the full inspection, you must ensure there is an independent second ('duplicate') inspection of structure and control system connections and safetying signed off in the MR after re-rigging as detailed in Section 4.4.

4.1 Step 2a Correct Assembly and Safetying of Structural Components

It is critical to inspect the correct assembly and safetying of the structural components. Check the following:

a. Wing main spar and other wing root pins must be fully engaged and safety-locked;

b. Wing outer panel and / or winglet connection pins must be engaged and safety locked;

c. All tapered structural pins must be pulled fully up on the taper;

d. Tailplane attachment pins and attaching features must be secure and safetyed;

e. Non-structural fairings associated with structure assembly must be secure; and

f. Wing struts and rigging wires (vintage sailplanes) must be installed and safetyed.

4.2 Step 2b Correct Connection, Rigging and Safetying of Controls

It is critical to inspect the correct connection and safetying of the controls. Carry out the following:

a. Visually inspect and check by light hand loading, that each manually connected control is correctly connected and safetyed at its point of assembly / disassembly, for example L'Hotellier couplings; and

b. Safety pins or similar approved safetying features are fitted to control connections eg L'Hotellier couplings, and are correctly installed. On many connection types it is possible to insert the safety pin incorrectly and lock the coupling open or insecure which is extremely dangerous. Be sure they are correct! Refer to Section 0 for details.

> **NOTE**
>
> Locking sleeves on Polish type quick connectors (eg Jantar and PW6) are prone to being unlocked during the checking process. Ensure the pin is visibly protruding and the sleeve is held fully locked, and do not physically unlock the sleeve and control to check that it was locked! Refer to diagram in Section 0.

While Steps 2c and 2d are covered at Sections 4.3.1 and 4.3.2 provide additional checks on control integrity, they are NOT a substitute for Step 2b where direct visual inspection of the connection and confirmation by light hand loads, is required.

4.3 Checking Integrity of the Control System

When checking the primary controls of a sailplane (elevator, ailerons, rudder), it is possible for the controls to **appear** to be correctly connected when in fact they are not. The DI Inspector must have knowledge of the particular features of the sailplane control connections and carefully check them.

Elevators: With some elevator connections, the weight of the elevator downwards simply holds the elevator under surface against the top of the elevator vertical pushrod where this pushrod emerges from the top rear of the fin. The elevator will move in the expected direction with movement of the control column despite the lack of any physical connection.

Ailerons: With some aileron connections, the weight of the aileron pushes it down which then pushes the actuating pushrod towards the wing root and further into the fuselage. In one example the connector in the fuselage has guide plates to accept the pushrod end before the push rod end reaches the coupling point, such that the push rod end can simply sit in the open guide plates. The aileron will move in the correct way with the control column without safe connection having been made.

It might be thought that such an occurrence is rather unlikely. Regrettably there have been too many cases around the world, many fatal, where sailplanes have taken off with disconnected controls, following a Daily Inspection on which this very problem was not detected. In Australia on average one sailplane each year is reported to have taken off with either a control disconnected or poorly connected and subsequently become disconnected in flight. Such cases, especially those involving instances of disconnected elevator controls, may leave the pilot no other alternative but to bail out of the sailplane, provided there is enough height to do so! Some flight manuals comment on this and how the danger may be handled.

4.3.1 Step 2c Checking the Unrestrained (Free) Behaviour of the Controls

WARNING

WHILE THIS PROCESS DOES CHECK IMPORTANT CONTROL BEHAVIOUR, IT DOES **NOT** PROVE THE CONTROL HAS BEEN CONNECTED AND SAFETIED PROPERLY. ONLY STEP 2B (REFER SECTION 4.2) DOES THAT.

It is a **MANDATORY** requirement that Daily Inspectors check that the direction and range of movement are correct and that the controls move freely across the range, using visual observation of and feel of the control system.

First exercise each control in turn and then elevator and aileron in combination checking for these outcomes:

a. Full deflection of the control and in the correct direction;

b. A brisk shake of the control column does not result in the elevator or an aileron separating in the absence of connection;

c. Smooth action throughout the movement and without any scraping noises or transient high resistance or persisting high resistance;

d. Ailerons display even behaviour between port and starboard (ie same up on both sides and down on both sides) and each deflects more upwards than downwards, ie. showing the feature called ‘aileron differential’;

e. The control column movement “around the box” when elevator is combined with aileron is smooth; and

f. The controls on reaching their maximum travel are stopped up against firm stops.

The check of the control system for correct direction of movement is critical. In the past there have been cases of reversed aileron controls eg Standard Libelle, Hornet, and reversed cables eg Blanik, IS28B2. Human error is a fact of life and needs to be minimised. Checks and double-checks are supposed to ensure that human error is detected before disastrous consequences eventuate. However, there are cases of sailplanes taking off with reversed controls, after the sailplane has passed through three stages of inspection: annual inspection, then DI, and then pilot pre-flight without the problem being detected.

4.3.2 Step 2d Checking the Restrained (Held) Behaviour of the Controls

> **WARNING**
>
> WHILE THIS PROCESS WILL DETECT IF THE CONTROL HAS NOT BEEN CONNECTED, IT DOES **NOT** PROVE THE CONTROL HAS BEEN CONNECTED AND SAFETIED PROPERLY. ONLY STEP 2B (REFER SECTION 4.2) DOES THAT.

It is a **MANDATORY** requirement that Daily Inspectors check the controls under restraint. This method will:

a. Detect the worst case of control disconnection;

b. Check the freeplay and whether it is acceptable, or unacceptable;

c. Check that the direction of the control movement is correct, or not; and

d. Check the control circuit from one end to the other end for load carrying.

On a number of occasions the controls restrained method has detected failure during maintenance to reconnect a control circuit at a location away from the usual rigging-derigging connection. It was also valuable in one case where the restraining hand loads caused the elevator pushrod to break due to hidden corrosion, and this event led to elevator vertical pushrod replacement world-wide in a range of sailplane types.

The controls restrained method requires two people: an assistant holds the control surface firmly while you try to move the control column or pedals against that restraint. Exercise each control firmly in turn and verify that the control in the cockpit has resistance in each direction. Resistance in one direction but not the other shows that the control is not properly connected.

The method will detect any connection that appears at first glance to be connected but in fact is not connected. It is very valuable for that purpose of detecting the worst case. However, this check will not detect if the control connection has in error been made in a way that may show a positive result now but still allows the connection to fall apart later on after an amount of time in flying service. Furthermore, it does not check that the control safetying is in place and correct. Only Step 2b does that.

4.3.3 Control Surface Free Play

While checking the integrity of the control system, it is important to check the amount of free play at each control surface. Although controls may be quite devoid of free play when new or fresh from maintenance, it is inevitable that a certain amount of wear will build with flying hours.

Free play may occur anywhere in the circuit, for example at the various bearings and bushes at control rod ends, at clevis pins used for rigging the controls and at the control surface hinges themselves. All the contributions to free play in any given control circuit add up and the result can be assessed by testing the control against restraint.

Modern sailplane flight and / or maintenance manuals will contain allowable free play limits for control surfaces. Vintage sailplanes may not have allowable free play limits in the manual, or there may even be no manual. In these cases, seek advice from an Annual Inspector as to what is allowable on these types. Daily Inspectors need to know the "ball park" range for control surface free play on the sailplane(s) being inspected.

On cable actuated controls with long cable runs, care is needed to avoid confusing free play with control cable stretch under load. This is usefully demonstrated whilst doing on-the-job training.

4.4 Checks After Reassembly

4.4.1 Reassembly of Whole Sailplane

A Daily Inspection is required after the whole sailplane has been re-assembled for the purpose of flying. In addition, an independent second ('duplicate') inspection for completion of structural and control system assembly and safetying is required. The independent second inspection is carried out by a Daily Inspector and follows the standard processes of Steps 2a to 2d above.

After the checks have been completed, both the person who performed the DI and the person who performed the independent second inspection must sign the Maintenance Release. The signature for the second inspection of structure and controls should be noted as such, eg "Second Inspection".

The advice to include a clear annotation as to what is being signed for, is especially relevant to the infrequent situation where the sailplane is being reassembled from the trailer for the purpose of simply putting it away in the hangar without regard to when it will be flown. Here the crew can complete the reassembly and control checking in which case the two signatures are simply duplicated inspections of structure and controls. In the absence of a clear annotation of this fact, the signatures could be taken as proof of a satisfactory completed DI on that day!

4.4.2 Reassembly of Control System Components or Reinstallation of Control Surfaces

Where a control circuit is reconnected and/or a control surface is reinstalled following disassembly or removal during maintenance, including at annual inspection or following repair, an independent second person inspection for correct reassembly and safetying is required. This is a precautionary check on the work conducted by the inspector doing the maintenance. The second inspection is certified in the logbook record in the case of maintenance, repair or annual inspection activities.

4.4.3 Automatic Control Connections

For sailplanes with automatic control connections on rigging, the independent duplicate check on those controls is optional in accordance with MOSP 3 Section 11.2.4.

This exclusion is intended to enable pilots responsible for their own self-launching sailplane with fully automatic connections on rigging to carry out independent operations. It is recommended that this exclusion is not relied on in the case where the Daily Inspector is signing out such a sailplane for a range of pilots, and perhaps crew, to operate.

4.5 Two Person Tasks

Four checks need an assistant for their competent performance:

a. The checking of the controls by the controls restrained method as above in Section 4.3.2,

b. The check on pneumatic instruments,

c. The checks on aerotow and winch releases, and

d. The wheel brake operation checks.

You need to arrange that assistance. As a practical suggestion it is recommended to carry out these four items near the start of the daily inspection (often with the cockpit checks) so that you can release your assistant to be useful elsewhere.

4.6 Unserviceabilities - Examples

Examples of sudden deterioration include:

a. Broken release springs;

b. Water or insects in pitot/static systems;

c. Instrument or radio failure;

d. Flat or low pressure tyres;

e. A failed component in a control circuit; or

f. Separation of control surface seals.

g. Some control systems, cable and even pushrod, change with temperature. Make sure the airbrake overcentre locks or cable tension/slackness are still within serviceable limits.

Again, this is not exhaustive, but gives some ideas of what can happen suddenly and unpredictably in normal service.

4.7 Unreported or Undetected Damage

This is outside the category of normal service and occurs when the sailplane has encountered the following, which should have been, but regrettably may not have been, reported by the pilot(s) or crew:

a. In-flight overload, typically caused by mishandled aerobatics or flying too fast in rough air leading to either overspeed or exceeding ‘g’ limits;

b. Hard landing;

c. Ground-loop on take-off or landing;

d. Damage in the hangar ("hangar rash") or trailering damage;

e. Outlanding damage; or

f. Damage from poorly designed/ used ground towing aids.

4.8 Unwanted Loose Objects

Accidents, including fatalities, have been caused by foreign objects such as tools, pens, lose screws, coins, etc becoming jammed in control circuits and causing loss of control. This can happen at any time, but a DI Inspector must be especially alert for such items when a sailplane has just come out of the workshop having been serviced or repaired. A Daily Inspector must have a high degree of curiosity, bordering on suspicion, when it comes to the possibility of loose foreign objects inside sailplanes.

Historically, coins dropped out of trouser pockets were an everyday hazard. This has now largely disappeared with the widespread use of debit cards. However, modern technology has introduced new items including styluses for touch screens, spare disposable batteries, plugs and adaptors for ports, and other assorted “tech bits”. Stones or small pebbles from people’s shoes are another source which also can quite effectively jam controls. Vacuum cleaning of cockpits is a regular and valuable DI task.

4.9 Summary

Daily inspection is a vital part of sailplane safety. The requirement on the Daily Inspector is to diligently apply check procedures on each occasion. Vigilance and inquisitiveness need to be exercised at all times.

5. PROCESS AND PRINCIPLES OF INSPECTION

Daily inspection is a process and certain principles apply:

a. Know what you are inspecting.

  i. Access flight manuals and/or notes on particular features of the type; and

  ii. Have the features of the sailplane type explained to you by an experienced DI inspector.

b. Inspect in an orderly / systematic manner. To ensure you miss nothing, work to a consistent process that you use all the time, including the order of the inspection of the surfaces of the sailplane where you are looking both overall and in detail.

c. Make the area to be inspected accessible:

  i. A sailplane can usually be manoeuvred to improve access for inspection in contrast to a powered aircraft which simply stands on its wheels. For example, raise the tail by means of the tail dolly to facilitate inspecting the tailskid or tailwheel; put the opposite wing tip on the ground to inspect the under side of this wing;

  ii. With a nose heavy sailplane, raise the nose for inspection underneath.

  iii. There can be small access panels with central spring loaded catches intended for daily inspection access, eg Blanik, IS-28.

d. Use all your senses and faculties:

  i. *Vision*: unaided - direct viewing, and the other possibility, shallow angle viewing of surfaces to highlight subtle discontinuities;

  ii. *Vision*: aided by bringing strong light to the task – by applying more light one's eyes achieve a better depth of field and darker areas are more fully illuminated – take sailplane out of hangar into bright light and/or use a torch. But beware that in the sun your eyes cannot see in darker places as well and you may need to shield your eyes from the sun;

  iii. *Vision*: aided by appropriate spectacles if you need these; and/or

  iv. *Vision*: aided by use of mirrors or hand lens with magnification.

  v. *Hand feel*: steady sensitive sweep of hand and fingers may detect surface discontinuities; and

  vi. *Hand loads*: modest hand loads applied to structure can detect security of attachments or looseness, e.g. stabiliser to fin firmness/looseness; restraint of controls checking free play, etc. But don't stress parts by heavy shaking or loads.

  vii. *Hearing*: listen for rattles or scraping noises around bearings or other moving parts;

  viii. *Hearing*: listen for noise when conducting wing shake which may indicate loose main fittings on the wing;

  ix. *Hearing*: listen for structural distress in overloaded FRP composite structures with potential internal damage eg disbonded ribs or frames;

  x. *Smells:* may indicate glue deterioration with wooden sailplanes, such as smells like soar milk;

  xi. *Smells:* may indicate deceased vermin on board; and

  xii. *Smells:* may indicate dead bugs in plumbing.

e. Mirror image principle: Taking advantage of sailplane symmetry about the centre plane, compare the feature of interest/concern on one side with its mirror image part on the other side.

f. Second sailplane principle: Inspect a second sailplane of the same type, if available on site, to get a better idea or feel as to what is normal for the type, eg has the torsional stiffness of this Libelle rear fuselage been reduced as a result of ground loop? It may help to check other Libelle(s) at hand.

g. Develop your knowledge on what is critical:

   i. Checking of the structural connections and the safetying, together with the flight controls, is the number one priority at the start;

   ii. Harness condition and attachment to structure; and

   iii. Unreported damage from the previous day(s) flying.

h. Seek second opinion:

   i. There are usually capable more experienced inspectors on site and available to provide advice on matters of concern; and

   ii. In this mobile phone age, especially with photo and/or video capability, the matter of concern may be amenable to contact with and advice from an experienced inspector off-site.

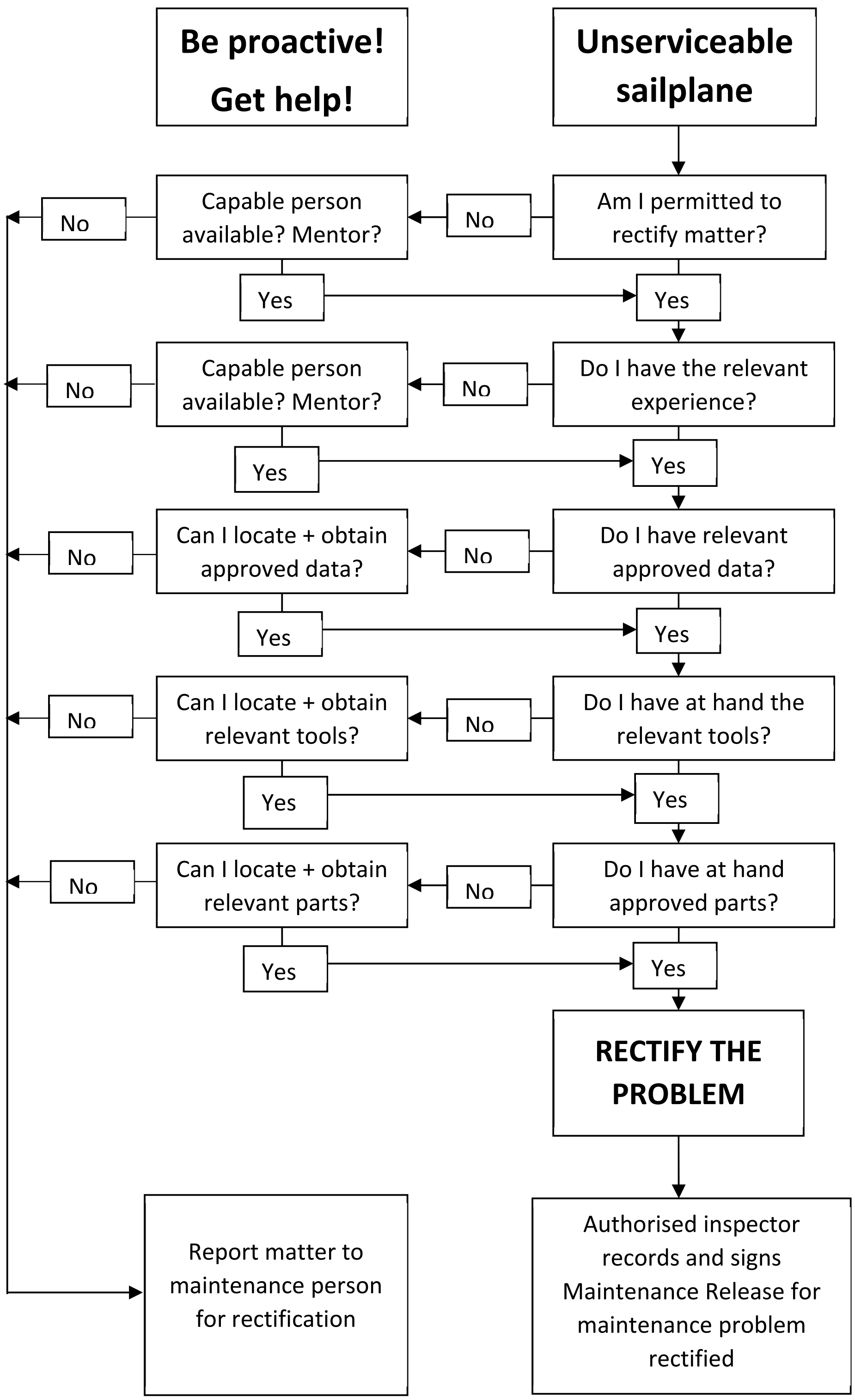
i. Check the history: If some deterioration is suspected or found, check the sailplane logbook for previous maintenance eg prior measurements, adjustments, repairs etc to see if there is a longer term pattern emerging.

5.1 Performing Maintenance

Daily Inspectors with relevant pilot maintenance training completed (and signed off) are empowered to perform the range of maintenance tasks on sailplanes and motor sailplanes as recorded above in Section 2.7.

There are situations where the DI person will find an unserviceability which would immediately prevent flight. However, if the unserviceability is a maintenance task which is amongst those listed at Section 2.7, it can be rectified by the pilot maintenance rated DI person, on their own or with assistance, to enable the sailplane to fly that day.

The following diagram of the logic involved has been developed from the CASA Maintenance Guide for power pilots published in 2010 and is equally applicable where the inspection of sailplanes is concerned.


Be proactive!
Get help!
Unserviceable sailplane
Am I permitted to rectify matter?
No
Capable person available? Mentor?
No
Yes
Yes
Do I have the relevant experience?
No
Capable person available? Mentor?
No
Yes
Yes
Do I have relevant approved data?
No
Can I locate + obtain approved data?
No
Yes
Yes
Do I have at hand the relevant tools?
No
Can I locate + obtain relevant tools?
No
Yes
Yes
Do I have at hand approved parts?
No
Can I locate + obtain relevant parts?
No
Yes
Yes
RECTIFY THE PROBLEM
Authorised inspector records and signs Maintenance Release for maintenance problem rectified
Report matter to maintenance person for rectification

6. RISK MANAGEMENT

6.1 Introduction

The benefits to safety from a positive and supportive safety culture were established decades ago as far outweighing the supposedly positive outcomes from a punitive culture. A club member, if they admit to a mistake, should not be subject to a culture of blame.

Change saw Gliding Australia and the clubs adopt the principles of a 'Just Culture', where after an incident we ask: "What can we learn from what went wrong or what showed serious potential to go wrong?" and "What can be done to avoid reoccurrence?" rather than any focus on "Who has caused the problem?".

In the early 2000's, Gliding Australia introduced an online reporting system and database to better capture, assess and act on reports of gliding accidents and incidents including airworthiness and DI issues. It took some years for members to become comfortable reporting their mishaps, as often they felt embarrassed or believed they would be blamed.

We know that we ALL make mistakes from time to time. So we need processes to try and deal with this reality. Gliding Australia receives reports on accidents and incidents to help understand **why** good people may have made mistakes and then **what** can be done to eliminate the mistakes or to at least mitigate against them happening again.

Gliding Australia now applies layered risk management and safety management systems, supporting a positive safety culture, open reporting, awareness and education. The Safety Management System is described in MOSP Part 5 SMS.

Honest human mistakes are now seen as a learning opportunity for the organisation and it's members. The individual(s) who made a mistake must experience that Gliding Australia or their club will respond positively to reporting safety matters. Supporting the person with additional training and mentoring may be an outcome. Within the club or a wider circle, changes to procedures or equipment may be outcomes which result.

However, it should also be recognised that willful misconduct will usually result in some form of disciplinary action such as suspension or removal of flying or airworthiness privileges.

The clubs and their members must support this positive reporting culture where issues, mishaps, errors and mistakes are openly reported so as to maximise the safety improvements and outcomes.

The next sections are a framework for thinking about behaviours to reduce errors, mitigate risks and improve safety outcomes.

6.2 Threat and Error Management

Threat and Error Management (TEM) is the process of detecting and responding to threats and errors to ensure that the ensuing outcome is inconsequential; that is, the outcome is not:

a. An error,

b. A further error, or

c. An undesired state - meaning a condition or attitude which was not intended.

In the past, human error in aviation was considered a weakness and we deemed the person involved to be 'guilty' of making the error. However, we all make errors from time to time. We need to acknowledge this, find ways to identify threats and errors, and then try to resolve them before they occur or when they occur.

6.2.1 Threats – Factors That Occur Outside Our Control

Threats are divided into two categories:

a. External. Poor accessibility, difficult control connections, poor lighting etc.

b. Internal. Fatigue, complacency, time pressures.

Anything that can lead us to disconnect from the task at hand can create hazards and/or avoidable dangers. For daily inspection, some examples of threats are:

TYPICAL THREATS	STRATEGIES TO COUNTER THE THREAT
Complacency	You remind yourself of the critical task you are undertaking.
Misunderstanding of structural rigging features and flight control connections, including safetying.	You follow through with Steps 2a to 2d at the start of the DI sequence. You pay attention to learning the details of the range of structural assembly features and control connections you encounter. Being curious is a valuable attribute. Refer EASA Safety Info Bulletin 2019-07_1 Sailplane Rigging
Features in compartments being hard to reach or see	Use bright light, either natural (move sailplane into sunlight) or torch, and/or use inspection mirror.
Inadequate, or absence of, tools or aids for DI at club	You acquire and bring your own basic kit for DI activities.
Physiological stress and/or fatigue.	Be aware of and assess your personal condition. If needed you get someone to help you, or someone does it for you. You take more time and focus on being more careful and conscientious. You rest, rehydrate and / or eat food before carrying out the daily inspection.
Psychological stress (e.g. frustration or other negative feelings)	Be aware of your personal condition. You get someone to help you, or someone does it for you. You take more time and care.
Time pressures.	Time pressures have caused accidents in the past. You recognise the fact that you are being placed under pressure and you push back against the sources of pressure. “It will be ready when I have finished the job properly.”
Interruptions and distractions	Interruptions and distractions have caused accidents in the past. You direct interrupting persons to speak to you after completion because best practise is to not interrupt people doing a DI. Leave your mobile phone in the car or clubhouse until you have completed the DI. If you have your mobile phone with you, have it on ‘silent’ or ignore it until after the completion of the DI. Respond to calls or texts afterwards. If interrupted or distracted it is best practise to start again from the beginning to avoid missing critical points.
Important documents needed to support DI activity are not at hand	You approach the clubs Airworthiness Officer to have the Flight and Maintenance Manuals and any club briefing notes on the sailplane type made available at the airfield. You contribute to making that happen rather than walking away leaving it to others.

6.2.2 Errors – Our Actions and Inactions

Errors are our decisions that lead to a deviation from what was intended or expected, thereby reducing safety margins, and increasing the probability of adverse outcome(s). For daily inspection, some examples of errors are:

<table>
<tr><th>TYPICAL ERRORS</th><th>STRATEGIES TO COUNTER THE ERRORS</th></tr>
<tr><td>Step 1: MR in your hand is NOT for this sailplane you are inspecting.</td><td rowspan="2">You must start the inspection with a careful reading of the correct MR so that you detect and understand the implications of the issues revealed.</td></tr>
<tr><td>Step 1: MR validity has expired due exceeding date limits.</td></tr>
<tr><td>Step 1: Scheduled maintenance has become due but no action taken thus far.</td><td>If action or lack of action is not clear, then you question and seek clarity.
Look around to see if experienced person is on hand to provide advice.</td></tr>
<tr><td>Step 1: MR records major defect(s) which have not yet been cleared.</td><td>Look around to see if experienced person is on hand to provide advice.
Use phone to reach a source of advice if needed.</td></tr>
<tr><td>Step 1: MR not signed for the DI completed.</td><td>Avoid interruptions and distractions.</td></tr>
<tr><td>Step 2a: Wings and /or tailplane not connected and/or safetyed properly.</td><td>Commence the physical inspection with DI schedule Step 2 with its four points as the first priority.
Ensure you know the rigging of this sailplane and if uncertain seek knowledgeable help or refer to manuals.
If rigged from trailer, storage or workshop, ensure one person directs the rigging and an independent person carries out the second inspection.</td></tr>
<tr><td>Step 2b. Controls not connected and/or safetyed properly.</td><td>Commence the physical inspection with DI schedule Step 2 with its four points as the first priority.
Ensure you know the rigging of the controls of this sailplane and if uncertain seek knowledgeable help or refer to manuals.
If rigged from trailer, storage or workshop, ensure one person directs the rigging and an independent person carries out the second inspection.
Ensure safetying checks do not cause inadvertent detachment of safety pins or sleeves.</td></tr>
<tr><td>Step 2c. Controls: Ailerons reversed or elevator up-down, deflections uneven.</td><td>Follow through step 2c, unrestrained behaviour of controls.
Seek help when uncertain.</td></tr>
<tr><td>Step 2d. Controls: Not well connected; aileron or elevator free play excessive.</td><td>Follow through step 2d, restrained behaviour of controls.
Seek help when uncertain.</td></tr>
<tr><td>Normalising defects.</td><td>An unfortunately common problem where a defect or issues is ignored as “It has always been like that”.</td></tr>
</table>

	Seek a second independent opinion when uncertain. Report the problem in the Maintenance Release (MR) and ask the more experienced inspector to clear the entry.
Confirmation bias.	Another common problem such as seeing a safety pin is present and assuming it is through the correct hole / fitted correctly. Be thorough and use a torch and/or mirror if required. Seek a second independent opinion when uncertain.

Note: These very serious errors and if not detected can lead to incidents or accidents with threat to life.

6.3 Club Culture

In a club environment it is important for the club leadership to instil the understanding amongst the members that they will not be penalised for reporting untoward events with the sailplanes they are flying or ground handling, hangaring, trailering, etc. Hiding adverse events due to feeling threatened by punishment or feeling ashamed due to making a mistake is counterproductive to safety. People need to be confident they can report adverse events without fear.

Also beware of authority gradient; it does not matter the experience or position of someone performing maintenance work or checks. Anyone can find unairworthy conditions.

6.4 Interruption During Inspection

As mentioned in Section 6.2.1 it is best practice that no-one is allowed to disturb the person inspecting during the conduct of the DI.

This also extends to mobile phones. Daily Inspectors should develop the self-discipline to leave their mobile phone in the car or clubhouse until you have completed the DI. If you have your mobile phone with you, have it on ‘silent’ or the self-discipline to ignore it until after the completion of the DI. Respond to calls or texts afterwards.

If you have commenced a daily inspection and you are called away, only to come back to the job later with some doubts about where you got up to, it is better to start the whole inspection again. Importantly, never sign the MR until the check has been fully completed.

6.5 Resisting Pressure to Hurry

As mentioned in Section 6.2.1 don’t rush, or be rushed because someone is waiting to fly the sailplane. Although the waiting pilot may not understand it at the time, you are actually doing them a favour by taking your time and doing a thorough inspection.

The Daily Inspector must resist being pressured to hurry at a critical point during the inspection, not always easy to do in the hurly-burly of a rapid rigging session or other situations of high demand. Always keep in mind the price that will be paid by the pilot if a DI fails to show up a disconnected or reversed control surface and the pilot also fails to detect the problem.

6.6 Undue Pride in Past Performance

We may pride ourselves on past performance and congratulate ourselves that we have, or the club has, “high standards”, but past performance counts for little because the competent performance of the inspection task this day with the particular sailplane in front of us is what matters. We might have done well in the past, but the past is past. We must continue to deliver competent performances each operational day. Complacency driven by past performance is the enemy of vigilance.

6.7 Familiarity Masking the Need for Greater Vigilance

This is the “familiarity breeds contempt” theme as related to sailplane inspection.

The more experienced inspectors can sometimes become too familiar with a particular sailplane and overlook potential problems. It can be the new inspector who is not familiar with a particular sailplane who detects problems because they are new to him/her. Therefore, never hesitate to ask questions, and don’t be put off too quickly by more experienced inspectors who say things like: “It has always been like that” or “Everyone knows about that problem”. If in doubt, report the problem in the Maintenance Release (MR), and ask the more experienced inspector to clear the entry. Most experienced inspectors will not object to such an approach. Remember, your signature for the DI makes you responsible for having certified that the sailplane is fit to fly for that day.

7. SAILPLANE AIRFRAME CONSTRUCTION

7.1 Fuselage

The most common type of fuselage construction in a sailplane is the so-called "semi-monocoque". The term "monocoque" means "one-shell" and in a true monocoque construction, all the loads would be taken by the shell, i.e. the surface skin. A semi-monocoque uses bulkheads and stringers to supplement the surface skin, thus spreading the loads throughout the entire structure. The surface skin of a semi-monocoque fuselage must therefore be regarded as primary structure and any damage grounds the sailplane until fixed. The only exception to this is any non-structural skin used as fairings around cockpits or wing-roots, etc. If in doubt as to whether anything is structural or not seek advice, leave the sailplane on the ground in the meantime.

The attraction of semi-monocoque construction is that it allows the designers to achieve the aerodynamic shape they are seeking. As always there is a disadvantage, which in this case is the vulnerability to damage of such fuselage designs. Outlandings in rocky paddocks frequently cause the kind of damage which prevents the sailplane being flown until properly repaired.

7.2 Wings

The wings are designed to withstand three main types of loads:-

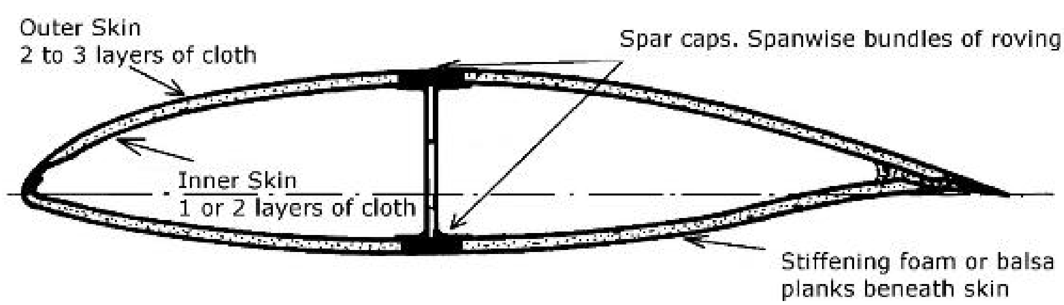
a. Vertical loads, in an upward direction due to lift in normal flight and in a downward direction due to weight when on the ground. The vertical loads produce bending of the wing. In flight, the top surface of the wing is in compression from bending and the bottom surface in tension. The opposite is the case on the ground. The vertical force is carried by the shear web between spar caps.

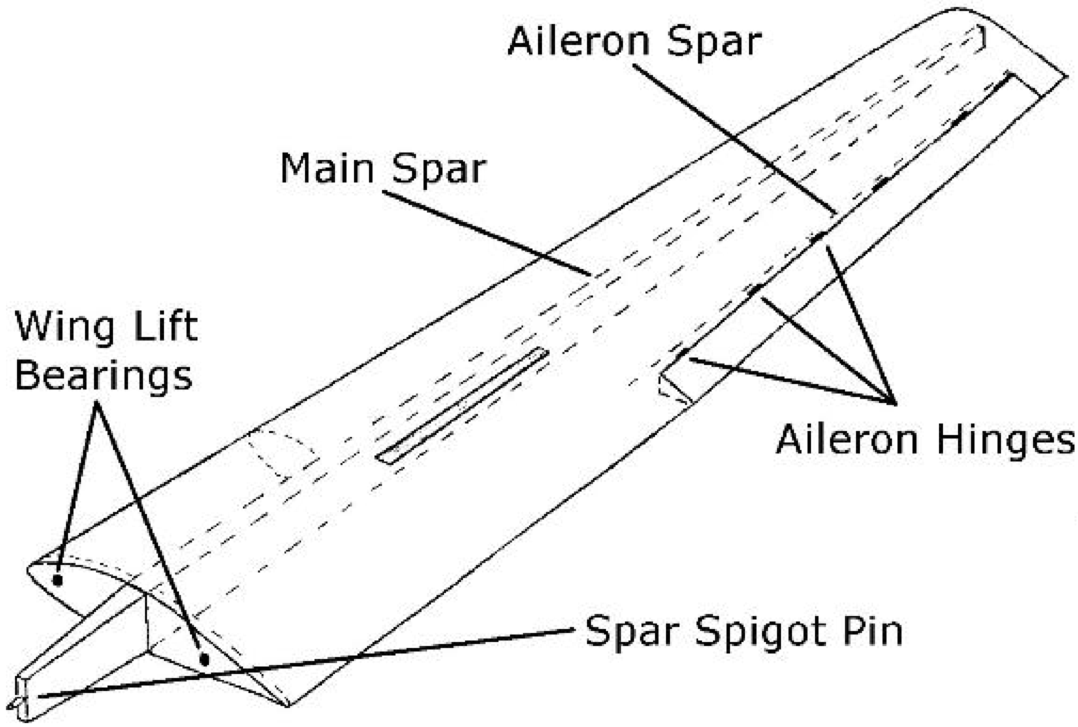
b. Torsional (twisting) loads exerted by the airflow around the wing.

c. Fore and aftwards loads in the chordwise direction of the wing cross-section.

In flight, the airflow and distributed wing weight produces these loads in various combinations.

The main spar of the wing takes the vertical loads. Main spars are not usually solid, as this would result in excessive weight. The usual method is to employ top and bottom spar caps of laminated material, either joined at the front and rear of the spar by shear webs forming a "box" construction, or to join the spar caps with a central shear web forming an “I” section. Both approaches can be made very strong with light weight. The laminations (wooden sailplanes and sometimes also metal sailplanes) or fibre rovings construction (FRP sailplanes) in the top and bottom spar caps provide some alternative load paths in the event of damage so that there is still useful residual strength. This approach may allow an inspector to detect that damage has started and requires repair before it gets worse. A typical sailplane main spar is most unlikely to suffer catastrophic damage without warning, unless undetected metal fatigue or corrosion occurs, or an extraordinary manufacturing defect occurred, or it receives a colossal blow (either in the air or on the ground).





The airflow around the wing exerts direct lift and torsional forces on the structure. These torsional loads on the wings are resisted by the tube-like characteristics of the wing shell structure. This may be the D-nose shell forward of the main spar in the case where there is mostly fabric aft of the spar or the whole wing shell skins with metal or FRP sailplanes

In metal or wooden sailplanes, there is usually a “drag” spar to take the chordwise loads. The drag spar may be a spar or brace running diagonally from the main spar to a point at the wing root (e.g. ASK13), or it may run parallel to the main spar along the leading edge (e.g. ES60, K-6). Many FRP sailplanes do not use spars, but are strong enough to take the chordwise loads in the skin.

There are some sailplanes which do not have a single main spar as such - they have a multi-stringer wing spar structure with load-bearing skins - effectively a semi-monocoque. Examples of this wing design are found with the Foka 5 and Phoenix.

The wings components described above, which are designed to withstand any of the major flight or ground loads, are designated primary structure. Any damage to primary structure is considered to be major damage and the sailplane must not be flown until repaired.

If during a daily inspection of a wooden aircraft, the inspector notes that there is minor damage between the trailing edge and other components, he is advised to contact a Form 2 inspector. The Form 2 inspector will determine the extent of the damage and make a decision whether the aircraft can continue in service. A temporary repair may be required. However this does not apply to the semi-monocoque wings described above. It is important to consult an experienced sailplane inspector if any doubt exists.

7.3 Tail Unit

The fin forms an integral part of the rear fuselage of the sailplane. The main spar of the fin, which may also be called the sternpost, is the component that the rudder hinges are attached to. The area where the fuselage tail tube and fin join or merge carries considerable loads, especially with inadvertent manoeuvres such as ground-loops. Inspectors need to watch this area very carefully.

The tailplane may be attached to the rear of the sailplane in one of a number of positions. It may be attached to the fuselage (e.g. Blanik), part-way up the fin (e.g. Puchacz) or at the top of the fin, forming a T-Tail (e.g. Astir). Low-set tailplanes are prone to damage from items such as rocks or long vegetation such as thistles in paddock landings. Moving the tailplane further up the fin eliminates most problems of this kind. T-tailed sailplanes are free of this kind of problem, but they add a lot of weight to the top of the fin and this can result in much damage to the aft fuselage in a ground-loop or similar incident, due to the inertia caused by the high-mounted weight placing a lot of torsion on the fuselage. This situation is made worse by fin water ballast tank(s) and fin battery carriage, eg DG505 two-seater.

Tailplanes vary in their constructional methods. Some are semi-monocoque and the surface of such tailplanes carry part of the structural load, thus rendering them susceptible to primary structural damage. Others have front and rear spars, and these may be more damage-tolerant. Once again, if in doubt about the serviceability of anything, seek advice.

Tailplanes are usually of a symmetrical aerofoil section (equal curvature top and bottom) and may produce lift in an upward or downward direction. In most circumstances, the force produced is downward in normal flight.

Control surfaces such as ailerons, elevators, rudder and flaps are constructed in basically the same way (spar and D-nose, etc) reflecting the wing construction.

Drain and ventilation holes are fitted at strategic points in the structure. They are vital to ensure that:

a. the structure, water tanks/bags and fuel tanks can ventilate, equalising inner and outer pressures during sustained climb and descent;

b. condensation does not accumulate; and

c. any water, i.e. rain or washing water, or fuel, can drain out properly.

It is the job of the DI Inspector to ensure that these drain and ventilation holes are clear of dirt or obstruction, and not inadvertently taped over. Care is necessary when clearing drain holes, especially through fabric covering, to ensure that you don't cause more damage than you avert.

If a fuel leak is seen the source must be determined and solved. Sometimes it is just a spill but residual fuel or a leak can be fatal.

7.4 Composite Construction

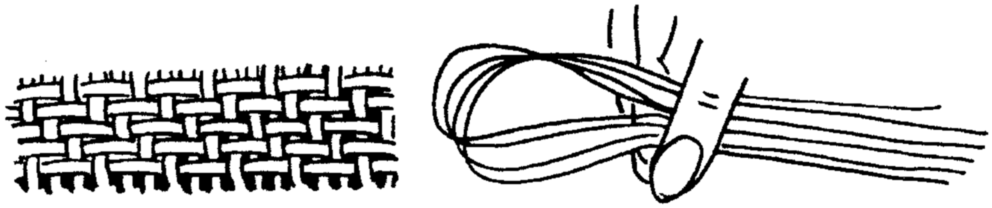
The term "composite construction" covers those sailplanes constructed from Glass Reinforced Plastic (GRP) and Carbon Reinforced Plastic (CRP). Sailplanes so constructed, together with any other fibre materials such as Kevlar, are generally referred to under the generic term of Fibre Reinforced Plastic (FRP) sailplanes and this term will be used here.

FRP construction is in principle very similar to wood, with the glass or carbon fibre strands in the construction being analogous to the fibrous material in timber and the epoxy resin surrounding the fibres being similar in concept to the resins in timber. However, FRP construction is stronger than wood although not necessarily lighter. Probably more importantly, it is capable of being moulded with great accuracy into the exact shape required and FRP sailplanes can be produced in large numbers more cheaply than wooden sailplanes.

An FRP sailplane is constructed somewhat like a large plastic model kit. This is obviously an over-simplification as far as the sophistication of the structure is concerned, but the full-size sailplane components are usually made in two halves which are eventually joined together. Thus the fuselage is taken from the moulds and joined lengthwise along top and bottom seams and the wings are likewise joined at leading and trailing edges.

The dual attractions of great strength and accuracy of form makes the FRP sailplane a thing of beauty to the beholder. The perfection of line and profile makes them aerodynamically superb and ensures that almost all production sailplanes nowadays are made from some kind of FRP.

Major structural components of an FRP sailplane (e.g. spars) are made from "rovings", ie unidirectional strands of glass or carbon fibre, impregnated with epoxy resin and usually cured under heat. The skin of an FRP sailplane is made from a "matrix" of FRP cloth, usually consisting of several layers of cloth often of different weight and weave and laid up with the cloth fibre directions forming suitable angles to each other, the whole once again impregnated with epoxy resin cured under heat.



Typical Twill Cloth and Roving Material

The skins of FRP sailplanes are usually formed from two rather thin skins sandwiching a thicker layer of lightweight foam material. The purpose of the foam is to provide structural stability with light weight and greatly reduce the need for large numbers of ribs and bulkheads in the structure. Typical trade names for the foam used in these structures are "Conticel", “Divinicel” and "Klegecel".

Older FRP sailplanes (e.g. ASW15) used balsa wood instead of FRP sandwich foam and you may still see quite a number of sailplanes in this category. There is nothing wrong with balsa wood in this application subject to keeping the balsa sandwich core dry.

FRP sailplanes are usually finished with "gelcoat", a polyester substance which is usually applied into the mould during the manufacturing process to become the exterior surface on release of the component from the mould(s). Some gelcoats are prone to cracking in the strong Australian sunlight and it is important to check the condition of the entire surface finish during a daily inspection. It is quite possible that cracks in the gelcoat extend deeper into the structure itself and may affect the sailplane's strength. As always, report anything you are uncertain about.

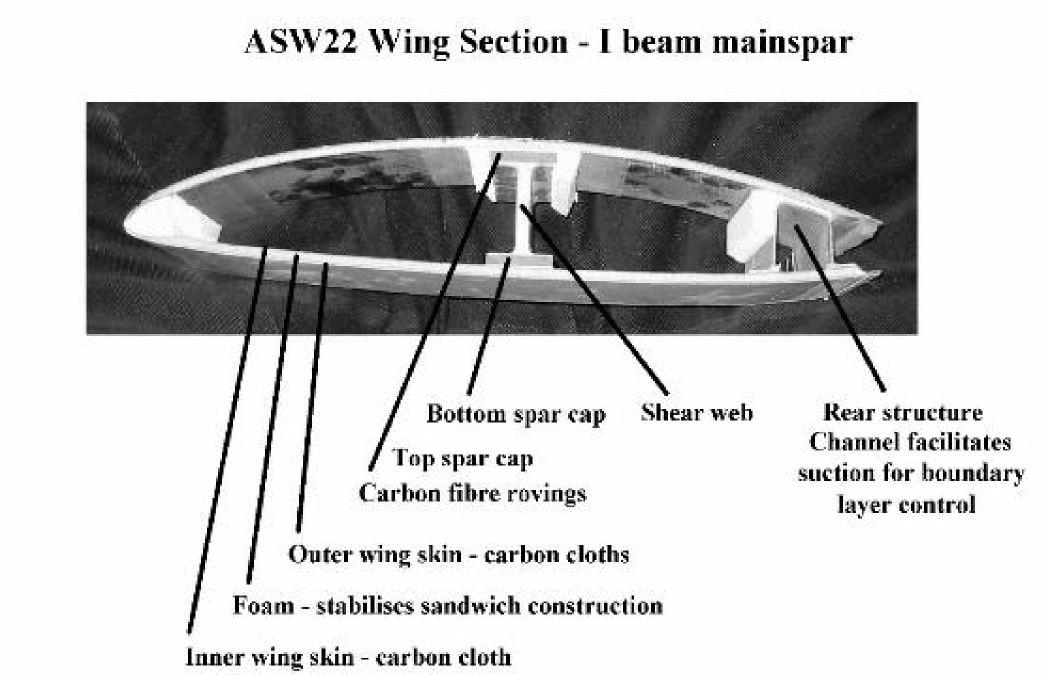
Some sailplanes are finished with polyurethane paint, which does not crack in the same way as gelcoat. Some of the Polish and Stemme sailplanes were finished with this paint material during production. Other sailplanes may have been re-finished with polyurethane to replace gelcoat which has deteriorated in service. Check with a more experienced person if you are uncertain what kind of finish you are inspecting.

The overall colour of FRP sailplanes is almost always white, with only the smallest amount of colour at the tips of the wings and maybe at the fuselage nose. This is because the airworthiness certification of the structure is usually only guaranteed up to 54 degrees Celsius and the white colour helps to ensure that the FRP does not overheat in the sun. Very modern aircraft may now be made from high temperature epoxies which are less affected by heat and some will be painted colours other than white. Next time you are out on the field, place your hand on the white surface and then on a red wingtip; the difference is really noticeable.

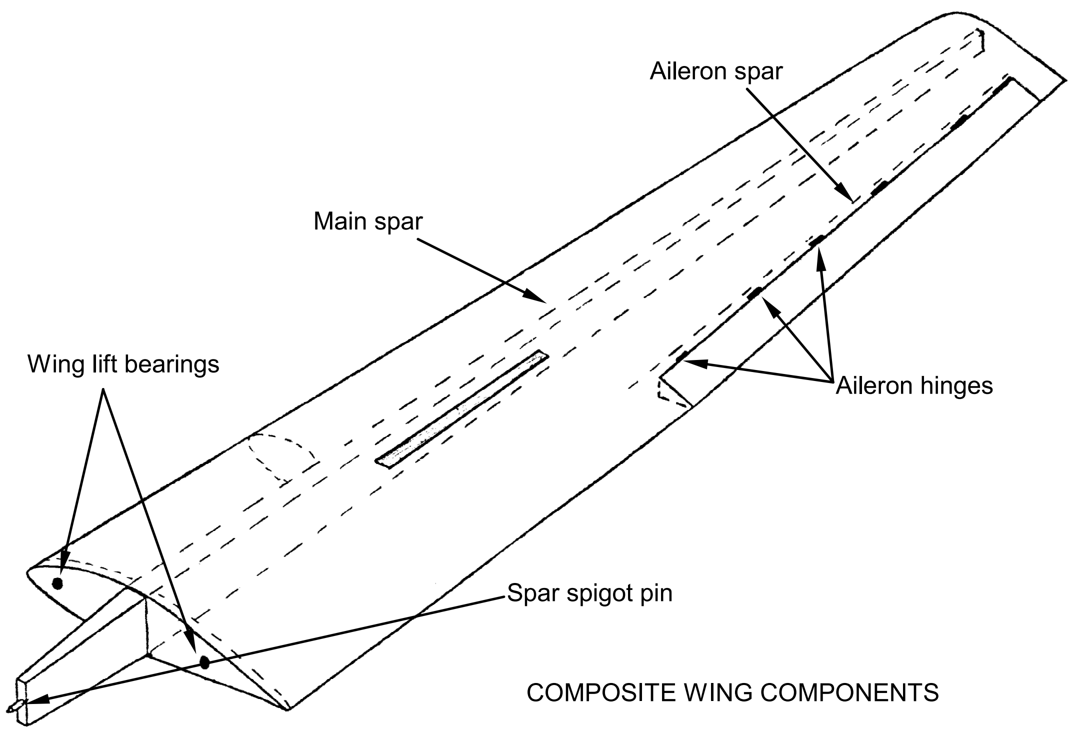
FRP structures are porous and water will cause damage if allowed to penetrate inside. For example, water expanding inside a structure on vaporisation will exert tremendous internal forces which will crack open the FRP structure and gelcoat. Therefore FRP sailplanes must always be wiped dry after washing and external surfaces should be waxed with approved polishes, avoid silicon and nano-particle components.

7.4.1 Wings

The wings of an FRP sailplane are basically similar to wooden and metal wings. A main spar consisting of top and bottom spar caps of fibre rovings and shear web(s) being fitted as in the other sailplanes, forming box or I spars or a mixture of both along the span (Janus). Many wings have blocks of foam around either the upper and lower caps. These are not structural and are positioned to control the epoxy when the upper and lower wing shells are glued together.



Torsional loads in an FRP wing are resisted rather differently from other sailplane types, very few ribs being in evidence for reasons described earlier. The skin is also load-bearing aft of the main spar as well as in front. Therefore the entire wing takes torsional loads and any significant damage to the skin anywhere on the wings of an FRP sailplane must be regarded as structural, grounding the sailplane until a more expert opinion is sought.



COMPOSITE WING COMPONENTS

Many FRP sailplanes are capable of carrying water ballast for fast cross-country flying. This may be held in bags in the wing forward structure or the water tanks may be built into the wing structure. Both means of carrying water are prone to developing leaks and this area of the sailplane must be checked especially closely for any signs of water damage.

7.4.2 Fuselage

All FRP sailplanes are at least a semi-monocoque and a few may be of actual monocoque construction - those thick sandwich skins again. Any damage must be regarded as structural and must be reported. Check carefully for water damage if the water-ballast outlets are in the fuselage, usually around the undercarriage area.

7.4.3 Tail Unit

Most modern FRP sailplanes have T-tails, that is the tailplane is mounted on top of the fin. Some of the older machines (e.g. the Puchacz and SF34) have their tailplanes in the so-called "cruciform" position, about a third of the way up the fin.

A particular problem with T-tails is that they may cause some damage to the rear fuselage if the sailplane is "ground-looped". A ground-loop is a rotation of the sailplane end-for-end around its vertical axis, usually caused by a wingtip contacting the ground while the sailplane is moving at some speed. As the tail sweeps around, the t-tail, with a large proportion of its weight at the top of the fin, causes a severe torsional (twisting) load to be applied to the rear fuselage in the area where the fin blends into the tail boom. This area must be checked very carefully for any signs of damage or over-stress. As many sailplanes of this kind use a tail-dolly for ground manoeuvring, it is essential that the dolly be removed to check this area.

Heavy landing damage in FRP sailplanes is not as easy to detect as in the other types, because FRP has a tendency to return to its original shape after it has been deformed. This means that, for example, de-lamination (structural separation) of skins can occur when excessive loads are applied to the structure, but it will be difficult to detect because the appearance of the structure looks very much the same as it did before it was damaged. This is the single biggest difficulty in detecting problems during daily inspections on these types and makes it very important that you recognise what you don't know and seek advice accordingly.

Control surfaces on FRP sailplanes are usually all-FRP. However, some sailplanes (e.g. SZD-50-3 Puchacz, SZD 51 Junior) have some fabric-covered control surfaces. The same principles apply to daily inspections on all these surfaces as apply to other types.

7.4.4 Inspectability of FRP Sailplanes

Due to a lack of hatches or other means of access, FRP sailplanes tend to be awkward to inspect internally for important components like control rods and cables, except those which you might be able to reach in and immediately behind the cockpit. Some sailplanes make it very difficult to inspect even those items which are disconnected and reconnected during de-rigging and rigging. For example, some sailplanes have aileron and airbrake couplings which have to be connected and safety-locked by feel alone, unless you are a contortionist.

A sound knowledge of the various types of couplings in use for control connections is therefore necessary, as you will often be working with one’s hands obscuring sight of the components.

7.5 Metal Construction

7.5.1 General

Metal sailplanes are constructed from a light alloy material which is predominantly aluminium. The sheet-metal parts used in sailplane construction (e.g. bulkheads, ribs and external covering) are usually the same light alloy material throughout the entire design. Highly stressed components such as wing-fittings, carry-through structures or structural pins will usually be of an appropriate grade of steel.

Metal sailplanes usually have their main surfaces clad in light-alloy. Their control surfaces may also be covered with the same material or they may be covered with fabric.

Load bearing paths along the structure are likely to be aircraft grade aluminium extrusions having a cross section dimension to match the loads.

7.5.2 Fasteners

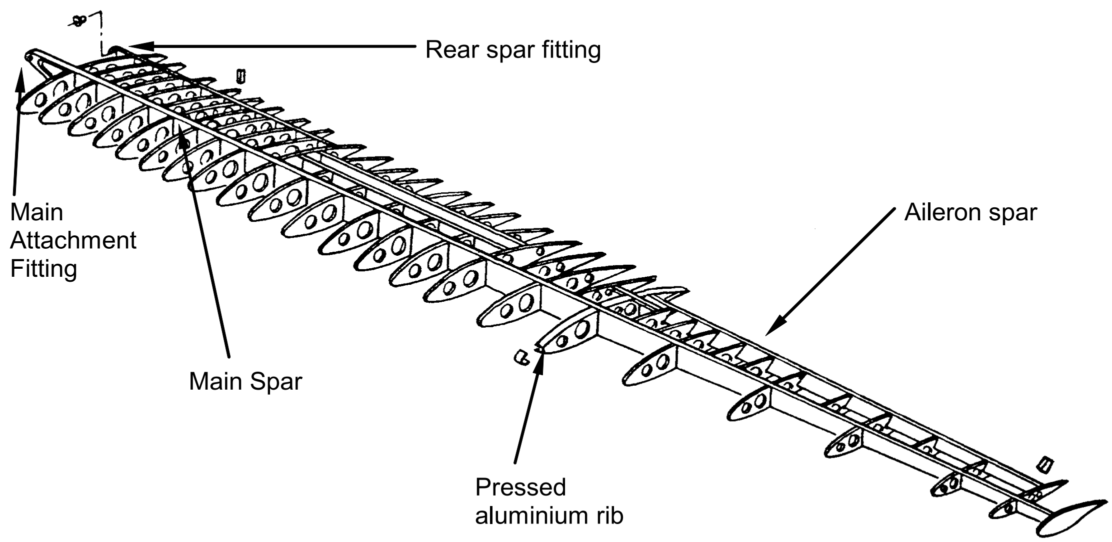
The most common method of attaching the components of a metal sailplane together is by use of rivets. Such a method of construction is adequately strong and lends itself easily to mass production. Epoxy bonding is an alternative method of constructing a metal sailplane, but is generally confined to home-built sailplanes of a rather specialised nature. For the purposes of this Daily Inspector manual, we will concentrate on riveted construction

The rivets used on sailplanes are usually of two kinds, round-headed rivets used internally and countersunk rivets used externally where drag reduction is important. Only a limited number of internal rivets will be easily visible on a daily Inspection, but all the external rivets will be easy to inspect.

Typical Metal Aircraft Rivets

7.5.3 Wings

The wings of metal sailplanes generally have a main spar, with ribs and wing shell forming a torsion box and some kind of drag spar, the whole usually being clad entirely with thin light alloy sheet.



Typical Metal Aircraft Wing Construction

7.5.4 Fuselage

Almost without exception, the metal fuselages of metal sailplanes are semi-monocoque. The same principles of inspection apply to metal semi-monocoque fuselages as to wooden ones.

7.5.5 Tail Unit

Control surfaces may be fabric covered (e.g. Blanik), metal covered (e.g. Pilatus B4) or a mixture of both (e.g. IS28B2 with fabric covered ailerons and metal clad flaps).

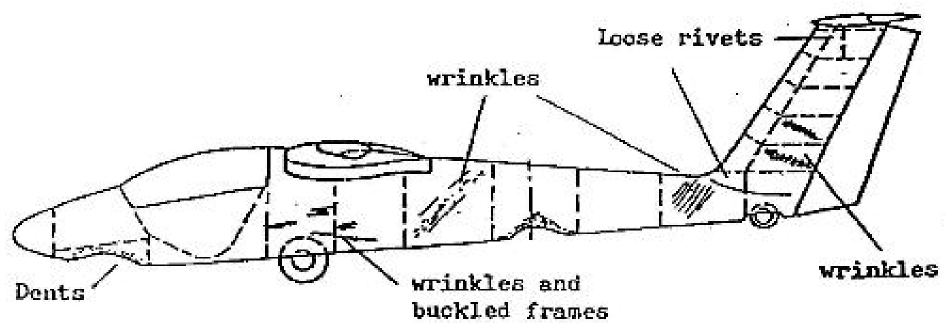
Metal sailplanes may be left unpainted (e.g. Blanik) or painted in various colours. Painted sailplanes are easier to inspect because any damage causes the paint to crack.

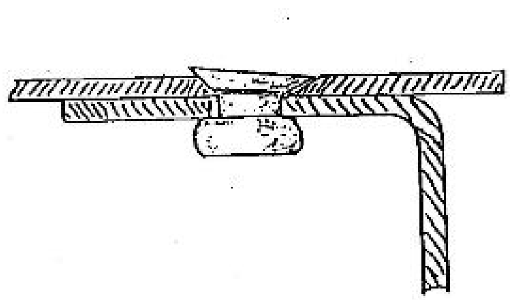
When checking metal sailplanes, the DI Inspector should look for obvious damage. Over-stress and heavy landing damage on metal sailplanes is usually obvious, the surface skin buckling and distorting to the extent that it can readily be seen. When inspecting the sailplane, make many variations of your angle of view to get the light in different positions on the surface; this will help show up deformities and damage.

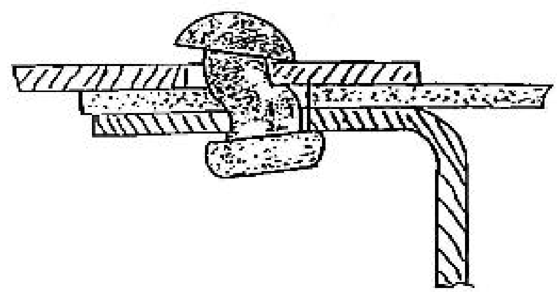
Another sign of damage on a metal sailplane is when the skin moves or "frets" around each of the rivets, leaving a powdery residue around the rivet area. These "fretting products" are black in colour and quite easy to detect. A small amount of working of rivets may occur on some types in normal service, resulting in slight paint-cracking occurring. Consult someone with more experience to advise on each individual case.

Metal sailplanes are more prone to progressive fatigue of the structure than other sailplanes, and this imposes a definite service life on some types. Fatigue is a very specialised area of expertise in aircraft structures and is well outside the scope of a DI handbook. However, it makes sense to look very carefully at a metal sailplane which has done many thousands of hours and is starting to show signs of old age. You may find cracking or deterioration of some kind which would be worth bringing to the attention of someone more experienced.

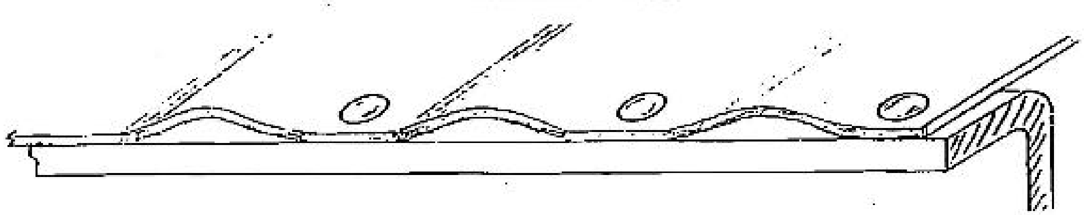
Corrosion may be a problem on some metal sailplanes. Look for white corrosion products on the surface of the skin or alloy extrusion components and report what you find.







Skin buckles between rivets:-



Some diagrams above give some idea of the structure of a metal sailplane and the points to look for during a Daily Inspection

7.6 Wooden Sailplane Construction

7.6.1 General

Wooden sailplanes are constructed from a variety of timbers and plywood, selected for specific purposes in the design.

Typical timbers are Sitka spruce (from Canada), Polish pine (Poland), Kiefer (Baltic fir from northern Europe) or Klinki pine (Papua New Guinea). Douglas fir may be used in some US designs.

Plywood is usually Birch ply from Finland, although Coachwood may be used on some homebuilt designs and Gaboon (African mahogany) ply on some UK designs.

7.6.2 Glues

Typical glues used in sailplane construction are:

a. Casein (a milk derivative), used in Australian designs and some older European types.

b. Phenol-formaldehyde, a clear glue popular in post-WW2 German sailplanes and some Polish designs.

c. Resorcinol-formaldehyde, a brown-black heat-setting glue such as Aerodux or Selleys 308, used in a variety of types and popular for some years for repair work.

d. Urea-formaldehyde, a two-part acid-hardened glue such as Aerolite or Selleys 306, popular in UK sailplanes. Kaurit is similar and had Bakelite powder added to improve its properties. Kaurit is widely used in the Schleicher “K” series sailplanes eg ASK-7 and ASK-13.

e. The various epoxy glues such as Araldite or Epiglue with the specific epoxy being selected to be appropriate to wooden aircraft construction.

Glue deterioration is a potential problem in sailplanes and must be watched for when carrying out any kind of inspection. Most modern synthetic glues are very strong, have quite good gap-filling qualities and are highly resistant to moisture when set. However, casein glue, being an organic substance, is badly affected by moisture and will ultimately lose all its strength in a short space of time if allowed to remain wet. If casein deterioration does occur, it gives off a very distinctive smell which is difficult to describe in words but will not be forgotten once experienced. It also turns dark around the area of the failed glue, instead of being the light tan colour of sound casein. Further investigation will reveal that de-bonding of the join in the area of the discolouration will have occurred. Most Australian-built wooden sailplanes are constructed with casein glue. There is nothing whatsoever wrong with casein glue, **provided** it is kept dry.

The other types of glue give relatively little trouble if they were applied properly during manufacture. Unfortunately this cannot always be taken for granted and there have been several cases of de-bonding of parts of sailplane structures because of inadequate gluing procedures during manufacture. Other debondings have occurred where the timber is directly exposed to moisture ie no fabric covering over the timber, and the expansion and contraction of the timber with getting damp and then drying out has cracked the glue.

Daily Inspectors must be on the alert for deterioration of any kind when carrying out their work. One effective way to check the integrity of glue joints from the outside of the sailplane is the method of tapping gently with a coin on the sailplane's skin. Good joints sound solid, but a failed glue joint is easily recognised by its hollow sound, similar to tapping the coin on surrounding unsupported structure. It goes without saying that this method should be applied with care, to avoid marks all over the outside of the sailplane. Get a good demonstration from someone competent.

7.6.3 Wings

Main spars are not usually solid timber, as this would result in excessive weight. The usual method is to employ top and bottom spar caps of laminated timber, joined with plywood shear web(s); either at the front and rear to form a box, or sometimes centrally to form an I beam, achieving high strength with light weight.

There is usually a drag spar to take the chordwise loads. The drag spar may be a diagonal spar or steel tube running from part the way out along the main spar back to a point at the wing root trailing edge (e.g. Ka6, ASK13), or it may run parallel to the main spar along the leading edge (e.g. ES60 Boomerang).

There are some sailplanes which do not have a main spar as such, they have a multi-stringer wing structure with load-bearing skins (effectively a semi-monocoque). Examples of this wing design are Foka 4 and 5, Cobra and SHK.

The wing components described above, which are designed to withstand any of the major flight or ground loads are designated primary structure. Any significant damage to primary structure is considered major damage and the sailplane must not be flown until repaired.

7.6.4 Fuselage

Fuselage construction varies considerably in wooden sailplanes. Some wooden-winged sailplanes, for example, have fuselages made out of welded steel tubes.

The most common type of wooden fuselage construction in an all-timber sailplane is the so-called "semi-monocoque". The term "monocoque" means "one-shell" and in a true monocoque construction, all the loads would be taken by the shell, i.e. the surface skin. A semi-monocoque uses bulkheads and stringers providing additional load paths supplementing the surface skin, thus spreading the loads throughout the entire structure. The surface skin of a semi-monocoque fuselage must therefore be regarded as primary structure and any significant damage grounds the aircraft until fixed. The only exception to this is any non-structural skin used as fairings around cockpits or wing-roots, etc. If in doubt as to whether anything is structural or not, seek advice, leaving the sailplane on the ground in the meantime. Examples of wooden semi-monocoque fuselage design are Ka6, Arrow, and Boomerang.

Sailplanes like the Kookaburra and Kingfisher, although the fuselage is slab-sided in appearance, they are also considered as semi-monocoque because the skin takes a significant part of the load applied to the whole fuselage.

Wooden semi-monocoque fuselages are not damage-tolerant. They must be inspected very carefully and any damage referred to a more experienced inspector for advice.

7.6.5 Tail Unit

The fin usually forms an integral part of the rear fuselage of the sailplane. The fin mainspar may also be called the sternpost and the rudder hinges are attached to it. The area where the fuselage and fin join or merge carries considerable loads, especially in inadvertent manoeuvres such as ground-loops. Inspectors need to watch this area very carefully.

The tailplane may be attached to the rear of the sailplane in one of a number of positions. It may be attached to the fuselage (e.g. Kookaburra), part-way up the fin (e.g. Boomerang) or at the top of the fin, forming a T-Tail (e.g. Pirat). Low-set tailplanes are prone to damage from items such as rocks or long vegetation such as thistles. Moving the tailplane further up the fin eliminates most problems of this kind. T-tailed sailplanes are free of this kind of problem, but they add a lot of weight to the top of the tail unit and this can result in much damage to the surrounding structure in a ground-loop or similar incident, due to the inertia caused by the high-mounted weight.

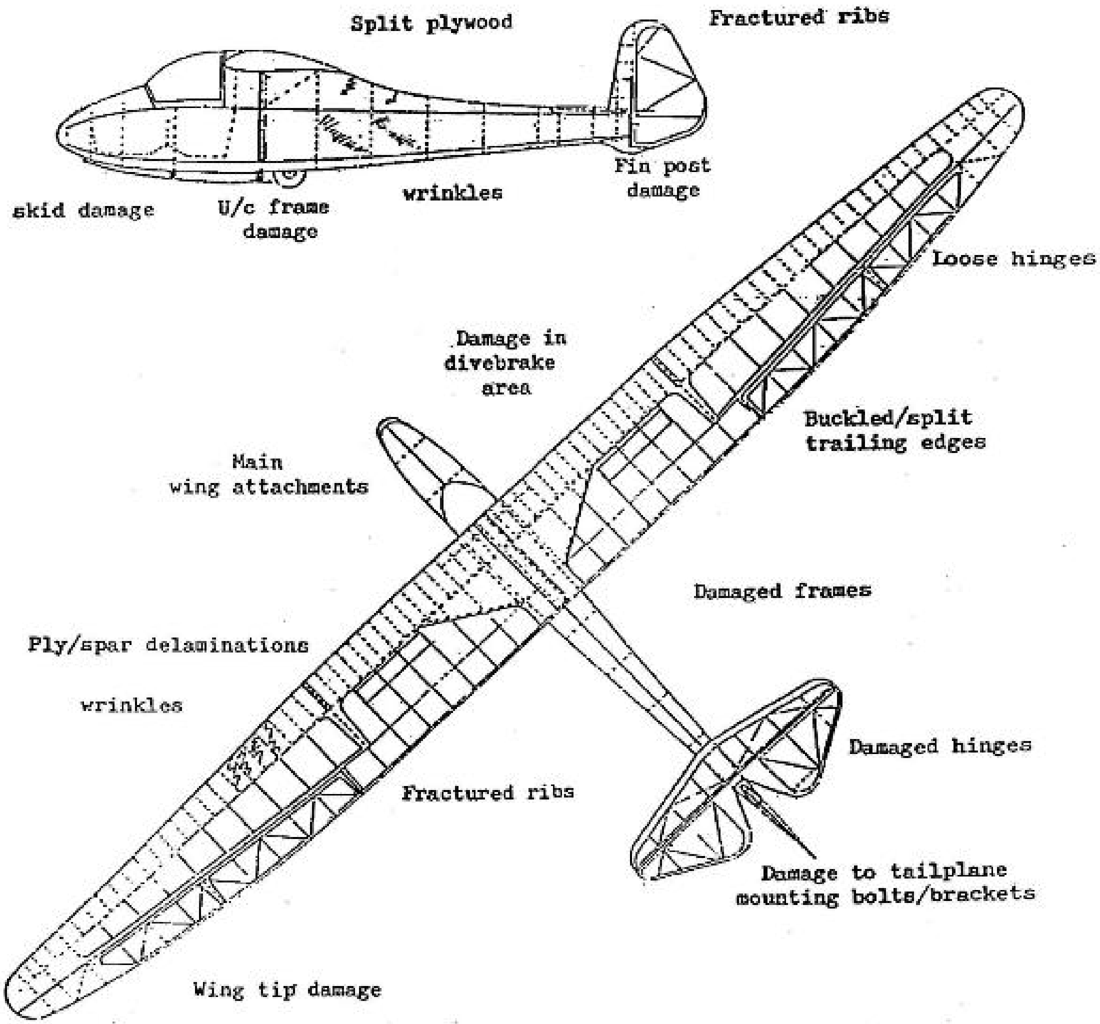
Tailplanes vary in their constructional methods. Some are semi-monocoque (e.g. K7, ASK13) and the surface of such tailplanes carries part of the structural load, thus rendering them susceptible to primary structural damage. Others have front and rear spars with timber and/or fabric covering (e.g. Kookaburra) and these are more damage-tolerant. Once again, if in doubt about the serviceability of anything, seek advice.

Tailplanes are usually of a symmetrical aerofoil section (equal curvature top and bottom, or possibly flat top and bottom) and may produce lift in an upward or downward direction. In most circumstances, the force produced is downward in normal flight.

Control surfaces such as ailerons, elevators, rudder and flaps are constructed in basically the same way (spar and D-nose, etc) as the wings and may be fabric or ply covered, depending on sailplane type.

Drain holes are fitted at strategic points in the structure of all wooden sailplanes for the same purposes as noted earlier with other sailplane structures. Note that some glues used with wooden sailplanes are susceptible to water damage making drain holes especially important.

The following diagrams illustrate the main points to look for when carrying out a Daily Inspection on a wooden sailplane.



7.6.6 Steel-Tube Fuselages

This commentary is included here because their most common use is on sailplanes having wooden wings and tail-units. But FRP sailplanes like Stemme have a steel tube centre section and others have a load transfer section of steel tube.

The attraction of welded steel-tube construction is light weight from use of thin-walled tubes combined with high strength. In addition, the entire strength of the fuselage is built into the steel structure itself, the covering (usually fabric) being solely aerodynamic in nature and carrying no load. A disadvantage of steel-tube fuselages is that they do not lend themselves to complex aerodynamic shaping resulting in somewhat angular shapes.

This fuselage design is popular on trainers such as the ASK13 or Bergfalke, and on single-seaters designed for early solo flying such as the K8. In this application, the light weight gives good soaring performance and the high strength gives good resistance to unskilled landings. The relative lack of aerodynamic form is not so important for these machines and the tolerance to damage of the non-load-bearing skin means that they can be kept going in service on any given day on the basis of temporary repairs, e.g. tape covering fabric damage.

The welded joints (analogous to the glue joints in a timber structure) are of course critical and are carried out by aircraft-grade welders approved by the local airworthiness authority for such work.

Steel-tube fuselages are usually entirely covered with fabric and there are often thin wooden stringers attached to the outside of the steel structure in order to give some slight improvement in shape to the fuselage fabric surfaces. In some cases fibreglass fairings are attached to the outside of the steel tubes, but this tends to add weight negating one of the main objectives of the design.

While steel-tube fuselages are very resistant to damage, they can get damaged in incidents like heavy landings. In the event of gross overloading the tubes can bend, buckle or split, or the welds can be damaged. Minor overloads can produce subtle ripples in the tube surface, called crippling, adjacent to welds and this possibility needs close inspection for detection. Any damage of these kinds must be considered as primary structural damage and must be repaired by an appropriately skilled and authorised person before the aircraft is flown.

Corrosion is also an issue with steel-tube and important because the tube walls are thin. Therefore be watchful for two main problem areas

a. Any sign of lack of paint protection of the tubes, especially in the cockpit area where pilots' entry and exiting can lead to protective paint being scraped off.

b. Accumulation of dirt and debris under the seat or in the v-shaped bottom of the rear fuselage which will retain moisture holding it against the tubing. This is a known starting-point for rust damage.

Probably the biggest thing in favour of steel-tube fuselages is that the structure is open and very easy to inspect. Therefore there is no excuse for not having a good look around inside them during a DI. In most cases, just about everything you need to see can be inspected without having to be a contortionist or the owner of a vivid imagination.

7.6.7 Fabric Covering

Most wooden sailplanes are covered with some kind of fabric. There are some exceptions to this, for example some US designs are entirely ply-covered, protected only by paint. However, the majority will have some fabric on them, either for the obvious purpose of covering areas which would otherwise have no covering at all or to add some protection to ply covering which is already in place.

Older sailplanes were commonly covered with cotton or linen fabric. Although "Grade A" cotton fabric is still obtainable and has a small but enthusiastic following, most modern fabrics are synthetic, usually polyester.

There are a large number of sailplanes which were originally built with cotton fabric (e.g. Blanik, which has fabric-covered elevators, ailerons, rudder and flaps) and which may or may not have been replaced with more modern fabric.

Cotton fabric is quite strong and reasonably light, but has poor resistance to ultra-violet rays and deteriorates rapidly with exposure to sunlight. It is also prone to rotting with age, especially if allowed to get wet.

The polyester fabrics used for aircraft covering (usually "Ceconite" or Stits "Polyfiber" or Oratex) is light and strong, with good resistance to both UV and rotting. However, most fabrics must be protected by an anti-UV coating, usually silver in colour and a DI inspector should check that the fabric is not of the "see-through" variety. In the rare case of encountering a vintage sailplane with see-through fabric, you will find that it usually has a clear but slightly amber-tinted UV block included in the final finish.

The kind of surface finishes applied to fabric-covered sailplanes varies widely, both in thickness and degree of gloss. A Daily Inspector can usually only check for general serviceability, without necessarily knowing, or needing to know, what kind of fabric it is or what kind of finish is applied to it.

One of the advantages of fabric-covered sailplanes is that they can be patched very easily if they are damaged. Unfortunately this means that some sailplanes (especially hard-working trainers) look like patchwork quilts after a few years service, unless great care has been taken to blend in the patches and match the surface colour when the repairs were done. Even though such a sailplane may not look very smart, it is probably still serviceable, but of course this cannot be taken for granted.

Fabric covering should be checked for signs of being worn through, any tendency to become unstuck from parts of the airframe or any damage from accumulated water inside the airframe. Particular trouble-spots are the edges of any surface which bears the brunt of wear, hangar-rash and abrasion damage, and those parts of the structure where water can get in and accumulate.

Drain-holes in fabric covering are essential and must be kept clear. Dark patches and "tide-marks" on the inside of fabric covering indicate past or present water damage. The rotting process will almost certainly have started and such fabric must be treated with the utmost suspicion, especially if it is cotton. As well as preventing the accumulation of water in vital parts of the structure, drain holes in fabric perform the essential job of allowing the inside of the structure to "breath", thus reducing problems caused by condensation inside the sailplane. They are particularly important at the "low-points" of a wing structure (usually along the trailing edges) and each side of the v-shaped bottom of a steel-tube fuselage.

There have been cases of fabric becoming detached in flight from behind airbrake boxes on some two-seaters, caused by incorrect attachment of the fabric during a re-cover job. A combination of airflow and enthusiastic washing of the structure by club members allowed water to penetrate under the fabric and loosen its grip on the structure. This kind of problem should be readily detected at the Daily Inspection stage.

Fabric which looks awful may still be serviceable. An example of this is "ring-worming", where probing fingers cause circular cracking to occur in a very brittle surface finish. This may be caused by the wrong kind of finish being applied, possibly by simply applying too thick a finish or maybe by plain and simple old age. In many cases the fabric beneath such cracking is quite sound, although you should not take this for granted. UV can penetrate cracks in the surfacing.

Sometimes fabric damage can be tolerated; in other cases the sailplane should not be flown until repairs are carried out. Most cases in the latter category will be fairly obvious. As with all inspection work on sailplanes, seek advice from someone more experienced if you are in doubt.

7.6.8 Detecting Damage in Wooden Sailplanes

If a wooden sailplane is overstressed in flight, a common sign is cracking of the ply skin, usually at the edges of the airbrake slots or possibly at the aileron gaps. In short, anywhere where a sharp-angled joint causes a stress concentration. Severe overstress may cause more damage than this, such as detachment of the ply skin from the leading edge due to really excessive wing-bending. In-flight over-stress may also cause damage at the base of the fin, where tail loads may have become excessive and cause damage to the fin/fuselage intersection. The tailplane itself may have partially failed in download if the sailplane was flown too fast and experienced a sharp edged severe gust. You will need to look underneath the tailplane for any sign of compression damage to the spar or skin.

7.6.9 Compression Shakes

A particular problem with wooden structures is the "compression shake". This is fairly common on aircraft with solid main spars, less common on aircraft with laminated spars. Fortunately most sailplanes are in the latter category. However, compression shakes may still be found in other parts of the sailplane, such as trailing edges.

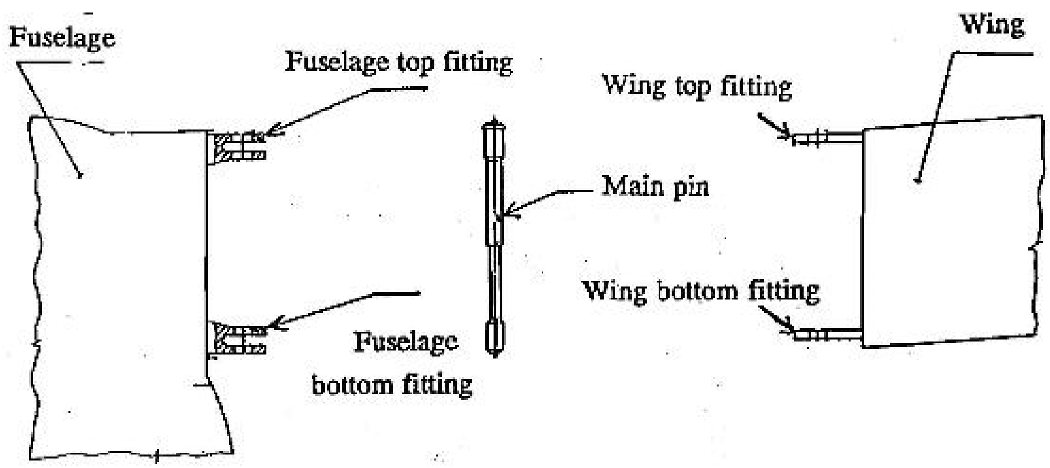
A compression shake occurs when a wooden component such as a spar or stringer is subjected to compression overload (e.g. due to wing tip collision with a wall when hangar-packing), sufficient to causes the wood fibres in compression to buckle or "jump" sideways. After unloading, when the fibres try to return to their original position, they are unlikely to line up the same as before, creating a discontinuity in the spar. If this occurs, most of the tension strength of the spar is lost and any attempt to fly an aircraft with a compression shake in a major structural component runs the risk of complete failure of that component in flight. If the component happens to be a main spar, the consequences of such a failure can be imagined.

Compression shakes are notoriously difficult to detect. The only sign that one may be present is usually a faint crack in a varnish or paint line at right-angles to the grain of the timber. In the case of a spar, this will be a chordwise crack. Any sign of such cracking must be referred to a Form 2 Inspector rated person.

8. ITEMS APPLICABLE TO ALL CONSTRUCTION TYPES

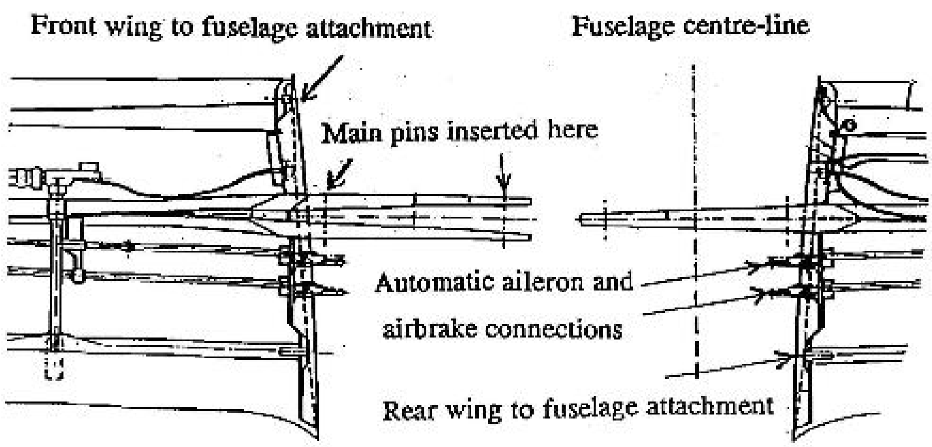
8.1 Main Pins, Drag Pins and other Attachment Devices

Because there are so many different ways of joining wings together and attaching them to fuselages, only a couple of typical examples will be described and illustrated. It will then be a relatively simple task to apply the principles to other situations.



L13 Blanik

In this example, viewed from the front, each wing is attached separately to the sides of the fuselage, using the fittings shown. A chrome-plated steel pin is inserted through all the fittings to secure the wing. Drag spar fittings and pins (not shown) are provided forward of the main spar fittings. Main spar continuity is provided by a steel carry-through structure in the fuselage.



Schleicher ASW 24

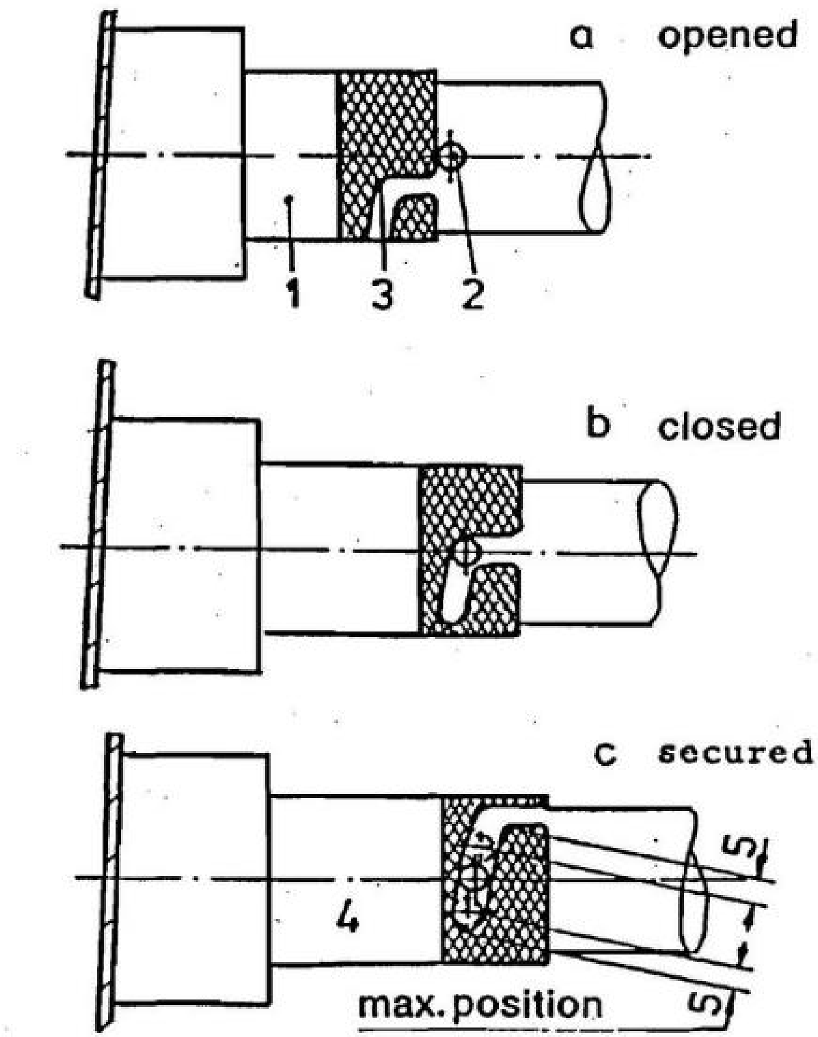
In this example, viewed from above, the single main spar extension from the starboard side is inserted between the double (forked) spar extensions coming from the port side. Two large diameter steel main spar pins are then engaged horizontally through bronze bushes in the interleaved spar extensions and these transfer bending between the wing spars. They also hold the two wing halves onto the fuselage via the four wing to fuselage shear pins which mate automatically when the wings are engaged to the fuselage in the correct position. On this particular type, ailerons and airbrakes also connect automatically when the wings are attached.

In the case of the Duo Discus, single spar extensions coming from port and starboard wings terminate at the ends in structural pins which project and engage into bearing sockets on the wing root rib structures. This arrangement transfers the bending load, and a modest sized centrally located pin through the spars is used to hold the wings both together and onto the fuselage.

With composite sailplane types the four wing to fuselage shear pins at the wing root to fuselage junction are almost always impossible to visually inspect, which argues for a quick look at them whenever they are inspectable such as during sailplane reassembly after trailering. Older sailplanes tend to be much better than modern sailplanes in this regard, which is a good thing because they generally have more pins to look for. The Long-wing Kookaburra, for example, has a total of ten structural pins to secure its three-piece wing together and attach it to the fuselage, and then there are the safety pins and control connections to consider.

All structural attachment pins are critical in terms of security. During the DI check that each necessary safety locking device is in place, whatever form that takes. Also pay attention to the structure into which the attachment pin engages. This structure may, for example, be tubular with welded straps carrying the loads deeper into the structure with issues of cracking developing in the welds.

When inspecting this part of the sailplane, the Flight Manual and/or Maintenance Manual may be useful for guidance. The example below is from the Flight Manual for the Grob G103 Twin 2. There are four of these fittings in the Grob, two on each fuselage side, connecting the wings to the fuselage. The locking ring acts to engage balls into grooves on the tips of the large pins which project from the wing root ribs and engage into these socket features in the fuselage.



Grob Twin 2 Wing Connection Fittings

If the main spar pins are tapered pins in contrast to plain cylindrical pins, then it is a very important issue that the pins are **fully pulled up on the taper** prior to safetying. An example of this is with the IS28 main spar coupling. Another is with the Foka 5. Here a competent wing loading test is needed to detect if there is an issue of inadequate pull-up on the taper which might occur for example if very viscous grease is used masking the feel of the pins pulling up on the taper.

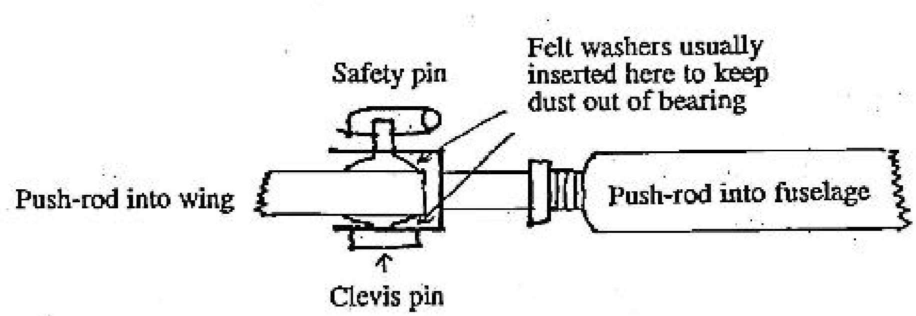
Fuselage structures around wing roots must be carefully checked for compression damage and cracking adjacent to drag pins and wing pins, in the event of any "ground-loop" incidents.

8.2 Push-Pull Rods and Couplings

The usual way of transmitting the pilot's movement of the various controls to the relevant control surfaces is by means of push-pull rods, a term often shortened to pushrod. These rods are made of thin-walled tubing which may be light alloy or steel. They are generally trouble-free, as long as they don't get damaged in some way. This damage can occur in a number of ways; being trodden on by pilots or passengers (eg Puchacz port side elevator pushrod in rear cockpit), over-stressed by wrong ground-handling techniques, bending due mishandling during rigging wing to fuselage (e.g. DG202 and Standard Cirrus), etc. A Daily Inspector must check those rods which can be seen through spring retained inspection hatches or accessible under cockpit floors or around seat-pans, and must investigate further if damage or distortion is found.

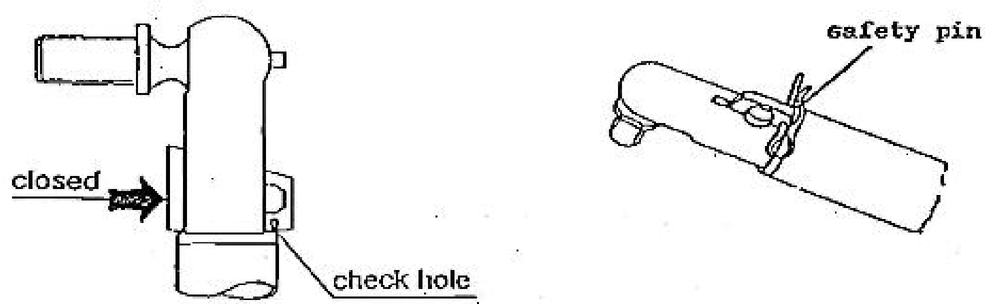
Push-pull rods may be connected to each other and to various levers and bell cranks by a variety of couplings. These are of two kinds, (a) those which do not normally get disturbed, except possibly for annual inspection or maintenance, and (b) those which get disconnected and reconnected every time the sailplane is rigged and de-rigged. Type (b) couplings come in many types, as follows:-

Clevises with pins or bolts



These are used on a number of older designs, such as the K7, ASK13 and many others. They are difficult to assemble wrongly and easy to check, provided of course that they are accessible.

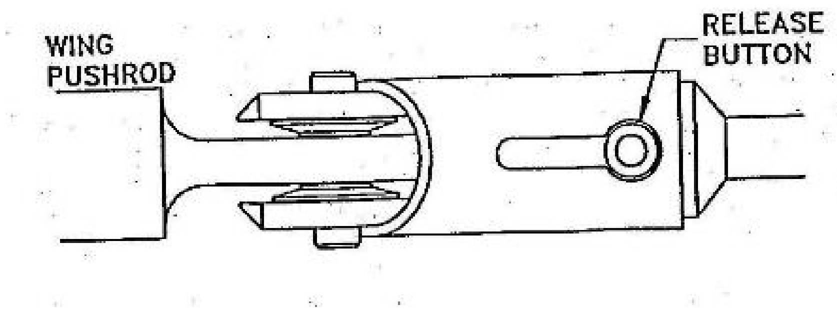
L'Hotellier couplings



These are used on many FRP sailplane types and some other sailplanes. They must be fitted with the additional safety pins and must be regarded as unserviceable if the pins are not fitted or do not work. World wide experience is that a L'Hotellier coupling without a safety pin can become disconnected in flight. The safety pins should be attached to the pushrod with a thin line, so that they do not get lost when the sailplane is de-rigged.

They also depend on regular greasing as a vital action for safe operation, and this is certain to be a maintenance action called up in the MR for sailplanes with L'Hotellier couplings.

The L'Hotellier balls are life limited parts and it is the Form 2 Inspectors job to see that they are within life limits. If they are nearing limits, you may find a maintenance action listed in the MR to replace specific L'Hotellier balls before a specified number of flight hours is reached.



Slide Clevises with Locking Barrels

Slide clevises with locking barrels are common on Polish sailplanes and are generally satisfactory if the small button is able to be easily seen and is observed to be projecting into the end hole providing security. They are less satisfactory if the connections are invisible and have to be assembled and checked by feel.

8.3 Push-Pull Rod Adjustment and Rod End Security

Push-pull rods need some method of lengthening and shortening for the purpose of rigging the control circuits correctly, for example for adjusting control surface deflections or the over-centre locking force with the airbrakes. At one or both ends of the pushrods, the rod end fittings are threaded and these screw into threaded features in the pushrod ends. By adjusting these end-fittings clockwise or anti-clockwise, the length of the pushrods can be readily adjusted.

The limit of how far one can screw the rod end fitting into the pushrod end is obvious - it will go so far and no further. At the other extreme, unscrewing the fitting needs some kind of guide as to how far to go. Unfortunately the inspector has no means of knowing whether such is the case, unless a witness hole is provided. In this case, a piece of wire inserted into this witness hole must be able to feel the threaded section of the rod end fitting within the pushrod. If the wire goes straight through, the threaded portion is not in safety because the rod end is not screwed in far enough. If a witness hole is not present which may be deliberate by design, there is nothing you can do about it and you are dependent upon the inspector who assembled the rod-end knowing what he/she was doing.

8.4 Cables

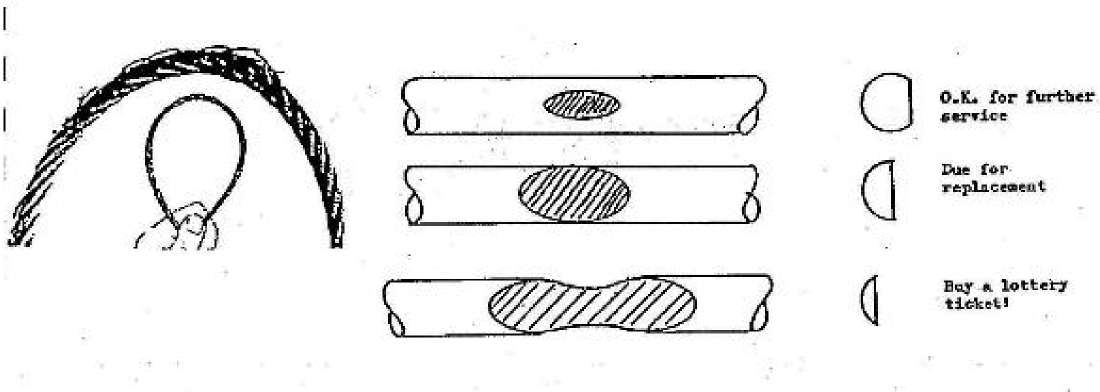
An alternative to push-pull rods is to use cables and in fact these are used in some of the ancillary control circuits on sailplanes which may use push-pull rods for the primary controls. Other sailplanes (eg Bocian) use cables for virtually everything from primary controls to such things as airbrakes and elevator trim.

Cable systems offer light weight but have the reality that inspection is vital because you are guaranteed that cables will fail in service unless subject to appropriate inspection and maintenance at appropriate intervals.

Cables are satisfactory, as long as they are able to be inspected easily and at appropriate intervals. This is where the torch comes in; some cables are difficult to inspect in ambient light but easy when illuminated by a torch.

Cables do not wear at all if they are in simple straight runs and not suffering from bending around pulleys or running through a fairlead with change in direction. Elevator cables, for example, may remain pretty straight for most of their run and only move through small angles at each end of the fuselage or possibly in the middle where the fuselage tapers a bit. As long as the bits at each end are inspectable, the straight run in the middle should not be a problem.

Where cables bend around pulleys or pass through fairleads with change in direction, they will eventually exhibit wear and fatigue. Typical examples of wear on cables appear below. Do not feel for broken strands with bare fingers - use cloth for the purpose and slide it along the cable, as blood is rather corrosive.



Examples of Cable Wear and Deterioration

When checking cables for wear around pulleys, check also that the pulleys rotate freely when the cable is moved. A frozen pulley increases the rate of cable wear and makes the control feel heavier and the control less pleasant to operate.

The DI inspector must also have some idea of how tight the cable should be. Steel cables expand and contract with temperature and the sailplane structure in composite materials or aluminium will have different temperature expansion and contraction rates compared to the steel cables. Then there is the additional significant difficulty with wooden sailplanes where the moisture content in the timber changes with the seasons leading to shrinkage in the hot summer and expansion in the wetter winter months. In this case it is normal to have to adjust the cables twice a year otherwise the cables will become too slack in summer and too tight in winter.

THE TENSION OF CABLES IS IMPORTANT. If they are too slack, it may be possible for the cable driven control surfaces to flutter. This is a potentially destructive mode of vibration of the control surfaces, which may excite the main surfaces to which they are attached (wing, tailplane, etc) into a flutter mode of their own. Even the short wing Kookaburra, with its fairly stiff wing, will produce life threatening aileron/wing flutter if it is flown with the aileron cables too slack.

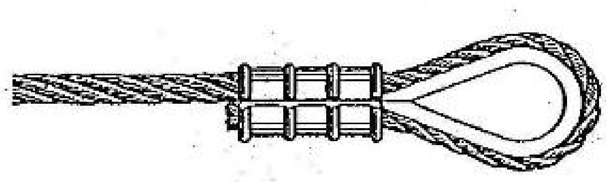
If cables are too tight, they can over-stress things like pulley attachments to the airframe. These can even become detached from their mountings in an extreme case. Even in a mild case of over-tightening, controls can be very stiff to operate and an otherwise pleasant sailplane can be a miserable thing to fly.

Estimating correct cable tensions on a DI is a matter of training. Make sure you are in no doubt about the required tensions on any sailplane you DI.

8.5 Cable Swages

Swaging is a method of terminating a cable using a metal sleeve compressed around the cable in such a way that the resulting joint is at least as strong as the original cable.

The most common method of swaging in Australia is the American "Nicopress" system, used because it is a simple and effective system. All our control cables (other than special orders) come from the USA anyway and are in imperial dimensions. The Nicopress system uses a copper sleeve matched to the imperial cable size and pressed with a special crushing tool, the resultant joint for 1/8” cable looking like the illustration below.



The above drawing shows an "eye" end, with thimble, used to terminate cables where they connect to other parts of a control system. The Nicopress system may also be used, albeit unusual, to make in-line joins, usually a minimum of two sleeves being used for this purpose.

Any noticeable variation from the kind of join shown in the above diagram should be reported to a more experienced inspector.

8.6 Harnesses

The harness is the pilot's last line of defence in an accident. If things go completely wrong and the sailplane ends up crashing, the pilot is dependent on the harness to hold him/her in the cockpit shell to achieve some protection against death or serious injury. Harness system serviceability is therefore of paramount importance.

Daily inspectors should look particularly for safe attachment of the harness to the sailplane airframe, the condition of the harness webbing, and the correct operation of the fasten/release mechanism. Many buckles and harness systems have ADs that must be checked, see General GFA ADs. On all harnesses, check that the webbing fills the full width of the buckles, to avoid twisting of the webbing and is not too wide as there is 2” webbing which does not fit 50mm hardware.

There are many variations in methods of attachment to the airframe. They range from simple wrapping of the harness webbing around substantial tubular fittings, to fixtures bolted through the structure.

Harness webbing is subject to progressive deterioration in strength and condition from continuing exposure to the ultra-violet rays in sunlight. A line has to drawn as to the strength reduction acceptable and so webbing has a prescribed life. This is usually ten years unless the manufacturer advises otherwise. This information is of very little use if the Daily Inspector cannot easily see the date of manufacture of the harness, and such information, which should appear on a panel stitched to part of the harness, may regrettably become obscure or disappear completely after a few years service. The Inspector therefore has to make a judgement on the condition of the harness as seen at the time, not easy in some cases. Use your common sense and err on the conservative side. In all cases you should find that the date of installation of the harness and its status at installation (new or second hand and X years old, etc) is listed in the aircraft logbook; so ask your Club Technical Officer or syndicate partner possessed of the logbook.

The webbing must be checked for abrasions, wear, damage, pulled or loose stitching. Some very minor abrasion is acceptable where the belt is regularly adjusted. Pay particular attention to the edges of the straps where they pass through slots or guides. Any edge wear, cuts or abrasions in these areas are cause for considering rejection and seeking experienced advice.

The fasten/release mechanism varies greatly from type to type. There are the old simple "peg" types, where a peg made of light alloy or bent steel wire is inserted through the triangular metal fittings at the ends of each of the pieces of the harness. There are special release boxes fitted to virtually all new harnesses these days, which are effective, almost maintenance free but which cannot be inspected internally without dismantling. The main thing is that the harness should be able to do its dual job of securing the pilot in flight against turbulence and manoeuvring or aerobatic loads, and protecting the pilot against deceleration and sliding underneath the harness in the event of a crash. If a DI Inspector believes that anything might detract from the ability of a harness to perform these functions, the sailplane should not be flown.

In some harness systems, the webbing can be specific to position. For example with Shroth harnesses the left and right shoulder strap lower elements are handed because of the way the clips are orientated to engage the buckle.

8.7 Ancillary Controls: Trim Systems, Airbrakes/Spoilers and Flaps

The Daily Inspector needs to understand the function of these in order to check their serviceability.

8.7.1 Trim Systems

Sailplanes are fitted with a system of trimming the control column loads in the elevator for different flight conditions, speeds and pilot weights. The systems are basically of three types, viz:

a. An elevator trim tab surface is fitted at the trailing edge of the elevator. The tab deflection is only adjusted by the cockpit control, and is not affected by elevator deflection. Some of these types have a single tab fitted to one side of the elevator (eg Kookaburra, Bocian), others have two tabs, one on each side (eg Blanik, IS28B2, Puchacz). Checking the correct sense of the trim tab operation involves matching the trim control position in the cockpit to the effect the trim tab deflection is having on the elevator trailing edge and therefore the elevator itself. As well as checking correct sense of movement, check as far as is accessible the integrity of the trim circuit from the cockpit(s) to the tail end.

b. A variation of the above is known as a "Flettner" tab, in which the elevator trim tab functions as an "anti-servo" or "anti-balance" tab. In this system the cockpit trim control functions normally, but the tab is also geared to elevator movement and moves in the same direction as the elevator. It is rather difficult to describe in words, but seeing it in operation will make it very clear. Such a system is found on K7, K8 and ASK13 sailplanes. It is also found on the all-moving tailplanes of Boomerangs and Slingsby Darts. Its function, as well as providing a trimming facility, is to provide elevator "feel" to the pilot, especially at high speed. Once again, check the integrity of the circuit as far as possible.

c. A spring or a number of springs is fitted in the elevator circuit within the cockpit interior. In this system there is no external tab surface, instead a double-acting spring provides a bias forward or backward on the control column to "trim" the sailplane in accordance with the position of the trim control lever in the cockpit. Mostly these springs are out of sight, and thus out of mind. These systems vary so much that you will need to make yourself familiar with each individual installation before exercising a DI signature. Check this kind of trim system by moving the trim lever fore and aft and the elevator, or all-moving tailplane, should also move in the same direction.

This third type predominates in modern FRP sailplanes because it eliminates in flight elevator trim tab flutter troubles and also the maintenance works associated with trim tab surfaces in maintaining them flutter free.

8.7.2 Airbrakes / Spoilers

Airbrakes or spoilers are fitted to provide the pilot with a means of increasing and controlling the rate of descent on the approach. They may be operated by cables (eg Falke, Bocian), push-pull rods (eg ASK13) or torque-tubes at the wing root (eg Puchacz).

Spoilers are usually held closed by a simple spring, against which the pilot pulls to operate them. There is usually no other method of locking spoilers and their operating system is very simple and usually easy to inspect.

Airbrakes have a geometric "over-centre" lock fitted to them, to keep them closed against the often considerable aerodynamic loads trying to force them open. This over-centre lock must steer the fine line between being strong enough to keep the airbrakes reliably closed during aerobatics or high speeds in turbulence, but not so strong that the airbrakes cannot be unlocked by a light weight pilot or that components of the airbrake control system are over-stressed. You must learn this kind of judgment on the job for the type of sailplane you are inspecting.

The over-centre locking mechanism can be within the fuselage centre, eg Janus, Standard Cirrus, etc, or out in each wing, eg Puchacz, LS3, DG505, etc.

You should check that activating the airbrake lever in the cockpit results in the airbrakes being deployed equally on both sides; above and below the wing as appropriate.

8.7.3 Flaps

These may be driven by push-pull rods or torque tubes. The components of the control system may be inspectable within the fuselage, but probably not within the wing.

Flaps should be checked for:

a. correct sense of movement;

b. operation over the full range from positive to negative; and

c. equal deflections on both sides.

8.8 Tow Releases

There are two main types of releases, the German "Tost" series, which predominates, and the British "Ottfur" (Ottley-Furlong) type, found occasionally. There are also some locally engineered variations found in amateur built sailplanes.

Tow releases for aerotow usually do not have a back-release mechanism fitted; but they may, like with the nose release in the IS28B2. Any release used for winch or autotow launching **must** incorporate a back-release mechanism.

For Daily Inspection purposes, the release mechanism itself must be checked for two main things, viz :

a. There is no excessive wear on the "beak" of the hook itself, looking in particular for signs of grooving of the hook which could cause the release rings to be firmly held, leading to failure to release. Also no excessive wear on the cage where the rings contact.

b. There are no broken release springs in either the main release mechanism or, if fitted, the back-release mechanism.

Point b is not quite so easy. By design this release spring has two independent ‘legs’. When a spring breaks, it is usually only one ‘leg’ of the spring which lets go, the other one still providing some spring return action, although much weaker. You check by operating the release handle and feeling the force to pull open the release(s). Try to detect weakened spring resistance as compared to normal.

The main hazard of a partly broken release spring in the **main** release mechanism is that the over-centre lock may not close fully, especially if the release is a bit dirty or poorly lubricated. This gives the over-centre mechanism "hair trigger" qualities and means that the release might inadvertently open at a critical point on the launch, giving the pilot an unnecessary emergency.

It takes a bit of experience to detect whether a spring is partly broken or not, especially as some sailplanes have additional external springs in the release system which mask the feel of the release springs on their own. Particular knowledge is required. All you can do is to treat the subject very conservatively until you build up enough experience to exercise judgment in each case. It should be the case with Tost releases that release spring failures in operation do not occur in service given that Form 2 inspectors are required to overhaul Tost releases to Chapter 16 of Basic Sailplane Engineering which has a schedule specifying the replacement interval at which new release springs are installed.

If both legs of the spring are broken, there is of course no spring action at all and the problem is obvious.

The implication of a partly broken spring in the **back-release** mechanism is a possible premature back-release, more of a nuisance than an actual hazard if it happens in flight, because it would occur at a reasonable height. However, if it happens on the ground in the case of an over-run of the cable, it could create a much worse problem.

Releases may be actuated by cable, pushrod or a combination of both. Check all aspects of the release system as far as you can see and seek advice on anything you don't like or understand. Cable-operated releases should have about 5-12mm free-play before force is felt to ensure that release mechanism closes fully. Beware of excessive binding of cables from damaged guide tubes or damaged cables inside guide tubes which can cause the release to not close properly.

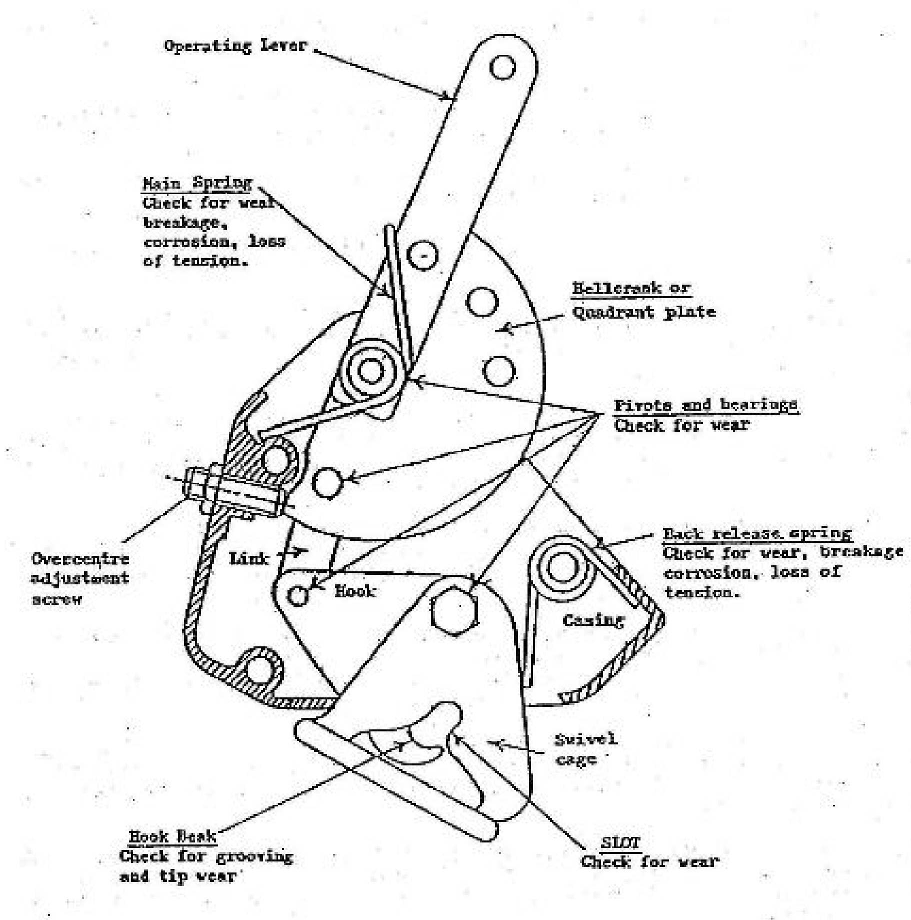
Functional checking of tow-releases consists of checking that the device releases the rope or cable under some degree of tension. This obviously takes two people, one pulling on the rope/cable and one pulling the release knob. This test applies to both aerotow and winch/auto releases.

For winch/auto releases only, the back-release mechanism is checked by pulling downward at approximately right-angles to the fuselage. This is awkward on some types with limited ground-clearance; just do the best you can to prove the serviceability of the back-release. The cable should back release under the influence of a fairly hard pull, but do not jerk it.

A typical Tost tow-release - belly-hook incorporating a back-release is shown below.

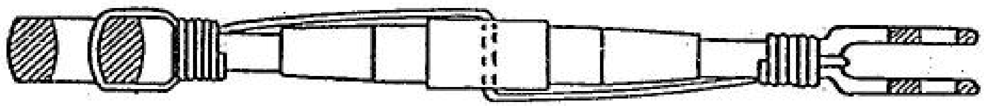
8.9 Turnbuckles

Turnbuckles are used for adjusting the tension in cables. They are simple devices, using two threaded ends inserted into a central barrel. One of the ends has a

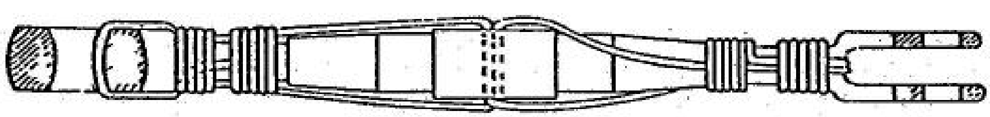


conventional thread, the other has a left-handed thread, which enables the barrel to be rotated to shorten or lengthen the turnbuckle, thus altering the tension in the cable.

When correctly adjusted, no threads should be visible protruding from the barrel. The turnbuckle must be locked, the most common method being with locking wire passed through the barrel and each end to prevent the turnbuckle from rotating. Unlocked turnbuckles must not be allowed to fly. Some examples of locked turnbuckles appear below. Some turnbuckles use special locking clips to achieve safetying in contrast to the use of lock wire.



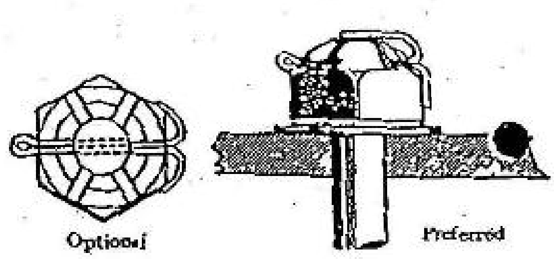
SINGLE WRAP



DOUBLE WRAP

8.10 Split Pins and Safety Wiring

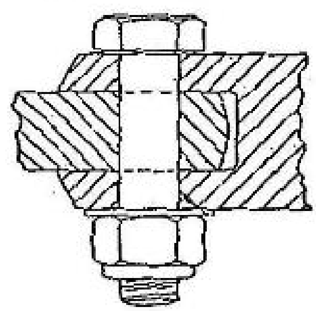
Split pins or cotter pins are used to lock a number of fasteners, the most common examples being castellated nuts or clevis pins. An example of a locked castellated nut appears below.



Safety wiring is not very common on sailplanes, but older designs might use it on some of their attachments. Motor-gliders, which are subject to engine vibration, use it much more.

8.11 Locknuts

These must be in safety, as shown below. 1 to 2 threads should be visible. "Nyloc" nuts must be discarded if they are only finger-tight.



8.12 Undercarriages

All undercarriage elements, main wheels, auxiliary wheels, skids, etc. are worked hard because of repetitive take-offs and landings, some of which occasionally are severe. Inspectors will find issues regularly with undercarriage elements needing attention, even if it is as simple as re-inflating tyres to correct pressure.

Sailplane undercarriages vary greatly from type to type. The simplest type, common on older sailplanes, is a fixed main wheel, unsprung, combined with one or more skids, e.g. the "Shortwing" Kookaburra has an unsprung main wheel and a nose skid mounted on two rubber blocks. The tailskid is mounted on a single rubber block. This combines simplicity with protection for the pilots and the airframe. Check the tyre pressure and the general condition of skids (condition of the sacrificial wear plate, etc.) and rubber blocks.

Some sailplanes have suspension systems fitted to their main wheels. These may take the form of rubber blocks in compression (ASK13 and ASK21), rubber bungies in tension (Puchacz), an "oleo-pneumatic" (gas plus oil) strut (Blanik and IS28B2), or springs (DG505).

Rubber blocks are often inaccessible and may not be easy to check. They are generally very robust.

Rubber bungies may be inspectable, but probably not without going to some trouble. The condition of the bungies may be apparent from the general “sit” of the sailplane. For example, the Puchacz with two people on board and sailplane resting on the nose wheel, should not have the tail sinking close to the ground due to weak bungies.

"Oleo" struts need special equipment to pressurize them to the correct value. At daily inspection with the Blanik and IS28B2 the rear seat is raised to access the oleo, and the adequacy of the distance between the end faces on the oleo barrel can be felt through the leather cover; the two finger width test. If the oleo is low pressure, there is not enough room for two fingers and the leather cover is concertina like. If it is low, the oleo leg will need pressurizing and this may or may not be possible on the day. Low oleo pressure is a major defect requiring rectification. Continuous operations with low oleo pressure is not acceptable due to cumulative damage to the airframe and may even endanger the pilots(s) in the event of a heavy landing.

Retractable undercarriages are common on modern sailplanes. They vary greatly in their design details, but they all have one thing in common - they are very dangerous if they are retracted on the ground. Beyond checking that the undercarriage selector is properly in the down position, it is a mistake to fiddle any further with it.

Warning systems are common on sailplanes with retractable undercarriages. Most of them are connected in such a way that if the airbrakes are opened with the wheel not locked down, a warning horn or buzzer will sound. For ground-test purposes, a test button facility is usually provided to enable a DI inspector to check that the system is working.

Tyre pressure is very important. In all sailplanes a correctly inflated main wheel tyre is essential for shock absorption to mitigate against the landing jolts or impacts they suffer. If there are additional suspension elements adding to shock absorption capability that is a bonus. A sailplane flown with low main wheel tyre pressure will propagate shock damage to the fuselage structure if it is landed heavily severely enough that the wheel rim contacts the ground. A high shock load can injure the pilot. Additionally very low pressure will result in tyre "creep" around the wheel rim if flown in this condition. This usually means that the valve disappears inside the tyre, usually tearing the tube in the process.

The required tyre pressures for sailplanes should be placarded near the relevant wheel. If the placards are absent or illegible then get them replaced so that the information is available at the point of need! Don’t tolerate missing information – take action!

It is very important that when tyres are pumped up be sure that the pressure gauge being used is a quality item which indicates accurate and thus meaningful pressure results. Regrettably (2011 year) there are poor quality Chinese imports sold in various stores where the tyre pressure gauge is of dubious accuracy. In some cases, only checking with a pressure gauge can ensure correct pressure, e.g. Puchacz nose wheel.

Check tyres for surface defects such as splits, or localised raised bubbles indicating broken cords inside the tyre construction due to rolling over spikes, e.g. pointy rocks.

Retractable undercarriages need to be checked for condition of the framework (usually welded steel tubing), doors undamaged and functional and door closing bungees OK, etc.

It is not unknown for a sailplane to be landed inadvertently with the wheel retracted, then the wheel popped down and the sailplane sneaked back into the hangar without the incident being reported. The DI inspector must be on the alert for slack pilots just as much as actual aircraft problems.

Hard landings may also cause compression damage in the undercarriage area, particularly for types with fixed undercarriages.

Maintenance tip: The best and time saving policy with tailwheels and nose wheels is to carry a complete serviceable spare wheel so that tyre and/or tube issues with the wheel can be rectified by direct installation of the serviceable item. Rectify the one removed later in the day.

8.13 Pitot Static Systems

The proper functioning of the airspeed indicator (ASI) depends on providing pitot and static pressures from the correct pitot and static pressure sources nominated by the designer in manuals, so that the ASI reads properly and the limiting airspeeds on the ASI dial and/or shown on placard(s) are meaningful.

Inspectors must be familiar with the pitot and static vent locations on the sailplane(s) being inspected.

Pitot pressure may be sourced from the nose at the nose release opening by means of a tube mounted beside (e.g. DG505) or amongst (e.g. Hornet) the nose release, or on the fin leading edge by means of a projecting tube marked as such. Vintage sailplanes may have a pitot tube mounted well above the nose and creating extra drag!

Static pressure vents are not always easy to find being flush with the fuselage surface at locations where the designer has fortunately proven that the surface pressure is a sufficiently close representation to the ambient static pressure field well away from the sailplane. Vents on the fuselage surface come in symmetrically positioned pairs:

a. on each side of the nose about 30cm back from the extreme nose and slightly above (e.g. Puchacz) or slightly below (e.g. LS3a);

b. on each side of the rear fuselage about half way between the wing and the tail, possibly two holes (e.g. Janus) or four holes (e.g. Hornet);

c. under wing static vents alone (e.g. Std Cirrus) or combining these with the tail boom static vents (e.g. Duo Discus); or

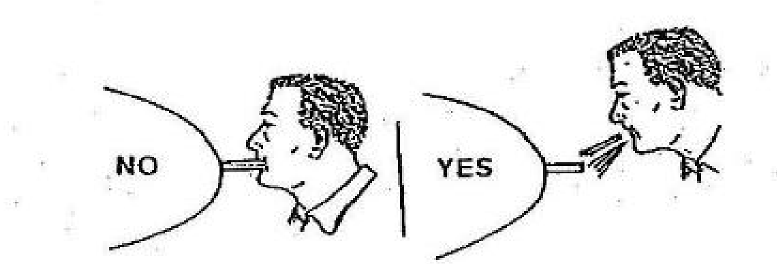
d. alternatively a multi source probe projecting from fin leading edge.

Whatever the layout, all the static vents on the fuselage surface are interconnected to provide a single tube feeding the average static pressure to the ASI.

Additional static vents, **not** intended for the ASI system, may be provided for connecting (electrical) variometers or other instruments.

Pitot-static systems should be checked for blockages, which may be caused by rain driven in by the wind, accumulated dust (which becomes mud if mixed with rain), insects and in particular insect nests. Various insects, but especially wasps, are known to favour pitot-static systems for building nests. Rain entering fin mounted pitot tubes is hazardous because the slug of water driven into the tube sits in the fin pressurising the line and causing the ASI to over-read. This might be observed as the ASI needle reading positively with the sailplane at rest.

Whatever the system, great care is needed when checking the functioning of the pitot-static system on a daily inspection. The diagram below are self-explanatory, the only desirable variation to the correct method being the placement of the hand diagonally across the pitot head, then blowing against the hand in order to direct a small amount of pressure into the pitot head.



8.14 Instrumentation

8.14.1 Airspeed Indicator

The airspeed indicator is functionally checked during the pitot-static check covered previously.

Note that Winter ASIs manufactured in the 2000 decade and onwards have a stop preventing the needle from going backwards in response to a puff on the static ports. This is a pity, because the small backwards movement of the ASI needle was a good test of the statics.

Puffing the statics sufficient to get the altimeter to indicate takes too great a puff pressure, such that the appropriate outcome with puffing the statics will usually be the absence of any indication, eg absence of a spurious response from the vario system due mistakes in plumbing.

8.14.2 Altimeter

The altimeter should be checked for basic functions by winding the sub-scale knob and checking that the main pointers move smoothly. An accuracy check can easily be carried out by obtaining the official current area QNH from the website. This figure, given in hectopascals (HPa), is then set on the sub-scale of the altimeter and the instrument should read the airfield's elevation above sea-level. Allowing a couple of HPa for the possible difference between your airfield location and the place where the area QNH might have been obtained, this is a useful check on the accuracy of the altimeter. One HPa equals about thirty feet, so if you see an error of more than 125 feet or 4 HPa, it is time to report that the altimeter needs re-calibrating.

Note that all GFA operations are based on QNH. Discrepancies in altimeter calibration render altitude information passed to other traffic meaningless. The DI inspector can act as early warning that calibration or adjustment of the altimeter is overdue.

8.14.3 Variometers

The variometers should be given a basic puff check to ensure that they are working and indicating correct sense. Before checking electrical varios, switch the instrument ON and allow around 30-60 seconds for the vario to warm up. Blow carefully across the probe and check that the vario needle moves in the correct direction and that the vario audio (if fitted) responds appropriately. Gentle puffing to increase pressure in the TE line corresponds to descending, while lowering pressure corresponds to climbing. However, there are so many different types of variometer that detailed guidelines are not possible here. Get familiar with those types you will be signing for and make sure you know how they work.

Instrument tubing should be checked for security and any damage, and any tendency to interfere with control systems under the instrument panel. If at any time, either a pitot or a static pressure line is disconnected, then a full leak test of that pressure line should be conducted. You should seek the guidance of a Form 2 inspector to assist with this task.

Many Total Energy (TE) probes are vulnerable to physical damage from persons moving around or over a tail boom or fuselage. Great care must be taken to avoid impact or bending damage. Protective covers must be removed for DI checks. If replaced, their removal must be confirmed in outside cockpit ABCD checks.

8.15 Electrical Systems

Before fitting a battery to a sailplane, check the battery for two things:

a. Inspect the battery for physical damage – especially if it is a Lithium Ferrous Phosphate (LiFePO4 or LFP) battery. Whilst batteries are robustly constructed, dropping them onto the ground or other impact damage, can damage the battery internally. With an LFP battery, this can lead to an internal short circuit which will rapidly heat the battery and release toxic smoke, something that you do not want to happen in flight. If an LFP battery shows signs that it has been dropped or damaged, or any signs of swelling or overheating, the battery must be removed from service and marked unserviceable.

b. Make sure that it has been adequately charged. Use competent battery chargers which are designed for the battery type. Modern chargers may incorporate a condition indicating capability. Otherwise measure the output voltage using either a voltmeter or using the fact that some radios and electrical variometers have the capability to display system voltage. If available, battery testing under load is a better approach. Some charging systems enable connecting an electrical load to the battery, and then measuring the output voltage of the battery after it has been under load for a few seconds. If the output voltage drops quickly, and/or continues to drop under load after

10-15 seconds, then the battery is suspect and it should be set aside, and the issue dealt with.

Maintenance tip: Given our dependence on battery power for operations and flight enjoyment, quality chargers and quality replacement batteries are a good investment.

Batteries must be properly secured. Remember that a battery weighing 5kg on the ground weighs 25kg when subjected to 5G. Elastic "ocky straps" or similar securing devices are completely unsuitable for securing batteries and must not be used. Proper fittings must be made up to provide the required degree of restraint. Do not sign for any battery installation you think might become a missile in rough air or during a heavy landing.

Some batteries are fitted inside the fin (e.g. DG505) or up under the instrument panel (e.g. Discus CS). In these cases, you must be sure, not only of the electrical serviceability of the battery installation, but also the implications of the battery fitment on the C of G of the sailplane.

Check that the electrical systems has the required master switch and fuses appropriate to the current drawn by the services powered by the battery. A primary fuse **must** be provided right at the battery in the wiring loom from the battery terminals. There are cases on record of in-flight fires caused by electrical wiring shorting to a metal airframe. These fires, together with their toxic fumes, would have been prevented if adequate fuses had been provided.

Some electrical systems have multiple batteries and other complexities. Make yourself familiar with any system you have not seen before. If necessary seek advice.

8.16 Radio

Checking the radio needs to take account of the state of the battery. A nominally 12 volt aircraft radio generally delivers its specified performance only when the supply voltage is actually 13.75 volts, which is the voltage of a light aircraft electrical system with the generator or alternator on line. Any voltage below this value will mean lower radio performance, i.e. reduced transmitter output and poorer receiver sensitivity. Most sailplane systems are not only set up to give a mere 12 volts, but many of them don’t deliver that, even from a fully-charged battery, usually because the distance between battery and radio is large and small diameter unnecessarily high resistance wire has been used. Fuses and circuit breakers also reduce voltage.

A flat battery, or low supply voltage due to poor wiring, may give symptoms which suggest that there is something wrong with the radio, whereas there may in fact be nothing wrong with it. For example, "motor-boating" in the speaker is a classic symptom of low electrical power to the radio. Don’t leave home without a good battery and good wiring.

Check all parts of the installation, including the microphone, speaker and all connections.

Some sailplanes do not have a radio mounted in the sailplane as a permanent fixture, but may have provision for mounting a hand-held radio when required. In these cases, check that the installation is secure enough to protect the occupant in the event of rough air or sudden deceleration, much like the battery installation.

If other sailplanes are active or a ground-based club radio is available, then a quick test call should be conducted to ensure that both the transmit and receive circuits are working. The format of such a call is “[Callsign of station being called] this is [the callsign of your sailplane] – radio check please”. The station you are calling should then respond with your callsign and one number. This number indicates the readability of your transmission on a rating from one to five; five indicating very good readability and one indicating almost unreadable (refer to the Airways and Radio Procedures Manual).

8.17 Placards

Placards are required for speed limitations, manoeuvre limitations, weight and balance limitations, and weak link strengths. Placards also identify control functions such as with the release handle and control position such as with undercarriage position. These placards must be in the clear view of a pilot when strapped in and the sailplane should not be flown if the information on the placards has been rubbed out or is otherwise unreadable.

Placards are essential given that sailplanes are permitted to fly without the flight manual in the cockpit on the proviso that the placarded information covers the critical matters. If some of the placards are unreadable then carry the Flight Manual (including up-to-date weight and balance data) on board whilst organising new placards to be made and installed.

8.18 Colour Coding of Ancillary Controls

Ancillary controls are colour-coded in accordance with international convention. The colours must be as follows:

a.	Elevator trim	-	green
b.	Airbrakes	-	blue
c.	Release knob/handle	-	yellow
d.	Canopy jettison	-	red

8.19 Corrosion

Sailplanes which spend much of their time in the coastal belt may suffer from corrosion of various types. Rust on steel fittings is a common problem and some judgment is needed to decide when such corrosion is no longer acceptable. It is better to have no visible corrosion.

Corrosion of aluminium alloy sailplanes may also be a problem and any unprotected areas inside the sailplane may show signs of such problems. Depending on the type of aluminium, the corrosion may either be:

a. White powdery material,

b. Dark spots or filaments in the surface, or

c. Flakey material looking like ‘Weet-Bix’.

As corrosion is a rather specialised subject, refer any doubts you may have to someone of greater experience. Also seek out opportunities which will increase your knowledge.

8.20 Ballast

There are three kinds; removable ballast, expendable ballast and fixed ballast.

8.20.1 Removable ballast

Removable ballast is defined (at CS22.31) as “ballast used to supplement the weight of an occupant and parachute, when lower than 70 kg, in order to keep the CofG position within limits. This ballast can be adjusted before, but not during, flight”.

Ballast is often used to keep the sailplane within its CofG limitations. Lightweight pilots often need to carry ballast in the cockpit to ensure that the CofG is far enough forward for safe flight. Such ballast is able to be removed when not required, but must be properly secured when it is carried.

Most modern sailplanes have purpose built boxes in the cockpit floor structure, into which purpose made steel or lead weights are inserted and secured. The security aspect is important and the mechanism to ensure secure fixing of the ballast needs to be checked on a daily inspection.

Sailplanes without boxes for secured ballast usually rely on some kind of under-seat ballast. A typical example of this kind of ballast may be sheets or slats of lead encased in a flat canvas bag. It is important that under-seat ballast must be fixed to the airframe in a secure- way, a common method being straps which attach to the lap-belt anchorages. Unsecured ballast is absolutely forbidden.

Particular care must be taken with sailplanes with multiple ballast boxes; e.g. DG1001S, with two nose ballast boxes under the front cockpit carpet, as well as a tail ballast box. Ensure that ballast box covers are correctly locked and safetyed; loss of a tail ballast box cover can also result in inflight loss of ballast.

8.20.2 Expendable ballast

Expendable ballast is defined (at CS22.31) as “ballast which can be jettisoned in flight and which serves to increase the weight and consequently the speed of the sailplane”. Many modern sailplanes carry water-ballast to increase their wing-loading for fast cross-country flying. This water is carried in the leading edges of the wings, either in tanks which are an integral part of the wing structure or in rubber bags secured inside the leading edges.

DI Inspectors should make themselves familiar with the particular installation being inspected, including:

a. the tanks themselves,

b. the inlet and outlet positions,

c. the cockpit controls and any instrument panel indicator (eg DG505)

d. and the dump valves

Water may also be carried in the fin on some types. Such a system is usually set up so that water cannot be dumped from the wings without also dumping the fin water at the same time. DI inspectors should check that the system does in fact work that way, otherwise it might be possible for the sailplane to be flown outside its aft CG limit, a dangerous situation.

When filling ballast tanks, this must never be done by inserting a hose directly into the tanks. The hose can flop over if unattended and seal the inlet applying mains water pressure which can be more than sufficient to blow the tanks and/or the wing apart. This has happened on a number of occasions. Water ballast tanks must only be filled by means of the water containers, or a suitable alternative. This will ensure that the maximum water pressure (i.e. head of water) at the tank inlet is limited to no more than that intended by the manufacturer.

8.20.3 Fixed ballast

Fixed ballast is defined (at CS22.31) as “ballast intended for correcting a deficiency in the sailplane’s balance”.

There can be fixed ballast installed in the fuselage to achieve the placarded minimum pilot weight. This is permanent and remains applicable until a reweighing is undertaken and revised placards are issued. It is usually installed in a way preventing removal. However there can be odd situations. The DG505 has a battery mounted in top of the fin which must be left in place to maintain the validity of the placarded minimum pilot weights. Similarly with the Duo Discus the two batteries mounted in front of the rear seat must be present in relation to the placarded minimum solo pilot weight.

8.21 Oxygen Systems

WARNING

OXYGEN IS VERY HAZARDOUS IN CONTACT WITH ANY GREASE, OIL, FLAMMABLE SOLVENTS, DUST, LINT, METAL FILINGS OR OTHER COMBUSTIBLE MATERIAL. ENSURE THAT IN THE AREA, ALL TOOLS, CLOTHES, HANDS AND EQUIPMENT OR CONSUMABLES ARE CLEAN BEFORE STARTING WORK ON AN OXYGEN SYSTEM. CONTACT WITH ANY OF THE ABOVE MAY CAUSE SPONTANEOUS COMBUSTION OR AN EXPLOSION.

GREASE OR OIL WILL CAUSE AN EXPLOSION ON CONTACT WITH OXYGEN.

KEEP AWAY FROM ALL FORMS OF COMBUSTION AND NAKED LIGHTS.

This is a very specialised area and many DI inspectors will not have encountered an oxygen system in the normal course of club operations. However there is increasing interest in high-altitude flying and a growing recognition of the value of oxygen on long and high summer cross country flights. There is no substitute for a good briefing on each individual system.

Oxygen is stored in sailplanes in high pressure cylinders at 1,500 to 3,000psi, 10,400 to 20,800kPa. When the supply valve is opened (always turn on slowly) that cylinder pressure is released into the line connected to the regulator. Oxygen reacts violently in the presence of any oily or greasy substances. If there is a leak in the high-pressure part of the installation and oxygen is brought into contact with such substances, spontaneous combustion is likely to occur. Apart from oils or greases commonly used in sailplane maintenance, substances which can cause problems include sun cream, lip salve and various ointments used to treat cuts and abrasions.

Be very careful in the presence of oxygen and remember that, if a fire does start, the oxygen rich atmosphere in the vicinity of the storage cylinder will ensure that you probably won't be able to put it out. Hence check security of supply lines coming from the oxygen bottle!!

There are two levels to inspection of such an installation at the DI. If height flying is not contemplated say due to operations under airspace limitations and/or masks unavailable, then the approach is to inspect for the installation for “no hazard”. If the oxygen system might be used then the installation must be inspected for “no hazard” **plus** the system inspected for full functional serviceability.

Given that the cylinders are heavy, they must be competently restrained by appropriate fittings.

Many oxygen-fitted sailplanes use Electronic Delivery Systems (EDS) powered by batteries. DI checks should ensure correct EDS operation and battery condition. Care must also be taken to ensure correct connection of tubing to cannula or masks, if fitted.

8.22 Wing Shake Tests

If you have watched a few Daily Inspections being done, you will have noticed that inspectors often take hold of one wingtip and shake it up and down. The purpose of the shake test is to show up any discontinuities in the wing structure. If the wingtip is gently and rhythmically moved up and down, and is allowed to find its own natural frequency of oscillation, it soon becomes apparent if the structure has any breakages in it.

Look for the other wingtip moving up and down in perfect harmony with the one you are moving. Any sign that the wings are not moving up and down together means serious problems somewhere inside the wing structure. On wooden sailplanes, look also for any signs of broken ribs or trailing edges, which will be very obvious when the shake test is carried out. You may also hear loose objects rattling inside the wing, which it would obviously be a good idea to investigate.

This test also shows up any tendency to looseness in the main pins at the wing roots. IS28B2 sailplanes have occasional problems with the tapered main spar pins not being fully pulled up on the taper and there maybe others.

The test may also show up loose objects in the wing(s), for example - tools left behind from maintenance, a snake (yes!!), acorns (stored by chipmunks in a UK example!), etc.

Those people who say that the shake test is useless are not quite correct. Those who say that the shake test is often overdone are closer to the truth. The clue is to make all movements gentle and look for the signs of damage/wear mentioned above. That is all there is to it.

Some sailplanes (e.g. Libelle, Hornet) may show signs of fore and aft movement at the wingtips. There may also be other types where this may be apparent. Know the limits of this movement on sailplanes you are inspecting and report anything you think may exceed these limits.

There is also the related test where two people on either wing tip apply a steady up and down load together. This is useful with wooden sailplanes in detecting loose wing root and main spar metal fittings, and with expanding tapered main spar pins (e.g. IS28B2) for detecting pins fully done up or not on the taper.

8.23 Tapes and Seals

Tapes and seals have vital functions and demand attention in all designs of sailplanes, old and new. The safety of the sailplane can be affected by seals and tapes which are progressively coming unstuck. At the very least the enjoyment of flying will be seriously upset by partially detached seals slapping noisily against the airframe. To get the picture, think about trying to complete that 500 km triangle after part of wing to fuselage taping has let loose.

The sealing strip or tape between the wing and aileron, or between stabiliser and elevator, may be a requirement for that type to achieve adequate control authority. Some people in the past operating vintage sailplane types have left the seal off assuming it is not required but then been profoundly dismayed at the lack of control! In the case of the Kookaburra, the aileron authority is halved!

Internal V seals between the rudder and fin interior can be mandatory, eg DG500 and DG505 sailplanes where they prevent the tendency to rudder flutter.

Tapes and seals (usually mylar) are held in place by adhesives which ultimately will let go. It is only a matter of time, be it six weeks, six months or six or more years. Exposure to UV and heat from the sun, and also water, will eventually deteriorate the adhesive. Look for the forward edge of tapes starting to lift off the surface.

Tail ballast box cover tapes must also be in good condition, as loss of a cover may increase risks of inflight loss of tail ballast.

Control surface tapes can shrink leading to control restriction, eg LS3a in full negative flap.

Even high quality cloth tape used on a stabiliser to elevator hinge line has been known after long service to have the leading half let go, creating a spoiler effect and seriously limiting elevator authority.

Much of the “electrical tape” sold to the public in chain-stores is of appalling quality. It is strongly recommended that PVC “electrical tape” be purchased from the large electrical wholesalers to the electrical trade.

A DI person is encouraged to replace deteriorating tapes, usually “PVC electrical tape”, covering wing to fuselage joins, stabiliser to fin joins, etc., that is to say fixed surface to fixed surface joins associated with rigging the sailplane.

Mylar seals over fixed surface to control surface hinge lines often also need attention but usually have specialised requirements making their replacement a matter for a person with a higher maintenance authority. The thin fixed white PVC tape used over the leading edge of mylar seals is within the ability of a capable DI person to replace provided the same or equivalent quality tape is available and the underlying mylar seal is still full secured.

So use high quality tapes and seal materials such as installed originally and/or as specified by the manufacturer. The price of enjoyment of modern sailplanes with their sophisticated sealing is vigilance in regard to seal condition and taping.

8.24 Interior Cleanliness

The cleanliness of the interior of the sailplane is of vital importance. The possibility of jamming of the controls by foreign objects such as stones or lost pens cannot be overlooked. This is especially true in the cockpit area, although it is surprising how far loose objects will stray if they are not located and removed. A vacuum cleaner is an essential item in any club and Daily Inspectors should be willing to use it regardless of any difficulty or awkwardness this might cause them.

Rechargeable battery-powered vacuum cleaners are powerful enough for cleaning cockpits and are a useful addition to a DI Inspectors equipment.

8.25 Exterior Cleanliness

It is important to keep the exterior of the sailplane clean, in order to make it easier to check for any signs of damage.

Leading edges of main flying surfaces (wings, tailplane, fin) are likely to be covered with dead bugs from the previous day's flying. These must be softened with water and removed, as they adversely affect the performance of the sailplane detracting from the enjoyment of flight.

When washing sailplanes of wooden and FRP construction, it is important to be careful that large quantities of water are not allowed to get into the interior structure. Be sparing with water around apertures such as airbrake slots and control surface gaps. **Never** use a hose to wash a sailplane.

8.26 Cockpit Canopies

The canopy is the "eye" of the sailplane. Flying a sailplane with a dirty canopy is potentially dangerous, as the pilot will not be able to keep as sharp a lookout as he is obliged to do at all times.

Canopies are made from acrylic plastic or occasionally polycarbonate. They must always be cleaned wet, **never** dry. The combination of plastic and a dry cloth means large amounts of static electricity, which naturally attracts large quantities of dust. This will ruin a $5,000 canopy very quickly. Once you have experienced the misery of flying a sailplane with a scratched canopy into the sun, you will realise how dangerous it is to clean a canopy dry. A good chamois and **plenty** of water is always the order of the day when cleaning canopies. It is important to thoroughly dry the canopy with the chamois as any small beads of water will leave a dirt mark when they dry.

The use of silicon based cleaners is to be avoided on FRP and canopies. However, the use of a good quality Perspex polish, such as Maguire's, is recommended on a regular basis as these polishes contain chemicals which are designed to rejuvenate the acrylic material and reduce the effects of static electricity.

If canopies become cracked, they must be stop-drilled. If cracks are left alone, they will get longer and longer, until eventually they will spread all over the canopy.

Some of the older plexiglass or perspex canopies tend to become milky with age. As this is a progressive process, it is easy to learn to live with the problem, when in fact there comes a point when the canopy needs to be condemned as dangerous. Do not be afraid to do this if you feel that the safety of the sailplane (and other airspace users) will be compromised by continuing to fly it. The same applies to "crazing" of canopies.

9. HARD LANDINGS AND GROUND LOOPS

If a sailplane is involved in a hard landing or ground loop, the sailplane must be inspected for damage, hidden or otherwise, by a Daily Inspector or Annual Inspector. Among the things that should be checked are:

a. Read the manufacturer's maintenance manual for directions and advice as to the issues to be covered in the inspection.

b. Inspect the exterior of the sailplane for obvious signs of damage – distortion of skins, cracks in the gelcoat, pulled rivets or fasteners, alignment of wings and tail surfaces, broken wing root taping.

c. Debrief the pilot(s) and any witnesses if possible to determine the severity of the suspected hard landing. Inspect the "G" meter if installed. If a high "G" event was experienced or suspected then act with more caution. Determine if any water or solid ballast was being carried as this could have a bearing on the level of inspections required.

d. Inspect the landing gear and wheelbox / undercarriage support structure for obvious signs of damage or distortion with weight off the wheel or skid. Inspect for the tyre and suspension elements bottoming out. Ensure that the wheel rotates smoothly and is not distorted. There may be grass in the tyre to wheel hub junction from sideways sliding in severe ground looping. Inspect nose and tail wheels and support structure.

e. Inspect the wing attachments and surrounding structure. Check for compression damage to the fuselage around the wing roots. Check the tail boom.

f. Check the wing structure by carrying out a wing oscillation check – with the sailplane on its wheel(s) gently oscillate one wing tip up and down. The opposite wing should react with the same or very similar oscillations.

g. If necessary arrange for the sailplane to be de-rigged and note any abnormalities during de-rigging such as tight pins or spigots.

h. Inspect wing pins, spigots and attachment devices.

i. Inspect fuselage for signs of damage, compression, bending or misalignment.

j. Inspect tailplane and fin for signs of damage, bending or misalignment. Pay particular attention to the tailplane to fin mounting and also the fin to fuselage tail boom connecting structure.

k. Inspect the seat structure by removing the seat pan if appropriate.

l. Inspect the security of any ballast or equipment installed.

m. Rig the sailplane – note any abnormalities.

It is a common misconception that hard landings only cause damage to the area immediately next to the undercarriage. This is not so; hard landings can cause far-reaching damage which may be detected well out on the wings and back to the tail end. As well as checking the obvious fuselage areas, check particularly for damage at the wing/fuselage joint and carry-through structure. Wings tend to flex forward with the sudden deceleration during a hard landing. Check also for trailing edge damage on the wings, a sure sign of a very hard arrival on the ground. Finally check the tail unit very carefully, as the sailplane's tail may have been still in the air when the front end arrived on the ground. The resultant slamming of the tail after the initial impact is capable of inflicting severe damage.

The damage may be found beyond the undercarriage because if the undercarriage carries the overload, then the overload is transferred to the structure supporting the undercarriage. If this carries the overload then the overload is in turn transferred deeper into the structure. The overload is thus transmitted through the structure testing each element in the load path in turn for any weakness and weakness may lead to damage occurring.

10. COMPLETING THE DI – SETTING THE SAILPLANE UP FOR A DAY'S FLYING

Beyond sailplane fitness for flight and safety considerations which have primacy in the Daily Inspection task, there is an important part of the preparation for flying which is to set the sailplane up with the equipment and facility needed for effective operation, and spotlessly clean so as to deliver sailplane best performance.

It is arguable whether these items of preparation are DI check items or matters for the pilots to complete later. Clearly with water ballast, the DI person verifies that the system is satisfactory for use, and since pilots are responsible for the safe loading of the sailplane for flight, the pilot can fill with water ballast after the DI. Arguing the other side of the coin, perhaps the DI person should verify that the water system doesn't leak which means filling the tanks/bags. Another example - the emergency locator beacon may need to be fetched from storage, and this is a lot easier whilst at the hangar rather than later after having towed out to the runway.

There is not necessarily a perfect answer to these dilemmas. Nevertheless, ask yourself at the end of the DI process "Are there any matters still needing attention to set the sailplane up for the days operation?"

Examples (not exhaustive):

a. Parachutes. If club policy is for parachutes to be worn generally, or in the case of competitions, the parachute(s) need to be retrieved from storage and inspected for serviceability. This means verifying via the record card that the parachute is within its repack period, checking the webbing, metal webbing clips, ripcord handle, container fabric and container flap press studs if any.

b. If local airspace maps should be on board, then check they are there. If relying on electronic navigation aids, ensure correct waypoint files are used and devices correctly configured prior to arrival on the flight line.

c. Water ballast. If cross country flight where use of water ballast is intended, then fill to the level chosen or the weight limits as appropriate.

d. Check that the required cushions are present.

e. Verify that a tie down kit is present and stowed.

f. Remove extraneous items and minimise clutter.

g. Install data loggers. Check security of portable devices and data connectors.

h. Install any emergency beacon needed for remote area flying.

i. Remove TE probe covers, remove any tape over static ports and / or ballast drains.

Clean the sailplane so that the surfaces are clean of all bugs. Enable the sailplane to deliver its best glide performance and not its bug degraded performance. There is little point to the factory producing excellent moulded surface accuracy and then throwing that performance away by operating with dirty buggy surfaces. It may be that clean start which helps you later get home on a marginal cross country final glide.

10.1 Two Seat Aircraft

When conducting Daily inspections of two seat aircraft, it is important to ensure direct connectivity between the controls in each cockpit. Make sure that, when the control in one cockpit is, moved there is a corresponding movement of the same control in the other cockpit. Also, check the freeplay between the control columns in each cockpit. Any excessive free play should be investigated. As far as practical, ensure that the instruments in each cockpit are reading the same.

10.2 When Rigging the Sailplane from the Trailer

There is the situation with rigging sailplane from trailer when you do get a chance to look at the sailplane in more detail prior to the DI starting. In is recommended that you seize the opportunity and have quick look at interior parts not usually inspectable at DI.

10.3 Powered Sailplane Engines Basic Checks

Some sailplanes are fitted with an internal combustion engine that is capable of:

a. Launching the sailplane – so called self-launching sailplanes; or

b. Not powerful to launch the sailplane but powerful enough to maintain level flight – so called sustainer engines.

Consult AIRW-M04 DI Handbook Powered Sailplanes for information on the daily inspection powered sailplanes.

A specific authorization (GFA Section 2) is required for a Daily Inspector to conduct daily inspections on powered sailplanes. Because there is more particular knowledge required of the specific powerplant installation at hand, Daily Inspectors need to consult the flight or maintenance manuals for specific checks required for each sailplane type and powerplant installation.

11. FUTURE TRENDS

11.1 Ultra-Light Sailplanes

With the introduction of the new class of ultra-light sailplanes we are likely to see changes in the frequency of occurrence, the nature of and scale of damage with these sailplanes. Essentially they are built with much lower structure weight. To compensate and achieve reasonable strength factors at the reduced weight they can employ high specification composite materials. But there will be some consequences because generally you don't get something, such as weight reduction, for nothing, ie without loss in other desirable qualities.

One desirable quality is that tailplane and fin leading surfaces have sufficient strength and stiffness so that whilst pushing the sailplane around on the ground peoples' hands do not crush the structure being handled.

Similarly peoples' careless behaviour sitting on the upper inboard wing surface of FRP sailplanes usually in the past only lead to slight dimpling of the sandwich foam, but with lighter structures there may be more serious consequences.

It is suggested that these lighter weight construction sailplanes will need more care in operation and consequently more vigilance during Daily Inspection.

11.2 Electric Automatic Flaps

There are a number of experimental sailplanes operating overseas that use electric actuators to drive the flap system so that the flaps are optimally positioned for the sailplanes speed, weight and 'g' load in flight. This is effectively a 'fly by wire' system, but they still retain a mechanical linkage to the cockpit as a backup.

Whilst sailplanes with these 'fly by wire' flap systems are (at the time of writing) not in mainstream production, it can be reasonably expected that some sailplanes in Australia may be modified or fitted with them in the future.

These systems are complex and require an electric actuator to drive the flap system, a number of redundant position sensors to measure the current position of the flaps and a control box.

Needless to say, this system should be turned off / deactivated during the daily inspection as the pitot static system puff checks may register as a change in airspeed at the control box and have the flaps change position unexpectedly.

The electric actuator and the flap position sensors will have their own unique daily inspection requirements and the sailplane flight manual will need to be consulted.

12. TRAINING RECORD

After the applicant has successfully completed the DI training syllabus, the trainer will affix a DI endorsement form to the applicant's glider pilot's logbook. The DI endorsement form can be downloaded from the GFA website.

Once endorsed in the logbook, the rating can be recorded in GoMembership. Photograph or scan the endorsement from your logbook. Log into GoMembership and click on the Credentials tab. Click on the 'Add Credentials' button and select Daily Inspector from the menu. Follow the instructions and upload the photo or scan of your endorsement.

Training as a DI inspector is a mandatory part of the Glider Pilot Certificate Syllabus and is a precursor to the issue of an Independent Operator Level 1 endorsement.

For further airworthiness ratings such as Replacement of Components or Annual Inspector, it is recommended that a Schedule of Experience book be purchased from the GFA online shop. This is effectively a logbook of your airworthiness activities and is useful for individuals and their mentors or instructors in tracking their airworthiness experience.

13. GLOSSARY OF ACRONYMS AND TERMS

AA	Airservices Australia - the national body responsible for the provision of Air Traffic Services to aviation.
AAF	Airworthiness Administration Fee – the fee payable to GFA for the issue of the documentation in support of a sailplane's annual "Form 2" inspection.
AC	Aerodynamic Centre - the point on a wing airfoil where the pitching moment produced by the aerodynamic forces is constant with angle of attack.
AD	Airworthiness Directive – a document detailing mandatory actions for the continuing airworthiness of the sailplane usually generated in response to some technical issue such as a serious defect requiring rectification advice from manufacturer
AN	Airworthiness Advice Notice - a GFA document providing non-mandatory airworthiness advice.
AIP	Aeronautical Information Publication - as issued by Airservices Australia.
ASI	Air Speed Indicator.
ATSB	Australian Transport Safety Bureau - the national body responsible for civil aircraft accident investigation being an independent Commonwealth Government statutory Agency...
BCAR	British Civil Airworthiness Requirements - the standard to which many British and some Australian sailplanes have been certificated. Now largely superseded by EASA and OSTIV standards.
Boom	The upper and lower spanwise beams of a sailplane main spar which carries the main bending loads acting on the wing. Also called a spar cap.
Box spar	A spar constructed of two booms top and bottom joined together by shear webs on both the front and rear of the booms thus forming a box in cross section.
CS-22	Certification Specifications for Sailplanes and Powered Sailplanes CS-22 issued by EASA.
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 stiffness of a control circuit resulting from components deforming or stretching under load. Higher stiffness = less deflection/deformation/stretching = less flexibility.
CG	The point on the aircraft through which the total weight acts with the line of action at right angles to the earth's surface.
CP	Centre of Pressure - the position on the wing where all of the aerodynamic pressure field may be represented by a single force vector with no moment.
CRP	Carbon Reinforced Plastic.
CTOA	Chief Technical Officer Airworthiness. The officer appointed by the GFA to supervise the airworthiness functions of the GFA and who holds delegated authority from CASA.
DI	Daily Inspection.
D-nose	For earlier sailplanes with little or not much structure aft of the main spar, 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
DoITRD	Department of Infrastructure, Transport, Regional Development and Local Government

EASA	European Aviation Safety Agency - implements Europe wide aviation regulation.
EDS	Electronic Delivery System (for oxygen)
FRP	Fibre Reinforced Plastic - a generic term for all forms of fibre reinforced plastic structures.
GFA	Gliding Federation of Australia.
GFA Ops Regs	The GFA Operational Regulations.
GRP	Glass Reinforced Plastic.
“I" spar	A spar constructed of two booms (top and bottom) joined together by a single shear web usually equidistant between the front and rear of the booms
JARs	Joint Airworthiness Requirements - a European standard - Section 22 re sailplanes and powered sailplanes now superseded by CS-22 issued by EASA.
MAC	Mean Aerodynamic Chord - the average chord of a flying surface taking into account geometric taper and other characteristics of the wing profile and geometry.
MAR	Mandatory Airworthiness Requirements. A set of GFA requirements for new sailplane types.
MOSP	The GFA Manual of Standard Procedures. Part 1 Administration; Part 2 Operations; Part 3 Airworthiness; Part 4 Soaring Development; Part 5 Safety Management Systems
MR	Maintenance Release. The document providing the legal records of the maintenance status of the sailplane and informing of the actions required of a Daily Inspector seeking to release the sailplane for flight operations on a particular day. Must be kept with the aircraft at all times.
OSTIV	An acronym in French which translates as "International Scientific and Technical Organisation for Gliding". A body of people interested in these aspects of 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 or over another.
Shear web	The vertical facing used to join together the top and bottom booms of a sailplane spar and carrying shear loads when the spar is deflected up and down.
STOA	Senior Technical Officer Airworthiness
TE	Total Energy (probe)
Torque tube	A metal tube which transmits control forces to a control surface (e.g. flaps) by means of torque/twist/torsion applied to the tube.
Torsion box	Structure designed to resist torsional (twisting) loads.