

## 31 - RIGGING, DE-RIGGING & DAILY INSPECTION

There are about as many different ways to 'pin' gliders together as there are types in existence, but GRP gliders are more alike in this respect than their wooden and metal counterparts from the 50's and 60's, and often less hassle to take apart and put together. Nevertheless, a few GRP gliders are a bit quirky; the Astir series has a novel and initially baffling take on how to stop the wings coming off. As for the older gliders, a few of them belong to the 'we've got all day' knitwear school of rigging, and required ingenuity, a patient crew, and a large mallet.

Rigging and de-rigging are usually straightforward, but gliders can, and have been damaged - occasionally seriously - in the process, so it is important that everyone involved knows what they're doing, and if they don't, to be well supervised by someone who does.

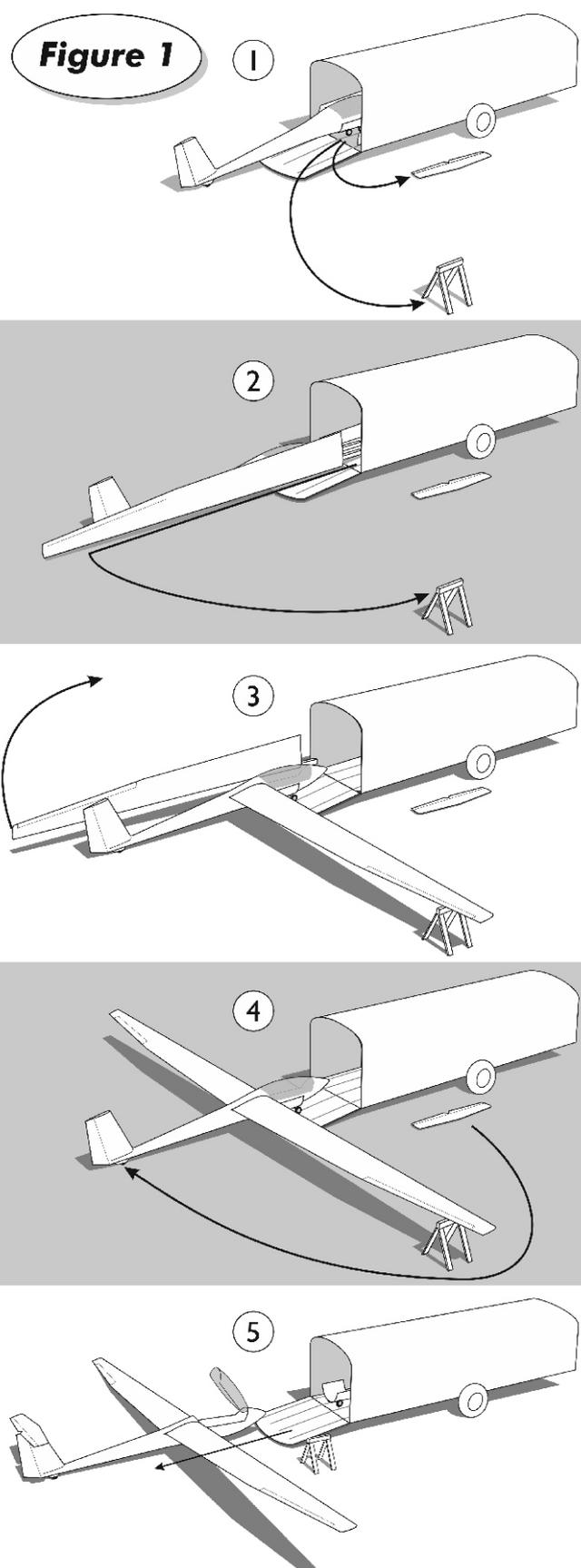
Unfortunately, opportunities to learn or even hear much about the skills are apt to be a bit thin on the ground. Landing out isn't exactly an everyday occurrence, and rigging and de-rigging don't figure much in general club conversation except as part of unhelpfully hilarious and/or horrific stories about retrieves. If clubs hangar their gliders at the end of flying, the opportunities for learning are even fewer. Private owners aren't much help here because they either rig on their own, have T hangars, or, not surprisingly, prefer to keep unskilled labour well away from their investment. Pre-solo pilots are, so to speak, 'uncalibrated'. They've no idea how heavy and unwieldy glider components can be, nor which bits are easy to damage and those that aren't. They don't know what 'take the twist' means, let alone what it involves. Does 'relax' always mean let go? ... and so on.

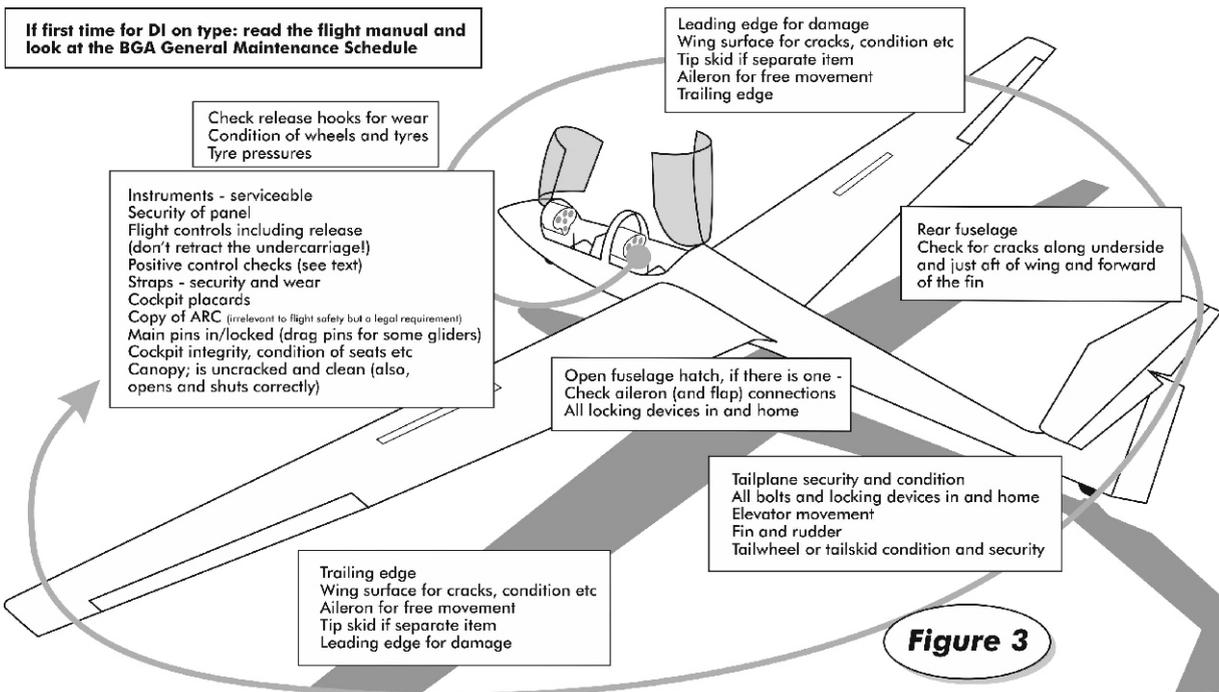
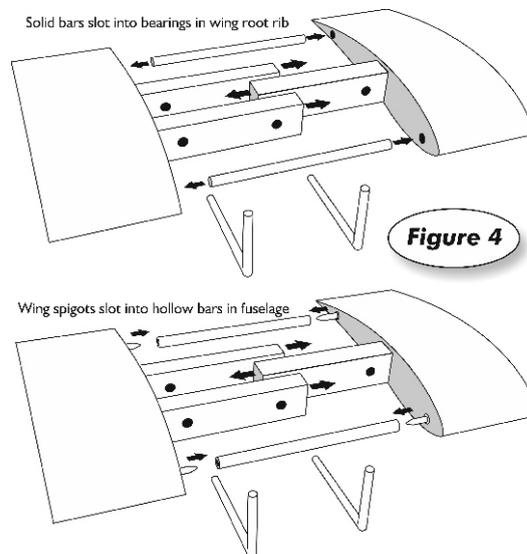
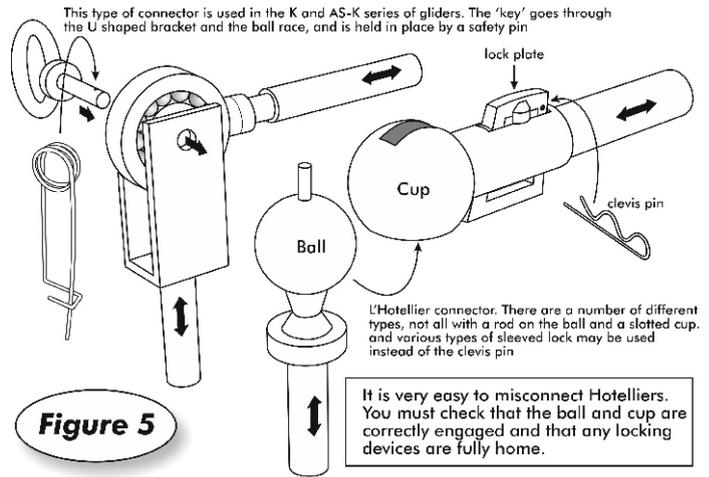
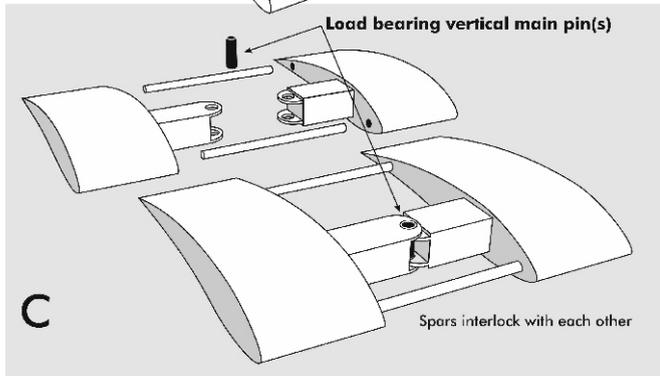
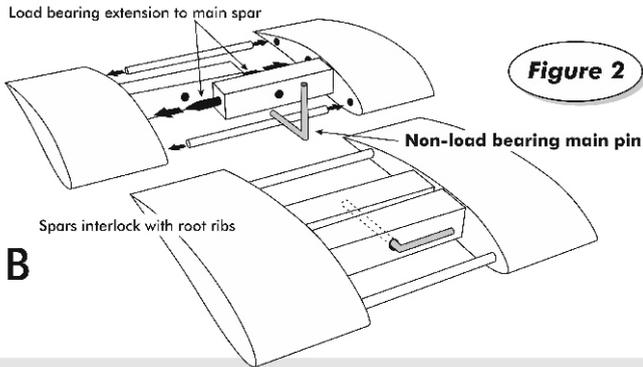
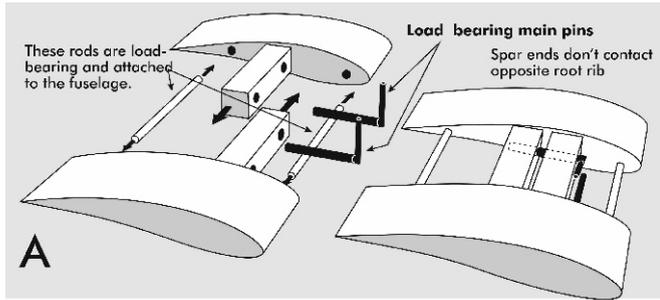
Suitable days for teaching rigging and de-rigging also require that the glider isn't flying, so any practice is more likely to take place on cold grey days when, at best, it isn't raining; the sort of days most people try to avoid. As a result, a solo trainee who flies club aircraft may only discover what de-rigging involves when they're roped in to retrieve someone else, or they themselves land out. The usual assumption in both cases is that whoever is in charge of the retrieve will know what to do. This appears to work, but as a teaching method it is haphazard and leaves a bit too much in the notoriously careless lap of the gods. Prior unhurried and unharried practical instruction in the techniques is preferable, accompanied by a short explanatory briefing on the subject. It doesn't have to be complicated. Always refer to the aircraft's flight manual for advice on rigging and de-rigging.

### Rigging

A first rig and/or de-rig needs to be closely supervised by whoever is in charge, and it's preferable that the trainee is by this time fairly well on in the training process and generally familiar with gliders. Though there are variations, at its most basic the sequence is more or less as illustrated in [figure 1](#);

- 1) tailplane out, fuselage out
- 2) first wing out
- 3) second wing out (tips/winglets on)
- 4) tailplane on. Connect all controls. If appropriate, lower and lock the undercarriage
- 5) push glider off trailer. DI





This list isn't overly informative and takes absolutely no account of type specific quirks/design features, amongst other things. Obviously the teaching needs tailoring to the aircraft being rigged, but there are more general points to be made along the way. Type specific detail also includes the trailer and its fittings, which are likely to have more individual variations (some of them bizarre) than there are glider types, though the situation with modern glider trailers is more uniform. As part of any instruction it is worth pointing out the pitfalls, or any areas which, on a general basis, can cause problems.

The instructions in this section are general and for guidance only. Always refer to approved published manufacturers information, in conjunction with the BGA GMS (Glider Maintenance Schedule) which outlines definitive rigging, de-rigging and DI tasks and procedures.

The following covers some of the points involved in rigging a 15m GRP glider, though almost all are applicable to any glider of any vintage:

- you must have read and understood the Flight Manual's rigging instructions for the glider, plus any notes that the club might have made about it
- fully understand the purpose and use of any tools and rigging aids, as specified by the manufacturer. Never use unauthorised tools or rigging aids as they can cause serious damage
- for almost every modern glider the trailer is a key item in the mechanics of rigging and de-rigging. Check it out before removing anything. This will give a good idea of how it's supposed to look when everything's back in. Trailer fittings vary, but at the least, note how they work on the trailer being used
- wind strength and direction can be a crucial factor. If the fuselage is wheeled out side on to a strong wind it will try and weathercock, particularly if the glider has a tail-skid. Rubber block type skids aren't very good on grass, but the metal ones common to older gliders are bad on concrete or tarmac. Also, taking a wing out of the trailer broadside on to the wind can be awkward and require more people than usual to handle. The wing has been designed to work exceptionally well when the wind/airflow blows onto its leading edge. If you offer it up to the fuselage leading edge into a strong wind, it will try to do exactly what it was designed to do, and either lift up or dive down. You may not be able to stop it. Best to have the wind blow along the span, either wholly or partially. Other factors may mean that there's no choice of trailer orientation. In which case rally lots of clued-up helpers
- be careful rigging when the trailer is sitting on even a slight slope along its length. The belly dolly which provided sufficient friction when the trailer and glider were on level ground may turn out not to provide as much as you thought
- if the tailplane needs to come out first, place it alongside the trailer where it won't be stepped on, or blown away if there's any appreciable wind
- NEVER put the tailplane on before the wings, and always take it off first. If the fuselage rolls over with the tailplane on very serious damage can occur. A few gliders have tailplanes which fold up on the fuselage and can't be taken off. Don't lock them down until the wings are on
  - set up wing tip trestles where they're supposed to go, or where they're easy to reach
- roll out the fuselage
  - does it stay in the dolly, on the trailer tailboard/ramp, or have to be lifted or rolled off? If rolled off, does the fuselage remain in the dolly for rigging or does the fuselage have to be supported (undercarriage fixed or retractable?) by a crew person - very common amongst older gliders
  - does the canopy have to be taken off before the wings are put on? If so, put it somewhere safe. Its usually safer to remove side-hinged canopies before offering up the wings - it can depend what gets in the way and what you might need to get at. Front hinged/swing-up canopies can be left open .. but watch out for the wind slamming them shut
- a specific wing may need putting on first, though it isn't usually a disaster if you do the wrong one. If one wing has a single root end spar and the other has two, the two pronged one usually goes on first ([figure 4](#))
- obvious as it may sound, try not to fall over while handling anything, especially the wings. Dropping a wing leading edge down onto, say, concrete from only a few feet (or from slightly higher onto grass) is a good but destructive demonstration of mass, inertia and acceleration
- push the first wing home and check that, looked at from above, the gap between the root rib and the fuselage is broadly parallel sided. Check the dihedral angle - it should be about the same as for normal flight
- put the trestle under the wing and check that it's secure. If the wing falls off the trestle there's a good chance of the fittings being bent and/or the spar end going through the top of the fuselage
- make sure the main pin or pins are within easy reach, and then offer up the second wing. The wingtip holder should provide about the same amount of dihedral in relation to the fuselage as on the opposite wing. (Note: if the fuselage isn't upright this can be tricky). Push the wing home. This can be a bit of a tussle with glider's using wing locking methods B and C ([figure 2](#)). B in particular because it requires 7 'pin and socket' joints (including the main pin) to be correctly lined up
- when the second wing is home check the other one hasn't come out
- insert the main pin (or pins) and push it/them fully home. Check that safety pins are in place or spring loaded catches connected. If the glider has a central vertically expanding main pin ([figure 2C](#)), make absolutely sure this is fully extended and fully home **at both ends**. The drag spar and front spar connections are automatic in modern gliders because the relevant load bars are built into the fuselage and either slot directly into the root end rib, or the root end spigots into them ([figure 2](#)), but on K13s, for example, there are drag and front spar pins instead. Make sure they are fully home and with their spring loaded 'hook' locks in place.

One might think that if the main pin wasn't in it would be impossible to get the glider clear of the trailer without the wings falling off, but in some gliders the main pin(s) are only there to prevent the wings sliding apart - ([figure 2, B, C](#) is a slightly different case in that it does both). Even when the main pin isn't in it is possible to get type B to the launch point without anything untoward happening, likewise if the main pins of A and C aren't fully home. With A you might get away with it, but not with B or C. When the wings are put under load and bend, as they will on a winch launch or if

manoeuvring vigorously after release from an aerotow, they'll come off.

- get help with the tailplane if there's an appreciable wind - the aerofoil is very efficient whichever way up it is and the unit is typically very light. It can also be big. Once the tailplane's properly located and pushed home, put in the locking bolt or bolts! If they're threaded (some stay in the fin and are both unthreaded and spring loaded) don't over-tighten them; finger-tight plus a bit more should be sufficient. Make sure any safety pins or spring-loaded safety locks are in place.

**NOTE:** L'Hotellier connectors (figure 5) are almost universal in modern gliders. They aren't fail safe. If the internal spring fails and the safety pin isn't in, the cup and ball will eventually part company. There are more types of connectors around than just the two illustrated in the figure. Almost none are completely fail safe. It is up to you to understand how they work, how they might not work, and to ensure that they are connected correctly and any safety pins/devices are properly engaged. Check.

- connect the elevator push rod. Put in any safety pins and check the connection visually, and additionally, try to pull (no brute force required) the push rod away from the actuating arm on the elevator
- connect the aileron and airbrake push rods. If the glider has flaps make sure they're connected. Put in the safety pins. Before closing the access hatch - if the glider has one - pull against the control rod connections to double check their security. A visual inspection isn't usually enough because even in bright sunlight it's often difficult to see inside
- don't assume that because the controls of some gliders are 'auto-connect' that they invariably do. In any situation where something is 'highly unlikely' or 'virtually impossible' there will almost inevitably be a set of circumstances where it's neither. Check
- if the glider was rigged on the trailer and has a retractable undercarriage, remember to lock it down before pushing the glider off the dolly
- tape the gaps between the wings and the fuselage, the tailplane and fin, and around the access hatch. This is important on modern gliders because not doing it can create considerable extra drag (and noise) and reduce the glider's performance
- do the DI

**NOTE:** If you drop anything into the glider (a safety pin down the fin, for example) during a rig, retrieve it before you do anything else, even if the item seems small and insignificant. If you leave it wherever it happens to be it probably won't stay there, and will start moving around. You may then be faced at some point during flight with a jammed control which no amount of effort on your part will unjam.

The glider should be treated as U/S until you have retrieved the dropped item.

## De-rigging

Even though this is rigging in reverse it is generally a bit easier to get the glider apart than put it together. Putting the glider into the trailer without damaging either, or both, is slightly more of a

problem, partly because de-rigging tends to be done in strange faraway places, and not always in ideal conditions.

- **NOTE:** if taking anything apart seems to require rather a lot of force, check - before you apply even more force - that you're not trying to do something impossible, like remove a wing with the controls still connected
- if you're in a field, check you've packed everything up before you leave

## Daily Inspections (DI)

**The main purpose of the DI is to check that the glider has been assembled correctly and is both structurally sound and fit for flight.**

Damage during rigging or de-rigging is one thing, but gliders can be rendered unairworthy by things that don't cause any direct damage. Failure to connect the controls correctly, or at all, is still a cause of serious accidents even though the DI and positive control checks ought to catch things like this. That they sometimes don't is often because the person who rigged the glider also did the DI, and was in a hurry. Genuine component failures do happen, but they are rare.

Only 'licensed pilots' can DI club gliders, so this bars pre-solo pilots from doing them. However, when training someone to do DIs, the first few sessions must obviously be 'guided tours' given by a suitably competent person. It will also be preferable - if not always possible - for the trainee to have been involved in at least one supervised rig or de-rig beforehand; this will give them a much better idea of what a DI's about, and why it is necessary.

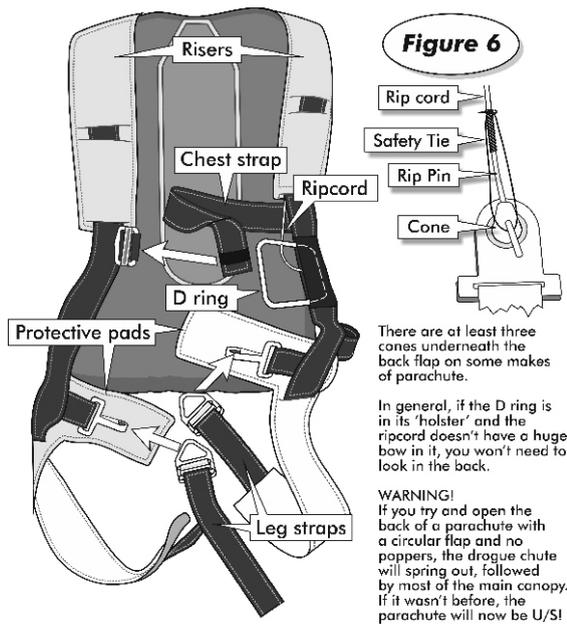
Points of general discussion might include:

- what we're looking for (both good and bad), and why are we looking for them (causes and consequences!)
- how do we know when something's wrong (eg., should we be able to wobble the fin sideways as much as this?)
- how serious is any particular fault likely to be (eg., superficial crack in the paint or something that's also in the structure underneath?)
- what needs to be done about it (is the glider U/S or not?)

Inevitably the first few demonstrations/walk throughs will be a bit wordy, but it is important to stress to the trainee the need for consistency and thoroughness. It's a mistake to assume that because a glider was 'alright' yesterday that it will be 'alright' today. This is how cursory DI's become the norm, and they are not 'alright'. The last landing of the previous day may have damaged the glider, and the pilot in charge might not have been aware of what happened, so there won't be any mention of it in the DI logbook. Nobody will know about it. Just occasionally a pilot may have known something went wrong and then have decided not to mention it. Regardless of what one might think about that, it's yet another reason for doing a 'proper DI'.

In addition, make these points to the trainee;

- give the DI your full attention. It's potentially life critical
- whether you rigged the glider yourself or not, be methodical. Follow a sequence. Start at the cockpit and work your way round the glider and back to where you started. Figure 3 lists most of the items that need checking, but refer to the BGA General Maintenance Schedule (GMS) which gives more detail on what's required



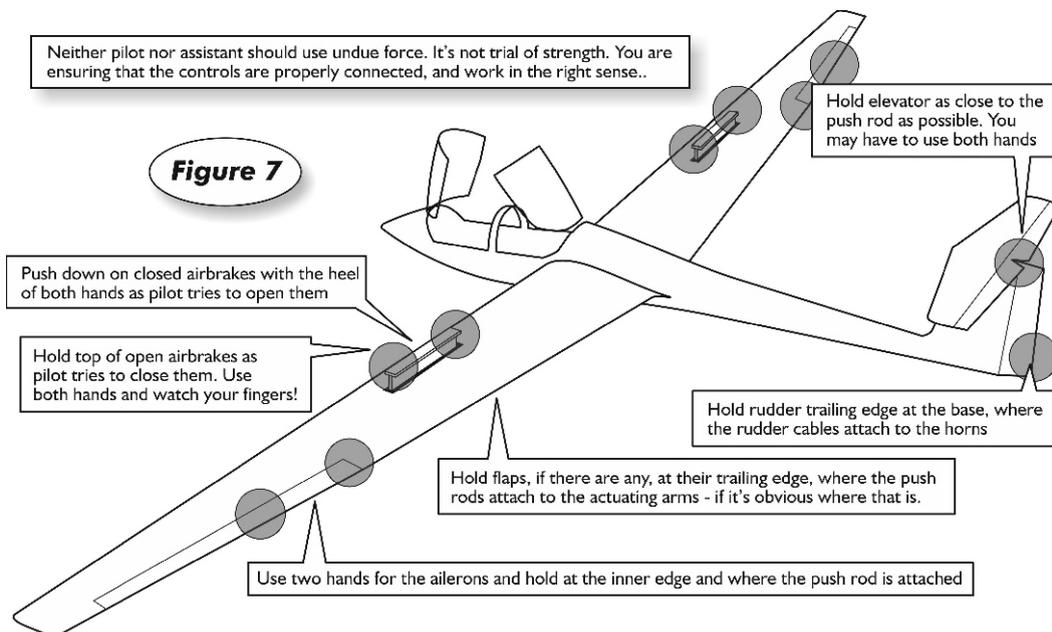
**NOTE:** It is very important that you don't allow yourself to be distracted or interrupted. If you are, go back one stage before continuing. Don't interrupt anyone else doing a DI unless there's a very good reason.

- if you're not sure about something you've come across, however trivial it may seem, ask
- leave looking at the glider's daily inspection book until you've finished the DI. It's easy to miss other things if you already know what you're looking for. When you do refer to the DI book and find you missed something, you'll know to be more thorough next time
- fill in the DI logbook and leave it in the glider
- parachutes are normally stored elsewhere and not left in the glider, but they are part of the DI. Be careful about how you check them out. Some have poppers (or velcro) and a flap on the back which you can open, allowing you to see whether the rip pins are properly through the cones (figure 6). Others don't have this, and if you try and open the flap (usually circular) the

drogue parachute will spring out like a Jack in the Box and most of the main canopy will follow it. You can't just stick all this back into the pack again. The parachute is U/S until it has been re-packed.

- Other points:
  - under an openable back flap there should be a thin thread around the rip cord and the rip pins (figure 6). While the thread can break, that doesn't make the parachute U/S - providing the rip pins aren't about to pull through the cones. The thread should never be replaced by wire or stronger thread as this may prevent the parachute from deploying
  - the rip pins should be unbent
  - with all parachutes check the release handle is being held in place and is neither flopping about, or looks to have been partially pulled
  - the harness should be in good condition, as should the pack and the metal fittings
  - check with the packing log card (which may be kept elsewhere) that the parachute is in date
  - if the parachute feels damp, it is U/S
- make sure that any documentation you are legally obliged to have onboard is actually there. Some of it has nothing whatsoever to do with flight safety, but you can still be prosecuted or invalidate the insurance for not having it to hand
- check that the cockpit information placard is legible and in date
- by all means check visually that the handle of a retractable undercarriage is in the correct detente, but during the cockpit checks try not to retract it

The most critical DIs are after a rig, and before the first flight following any major inspection/work, such as the C of A. Check that the controls work in the right sense. Rare though it may be, it is easy to connect cable operated controls - common in older gliders - the wrong way round when putting everything back in place. Applying right rudder might then give you left rudder, and vice versa. Cross connecting the ailerons is much more serious because, judging by accidents in the past, you don't have any time to work out what's wrong if you've just taken off and a wing starts to go down. Cross connecting rod operated controls is far harder because it



usually requires them to be bent over each other using sheer brute force. You'd probably notice! Check.

It is very important to be aware that the person ultimately responsible for the safe condition of the glider - even if they've done none of the maintenance or the DI - is the pilot in charge, the PI.

### Positive control checks

These are to check the security of the connections and that the controls are moving in the correct sense. There are two ways to do this, one with the pilot holding the stick central, and the other with the assistant preventing the control surfaces from moving. In most cases it may be better for the pilot to move the stick against the assistant's resistance, and the advice that follows assumes this convention.

In T-tailed gliders the elevator can go up (stick back) and down (stick forward) even when not connected to the vital push-rod that comes up through the fin, simply because the elevator rests on the end of the push rod. In flight the elevator will stream in the airflow, and even if small amounts of 'up' are available by virtue of the push rod contacting the elevator, there won't be any down. Check the connection!

As far as the ailerons, airbrakes (perhaps flap) connections are concerned, the access hatch in modern gliders is small and getting two hands in is difficult. It's usually dark inside and not easy to see what you've done, or even to do it in the first place. L'Hotellier connectors are clever devices, but it is possible to half connect them. They will look OK until any force is applied, whereupon they pop apart and disconnect. This is not something you want to happen when you're in flight.

In all the above cases positive control checks should pick up the problem.

Don't be heavy handed with these checks. If a held aileron starts to bend when the pilot moves the stick it means it's not being held near the actuating rod - which isn't always in the most convenient place for the check. Two hands might be better; one across the gap between the aileron and wing (see [figure 7](#)) and, if possible, the other adjacent the push rod.

One important part of the positive control check is not to provide the person holding the control surface with the answer to any questions you ask them. For example, don't say *Elevator up?* It is not unknown for the assistant, despite all physical evidence to the contrary, to say 'Yes' when the right answer would be 'No'. Box clever on this. Say *Elevator?*, for example, and *Left aileron?* If your assistant knows exactly what you're asking, then he has to look at/feel the control surface movement before giving you an answer.

### Pilot maintenance: gliders and motor gliders

If you have found a problem with the glider during a DI, or you want to do maintenance work on it such as change a tyre or replace an instrument, are you allowed to do it? Two important principles are involved:

- Firstly, you must have permission from the aircraft's owner(s) to do any work. If you happen to be the owner you obviously don't need to ask your own permission,

but if you intend working on club aircraft (even if it is only to change the tyre) you must obtain the Club's permission. Strictly speaking this would be through the club's committee, but it is more likely that on the grounds of common sense and simple practicality they will have designated 'a responsible person' (or persons) to make such decisions on their behalf.

- Secondly, you are only permitted to do work which you are competent to carry out. If you're not sure how to do something, you can do the work under the supervision of someone who is officially regarded as competent - who may decide that you're not. It is they who will take final responsibility for the quality of your work.

If the aircraft is part of the BGA maintenance organisation you can find a list of what you can and can't do in the BGA Airworthiness and Maintenance Procedures Manual (AMP), available in the technical section of the BGA website. If you can't face wading through the ever expanding paper work, refer to a local BGA inspector, who will be able to advise, guide and train you to do simple maintenance tasks.

### Walk round before flight

The person ultimately responsible for the 'safe condition of the glider at take-off' is the pilot in charge, the PI. If you're the owner, rigger and DI'er, there are no problems. You get it wrong, your fault. The situation is slightly more complicated if you're not the owner (it's a club two seater, say), and you neither rigged it nor did the DI. Don't assume that if you are getting into a glider which you don't own that all the pre-flight actions have been carried out. At the very least have a look at the DI book.

It pays to do a walk round before you get into the glider. This is not a DI, it is a final check to confirm that the glider is fit for flight and that you haven't forgotten something obvious, such as leaving on the tail dolly.

### Tail dolly piece

Taking off with the tail dolly still attached makes keeping straight on the take-off or landing ground run a bit fraught - particularly if there's a cross wind. You could argue, somewhat flippantly, that if the glider does a ground loop during landing - which is quite likely - at least the castoring tailwheel will help stop the fuselage breaking in half, but the most serious problem you're likely to encounter is far more dangerous. Tail dollies are heavy and about as far away from the CG longitudinally as it is possible to get, and if you're already towards - or at - the bottom end of the allowable range of cockpit weights, the CG may be pushed way outside limits. You're then highly likely to be faced with a serious control problem at the worst possible moment - just after you become airborne.

A further depressing aspect of tail-dolly incidents, risk to life and limb excluded, is that not only does the pilot not notice anything wrong before he straps in, but neither, apparently, does anyone else; not the wingtip holder, the launch marshal - no-one. Are we paying attention?