PARACHUTE & HARNESS EQUIPMENT CARE

Chute Clinic, with Notes on Willi Muller's Presentation

by Rob Kells and Steve Parsons
Courtesy: WILLS WING USA

The following article is taken from an outline we use to do parachute seminars. It is written with the hope that you will take this information and put it to use in your flying, to increase your flight safety. This is not about how to repack your parachute. We suggest that you leave the packing to someone who does it often. Our thanks go to Vincene Muller for badgering us into writing the original article and to Sherry Thevano for pestering us to update the material.

Over the last several years we have done 25 parachute seminars, and repacked more than eight hundred 'chutes.

Over 1/2 of the systems in the early seminars were improperly maintained and 10% of these parachutes would not have deployed under any circumstance! These statistics have improved dramatically over the years as pilots come back to service their equipment annualy.

If you have not attended a formal parachute seminar we suggest that you do so immediately. Aviation has made the world much smaller but it is still hard to miss it if you fall!

PARACHUTE DEPLOYMENT SEQUENCE

LOOK-GRASP -PULL-LOOK-THROW-PULL-
LOOK for the handle, **GRASP** the handle, **PULL** the deployment bag from the container (with most systems a down-and-out at about 45 degrees works best), **LOOK** for clear air, **THROW** towards clear air and into the direction of the spin, **PULL** the bridle (reach back to your main support strap to locate it) To clear the chute from the container and accelerate the deployment sequence. If the parachute is not open, pull it back and repeat the throw.

Try to steer away from ground obstacles and land into the wind. In a paraglider after the deployment you want to try to fly the glider up to meet the reserve or if you are unable to do that pull continuously on a brake line until you have the canopy in your hands to avoid downplanning.

If your glider is falling at 60 MPH, (88 feet per second), three seconds is 264 feet; if you take ten seconds the distance will be 880 feet. The successful execution of the deployment sequence under adverse conditions will depend on your level of preparation. Do not practice in-air deployments! They can be very dangerous.

There is no substitute for repeatedly practicing this procedure in a simulator. Deployment times range from three to ten seconds. The deployment times have gotten faster over the years of repeated seminars through practice.

EQUIPMENT SELECTION AND CARE

Your chute is only one part of your safety system. As with any system, reliability is only as good as the weakest link.

HARNESSES

All properly built harnesses are strong enough to withstand the openingshock of a normal parachute deployment if they are properly maintained. Most harnesses are not designed to withstand the opening shock of a hang glider reserve from terminal free-fall velocity. To withstand higher loads and adverse loadings conditions- like head down—the shoulder straps, leg loops and back strap should be joined by a primary structural reinforcement to the main support straps. If you are interested in a technical reference on conventional skydiving equipment and parachutes, we recommend *The Parachute Manual* by Dan Poynter, available from Parachuting Publications: P.O. Box 43232, Santa Barbara, CA 93103.

CARABINERS

Aluminum carabiners are typically rated at 1800 to 2800 kilos (4,000 to 6000 pounds) ultimate strength when new, but are susceptible to fatigue from nicks and scratches. Most steel carabiners are rated at about 5000 kilos (11,000 lbs.) are are much more durable. We do not know of any failures of high quality alloy steel carabiners, but we suggest that you replace even a steel carabiner after 3 to 5 years of regular service, and replace aluminum carabiners at any time there is apparent wear.

ULTRAVIOLET DETERIORATION

Harnesses, sails, and parachutes are constructed primarily of nylon, polyester, Kevlar and/or Spectra. All of these materials deteriorate with exposure to sunlight. Sunlight is by far the greatest factor in the decay and depreciation of your equipment. The rate of deterioration depends on many factors: the type of material, the finish or coating applied to yarn fibers, the thickness of the material and of course, the intensity of the radiation. Fluorescent pigments fade as much as ten times faster than more stable colors such as dark blue or black.

UV deteriorated stitching in webbing support straps may fail long before webbing becomes unserviceable. You can minimize the adverse effects of exposure by not setting up until you are prepared to fly and stowing your glider and equipment in their protective cover bags promptly after landing. If you fly regularly, and your equipment sees a lot of UV, have any suspect items inspected by your dealer or the manufacturer.

Paraglider fabrics typically have a useful life of between 150 and 300 hours or more of air time, depending on materials and construction, if they are properly cared for and maintained.

BRIDLES

Most older parachutes were constructed with 2 inch tubular nylon bridles. If properly sewn, these bridles have an ultimate strength of approximately 4,000 lbs. Today's standard bridle is 1 inch flat webbing, usually Type 18 or Type 24 with an ultimate strength of approximately 2800 kilos (6000 lbs.). This webbing, style is much less likely to be cut by hardware. The minimum bridle length for hang gliders should be 25' to reduce the likelihood of parachute entanglement with the glider.

Paraglider bridles are typically five feet in length and require a structural attachment to the harness that will bring the pilot down feet first.

Finally, a protective sheath on the exposed portion of your bridle willreduce wear and tear and UV deterioration. A sheath is particularly important on Kevlar bridles which are thinner and loose strength at a much faster rate.

CANOPY DESIGN

Standard conical parachutes were the most common configuration used for hang glider reserves in past years. A variation of the conical configuration is the "Pulled Down Apex" (PDA). These designs have a short center line attached to the apex of the canopy to increase the inflated diameter. PDA's can be made smaller in weight and bulk without sacrificing decent rate. Since deployment time is a function of size, PDA's usually open faster. Unfortunately, opening shock is a function of opening time, so faster opening chutes open harder.

When Wills Wing first tested a PDA design in 1981, the opening load from a deployment at 120 mph with a 300 lb. dummy failed the skydiving test harness. At lower speeds typical of most hang glider and paraglider deployments, this shock would be significantly lower, but we recommend that you do not combine the PDA design with an inelastic Kevlar bridle.

A further concern with PDA's is sensitivity to design and tuning parameters. A rigorous drop test program is essential for development of a stable, low sink rate, structurally reliable design. If for example the apex is pulled down too far, the canopy will be unstable and oscillate.

Some very early parachutes were manufactured with only 10 lines compared to the twenty or more lines on most designs. These early chutes should be either refitted with 20 lines by a certified parachute shop or replaced with a more airworthy design. Also, most modern canopies use "v-tab" reinforcements at the line/skirt junction and additional panel reinforcement. Most chutes can be upgraded to this configuration if desired. Any chute which has been exposed to excessive heat or caustic/acid liquids should be inspected by a qualified rigger or the manufacturer. Damaged panels can be repaired or replaced for a nominal charge.

It is very important to realized that all chutes are not created equal! Different makes of canopies with the same numbers of gores (panels that make up the parachute) can vary in sink rate performance by more than fifty percent!

Free Flight Enterprises has discontinued production of the 18 Gore PDA. We feel that too many pilots are choosing size rather than margin of safety. Many heavy pilots, flying in adverse conditions, have purchased them for the reasons cited above. A pilot under 150 pounds body weight is within the recommended weight range of an 18 gore only at low density altitudes (although there have been many saves with more weight). Wills Wing and Free Flight have chosen the conservative path and they recommend larger reserves.

Below is a table that will allow you to compare the relative sink rate verses test weight data.

DEPLOYMENT BAGS

All modern hand deploy systems are packed in a bag or diaper to help clear the canopy and lines to the perimeter of the glider before the opening sequence initiates. Most malfunctions that we have observed during practice deployments at parachute seminars are related to poor bag design and/or lack of maintenance (the rubber bands are brittle or even broken). If your deployment system relies on rubber bands, they should be replaced at lest once every 6 months; more often if in a hot climate. You must use the recommended size and type of bands for the bag to function properly. Wills Wing/Free Flight containers include a separate pocket for protecting and stowing lines, also reduces the likelihood of problems normally encountered with poorly maintained systems.

PIN LOCKS

An accidental parachute deployment is a very dangerous occurrence. A pin lock system is the most effective mechanism for preventing an unintentional deployment without compromising your ability to execute a normal deployment. If you do not have a pin lock system, have one installed before your next flight. You must use the proper pins, finger lock and continuous eye assemble. Cotter pins can jam and effectively make deployment impossible.

BALLISTIC/MECHANICALLY DEPLOYED CHUTES

A number of mechanically deployed parachute systems have been marketed to pilots. Rocket deployed systems offer the best performance and seem to be the only ballistic systems suitable. Deployment is very fast without recoil. Both rocket and parachute are mounted on the harness. Some configurations have an optional hand deployment sequence in case of mechanical failure. The newest theme on rocket deployment is one that is powered by compressed air.

Rocket systems have many saves to their credit, some which probably would have been unsuccessful with hand deployments. Still, there are significant safety concerns beyond those associated with hand deploy systems. Proper installation and maintenance is more critical to reliable performance. Improperly installed rocket systems may be impossible to activate, or worse, may injure the pilot or bystanders within range of the rocket. Many pilots opt for an independent dual parachute system-one

rocket and one hand deploy. A dual system also provides an additional margin of safety in case of parachute entanglement, at the expense of increased weight and expense.

NEW HARNESS :
INITIAL INSPECTION AND PREFLIGHT

The following inspection should be performed before each and every flight. A thorough harness preflight is equally as important as a glider preflight. Once familiar with the procedure, it takes only a few moments.

1) Inspect the seams on the main suspension straps.
2) Inspect the seams on the leg straps, both sides. If your harness is equipped with adjustable let loops, check the folded stop at the end of the loop to make sure it is securely sewn and will prevent the webbing from slipping through the buckle in the full loose position.
3) Inspect the seams on the shoulder straps and the webbing loops for the forward support lines to your shoulder and chest area, both sides. Check the adjustment of the shoulder straps and lock them as shown in the harness adjustment procedure.
4) Inspect all other seams; look for any missed stitching on webbing junctions.
5) Inspect the carabiner. Nicks and scratches are stress risers and may cause premature fatigue induced failure.
6) Inspect all the webbing/parapac for material flaws, cuts or wear.
7) Check that your parachute is secure in the container and that the safety lock system is properly installed.
8) Bounce up and down in the harness to test that the parachute container Velcro and safety lock system is secure and properly installed. The bridle should be taped or velcroed to the main support strap to stop it from fluttering in the wind and make it less likely to tangle. A force of not more than 20 lbs should release the bridle from any such securing mechanism.

GENERAL HARNESS MAINTENANCE PRECAUTIONS

Do Not Leave Your Equipment In the Sun. Ultraviolet light is very harmful to nylon and polyester materials. Avoid exposing your harness to extreme heat. The bed of a pick-up truck or the trunk of a car may get excessively hot due to the routing of the exhaust system Heat is particularly damaging to parachutes.

Keep Your Harness Clean. Acids, gasoline and other solvents may degrade the structural material in your harness. Do not use harsh detergent or cleaning agents. Wash with plain water, using a sponge or soft brush and a mild detergent applied locally to spots and stains.

Inspect Your Carabiner. Replace if it is nicked, deeply scratched or if the locking gate does not function properly. Do not clip your carabiner into any point that does not provide a completely free unrestricted pivot. Torsion or bending loads will significantly reduce its strength.

PREFLIGHT PRECAUTIONS

Before every flight. Perform a complete pre-flight inspection of your harness. Check for excessive wear. Inspect all knots. Check to make sure the lines are properly routed, your parachute is secure and that your harness is properly clipped into the glider. Make sure that your legs are in the leg loops. If for any reason you unclip before flight, take the time to **do another check**. Taking off unclipped or with an undetected harness or other suspension problem is one of the most frequent and most dangerous errors made by experienced pilots.

Practice entry and exit procedures in a simulator, with storage containers loaded, before your first flight.

Exercise extreme caution when flying over water or landing in restricted beach area. **If you land in the water,** unhook from the glider and hold the carabiners in your hand to prevent them from hooking lines. Do not try to get out of the harness until you are free from the glider. Most harness body's are padded with closed cell foam which will provide some flotation.

Most harnesses have a zippered convenience pouch in the bottom of the parachute container. Do not load this pocket with anything which might interfere with the parachute. Do not store any sharp objects in the front containers which might be dangerous on a crash landing.

Install a hook knife on an easily accessible area of your harness.

REMEMBER THAT IT IS IMPORTANT TO BE PROFICIENT AT USING YOUR EMERGENCY RESERVE AND TO MAINTAIN YOUR EQUIPMENT.

THE SINGLE MOST IMPORTANT DECISION WE CAN MAKE AS PILOTS IS WHEN NOT TO FLY SO WE NEVER NEED TO USE OUR RESERVE!

'CHUTE CLINIC

I have had the pleasure of attending Willi Muller's 'Chute Clinic held in Vernon each year. It is one of the most professional and detailed presentations I have encountered in the sport. The Clinic is based on Rob Kells revised Parachute Deployment/Repack and Harness Inspection article which I am sure Willi would be pleased to forward.

While reading this article alone would benefit any pilot, I cannot urge clubs strongly enough to take advantage of accessing professional skills and practiced eyes to point out problems and solutions.

Dealers present at the clinics can do a very brisk business bringing some rather surprised pilots up to snuff with their equipment. In particular:

1. The double pouch deployment bags prove their worth.
2. Many pilots replace worn and UV faded bridles.
3. Willi Muller's cheap and effective suggestion to extend short bridles with (easily replaceable when damaged) 5' Paraglider bridles is a big hit.
4. Many pilots will no doubt be contacting companies capable of harness repairs or upgrades.

Some 'chutes are almost guaranteed to malfunction—one really important reason for having this course regularly.

Use 1'/4" X 2" (5mm X 5 cm) width rubber bands, example Wilson #64, or APSCO #61, for the side of single pocket bags which require all shroud lines to be folded into one bundle along the side of the container and secured by one rubber band at each end. For the three ties closing the flap of this container type, and for double bag containers which have a maximum of one fold of shroud lines banded by the inner container fold as well as only one fold of bridle line banded by the outer container fold, use the shorter 1/4" X 1 1/4" rubber bands.

The point in both cases is to firmly secure the lines with only 1 inch (+) of folded line protruding. Excessive line protrusion through the rubber band can result in the lines folding over the band, one of the big causes of deployment failure in practice sessions.

The use of 3mm width rubber bands should be discouraged. How did these ever gained acceptance over the years? 3mm width bands have too much stretch and because they don't hold the lines firmly enough are usually installed with 2–3 inches of shroud lines protruding in order to hold them. Alternatively we often see very short, narrow or broad bands which pinch grab the shroud lines.

This is, in my opinion, one of the major causes of deployment failure in practice sessions—as I said above, the shroud lines fold over the rubber band—effectively a lock out. In particular, the practice of stretching the bands to double wrap the shroud lines in order to hold them firmly is to be condemned—an obvious knot situation.

The double pocket deployment bags are a marked improvement on the old single pocket system which stores the side shroud lines in a bundle on the side. It is difficult to envision this system running into deployment trouble as only two single folds of the shroud lines next to the 'chute and two single folds of the bridle just past the shroud line attachment are secured by rubber bands. This system appears trouble-free and its comparative ease of deployment is a dramatic selling point for it in practice sessions. Poor deployment bag design combined with the wrong rubber bands accounts for most failures.

WILLI MULLER NOTES: Practice the look-grab-look- (mentally) throw procedure in-air whenever you are bored.

Paragliding Reserve Chute manufacturers have a great "invention" for us. They have a short (+5') bridle attached to the shroud lines—it's all they need. Hang glider reserve chutes' greatest wear and tear occur to the exposed section of the bridle, from where it leaves the container to the carabiner attachment point. Also, most older chutes are of inadequate length (+18').

Both problems can be solved by adding one of these 5' sections on to the end loop of your parachute. If wear and tear occurs, don't replace the entire bridle (the contained section is usually in pristine shape) you just unloop the paragliding section and replace it. EASY, simple solution!

PDA reserve chutes descend like a falling leaf—disconcerting but effective—some have recorded 1/2 the sink rate of older reserves.

A For Sale table with replacement bridles, carabiners, double containers, pin locks, UV over sleeves, etc., generate good sales.

Decisions to replace unsafe items like worn bridles, carabiners, or to upgrade to new ideas such as double bag containers, get rationalized and discarded if "impulse shopping" is not provided.

This information provided at the Reel Hang Glider Pilots annual Parachute Clinic.