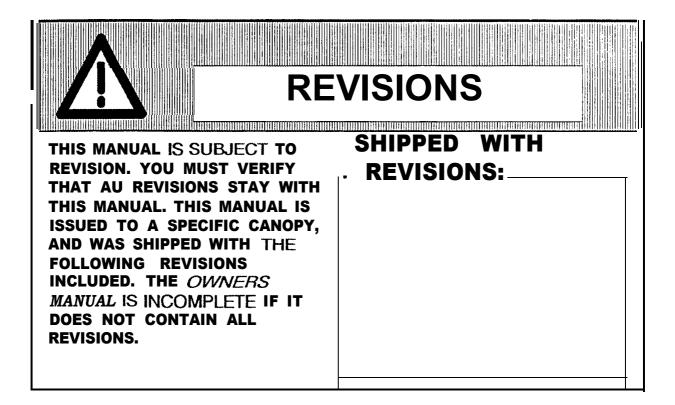




Serial #:



Ram-Air Parachute Owners Manual

Part # PI 3001

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Quick Reference:

Please read this manual for the first time from front to back, beginning on page 1. After doing this, please fill in and return the postage-free owner registration card.

To find:

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About this manual . . .

Single words displayed in **bold** type will be found in the Glossary on page 7 **or** in the above "Quick Reference."



This warning **symbol** indicates items of extreme importance throughout the manual. Bold **type** is also used **for** emphasis.

WARNING



Skydiving is a sport in **which** the risk of **injury** or death is inherent. Nothing can reduce the risk to zero **or** guarantee your safety. Your participation in the sport is an admission that in spite of the training you have received, the level of proficiency you have achieved, the equipment you have bought **or** borrowed, and the abilities of all involved in your skydive, **injury** or death could occur.

Your participation means **you accept total responsibility for your own injuries or death** whether arising from personal error, equipment malfunction, the others involved in your skydive **or** manufacturer error.



In spite of all that is done to **ensure that** our canopies will operate properly, nothing and no one **can** guarantee that **injury** and death will not occur as a result of their use.

By jumping **our** canopy you are accepting the risk that it may not operate properly due to your error **or** to a **defect** in design, raw materials, workmanship, manufacturing process, **or seller's** error. By using this canopy, **or** allowing it to be **used** by others, you waive any manufacturer liability for personal injury or other damages arising from such use. **If you are not willing to accept this risk**, **you may return the unused canopy to your dealer within 30 days of purchase for a full refund.**

Precision canopies are **sold** with all faults and without any warranty for fitness for any **purpose. Manufacturer** also **disclaims** any liability in tot-t for damages, **direct Or** consequential, including personal injuries, resulting from a malfunction **Or** from a **defect** in design, material, workmanship, or manufacturing technique whether **caused** by negligence on the **part** of the manufacturer **or** otherwise.

TRAINING



Unlike simple **decellerating** devices such as traditional round canopies, the ramair parachute is a true flying **machine** and **cannot** be operated safely without a thorough understanding of the proper techniques.

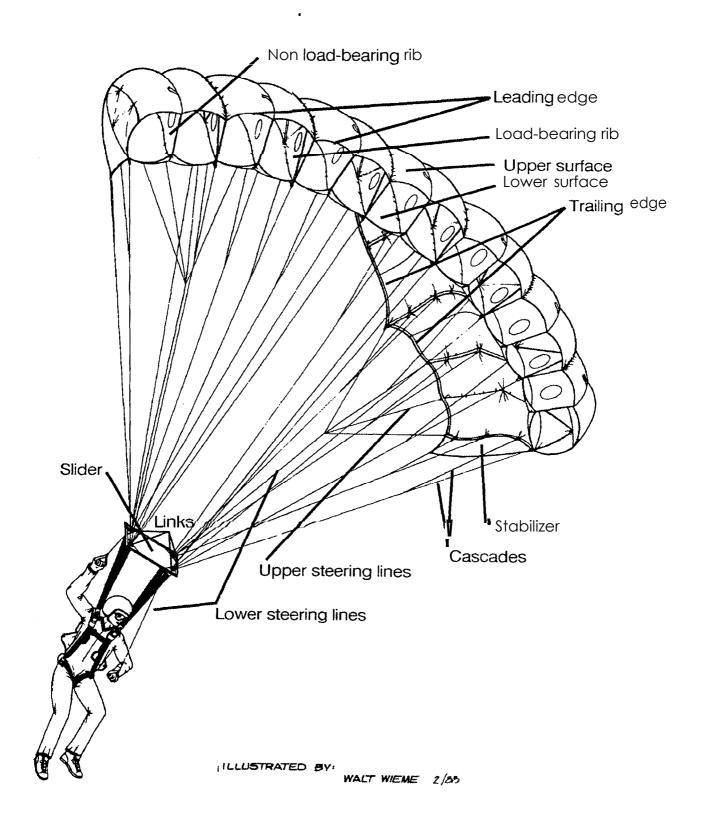
Precision Aerodynamics makes no attempt to provide training either through this manual **or** in any other way. Your **purchase** of this equipment does not represent an assumption by the manufacturer that you are appropriately qualified to operate it.

Before using this equipment you must complete a **controlled program** of **instruction**, and read and understand all appropriate flight manuals and packing instructions.

US E I N COMPATIBLE HARNESS/CONTAINER



This Precision **product** is not a complete parachute System. It is meant to be used only in conjunction with **approved** harness/container Systems . **Assembly** instructions (for connecting the canopy to the harness/container System) are provided in this manual. **Packing** methods (for folding the canopy, stowing the lines and Container closure) will vary with Container **design**. Be certain to obtain packing instructions from the Container manufacturer.



PRECISION AERODYNAMICS

Glossary

Aft section-The section of canopy located between the D line groups and the trailing edge.

Angle of attack-The angle created by the relative wind line and the Mean Aerodynamic Chord line of the wing.

Approved-For the purpose of this manual, refers to procedures or items subject to manufacturer approval.

Aspect Ratio-Descri bes t he relationship between the dimensions of a canopy. It is expressed as span divided by chord. A ruler 12 inches long and one inch wide has an aspect ratio of 12, written as 12:1.

Assembly-For the purpose of this manual, refers to the attachment of the canopy to the risers. The procedure for attachment to the harness/container is determined by the harness/container manufacturer.

Chord-Refers to the distance from the canopy **leading** edge to the canopy trailing edge.

Compatible-The manufacturer of the harness/container to be used has tested and determined compatibility with the specific model and size of each component in the System.

Exit Weight-The weight of the jumper including all equipment. The "ready-to-jump" weight.

FAA Parachute Rigger-A person identified and certificated by the FAA for packing of reserve or emergency parachutes. To pack a reserve or emergency parachute, a person must additionally meet all qualifications outlined by each manufacturer of the equipment involved (see page 13).

Lift-to-Drag Ratio-The lift

generated by a device, divided by the drag produced, expressed as a ratio. Nominally equal to glide ratio. Anything which increases (or decreases) the ratio of lift to drag increases (or decreases) the theoretical glide angle.

Packing-For the purpose of this

manual, refers to stowing the folded canopy in the harness/ Container and closing the Container. Packing instructions are provided by the harness/ Container manufacturer.

Porosity-Is an index to the resistance of a material to Penetration by **fluids** (air). Low **porosity** indicates a great resistance to air migrating from one side of the material to the other. **High porosity** indicates a material **which** allows air to pass through.

Span-Refers to the distance between the canopy right side and canopy left side.

Wing Loading-Is expressed as

the amount of weight supported by a given Segment of the surface area. Example: **a** canopy with 200 square feet of surface supporting an exit weight of 175 pounds yields a wing loading of .875 pounds per square foot (175/200).

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New Owner's Checklist

O Before assembling this canopy to a System, complete the following Checklist:

A AWARE that if this canopy is approved for use as a reserve, federal law requires it to be inspected and installed (and repacked at the appropriate intervals) only by a current qualified FAA parachute rigger. Federal law also requires the canopy be packed according to instructions provided by both Precision and the manufacturer of the harness/container System. I have read and understand the Federal Aviation Regulations (FAR) Part 105. (see page 53.)

O **I UNDERSTAND** this canopy is not a skydiving **system**, but rather a **part** of a total System. It must be installed in a **compatible harness**/ Container **system** in accordance with instructions provided by the manufacturer of that **system** and by Precision Aerodynamics.

O I AM QUALIFIED and practiced in the Operation of a ram-air parachute canopy. I have read and understand the section in this manual on "Canopy Size Selection" (page IO), and have determined the best canopy size for my weight. I understand my exit weight will affect canopy behavior and Performance, especially glide and landing Performance.

O **IUNDERSTAND** this canopy is designed to be used as a main canopy only, unless it has been TSOed for use as a reserve. It may be used as one or the other (if FAA approved for use as a reserve) but it is not to be used for a reserve if it has been intentionally jumped as a main canopy. One familiarization jump is allowable prior to packing for reserve use.



O I HAVE INSPECTED the shipping Container and contents for complete materials and for darnage which could have occurred during shipping. All components are included and are undamaged.

O I UNDERSTAND the necessity to explore the flight behavior of any new canopy by operating it initially under the safest possible conditions. I know all parachutes can be incorrectly installed (and can therefore operate incorrectly). I know I need to leave extra margin in selecting a flight path when judging the performance and behavior of a new canopy.

O **I AM FAMILIAR** with instructions for storage, cleaning, maintenance and repair beginning on page 48.

| HAVE CHECKED

compatibility of my harness/ Container system with this canopy, and the harness/container includes all necessary components not included with the canopy.

O I HAVE READ and understand the "Packing Instructions" on page 17 or 25 (for main canopies) and have provided my rigger with the appropriate reserve packing instructions (pages 13-24) if this canopy is to be used as a reserve.



Selecting the **Right Canopy**

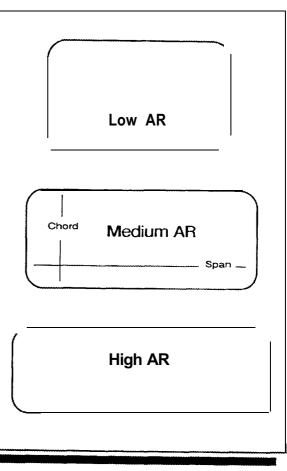
Weight and See

This section provides information on canopy selection and the ways in which Performance varies with exit weight. Use this information to select the proper canopy for your weight and/or to ascertain how the performance and flight behavior of your canopy will vary depending upon where your weight falls along the acceptable range. Although some pilot weights may fall within the acceptable range for more than one canopy size, Precision recommends you choose the canopy for which your listed weight is not at one extreme or the other of allowable weig hts.

Choice One: Which Canopy?

Your first decision in selecting a canopy will be choosing an Aspect Ratio (AR). A higher AR (it means a wider side-to-side, or **span** compared to the front-to-back or chord measurement) produces less drag for a given amount of lift, which results in a more efficient design.

Higher AR canopies (Precision's Falcontm, for example) exhibit performance significantly better in one area: a much improved



Lift-to-Drag ratio $(^{L}/_{D})$, because the drag produced for a given lift requirement is even less.

For equal canopy areas, these canopies provide more "glideability" than their smaller, more "Square" counterparts. This performance is gained at the expense of some of the more familiar characteristics of traditional canopies. The higher Performance may demand more from the Operator: more judgment; more planning; more landing area. The high-AR canopies deliver more forgiveness in selecting an exit "spot" but in return require more accuracy during final approach and a longer area for the landing flare. If "nailing" the target is your bag, or for tighter landing spots such as those encountered in most demonstration jumping, you may not prefer a canopy with a super-high Aspect Ratio.

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Remember: Higher Aspect Ratios yield more efficiency in the **glide** and require more area for the final **approach** and landing than their counterparts with lower Aspect **Ratios**.

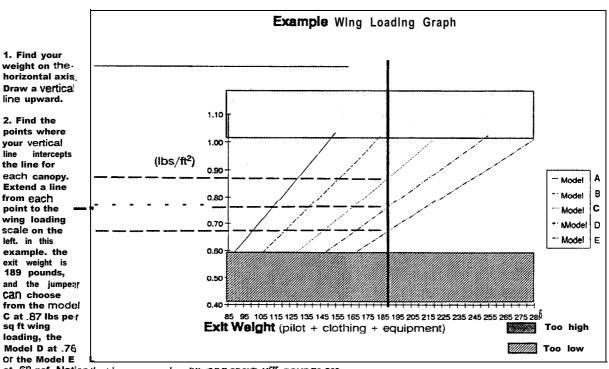
Choice Two: Which Size?

After canopy type another choice exists: Which canopy size?

In determining the weight range specification of a canopy, the manufacturer considers many factors: What weight will the canopy stand structurally? Where do you draw the line as flig ht Performance deteriorates at high speeds (too little weight) and low speeds (too much weight)?

As a jumper selecting a canopy size, you should consider the same factors. There is a theoretical "ideal" weight for each canopy. But since the number of canopy sizes it's feasible to build is limited, you may not actually be able to choose a canopy for which your weight is ideal. Precision recommends you choose a canopy which allows the most margin on either side of your weight. In other words, it's best not to choose a canopy for which your weight is at the extreme of allowable weights.

Please turn the page for more Information. . .



at .68 psf. Notice that jumpers below 85 and above 285 pounds are outside the acceptable weight range for these canopies. Remember too that reserves are approved by FAA under TSO C-23c category B for use at exit weights up to 254 pounds only.

Here are some of the **effects** of weighf **change** on canopy **performance**:

Higher Weights (nearthe maximum allowed)

FLYING SPEED INCREASES

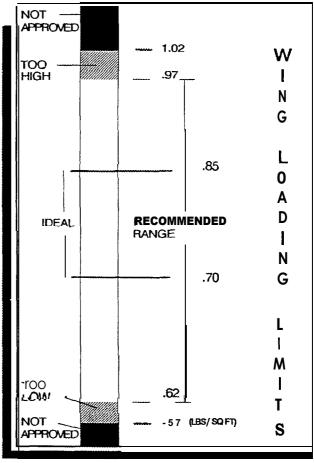
The glide angle of a canopy remains fairly constant as weight is added to the System. However, as weight increases so does the **speed** at which the canopy travels in **order** to **produce** enough lift to equal that weight.

SINK RATE INCREASES

Since the glide angle is nearly constant, and forward **speed** is increasing, downward **speed** also increases. The increased sink rate will result in the need for more **precise** flare timing and the increased weight also prolongs deceleration **during** the flare. You may need to flare sooner and more aggresively if you are at the high end of allowable weight. **Caution:** don't flare too high!

STALL SPEED INCREASES

Stall **speed** is related to **wing loading** (amount of weight supported by **each square** foot of canopy) more than any other **factor**. As weight increases, so does the **speed** at which the canopy **stops** flying smoothly. This means **faster** landing **speeds overall** and perhaps a tendency, while familiarizing yourself, to flare too late.



Lower Weights (nearthe minimum allowed)

FLYING SPEED IS REDUCED

Again at the same glide angle, the lower weight **produces** less forward **speed...**

SINK RATE **IS** REDUCED

...and less downward speed than weights in the middle of the range.

STALL SPEED IS REDUCED

Stall **speeds** are less at the lower wing loading, and deceleration in the flare requires less energy. The tendency with light wing loading might be to flare too high or too soon on your first several flights. The canopy may not fly fast enough to provide for sufficient flare unless you increase speed. For . safety's sake, a canopy should be allowed to glide naturally at the best approach speed.

Exit weight is a consideration when trimming (setting the **pitch** angle of) a canopy, and weight Variation will affect the trim. Canopies are trimmed prior to shipping by the manufacturer. Angle of attack of the canopy in flight is determined by the factory trim setting. Do not attempt to adjust the factory trim setting.

It is important to select a canopy which places you well within the center of the weight range. Above or below the center of the range, a canopy may not alide at the "ideal" speed due to a less-than-ideal angle of attack.

Remember: For the most efficiency, the most "forgiveness" and the greatest satisfaction, choose the canopy best suited for your exit weight.

Remember: "Exit weight" includes your weight plus the weight of any clothing, equipment or instruments you wear while jumping. Calculate your exit weight.

Reserve Canopy Installation and Packing

Instructions for packing of reserve canopies will vary with harness/ Container design. Refer these instructions for installation and folding (pages 13-24), then consult the harness/container manufacturer's instructions for inserting the canopy in the bag and closing the Container.

Main Vs. Reserve



A canopy which has been intentionally jumped as a main canopy (beyond one familiarization jump prior to reserve packing) should not be packed or used as a reserve- You may, however, use a canopy which has been previously packed as a reserve as a main canopy. After you intentionally jump the canopy as a main, do not return it to Service as a reserve.

Experience and **Currency Requirements** for Reserve Packing

The FAA Master or Senior Riager who packs a Precision canopy into a reserve or emergency Container must have logged a minimum of 10 complete ram-air pack jobs, with at least one being of the same canopy/ Container combination and within the preceding 120 days. Failure to observe this requirement is a Violation of Federal Aviation Regulations Part 65.129.

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Attaching the Canopy to the **Risers**

Canopy attachment fvr 7-cell (9-cell) modets. Nine-cell tine numbers in (bold).

1. Lay out the canopy on its left side, the slider spanwise with its tape down and lay out the Container with the harness up.

2. Thread one slider bumper over each main riser and down a few inches. (Omit for reserves, if desired.)

3. Place the slider on the risers spanwise, with its tape facing the canopy.

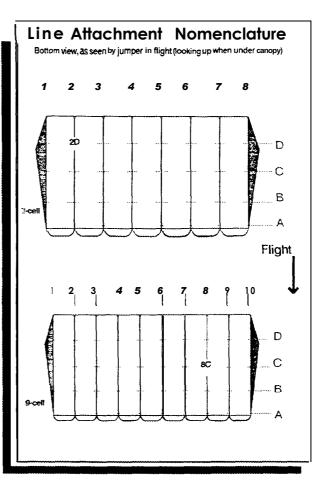
3. Locate the leading edge and A line attachment. Follow line 8A(1 OA) to the outboard side of its link and attach the link to the right front riser, **finger** tight.

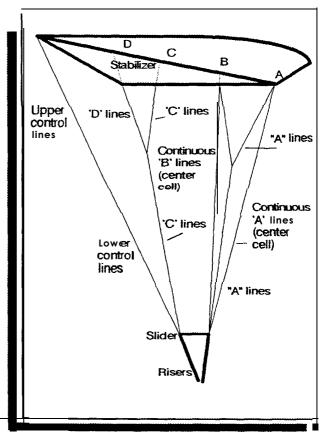
4. Pick up line 1A at the canopy attach point and follow it down to the outboard side of its link and attach the link to the **left** front riser, **finger** tight.

5. Turn the Container over, harness down, and **orient** the rear risers to receive their respective links. This simplifies CD link attachment.

6. Rotate the leading edge under the rest of the canopy. Split the aft section along with its associated control line groups to make the CD links easily accessible for routing and installation.

7. Locate the data panel at the center cell's upper surface trailing edge. From this center reference point follow the trailing edge to the left stabilizer and pick up line 1 D.





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8. Route this **line** to the outboard side of its link and attach the link to the **left** rear riser, **finger** tight.

9. Again from the **center** reference, follow the trailing edge to the right stabilizer and pick up line **8D(10D)**.

10. Route this line to the outboard **side** of its link and attach the link to the right rear riser, **finger** tight.

11. Return to the **center** reference **point** of the trailing edge. **Locate** and pick up the left side upper control lines consecutively. Verify their continuity to the junction with the lower control line.

12. Removing twists as you go, follow the **left** lower control line to its running end. Route it through the appropriate slider grommet, and the guide ring.

13. Remove the toggle from the riser and route the running end of the lower control line through the toggle attachment loop.

14. **Slide** the toggle up to the mark on the control **line**. Secure it with an overhand knot tied **closely** to the toggle.

15. The control line attachment for the right side is done in a similar **manner**.

16. When the control line installation is **complete** you may wish to compare the two toggle **attachment settings under equal** tension to ensure their **uniformity**.

17. This is an appropriate time to verify continuity of the control line System. Begin at the trailing edge on each side, verifying that all twists have been removed from the upper and lower control lines. Also make sure that the lower control lines have been properly routed through their appropriate slider grommets and guide rings, and that toggles have been properly secured equidistant from the trailing edge.

18. Separate the **aft section** and control line groups to their **respective** sides and **locate** the **center** reference **point** at the trailing edge.

19. Following the trailing edge control sutface outboard will lead you to the **left** stabiliter's **bottom** seam and the attachment **point** of **line** 1 D.

20. Holding D lines 1, 2, 3 and 4(1,2,3,4,5) in your right hand and D lines 5, 6, 7 and 8(6,7,8,9,10) in your left hand, verify the continuity of the C and D lines through the cascades to their respective rear risers.

21. Gather in the control lines and flip the canopy over so the **leading** edge **faces** up. Verify this orientation by locating the attachment **points** of A lines 1 and **8(10)**.

22. In the same **direction** you flipped the canopy, rotate the Container **system** harness-up.

23. Pick up the front riser groups, follow them to the canopy, and separate.

24. Pick up A lines 8, 7, 6 and 5(10,9,8,7,6). If you have continuous center cell lines, follow the bottom seam down and pick up line 5B(6B). Verify continuity of the A and B lines, through the cascades, to the right front riser.

25. Pick up A lines 1, 2, 3 and 4(and 5). If you have continuous center cell lines, follow the bottom seam down ' and pick up line 4B(5B). Verify continuity of the A and B lines, through the cascades to the left front riser. The continuity check is now complete.

26. Tightening the connector links properly is critical to safety. Thread the barrel up snugly against the barrel stop. Use a 9mm wrench to secure the links.

DO NOT OVERTIGHTEN ! A Overtightening the connector links can be dangerous because it could strip the threads or split the barrel. This is an appropriate time to inspect the links for any darnage possibly inflicted during tightening. Inspect each link thoroughly for any signs of darnage which could deteriorate structural integrity.

27. Move the slider from the risers, across the tightened links onto the suspension lines.

(Omit step 28 for reserves, If step 9 was also skipped.)

28. Move the slider bumpers up and install them at the links in the manner shown in the illustration. An 8-foot length of 3/32" MW finish lacing tape is included with your new canopy to secure the bumpers as shown.

This completes the assembly process.



It is assumed throughout these instructions that you are assembling to "Standard" risers, which will result in a distance of 4 inches from the inside of the control line guide ring to the top of the riser.

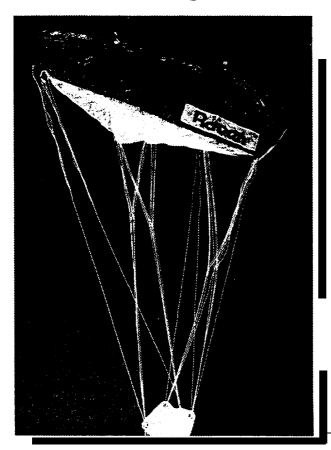


Reserve or Main Canopy Folding

Reserve canopy folding is accomplished by "**stack**" packing (also known as side packing) **only**. Reserve or main canopy folding **can** be accomplished by "**stack** packing" in the following **manner**. The instructions for "pro packing", **which** is approved for the main canopy only (pro packing is not approved for reserves) begin on page 25. The Checklist below applies to either method.

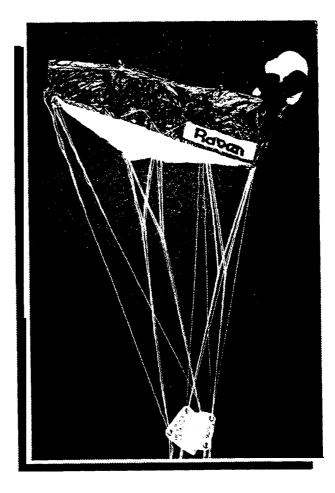
Prepacking Checklist

- O Bridle Attachment Point (main only) Tools Required: Three shot bags.
- 0 Canopy
- O Slider Stops
- O Links
- **O Slider Bumpers** (main only)
- () Slider
-) Lines
- O Control Line Locking Loops

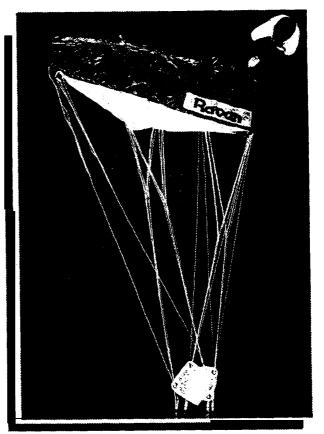


1. To propare for packing, orient the container harness down, the slider at the links, with the lines clear and the canopy on its left side.

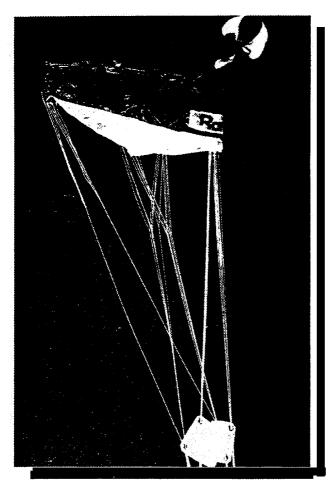
2. Fold the leading edge under, using caution not to twist the A lines.



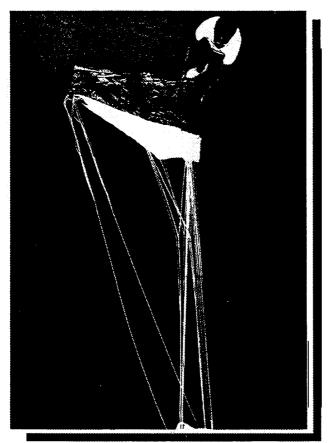
3. S-folding the A iines under the B lines keeps the canopy centered on the Container.



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4. S-fold the C lines and the D lines onto the stack.



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5. True "S folds" distribute equal amounts of canopy fabric bulk to each side of the stacked line groups.

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6. When the S-folds are complete, purge the air from the remaining portion of the canopy.



7. Clear the D-C section, the C-B section and the B-A section of the right stabilizer. Likewise clear all sections of the left stabilizer. Clear the sections aft of the D lines. Reestablish equal line tension from the high points of each S fold.

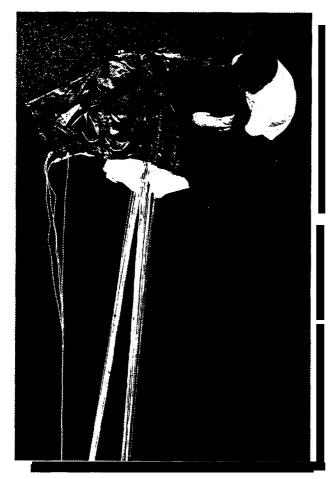
Next, set the deployment brakes.



Instructions for setting the brakes will vary with Container design. Follow the nstructions supplied by the manufacturer of the harness System.



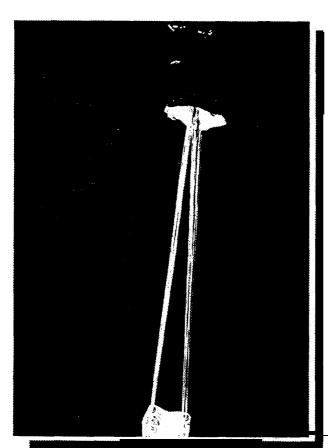




8. In dressing the aft section of the airfoil, the left hand serves two purposes. First, it contains the flaked trailing edge. Second, it helps maintain tension on the D lines and associated attachment points.

Extra time and attention in dressing the **aft** section of the airfoil not only enhances a more orderly deployment, but is also **helpful** in canopy bulk distribution when filling out the free bag.

When the right aft section of the canopy has been dressed, contain it with both knees.

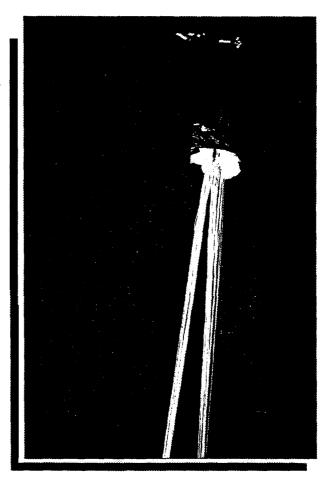


9. Gather up the left section in order to dress it away from you in a similar manner. Reestablish tension on the D lines.

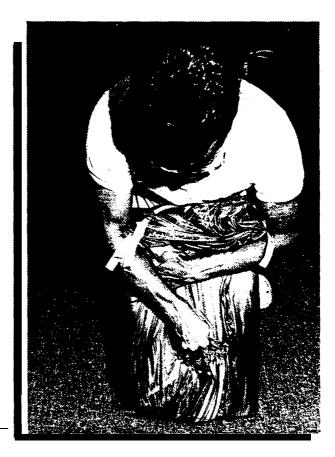
10. All of the seams across the aft section of the airfoil are either double stitch row, non-load bearing type or blind stitched loadbearing seams. All these seams are folded parallel and adjacent to the line groups, while the fabric between these seams is folded on the outside. Dressing the seams as high on the aft section as is practical helps keep slack from developing in the D lines. It will also help in distribution of the bulk.

Kneeling on the trailing edge, purge the air from the canopy. Folding **under** the edges of the flaked **aft** section assists in controlling the airfoil when exposing the **leading** edge.

As you pack, good technique Warrants that you purge the canopy frequently to ensure **optimum** control.

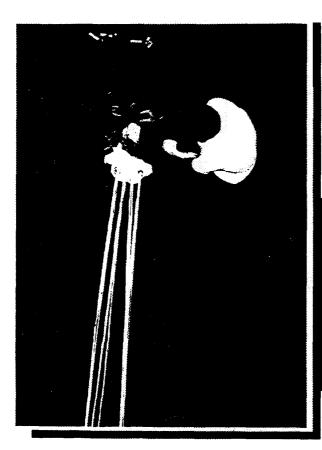


11. Lift the canopy onto your lap and expose the high **points** of the leading edge.





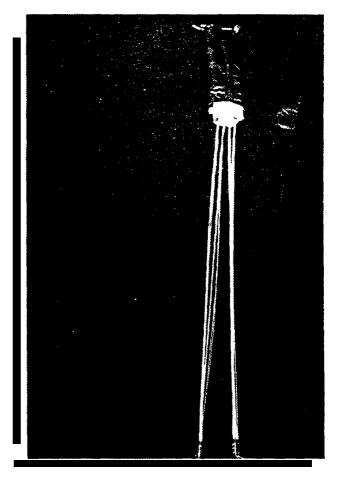
12. While maintaining control, return the canopy to the floor and purge again.



13. Grasp the slider, and without lifting the grommets from the carpet, bring the slider up the lines and set it against the stops. Spread the grommets to distribute the bulk. Position the slider under the trailing edge.

14. Dress the canopy to the width of the free bag, plus 2 inches on each side

This concludes the canopy folding sequence. Installation into the deployment bag and/or container must be done in accordance with instructions provided by the container manufacturer.



Main Canopy Folding

Main canopy folding can be

accomplished by "**stack** packing" in the normal **manner (page 17), or** "propacking" (sometimes known as the "stand up" pack job). The instructions for propacking begin **on** page 26. The Checklist below applies to either method.

Attention to the following items will help to prolong the life of your canopy and to prevent darnage during the packing procedure:

1. Pack where the wind will not affect you.

2. Do not pack on concrete or asphalt. This will **cause** additional wear on lines, links and **fabric**. **Packing** on a dry lawn or packing mat is preferable.

3. Inspect the canopy **prior** to every packing. The following Checklist is explained in greater detail on **page 41**.

Prepacking Checklist

- **0** Bridle Attachment Point
- 0 Canopy
- 0 Slider Stops
- 0 Links
- () Slider Bumpers
- () Slider
- O Lines
- 0 Control Line Locking Loops

Main canopy packing instructions begin on the following page. Reserve packing instructions begin on page 13.

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PRECISION A

Main Canopy Folding Instructions

The Line Check

1 • Crouch next to the risers and face your canopy. Slip the fingers of your left hand between each left-hand riser and between the left-hand steering line and the risers. Do the same with your right hand. The idea is to have each line group and each steering line occupying its own slot between two of your fingers.

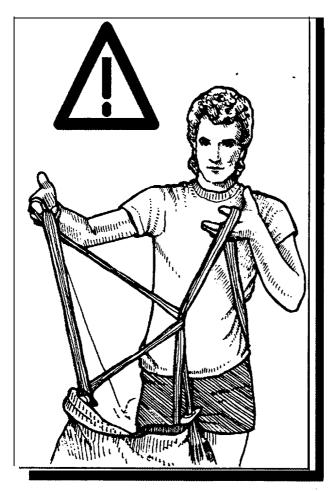


2. Stand between the right- and left-hand riser groups and start moving up the lines, allowing them to slide between your fingers. Push the slider ahead, until you reach the lower surface of the canopy.

At this **point**, it's possible to determine whether or not your canopy and lines are straight. **If** you have twists in the lines as shown, your rig has done a "loop" through your risers at some **point**. To fix this, drop the lines, **stretch** the canopy and lines out again and straighten out the entanglement. Get help from a **rigger** if you have any questions. Repeat the line check after Clearing to **confirm** you have done it correctly.



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3. If you have something that looks like this, it's likely a control line is passed around everything else.

Acontrol line which passes around everything else will result in a malfunction that will almost surely require a breakaway.

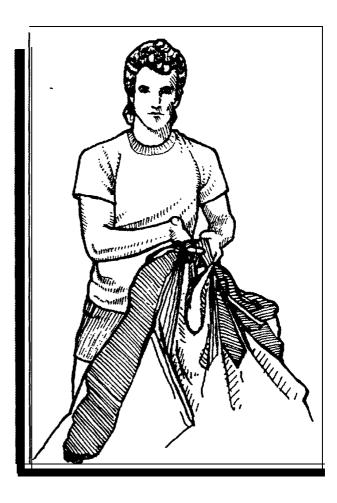
To fix this, lay the canopy down on the ground. Starting at the canopy, find the **second** and third lines on one end **cell** (these are called the B and C lines).

Carefully follow these two lines down through the slider to the links on the risers. You should be able to see where you will need to pass your rig through the lines to correct the steering line routing. Again, seek **capable** assistance if you have any questions.

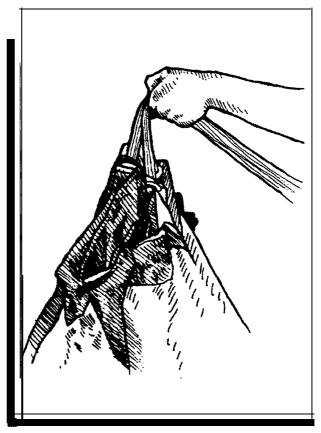
Flaking the Leading Edge

4. When you **reach** your canopy, pull both hands apart as far as the slider will allow. Shake the canopy a couple times to **settle** everything.

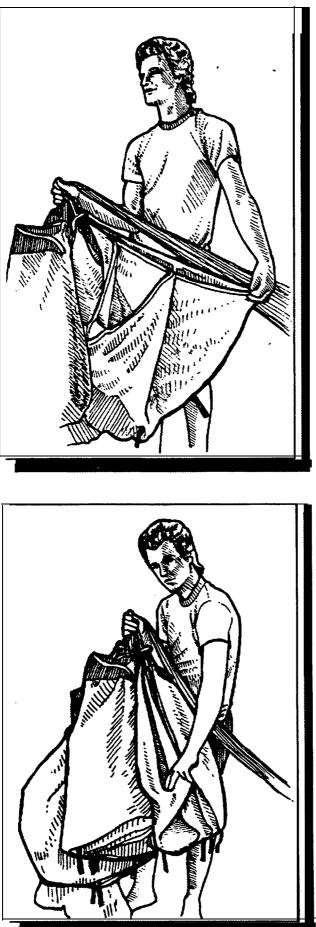
5. Now step to one side, outside the lines and transfer the lines in one hand to the other . . .



6. ... so you are holding all the lines in one hand--preferably with your stronger arm.



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7. Locate the leading edge of the canopy; it should be facing your rig. (If it is facing "up" or away from your rig, it might mean your canopy has been attached backward.)

8. Starting with the end cell nearest your legs, flake the entire leading edge with one hand as shown.

9. Pull each cell all the way out and keep it in your hand. Then move to the next cell, taking care not to miss any, until all of them are in your hand.



10. When you've got the entire leading edge flaked . . .



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1. . . tuck it between your knees and hold it there.

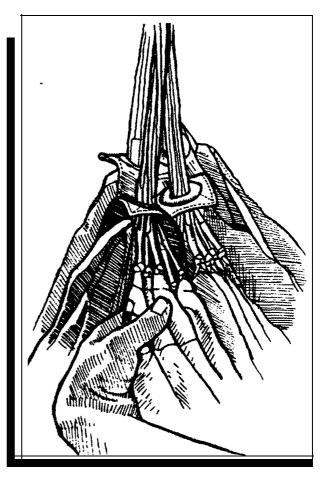
1 vie

Clearing the Stabilizers.

12. Since all the lines are bunched up in the middle, pull out each stabilizer panel one by one until they form an irregular shape resembling the petals of a flower viewed from the top.

13. Find the group of A lines on one side of the canopy. With the canopy held in front of you as you have it now, the A lines are the front, **part** of the **line** group that go through the front **slider** grommets, the ones that should be closest to you.

(Each load-bearing cell rib has four lines attached to it: the A line at the leading edge, followed by the B and then the C lines, ending with the D line closest to (but not on) the trailing edge. Some cells have confrol lines attached to them at the trailing edge. The A and B lines pass through the front grommets of the slider, while the C, D and control lines all pass through the rear grommets.)

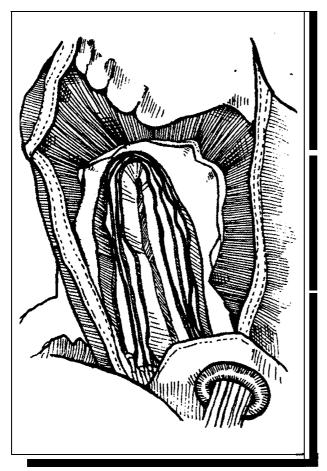


14. Since there is a lot of fabric between the A and B line attachment points, it's easy to separate the two line groups; (See the drawing.)

Now you're going to S fold the rest of the canopy like the stabilizers. Put your hand in between the A and B lines on one side (near where they pass their own grommet) and pull them out to one side. This will give the cells on one side the correct type of flaking. Now repeat with the other A and B group, pulling the fold out the other side.



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15. Now that you've **pulled** out the canopy between the A and B line groups, do the same thing between the B and C lines: **pull** the fold between the two groups out to **each** side. When you look down between the stabilizer folds **after** you've done your "flaking," the folds should look **nice** and neat like this.

Flaking the Trailing Edge

16. Now find the D line group, the group of lines nearest the tail. (Not the control lines; they are attached at the traiiing edge.)

Owners Manual

PRECISION AERODYNAMICS 3 3

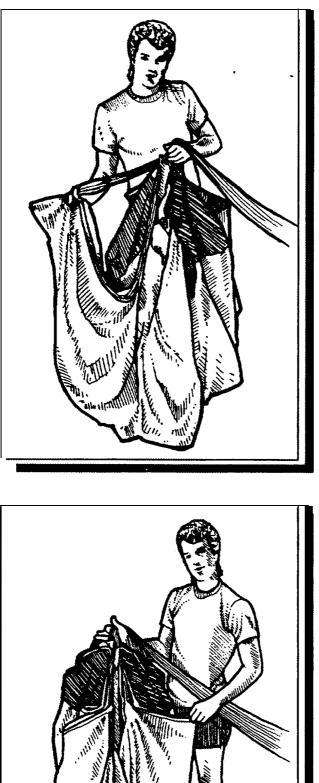
17. Take the whole **D** line group on one side . . .





18. fold it with one motion to put a real fold in the fabric between the C and D lines. Do the same thing on the other side.

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19. Now grasp the control lines where they attach to the trailing edge, **pull** the entire trailing edge out and drop it straight down.

20. Flake the trailing edge neatly on each side as shown. The center portion of the trailing edge--the section between the left-hand and right-hand control lines--can't be flaked and will hang down. You'll straighten this out next.

21 Reach down and pick up the very middle point of the trailing edge (the ID panel is sewn to the top of the center cell near the trailing edge.) Lift it up and put the very middle seam up with the slider grommets, holding it in place with your thumb or finger.

If your canopy is new, or if it tends to open uncomfortably fast, then follow steps 22 through 25. Otherwise, skip to 26.

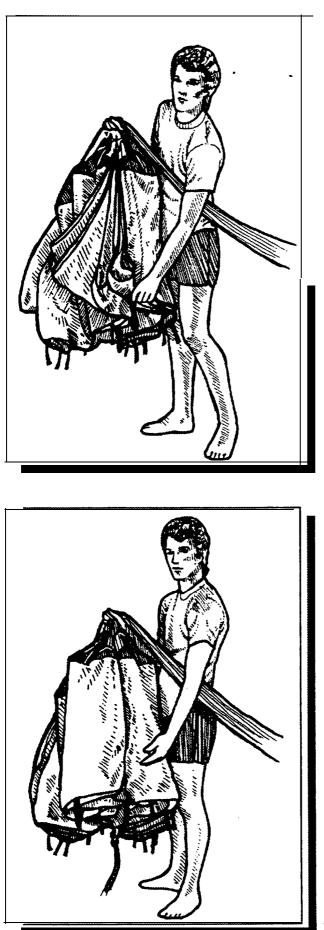


Optional (For Slower Openings)

22. Loosen your knee grip on the **leading** edge of the canopy. Find the very middle of it. (It's easy. Just run your hand down between the front two slider grommets; exactly half the lines will be on one side and half on the other.)



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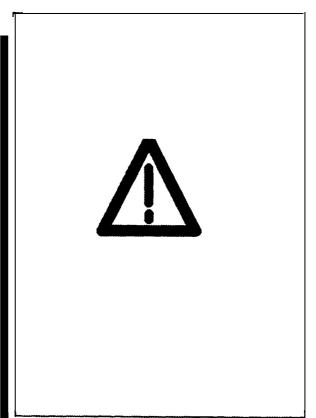
23. While leaving the very middle cell hanging, pick up all the others on one side and roll them in toward the middle.

24. Do the same on the other side. When you're done, this is how the **leading** edge should look.

25. This shows how steps 23 and 24 help siow down openings. As the canopy opens (remember, this illustration shows the canopy upside down), the center cell inflates and the sides are slowed somewhat by the fact that they are rolled separately. The result is more controlled, symetrical inflation.



If you want your canopy to open faster, just leave the leading edge hanging neatly flaked; don't roll it at all. (Skip steps 22 through 25.) This leaves the leading edge exposed to the airstream and will help the canopy inflate faster.



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26. You have in your hand a neatly flaked canopy. The leading edge is brushing up against your legs and the middle of the trailing edge is still being held along with all the lines.



27 On one side, start at the middle of the trailing edge being held under your thumb and pull the excess material straight out. You're pulling out the trailing edge of the canopy that extends from the inside control line to the very center of the trailing edge.

28. Holding the lines firmly with the other hand, wrap that part of the trailing edge halfway around the canopy. Hold it in place with your knees. Fold the trailing edge on the other side of the canopy in the same way.



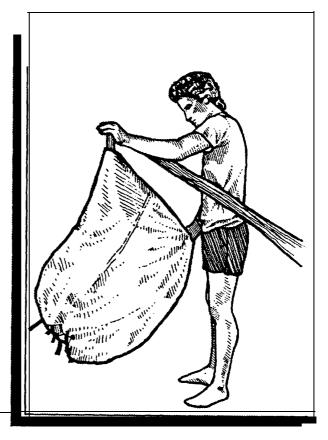
BE CAREFUL WHEN PULLING THE TRAILING EDGE AROUND THE BUNDLE. BE SURE TO LEAVE THE CONTROL LINES UNDISTURBED. IF YOU WRAP THE CONTROL LINES AROUND THE BUNDLE ALONG WITH THE TRAILING EDGE, YOU MAY INDUCE A LINEOVER MALFUNCTION.



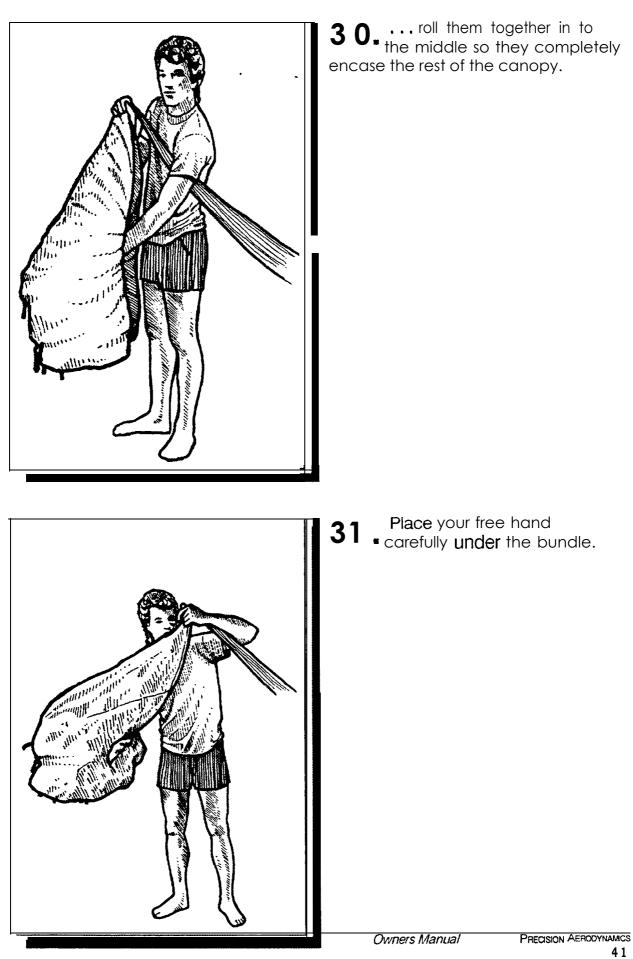


Take both trailing edge pieces in one hand and. , .

Owners Manual



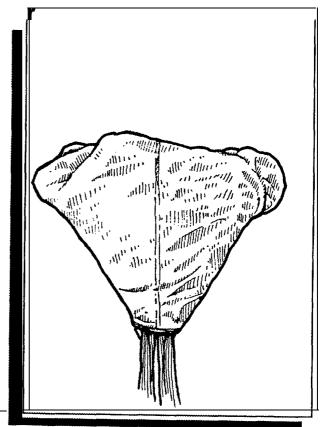
PRECISION AERODYNAMICS



32. Swing it out slightly so that lines stay taut and gently lay it on the floor.



33. As it rests on the floor, the canopy should be triangular in shape as shown.



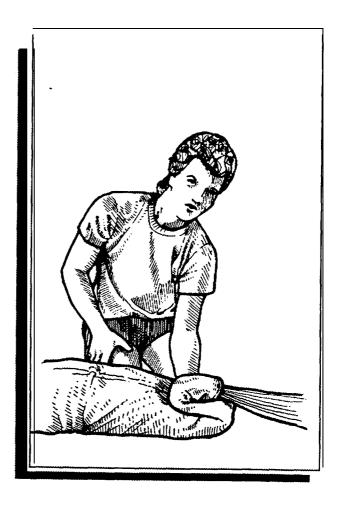


34. Tuck the sides under, starting at the slider and working up, making the canopy into a flattened cylinder shape.

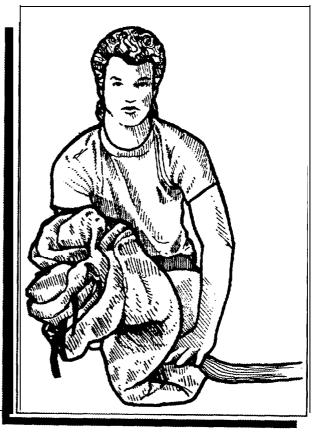


35. Move to the **side** of the canopy and put one hand **under** the slider edge of the **bundle**. **Place** the other hand on top a **little** farther up.

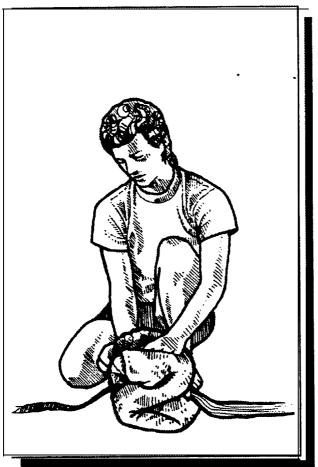
36. Make a small S fold as shown.



37. Now put one hand **under** the top of the bundle and make an S fold in the opposite direction, as shown.

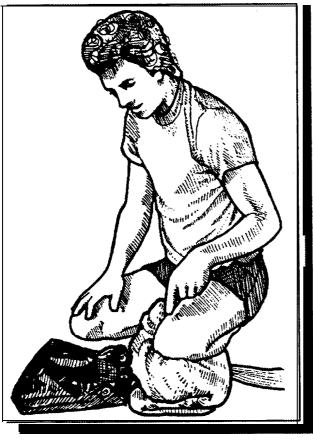


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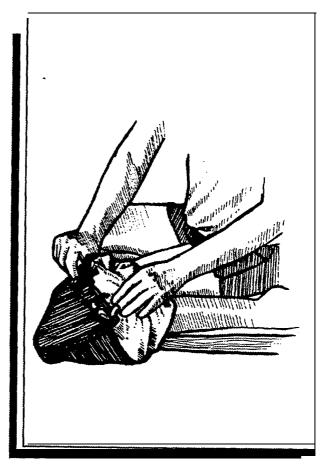


38. You should now have a neat, compact bundle. Try to make the **folds** so that the bundle ends up being just a little wider than the deployment bag.

39. Place your knee in the middle of the canopy to keep it together while you pull the bag over it.



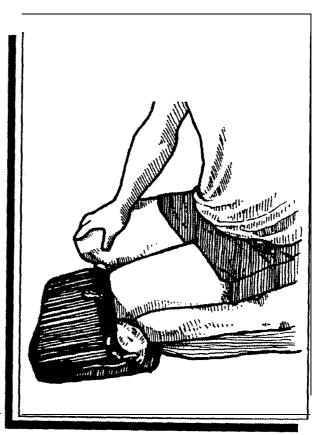
4 0. With your knee still in place, pull the bag over the canopy one side at a time. Hold the corner of the canopy bundle up while you pull the bag over it; then roll the canopy into the corner of the bag. This helps get the canopy firmly into the corners, making a neater pack job.



4 1. The whole canopy should be in the bag before you remove your knee.

Follow your harness/container manufacturer's instructions for closing the bag, stowing the lines, placing it in the pack tray and closing the Container.

It takes **practice** to pack both quickly and neatly. Every **jumper** has their own "system" to make the job easier, and you'll quickly develop one of your own.



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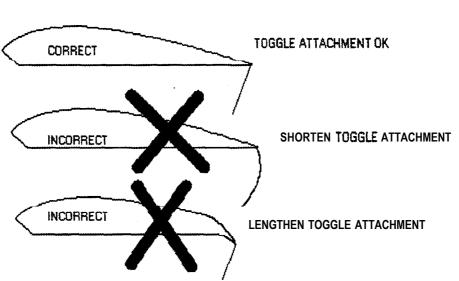
Toggles and Control Line Information

You should attach the toggles to the canopy control **lines** according to instructions provided by Precision and the manufacturer of the **harness**/ Container System. Marks are provided on the controi lines **which** indicate the proper attachment **point** for most Standard length risers.

Jhe toggles are properly installed if the control lines just become taut with the canopy in **full** forward drive. Jhe trailing edge should form a continuous line with the lower surface.

Don't Reposition the Toggles to Adjust Control Stroke!

Jhe toggles should be **attached** so the canopy trailing edge forms a continuous line with the lower surface and the control lines are just taut when the toggles are released, with the **parachute** in full **glide**. Do not use toggle location to **adjust** control travel. You will distort the **airfoil** shape and degrade flight Performance.



in

Canopy Side View, In Right With Toggles Released

Owners Manual

. . . .

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Care

In addition to regular inspections of every detail on your Precision canopy, proper care requires you treat it carefully during everyday use. The fabric used in its construction is amazingly strong and lightweight--but will lose both strength and porosity if it suffers physical abuse. Any abrasion, fluid contact, extreme temperatures or exposure to sunlight will cause some degradation in its strength and/or porosity. Avoid subjecting your canopy to any of these conditions.

Icarus' Bane: Run from the Sun

The Sun warms us and feeds us and lights our way. Perhaps the negative effects of sunlight can best be recalled after an unintentional afternoon nap on a stark-white sandy beach. The same UltraViolet radiation that flogs the shoulders of a sleeping tourist seriously weakens everything it shines upon. One of the most effected materials is nylon.

In fact, according to Dan Poynter's *The Parachute Manual*, "Many sport parachutists pack outside in the sun. If we assume that their canopies are exposed 15 minutes **each** time, then after 280 jumps, the assembly has been in the sun the equivalent of seven IO-hour days which is probably enough to lower the strength **50%**. And this does not include the 2 minutes per jump when the entire **parachute** is **exposed.**"

Do not expose your canopy to the

sun's harmful UV radiation any more than absolutely necessary--it will last longer and retain more of its strength when shielded from UV.

Keep it Up

It has been said that the only substance not harmful to a nylon canopy is air (specifically, dark air). One very bad habit is that of dragging the canopy from the landing **spot** to the **packing** mat. Don't be guilty of such careless treatment, **because** the penalty **can** be a severely reduced canopy life, as **well** as a possible loss of **structural** integrity due to the abrasion.

Always pick up the entire canopy and all the lines after landing, and carry them to a clean storage or **packing** area, away from sunlight. **Protect** the canopy from any contact, especially abrading or contaminating environments.

Keep it Dry

Precision recommends you never allow the canopy to get wet. Do not wash the canopy. Washing increases the fabric's porosity substantially, which can slow down openings and degrade Performance. Do not intentionally jump the canopy in the rain or into water.

If your canopy becomes soiled, you will have to decide whether washing or the presence of dirt is the most harmful. If you get the canopy wet, hang it to dry in a low-humidity area away from sunlight.

"The Trunk Ate My Canopy."

Be careful where you **choose** to store your canopy for long **periods**. Never store your gear where prolonged heat is a **factor**, such as the trunk of a car. Nylon is very unforgiving of high temperatures.

Maintenance

Preflight Inspection

Prior to **packing** the canopy, check the following items:

Bridle **Attachment** Point-Check the bridle attachment to the canopy, and check all seams and reinforcing tapes in the bridle attachment area.

Canopy-Free from holes, rips or snags. Check for broken stitch rows along the seams and on the tapes. All reinforcement tapes must remain well secured.

Slider Stops-Missing or damaged **stops can** trap the slider **during** deployment, and prevent it from traveling down the lines.

Links-Connector links must be secure and undamaged. It is important to check the links frequently. Do not overtighten the links, as overtightening could **strip** the threads and **split** the barrels.

Slider **Bumpers--Check** the bumpers to make sure they are properly secured with tacking thread (page 16). Missing or damaged bumpers may **allow** the inside of **the slider** grommets to rub against the **links**; when this occurs the grommets **can** develop abrasive inside edges which **can** weaken or **cut** through lines as the slider travels up and down.

Siider-Check the slider to make sure the grommets remain smooth and firmly in **place** within the reinforcement **tape.** Also **watch** for tears or **picks** in the **fabric**, broken stitch rows, and loose reinforcement tape.

Unes-Check the lines for areas which are frayed or "fuzzy." Pay special attention to the line attachment points (on the airfoil) and the link attachment points.

Control Line Locking Loops-The finger trapped brake-set loops deserve careful scrutiny for signs of wear. Watch for picks or snags in the line and loose or broken stitches in the bartacks.

Repairs

Small rips or tears in the open area of the canopy may be repaired in the normal manner. (See your rigger or loft.) For more extensive darnage or if you are in doubt, contact Precision.

Modifications



Owner **modification** of Precision canopies is not approved **under** any circumstances.

How to Contact us

Precision is very proud of its products, and we **place** the highest priority on providing you with the very best of Service as the owner of a Precision ram air canopy. **If** you need to contact us for any reason, use the following procedure.

To Order Parts and Equipment:

You may order Precision products from your nearest authorized Precision Aerodynamics dealer. Phone **1-800-222-3933** and ask for the name of the dealer nearest you.

For Help:

1. Read this manual first. You may find the **answer** to your question.

2. If you have read the manual and still need to contact us for any information or with specific questions **about** your canopy, you will need:

a. The serial number and model of your canopy (see inside front cover) b. The make, model and serial number of your harness Container system

3. Phone us at: (615) **949-4688**. Tell the person answering that you are a canopy owner, and ask to speak to the **Product** Support Desk.

About Precision

Founded in 1982, Precision Parachute has built a reputation that lives up to our name, by providing the utmost quality in sport and military parachutes. Precision canopies are built one at a time, individually cut from specified materials which we test ourselves--every single lot of fabric, tape, webbing, thread, grommets, links, or rings. We test them all ourselves, and absolutely reject materials which do not meet our rigid Standards. Precision's lab now tests materials for most of the parachute industry, including our competition.

For Information:

For general information, phone us at: (615) 949-4666. Explain the nature of your question and you will be directed to the appropriate department.



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At Precision. we test the strength of wery bolt of fabric received from the mill. We measure porosity to verify resistance to airflow. Fabric is tested for thread count. tensile strength. elongation, weight, shrinkage, pH factor, heat and Ultra Violet resistance.

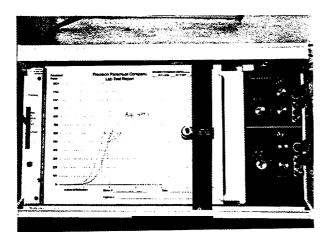


TSO

The FAA's Standard for certification of reserve parachutes is a rigorous test of a canopy's integrity and Performance (see page 57). Precision was the first manufacturer to certificate a canopy (the Raven) under the newer, tougher C-23c standard-It's our philosophy that a main

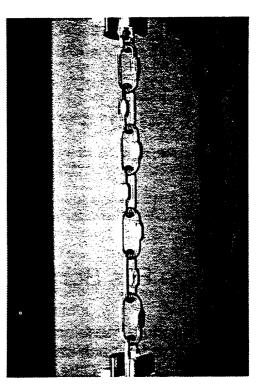
A Cut Above

After testing in our laboratory, fabric for each canopy is individually cut from precise Patterns, not Stack-folded and cut in mass quantities. The result is a more consistent construction phase, preserving the original airfoil and reducing built-in stress on the canopy.





Since we cut each canopy component individually, there is little extra cost involved in furnishing custom colors. So we include a total choice of color schemes for every owner--at no additional charge.



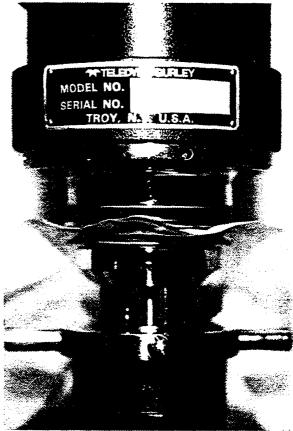
canopy, which sees constant use compared to a reserve, needs to be tested and certified to at least the same Standards as a reserve. So we believe in certificating each model, to provide further assurance that your canopy will last a long time and perform to your satisfaction. Even though federal law allows parachute manufacturers to build main canopies with none of the expense associated with reserve testing and certification,

FAA approved manufacturing procedures and recordkeeping methods are followed for all **our** products, whether they are **TSOed or** not.



Performance Gains

In developing the **technology** to accomplish these goals, we have also improved Overall construction methods. This has resulted in **cleaner**, more **consistent** canopy airfoils and reductions in stress between canopy components **during** use. Although it **can** be argued that the certification procedure adds to the **cost** of a canopy, our experience indicates the opposite is true. The greatest **evidence** of that is in comparing the price and Performance of our products with others.



One Size Fits Some

Ram-air **parachute** manufacturers have long provided **each** canopy **model** in a **single** size. Other sizes were available in other models. Precision began by offering a wide range of choice in canopy size, **which allows** the jumper to select a canopy most suited for his or her own weight. Weight, we know, is the greatest factor affecting canopy Performance. Precision was the first manufacturer to offer a choice of sizes designed to "normalize" **performance** among jumpers of different weights.

Appendix A

FAR Part 105: Parachute Jumping

Current as/of May 1, 1988

SubpartA-General

105.1 Appiicabiiity.

(a) This Part prescribes **rules** governing parachute Jumps made in the **United** States except parachute Jumps necessary **because** of an in-flightemergency.

(b) For the **purposes** of **this** Part, a "parachute Jump" **means** the descent of a person, to the surfacefrom an alrcraft **in** flight. when he intends to **use**, or **uses**, a parachute **during** all or part of that descent.

Su bpart B - Operating Rules

105.11 Applicability.

(a) **Except as provided** in paragraphs (b) and (c) of this **section**, this subpart **prescribes** operating **rules** governing parachute **jumps** to **which this** Partappiies.

(b) This subpart **does** not apply to a parachute **Jump** necessary to meet an **emergency** on the surface, when it is made at the **direction**, or with theapprovai, **ofanagencyoftheUnited** States, or **ofa State**, **PuertoRico**, the **District of Columbia**, or a possession of the United States, or of a political subdivision of any of them.

(c) Sections 105.13 through 105.17 and paragraphs 105.27through 105.37 of this subpart do not apply to a parachute Jump made by a member of an Armed Force -

- Over or within a restricted area when that areaisunderthecontroi of an Armed Force; or
- (2) In military operations in uncontrolled airspace.

(d) **Section** 105.23 does not apply to a parachute **Jump made by a member of an Armed Force within** a restricted **area** that extends upward from the **surface** when that area is **under** the controi of an **Armed Force**.

105.13 General.

No person may make a parachute Jump, and no piiot in command of an **aircraft** may ailow a parachute **jump** to be made from that **aircraft**, if that **jump** creates a **hazard** to air **traffic** or to **persons** or propertyon the surface.

105.14 Radio equipmentand **Use** requirements.

- (a) Exceptwhen otherwise authorized by ATC-
 - (1) No person may make a parachute jump, and no pilot in command of an aircraft may allowaparachutejumptobemadefromthat aircraft, in or into controlled airspace unless. duringthatflight.
 - (i) The **aircraft** ie equipped with a functioning two-way rad lo communications **system** appropriate **totheATCfacilitiesused**;
 - (ii) Radio communicationo have been established between the aircraft and the nearest FM Air Traffic Controi Facility or FM Flight Service Station at least 5 minutes before the jumping activity is to begin, for the purpose of receiving Information in the aircraft about known air traffic in the vicinity of the jumping activity; and
 - (III) The Information described in subdivision (II) ha8 been received by thepilotincommand and the jumpers in that flight; and
 - (2) The **pilot** in command of an **aircraft used** forany jumping activity in **or** into **controlled airspace shall, duringeach flight**-
 - (I) Maintain or have maintained a continuous watch on the appropriate frequency of the alrcraft's radio communications system from the time radio communicationa are first established between the alrcraft and ATC. untli he advises ATC that the Owners Manual Precision AEPCONNERS 53

jumping activity is ended from that filght: and

(ii) Advise ATC that the jumping activity is ended for that filght when the last parachute Jumper from the aircraft reaches the ground.

(b) If, during any flight, the required radio communications system is or becomes inoperative, any jumping activity from the aircraft inor intocontrolled airspaceshall be abandoned. However, if the communications system becomes inoperative in flight after receipt of a required ATC authorization, the jumping activity from that flight may be continued.

105.15 Jumps **over or** into congested areas **or** openalrassemblyofpemons.

(a) No person may make a parachute jump, and no pilot in command of an aircraft may aiiow a parachute jump to be made from that aircraft. over or into a congested area of a city, town, or settlement, or an open air assembly of person8 uniess a certificate of authorization for that Jump has been issued under this section. However, o parachutist maydrift overthat congested area or open air assembly with a fuily deployed and properly functioning parachute if he is at a sufficient altitude to avoid creating a hazard to pemonsand property on the ground.

(b) An application for a certificate of authorization issued underthissection ismade in a form and in a manner prescribed by the Administratorand must be submitted, to the FAA District Office having jurisdiction over the area in which the parachute Jump is tobe made, at jeast four days before the day of that jump.

(c) Each holder of a certificate of authorization Issued under this section shall present that certificate for Inspection upon the request of ths Administrator, or any Federal, State or local official.

105.17 Jumpsoverorontoairports.

Uniess prior approvai has been given by the airport management, no person may make a parachute Jump, and no pilot in command of an aircraft mayaiiow a parachute jump to be made from that aircraft -

(a) Over an **airport** that does not have a functioning controi toweroperated by the **United** States; or

(b) Ontoanyairport.

However, a parachutist maydrift over that alrport with a fully deployed and properly functioning parachute if he is at least 2.000 feet above that alrport's traffic pattern, and avoids creating a hazard to air traffic or to persons and property on the ground.

105.19 Jumps in **or** into controi **zones** with functioning control **towers operated** by the United States.

(a) No person may **make** a parachute **jump**, and **no pilotin command mayallow a parachute jump** to **be made** from that aircraft, in **or** into a control zoneinwhichtherelsafunctionIngcontrol tower **operated** by the United **States without**, or in vidation **of the terms of**, an authorization **issued** underthis section.

(b) Each request for an authorization under this sedion must be submitted to the control tower having jurisdiction over the control zone concerned and must include the information prescribed in 105.25.

105.21 Jumps in **or** into positive controi areas. (a) No **person** may **make** a parachute Jump, and no piiot in command of an **aircraft** may **allow** a patachute **jumpto** be madefrom thataircraft, In **or** Into a positive controi **area without, or** in vlolation of, an **authorization issued under** this section.

(b) Each request for an authorization issued under this section must be submitted to the nearest FM Air Traffic Control Faciiity or FM Filght Service Station and must include the information prescribed in paragraph 105.25(a).

105.23 Jumps in or into other alrspace.

(a) No person may make a **parachute** Jump, and no pliot in command of an **alrcraft** may aiiow a parachute Jump to **be** made from that **alrcraft**, in **or** into **alrspace** unless the **nearest** FAA Air Traffic Control Faciiity **or** FM **Flight** Service Station was notified of that Jump at least 1 hour **before the jump** isto be made, but not more than 24 houm before the jumping **is** tobe completed, and the **notice contained** the Information **prescribed** In Paragraph **105.25(a)**.

(b) Notwithstanding **paragraph** (a) of this section, ATC may **accept** from a parachute **jumping organization** a written **notification** of a scheduied **series** of **jumps** to be made **over** a **stated period** oftime not iongerthan 12 **calendar** months. **The notification** must contain the information **prescribed** by paragraph **105.25(a)**, identify the responsible **persons** associated with that **jumping activity**, and be **submitted** at least 15 days. but not more than 30 **days**, before the jumping **is** to begin; ATC may **revoke** the acceptance of the notification for any failure of the jumping **organization** to compiy with **its terms**.

(c) This section does not apply to parachute

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Jumpsin or into any airspace or place described In Paragraphs 105.15.105.1 9, or 105.21.

105.25 Information **required**, and **notice** of canceilation or **postponement** of Jump.

(a) **Each** person requesting an authorization under paragraph 105.10 or 105.21, and each person submitting a notice under paragraph 105.23, must include the following Information (on an individual or group basis) in that request or notice:

- (1) Thedateand time **jumping will begin**.
- (2) The size of the Jump zone expressed in nautical mile radius around the target.
- (3) The iocation of the **center** of the Jump **zone in relation to**-
 - (I) The nearest VOR facility in terms of the VOR radial on which it is located and its distance in nautical miles from the VOR facility when that facility is 30 nautical miles or less from the drop zone target; or
 - (II) The nearest airport, town or city depicted on the appropriate Coast and Geodetic Survey WAC or Sectionai Aeronauticai Chart, when the nearest VOR facility is more than 30 nautical miles from the drop zone target.
- (4) Theaititudesabovethesurfaceatwhich Jumpingwiiitake **piace**.
- (5) The time and **duration** of the **intended jumping**.
- (8) The **name, address**, and **telephone** number of the person requesting the authorization orglving notice.
- (7) The identification of the aircraft to be used.
- (3) The radio frequencies, ff any, available **Intheaircraft**.

(b) Each person requesting an authorization under paragraph 105.19 or 105.21. and each person submitting a notice under paragraph 105.23. must promptiy notifythe FAAAir Traffic Controi Faciiity or FM Fiight Service Station from which it requested authorization orwhich itnotified, if the proposed or scheduled jumping activity is cancelled or postponed.

105.27 Jumps over or within restricted or prohibited areas.

No person may makea **parachute** Jump, and no **pliot** in command may **allow** a **parachute** Jump to be **made** from that **alrcraft**, **over or** within a **restricted area or** prohibitad **area unless the** controlling agency of the **area** concerned **has** authorired **that jump**.

105.29 Flight visibility and clearance from clouds requirements.

No person **may make a parachute** Jump, and no **pliot** in command of an **aircraft may** allow **a parachutejump to be made from that aircraft**-(a) intoorthrough a cloud; **or**

(b) When the flight visibility is less, or at a distance from douds that is less, than that prescribed in the foilowing table:

Altitude	Flight Visibility	Distance from Clouds	
1,200 feel or less above the surface regardless of the MSL altitude.	3 statute miles	500 feet below 1,000 feet above 2,000 feet hprizontal	
Hore than 1,200 feet above the surface but less than 10,000 feet MSL	3 statute miles	500 feet below 1.000 feet above 2,000 feet horizontal	
More than 1,200 feet above the surface and at or above 10.000 feet MSL	5 statute miles	1.000 feet below 1,000 feet above 1 mile horizontal	

105.31 [Deleted]

105.33 Parachute jumps at night.

(a) No person **may** make a **parachute** Jump, and no **pilot** in command of an **aircraft** may ailow any person to make a **parachute** Jump from that **aircraft**, at night, uni888 that person **is equipped** with **a means** of producing a light visible for at **least three** miles.

(b) **Each** person making **a parachute** Jump at night **shall** dispiay the iight required by paragraph (a) of this **section** from the **time** his canopyopens until he **reaches the surface**. 105.35 Liguorand **drugs**.

Noperson may make a parachute jump while, and no pliot in command of an alrcraft may allow a person to make a parachute Jump from that alrcraft if that person appears to be, -

(a) Under the influence of intoxicating liquor; or (b) Using any drug that affects his facuities in any way contrary to safety.

105.37 Inspections.

The Administrator may Inspect (Including inspections at the Jump site) any parachute Jump operation to which this Part applies, to determine compliance with the regulations of this Part.

Subpart C - Parachute Equipment

105.41 Applicabliity.

(a) Except as provided in paragraph (b) of this section, this subpart prescribes rules governing parachute equipment used in parachute Jumps towhlchthisPartapplie8.

(b) This subparagraph does not apply to a parachute Jump made by a member of an Armed Force using parachute equipment of an Armed Force.

105.43 Parachute equipment and packing regulrements.

(a) No Derson maymake a parachute Jump, and no pliot in command of an aircraft mavaliow any person to make a parachute Jump from that aircraft, unless that person is wearing a single harnessdual parachute pack, havingatieastone main parachute and one approved auxillary parachute thatare packed as follows:

- (1) The main parachute must have been packed bya certificated parachute rigger, or by the person making the Jump, within 120 days before the date of it8 Use.
- (2) The auxiliary parachute must have been packed by a certificated and appropriately rated parachute riggerwithin 120 days before the date of its use.

(b) No person may make a parachute jump using a static line attached to theaircraft and the main parachute unless an assist device, described and attached as follows, is used to aid the plot chute in performing its function, or. if no pilot chute is used, to aid in the direct deployment of the main parachute canopy.

- (1) The assist device must be long enough to ailowthe container to open beforea load is piaced on thedevice.
- (2) The assist device must have a static ioad strength of -
 - (I) At least 28 pounds but not more than 160 pounds, if it is used to ald the pilot chute inperforming itsfunction; or
 - (ii) At least 56 pounds but not more than 320 pounds, If it is used to aid in the dlrectdepioyment of the main parachute canopy.
- (3) The assist device must beattached -
- (i) At one end, to the static line above the static line plns, if static plns are not used, above the static line ties to the PRECISION AERODYNAMICS Owners Manual

parachutecone; and

(ii) At the other end, to the pilot chute apex, bridiecordorbridleioop. or, ifno pilot chute la used, to the main parachute canopy.

(c) No person may attach an assist device required by paragraph (b) of this section to any main parachute uniess he hae a current parachute rigger certificate issued under Part 65 of this chapter or is the person who makes the jump with that parachute.

(d) For the purposes of this section. an "approved" parachute is -

- (1) A parachute manufactured under a type certificateoratechnicaistandard order (C-23 series): or
- (2) A personnel-carrying military parachute (other than a high aititude, high-speed, or election kind) identified byan NAF, MF, or ANdrawing number, an AAF order number, orany military designation or specification number.

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TSO-C23c Performance **Standards**

Current as/of May 1, 1988

Aerospace Standard 8015A Issued by: Society of Automotive Engineers, Inc. 400 Commonwealth Avenue Warrendale. PA 15096

AS 8015-A • Minimum Performance Standard for Parachute Assemblies and Components, Personnel.

This specification defines the minimum Performance Standards for personnel parachute assemblies to be carried in aircraft or worn by parachutists for emergency use.

1. Scope: This specification COVERS two types and three weight 'speed categories of personnel carrying parachute assemblies:

1.1 Types

1.1.1 Reserve parachute assembly (the term reserve and auxiliary are used synonymously).

1.1.2 Emergency parachute assembly.

1.2 Weight/Speed Ranges: The weights and speeds are maximum for each category.

1.2.1 Category A: QO kg (198 lb) '130 knots.

1.2.2 Category 6: 115 kg (254 lb) /150 knots.

1.2.3 Category C: 115 kg (254 lb) '175 knots.

2. Definitions:

2.1 Reserve Parachute Assembly: A parachute assembly which is worn in conjunction with a main parachute assembly used for premaditated jumps.

2.2 Main Parachute Assembly: A parachute assembly. excluding the harness. that is used in conjunction with a reserve parachute assembly as the primary parachute assembly (the one intended for use) for a premeditated jump.

2.3 Tandem Parachute Assembly: A parachute assembly having a reserve and a main parachute. stowed separately. but in compartments on the same side of the body.

2.4 Emergency Parachute Assembly: An emergency parachute assembly worn for emergency. unpremeditated use only,

2.5 General: For purpose of this specification a parachute assembly normally consists of seven major components:

1. Canopy (includes Suspension lines).

2. Deployment device (sleeve. bag. or equivalent) if used.

3. Pilot Chute (including bridle). if used.

4. Riser(s), if used, when not integral with harness

and 'Or canopy. 5. Stowage Container (pack).

6. Harness.

7. Primary actuation device (ripcord assembly or eauivalent).

3. Material and Workmanship:

31 Materials and workmanships shall be of a quality which documented experience and or tests have conclusively demonstrated to be suitable for the manufacture of parachutes. All materials shall remain functional for storage and use from

-40 degrees to + 93.3 degrees C (-40 degrees to + 200 degrees F). All plated ferrous parts shall be treated to minimize hydrogen embrittlement.

4. Detail Requirements:

4.1 Design and Construction:

4.1 .1 Fittings: All fittings shall be designed to support the proof loads specified in the applicable specification. drawing. Standard. etc., with yielding.

4.1.2 Stitching: Stitching shall be of a type that will not ravel when broken.

4.1.3 Primary Actuation Device/Ripcord: The primary actuation device/ripcord, including joints between the handle and the release, shall withstand the test loads of 4.3.1 without failure and shall meet the functional requirements of 4.3.2. The actuation grip shall be located so as to be readily visible and accessible.

4.1.4 Harness Release: The harness shall be so constructed that the rider Can separate himself from the canopy and 'or harness assembly unaided.

4.1.5 Main Canopy Release: A quick releasing device between the harness of a reserve parachute assembly and the main canopy. is mandatory.

4.2 Marking: Except as noted below. the following information shall be legibly and permanently marked on each major component in a location subject to a minimum of Obliteration: -Part number, including dash numbers -Manufacturer's name and address -Date of manufacture and/or serial number -FAA TSO-C23c

-Category A. 6. or C placards (see table)

4.2.1 Stowage Container: The information in 4.2 shall be marked on or attached to the outside of the parachute stowage Container (pack). In addition. the stowage Container shall be provided with a parachute data card pocket constructed such that the card will not be lost but will be readily accessible.

4.2.2 Canopy: In addition to the above information, the canopy marking shall include the canopy serial number.

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PRECISION AERODYNAMICS 57 4.2.3 Primary Actuation Device/Ripcord: The following information shall be marked on the Primary Actuation Device/Ripcord: -Part number. including dash number -Manufacturer's identification -TSO-C23c -Batch or serial number. and /or date of manufacture

4.2.4 Documents: The manufacturer shall provide all necessary instructions and/or manuals.

4.3 Qualification Tests: The following minimum Performance Standards shall be met. There shall be no failure to meet any of the requirements during the qualification tests of this section. In CaSe of a failure. the cause must be found. corrected. and all affected tests repeated.

4.3.1 Ripcord Test: The ripcord. including all joints between the handle and the release, shall not fail under a straight tension test load of 1335 N (300 lbf) applied for not less than three seconds. If the ripcord is to be static line operated, the test shall be 2670 N (600 lbf) for not less than three seconds. The pins, if used, shall not yield under a 36 N (8 lbf) load applied to the cable (or equivalent) perpendicular to the axis of the pin. The pin shall be supported for 13 mm (.5 in.) maximum at the end farthest kom the Cable attachment.

4.3.2 Pull test. Primary Actuation Device Ripcord: Reserve parachute assemblies shall be tested both with the main compartment(s) full and empty.

4.3.2.1 Human Factors: The primary actuation device shall be ground tested by use of a representative group of no less than five male and five female subjects. They shall be able to function the actuation device without any undue difficulty while in a suspended harness. The ripcord or equivalent shall be sealed for these tests.

4.3.2.2 Puil Test: A load AT THE RIPCORD HANDLE of not less than 23 N (5 lbf) (applied in the direction giving the lowest pull load) nor more than 97 N (22 lbf) (APPLIED IN THE DIRECTION GIVING THE HIGHEST PULL LOAD UNDER NORMAL DESIGN OPERATIONS) shall be required to CauSe a positive and quick functioning of the parachute assembly on all tests. A minimum of ten pull tests is required. For ehest-type parachute assemblies. the maximum pull shall be 66 N (15 lbf).

4.3.3 Compressed Pack and Environmental Test: Three drops shall be made to the lowest applicable Speed phase in 4.3.6 except that prior to the test the parachute assembly shall be subjected to the following conditioning:

4.3.3.1 Four hundred continuous hours with a 890 N (200 lbf) load applied to compress the pack. Sixteen hours at 93.3 degrees C (+200 degrees F) without the 890 N (200 lbf) load. Immediately re-apply 890 N (200 lbf) load and stabilize to ambient and test drop. 4.3.3.2 Sixteen hours at -40 degrees C (-40 degrees F) without the 890 N (200 lbf) load. Immediately apply 890 N (200 lbf) load and stabilize to ambient and test drop.

These tests may be combined with 4.3.6 when practical.

4.3.4 Strength Test: No material(s) or device(s) that attenuate shock loads and is not an integral part of the parachute assembly or component being certified

Owners Manual

PRECISION AERODYNAMICS

may be used. Tests may be conducted for either a complete parachute assembly or a separate canopy. There shall be no evidence of material. stitch, or functional failure that will affect airworthiness. The same canopy, harness and for riser shall be used for all 4:3.4 tests. Parachute assemblies may be tested in accordance with Category A, B, or C.

4.3.4.1 Parachute Assembly: Three drops shall be made with a 136 kg (300 lb) man-shaped dummy. The velocity of the dummy shall be in accordance with Category A. B. or C schedule (see Table 1). Where easily detachable hardware (such as Snap and Ring) is used to attach the canopy or riser(s) to the harness a CrOSS connector must be used and one test shall be made with only one attachment engaged to test the CrOSS connector and hardware.

4.3.4.2 Canopy (Alten-rate test for 4.3.4.1): Three drops shall be made with a suspended weight of 136 kg (300 lb) and a velocity in accordance with Category A. 6. or C schedule (see Table 1). A test vehicle (e.g., a bomb) may be used. The canopy. deployment device (if used). a pilot chute (if used). and riser(s) (if used) shall be tested as a unit. The riser(s) or equivalent shall be secured to the test vehicle in the same Manner that it is intended to attach to the harness. Where easily detachable hardware (such as Snap and Ring) is intended to attach the canopy or riser(s) to the harness. one drop shall be made with only one attachment engaged to test the CrOSS connector and hardware.

4.3.5 Functional Test (Twisted Lines): A minimum of five drops shall be made with a 77 kg (170 lb) dummy or person. The indicated air speed at the time of release shall be 60 knots. Three twists (360 degrees each) shall purposely be packed in the Suspension lines adjacent to the lowest attachment point to the canopy. The parachute must be fully open within four seconds from time of pack release.

4.3.6 Functional Test (Normal Pack): There shall be a minimum of 46 drops from an aircraft with a 77 kg (170 lb) dummy or person. The indicated air speed at the time of pack release shall be as follows for 16 drops each: 60.85. and 110 knots IAS. In addition. Reserve Parachute Assemblies shall be dropped 8 times by breaking away from an open and normally functioning main parachute canopy and releasing the Reserve pack within two seconds of the breakaway. The parachute conopy must be fully open within three seconds from time of pack release. These tests may be live jumps by a 77 kg (170 lb) (min) individual except that at least two dummy drops shall be made at 66.85. and 110 knots IAS. Reserve Parachute Assemblies shall be tested with the main compartment(s) full and empty (24 tests full).

4.3.7 Rate of Descent Tests: There shall be at least 6 drops. of which at least 3 shall be dummy drops. from an aircraft with a 77 kg (170 lb) (min) individual and/or dummy. The average rate of descent shall not exceed 6.4m (21 ft) per Second for the last 30m (98 ft) corrected to standard sea [eve] altitude conditions. A method shall be employed for direct and accurate measurement of rate of descent such as the use of a weighted Cord or cable by which the descent may be timed for the last 30m (98 ft) from the time of ground impact of the weight to ground impact of the dummy. The oscillation shall not exceed 15 degrees from the vertical. These tests may be combined with other

tests in this section.

4.3.8 Live Drop Tests: There shall be a minimum of 4 live drop tests from an aircraft with an individual weighing 77 kg (170 lb) (PLUS the weight Of the certificated reserve parachute assembly). Two drops shall include a free fall of not more than three seconds and two drops shall include a free fall of at least 15 seconds. These tests may be conducted in conjunction with functional and/or rate of descent tests when practical. (The user must suffer no significant discomfort from the opening shock and must be able to disengage himself unaided from the harness after landing.) For this test the standard harness may be altered to permit attachment of the certificated reserve parachute assembly (less harness) provided that such alteration does not interfere with the normal Operation of the parachute assembly being tested. Reserve Parachute Assemblies shall be tested with the main compartment(s) both full and empty.

5. Component Qualification:

5.1 Parachutes may be qualified as complete assemblies or as components (e.g., just the harness ' Container assembly). The airworthiness of a parachute assembly including other separately approved. NOnoriginal components is the responsibility of the manufacturer who performs the certifying tests for the parachute assembly. The manufacturer shall publish and make available a list of interchangeable components which have passed the following tests in Section 4.3 when tested in conjunction with the assembly or component(s) being certified.

5.1.1 Canopy Including Suspension Lines: 4.3.2. 4.3.3. 4.3.4.1 (or 4.3.4.2). 4.3.5. 4.3.6. 4.3.7. 4.3.8

Table 1

Category A, B, or C Schedule

Category A Test: 136 kg (300 ib) at 150 knots.

Placard: Cotegory A: This parachute is limited to use by persons up to 90 kg (198 lb) fully equipped, and up to 130 knots.

Category B Test: 136 kg (300 lb) at 175 knots.

Placard: Category B: This parachute is limited to use by persons up to 115 kg (254 lb) fully equipped, and up to 150 knots.

Category C Test: 136 kg (300 lb) at 230 knots.

Placard: Category C: This parachute is limited to use by persons up to 115 kg (254 lb) fully equipped, and up to 175 knots.

Speeds are given in keas, and are intended to be at pack opening.

Precision Parachute Trouble Report Form serial # QC-8 PHOTOCOPY FORM, PRINT LEGIBLY OR TYPE, AND MAIL TO: Precision Parachute, Highway 127 North, Dunlap, TN 37327					
Description of malfunction or defect					
Extent of darnage					
 User's name					
User's name Address CityStateZip	Teiephone				
Date Signature					
for office use:					
Date received	by				
MRB Date	by				
Signed by Engineering Signed by Production Signed by Quality Control	Date				

PRECISION AERODYNAMICS 60

RAVEN OWNER:MANUAL

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PRECISIONPARACHUTECOMPANY P.O. Box 691 Dunlap, Tennessee 37327 (615) 949-4688 S/N 463033 DOM N 0 V - 1986

FAA TSO-C23c CATEGORY B: This paraghute is limited to use by persons up to 115kg (254LB) Fully equipped, and up to 150 Knots.

WARNXNG !

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The Raven canopy is designed for high Performance, maxiizing speed and glide ratii. At higher canopy loadings (of more than about 78 pounds per square foot, the canopy will exhibit a rapid turn tendency if the toggles are depressed too rapidly, or too rar.

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At lower wing loadings, the canopy will be more docile. Be sure to select the canopy you will jump based on loading (canopy area divided by the total suspended ueight. If you and your rig weigh 200 pounds, a loading of .78 would be achieved with slightly more than 250 square feet [Raven 3 or 4].)

1 NOVEMBER 1983

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PARACHUTE CONSTRUCTION AND PERFORMANCE SPECIFICATIONS

RAVEN SERIES

Precision Parachute Company

P.O. Box 691 Dunlap, TN 37327 (615) 949-4688

Manufactures of Quality Deceleration & Becovety Systems

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		RAVEN 1	RAVEN 2	RAVEN 3	RAVEN 14
	SURFACE AREA	181 ft ²	218 ft ²	249 ft ²	282 A²
	WEIGHT	5.8 lbs	6.5 lbs	7.2 lbs	7.9 lbs
	FABRIC	1.102 o-3 cfm	1.1 oz o-3 cîm	1.1 02 o-3 cîm	1.1 oz o-3 cím
	WING SPAN	19.8 ft	21.6 ft	23.2 ft	24.8 ft
	WING CHORD	8.8 ft · ·	9.6 ft	10.3 ft	11.0 ft
E	ASPECT RATIO	2.25:1	2.25:1	2.25:1	2.25:1
-	MAX SUSP WT	166 lbs	198 lbs	229 lbs	261 lbs
	TYPE CONSTRUCTION	1 Beam	I Beam	I Beam	I Beam
	LIFT/DRAG RATIO	4:1	4:1	4:1	4:1
	PACK VOLUME	412 in ³	454 in³	564 in ³	646 in ³
	SUSP LINES	525 Dacron	525 Dacron	525 Dacron	525 Dacron
	REEFING SYSTEM	Slider	Slider	Slider	Slider
	DEPLOYMENT DEVICE	Bag	Bag	Bag	Bag
	FORWARD SPEED	25-30 mph	25-30 mph	25-30 mph	25-30 mph
	CROSS PORTING	STD	STD	STD	STD
	PACKING TABS	STD	STD	STD	STD
	CONTINUOUS LINES	STD	STD	STD	STD
	CUSTOM COLORS	STD	STD	STD	STD

DISCLAIMER

0.0.0.1 DISCLAIMER

Precision Parachute makes no warranty of any kind as to the fitness or suitability for any purpose of the RAVEN canopy. Precision Parachute Company also disclaims any liability in tort for damages, direct or consequential, including personal injuries, resulting from a malfunction or normal use or from defect in design, material, workmanship or manufacture whether caused by negligence on the part of Precision Parachute Company or otherwise. By using Precision Parachute's products or allowing them to be used by others, buyer and user waives any liability of the manufacturer for personal injuries or other damages arising from its use. Chapter 1

Flying the Raven Ram-air Canopy

1.1 DEPLOYMENT

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1.1.0.1 Level deployment

Many square canopy malfunctions are caused by deployment in an improper attitude, as when the shoulders are not ke with the horizon or the jumper is not in control during deployment. Initiate your deployment with enough time to ensure a controlled posture as the canopy is extracted.

If you are not qualified to pilot this canopy, get qualified. Then return to this text and resume reading.

1.1.0.2 Canopy check

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After deployment is complete, check the canopy by:

- 1. looking overhead for evidence that all cells are not fully inflated.
- 2. Check the routing of Suspension lines and the position and condition of the slider .
- **3.** Check that the canopy is flying straight with no tendency to turn.

1.1.0.3 Releasing the Brakes

The brakes are released after the canopy check is complete.

- 1. Look at both steering toggles on the back of the rear fisefs.
- 2. Grasp the toggles firmly, and pull down positively on both at the same time until you feel both brake stows release.
- 3. Hold equal tension on the steering toggles and slowly allow them to retract up against the stops.
- 4. Check again that the canopy is flying straight with no steering input required.

1.2 PLANNING THE APPROACH

1.2.0.1 The Importance of Beginning Early

The ram-air sport parachuting canopy is truly a low-Performance glider. With its mobility, controllability and speed it represents a great improvement over traditional "drag-only" devices such as the conventional round canopy. But like a glider pilot, we are charged with one immutable law you only get one chance at every landing. The me consistent success can be acheived only by carefully planning our approaches and allowing for changing conditions during the approach. Approach planning should begin the moment the canopy is flying properly.

1.2.0.2 Turns and Speed

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The ram-air canopy achieves its Performance through the ability to change the canopy's angle of attack. The ram-air pilot thus controls the speed (and therefore the glide angle and sink rate) of his canopy by changing its angle of attack. When the steering toggles (or "brakes", as they are commonly called) are fully retracted ("up"), the canopy flies at its minimum angle of attack – producing maximum speed, maximum sink rate and maximum gliding distance. We don't really want to land the canopy under these conditions, but in order to achieve maximum Performance we must understand and be able to use the energy of the canopy differently at different times during each flight.

1.2.0.3 Fast and Slow Flying

The range of speed control goes from full glide to STALL. The greatest sink rate will occur at full glide. The most hazardous flying is that done close to the STALL. A Stall is produced when the steering lines are pulled far enough to incease the canopy's angle of attack beyond the point at which the smooth flow of air is interrupted and the canopy deflates.

Stall recovery is accomplished by SLOWLY releasing the steering lines to allow the canopy to return to normal flying attitude. If recovery is not allowed, and the steering lines are kept extended, the canopy and jumper will begin a new descent without benefit of lift.

The middle of the road between full-glide Performance and the stall is a much more forgiving range as far as the canopy is concerned. The canopy will not glide as far at moderate angles of attack (often called "half-brakes") as it will full-glide, but the sink rate is close to the minimum, and a decent "landing" can be accomplished at this speed and sink rate.

"Half-brakes" is acheived with the steering lines pulled about halfway down, at shoulder level or slightly below. This is the flight attitude to maintain in bumpy air or at any time you are unsure of conditions in the air or on the ground during landing.

1.2.0.4 Turning

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Our ability to turn the ram-air canopy safely is limited IJ by the altitude available to perform the turn; there must always be enough altitude. But the penalty for steep or sudden turns is always degraded Performance. Many ram-air pilots are injurer seriously due to turns performed too close to the ground. We should make it a rufe never to turn more than gently (for Jhe sake of small corrections) when we are less than 200 or 300 feet from the ground.

Turns are possible at any gliding speed, and those made at full glide will produce the greatest degradation o performance. Those performed at lower speeds will result in slower turns as well as less of an increase in sink rate.

If we follow good practice, every approach should end where the landing phase begins - at about 100 feet of altitude, lined up with the landing target flying into the Flying at half-brakes will wind, flying at half-brakes. allow us to make corrections to either increase or decrease our glide. DO NOT allow yourself to get into DEEP brakes w hile trying to arrest glide. a WARNING 1 ALTITUDES IS STALL AT LOW Α POSSIBLY THE MOST HAZARDOUS CONDITION FOR THE RAM-AIR PILOT.

If an approach is properly planned, it will allow the pilot to return to full glide at no less than 30-40 feet and perform a graceful flare, arresting forward speed and sink rate simultaneously, arriving at touchdown with (ideally) no speed and no sink rate.

1.3 Landing

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The landing of a ram-air canopy is no different from any landing in a heavier-than-air craft - it consists of arriving at the landing site with a good glide speed, and carefully coordinating an increase in angle of attack (called in this instance the FLARE) to arrest sink rate. A perfect landing results when the canopy stalls at the moment the pilot touches the ground. Depending on Windspeed, the landing could be accomplished at zero forward speed or at 10 mph. With the average pilot and canopy combination, a flare should be begun at about 10 feet of altitude when the windspt *x* i Zero. Normally, the higher the Windspeed the longer you ca wait to begin a flare. Good technique here will result onl from consistent practice.

1.4 Landing at half-brakes

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For the inexperienced ram-air pilot, or for experience pilots either impaired or subjected to harsh conditions, th landing can be accomplished at half-brakes. Choose th landing area and line up into the wind. Hold the brak setting through the landing, and perform a parachute landin fall (PLF) as you would for a round canopy. Do not att ap the last-minute flare, and DO NOT release the brakes durin the approach at any time.

Chapter 2

Packing the Raven Canopy

2.1 WARNING !

The Raven ram-air canopy is shipped uninstalled. It is the owner's responsibility to have it installed on the harness/container system by a qualified rigger, and to ascertain that the canopy is correctly installed and oriented according to the instructions of the harness manufacturer. This manual assumes proper installation and orientation has been completed.

ALL SQUARES CAN BE PACKED BACKWARD.

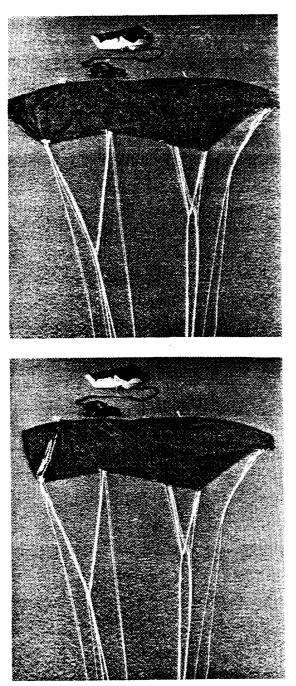
The factory recommends BAG DEPLOYMENT. This canopy has not been tested for other than **BAG** DEPLOYMENT.

2.2 Packing Steps

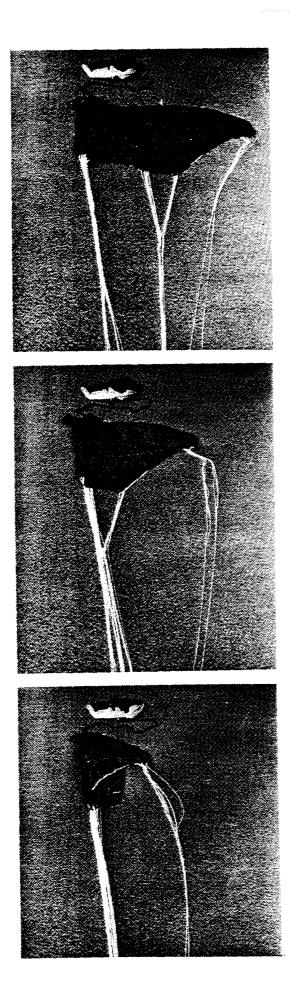
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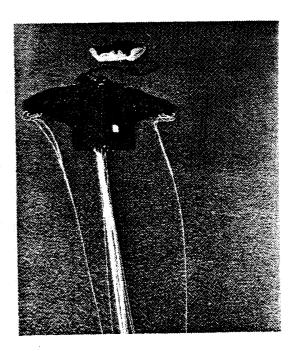
- 1. Orient the canopy on its side as shown with nose left and the slider down. Flake the canopy by grasping the lower front and lower rear packing tabs and pulling the associated line group taut. Repeat for each cell un til all seven are pleated or "flaked" and all line groups are taut and stacked upon one another. Check the line orientation and the orientation of canopy to harness.
- 2. Fold the nose back as shown.

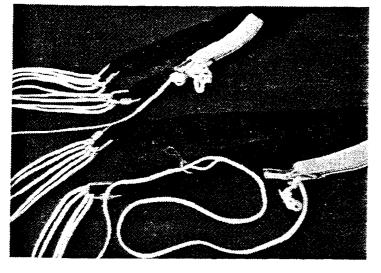


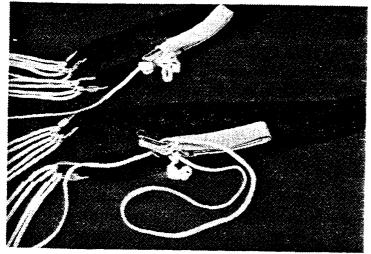
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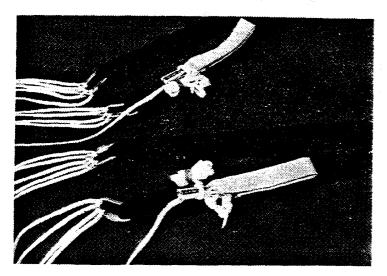
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- 3. Grasp the canopy above "B" lines and stack "B" lines on top of "A" lines
- 4. Grasp the "C" lines and stack them on top of the A-B stack.
 - 5. Stack "D" lines on top of the A-B-C stack
- 6. Split the tail as shown so the left and right control line group are on either side of the center cell.

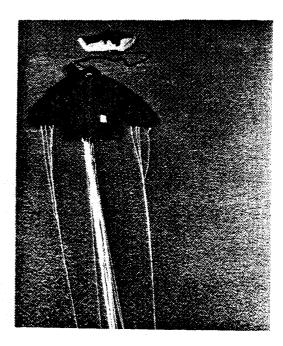




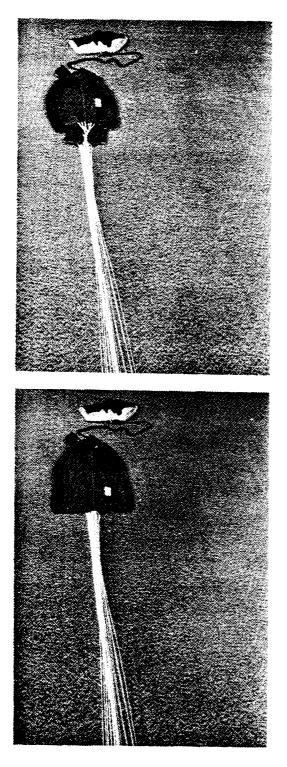




- 7. Set the brakes. Brake setting technique will vary according to the harness/container system. These photos show the Relative Workshop type system with one brake stowed, one unstowed.
- 8. (Continued)
- 9. (Continued)
- 10. This photo shows the tail split after the brakes have been set.



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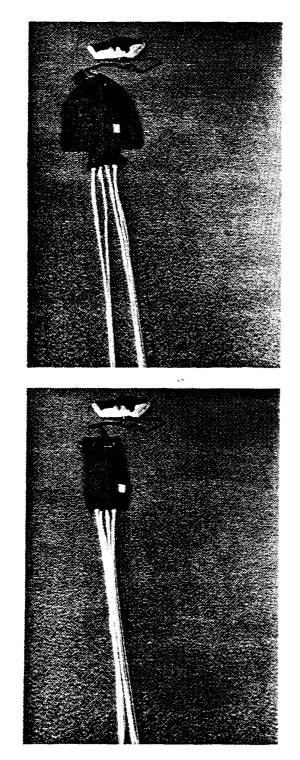


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- 11. Flake the tail.
- 12. Pull down the center cell of the tail to cover the canopy as shown.

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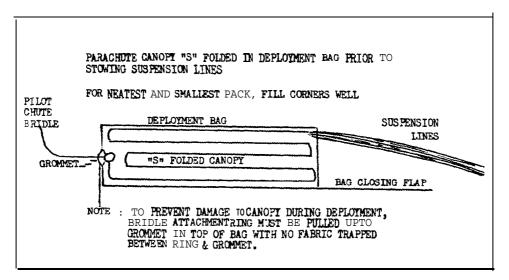
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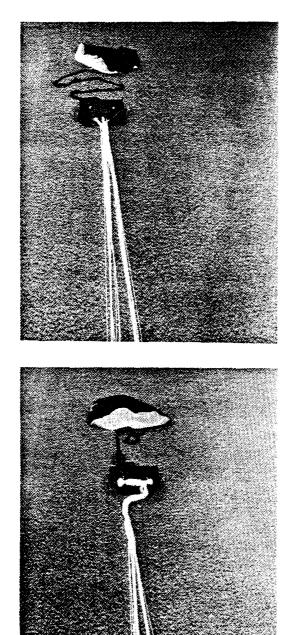
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- 13. Pult up the slider.
- 14. Tunnel the canopy (dress to the width of the deployment bag, with the slider UNDER the tail.) Pull the bag down over the top of the canopy.

- 15. Check the bridle attach ring. The ring should pull up against the bag grommet and there should be no fabric between the ring and the grommet.
- 16. This illustration shows a cross—section of the canopy S-folded in the bag.







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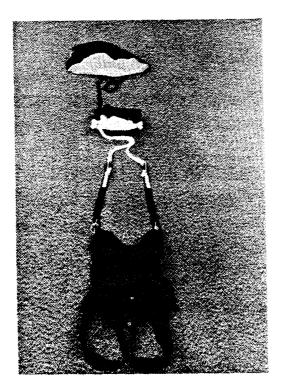
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- 17. Dress the bag prior to stowing the lines.
- 18. Closing stows should be made in accordance to the bag configuration, with the f ollowing guidelines: Route the lines cleanly, and don't stow more than one inch of lines on the outside of the stowing bands.



19. Stow lines to within no less than six inches, no more than 16 inches.

2.2.0.1 Closing

Continue in accordance with Container maufacturer's instructions.