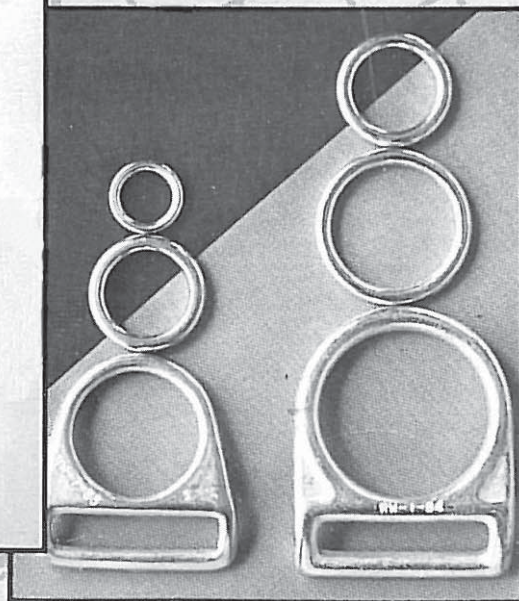


W · O · N · D · E · R · H · O · G

# Vector

OWNER'S MANUAL



**Relative Workshop**

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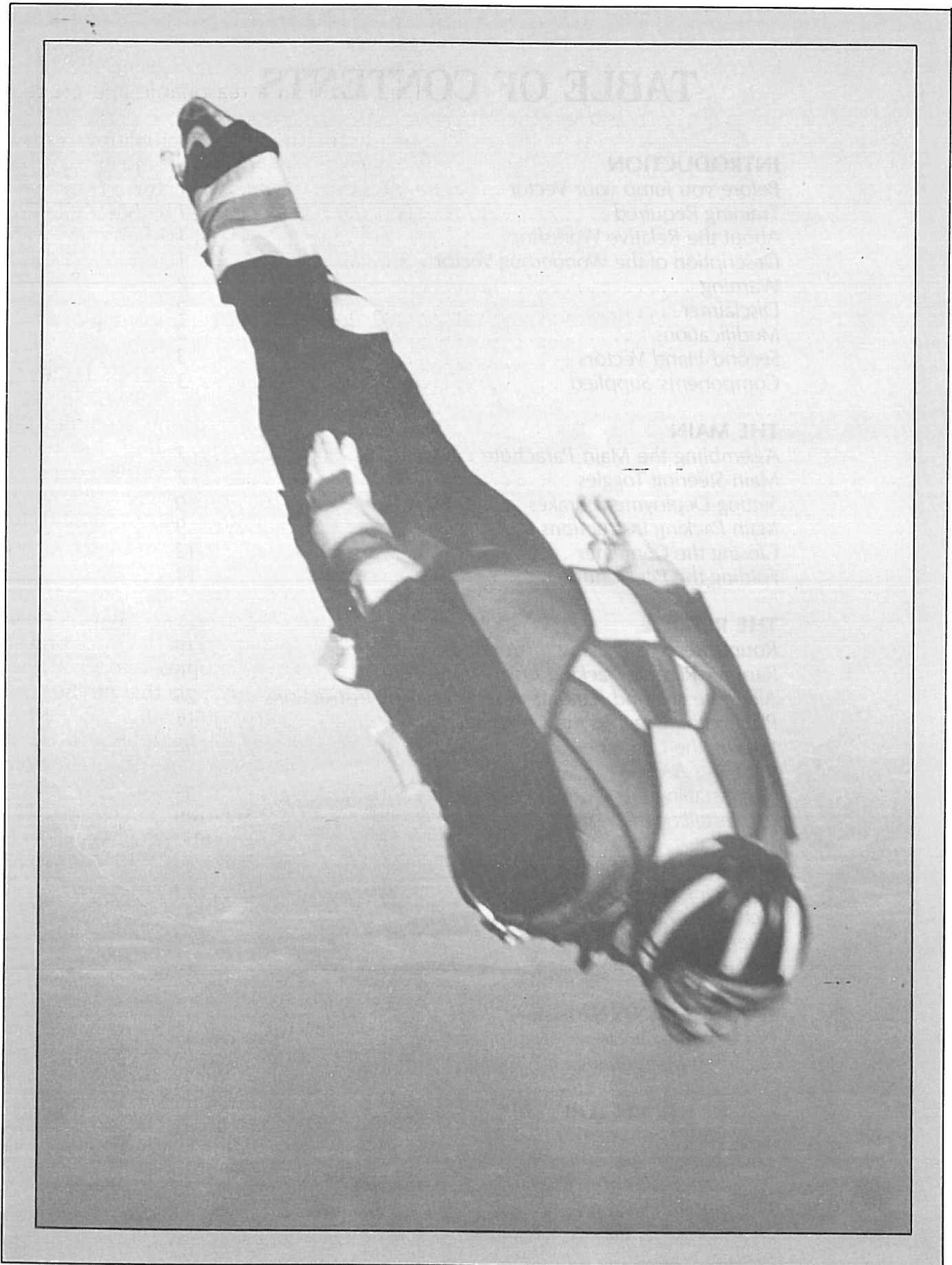
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Connie Simpson swoops by photographer Norman Kent. This manual was produced by AeroGraphics, DeLand, Fla. Design and illustrations by Sandra Williams. © 1987 Relative Workshop, Inc. All rights reserved.

# INTRODUCTION

Congratulations!

By choosing the Relative Workshop Wonderhog Vector program you've shown that you'll settle for nothing less than the best.

## BEFORE YOU JUMP YOUR VECTOR

Please read this manual thoroughly before assembling or using your Vector, even if you've owned or jumped a Vector before. We've recently made several important changes to the rig, and you should know about them before going into the air.

If after reading this manual you still have questions concerning the Wonderhog Vector, please contact us. We'll be happy to help you.

If you have any suggestions or see a need for changes in the Vector, please let us know by calling or writing the Relative Workshop, 1725 Lexington Ave., DeLand, FL 32724. (904) 736-7589. We're open from Monday through Friday, from 8 am to 5 pm Eastern time.

## TRAINING REQUIRED

If you've never jumped a Vector before, or if you're transitioning from other types of gear, be sure to receive instruction on its use from a knowledgeable instructor. This instruction should consist of a practice session in a suspended harness or on the ground where you practice both routine and emergency procedures.

This manual is not a course of instruction on how to make a parachute jump. Nor does it contain the various regulations that govern sport parachuting and related activities.

It is the responsibility of the owner to insure the Vector is properly assembled, maintained, packed, worn and used. It is also his responsibility to seek out and obtain proper training before he uses it.

The person who inspects and packs both the main and reserve parachutes must be qualified to do so.

The owner of a Vector should not loan it to another person without first determining that the person is fully capable of using it properly and safely.

Finally, nothing in this manual is meant to

discourage the reader from using the Wonderhog Vector in a reasonable and prudent way.

The information and specifications in this manual were in effect at the time of printing. The Relative Workshop, Inc., however, reserves the right to change the Vector at any time without notice and without incurring any obligation.

## ABOUT THE RELATIVE WORKSHOP

The Relative Workshop has been designing and building state-of-the-art skydiving rigs since 1975. We invented and patented the hand deployed pilot chute and the 3-Ring release. We introduced innovative construction techniques that have made rigs safer, lighter and more comfortable. Many of these innovations have been adopted by the entire industry.

The Relative Workshop does more than just build rigs: We try to provide a total solution to your equipment needs. We offer most brands of main and reserve canopies, and we'll work to help you get the products that are best for you. We also carry jumpsuits and other accessories. We have the facilities and expert staff to assemble, pack and maintain your Vector and its parachutes.

Finally, your satisfaction comes first. We want you to be happy with your Wonderhog Vector, and we welcome your questions and comments.

## DESCRIPTION OF THE WONDERHOG VECTOR

The Wonderhog Vector is a piggyback harness and container system designed for freefall sport parachuting. It is available in a wide variety of container sizes to fit practically any main or reserve canopies, either round or ram-air. It is manufactured in accordance with FAA TSO c23(b).

## MAIN PARACHUTE SYSTEM

The main canopy is deployed by a hand deployed pilot chute. It is packed into a con-

tainer that is held shut by a curved locking pin. The curved locking pin permits the pilot chute to easily extract the pin from practically any angle.

The main canopy may be jettisoned from the harness by its patented 3-Ring release system, a single point system that is activated by a soft handle located on the right main lift web.

## RESERVE PARACHUTE SYSTEM

The Vector reserve container can be manufactured to accept round or ram-air reserve canopies. The reserve parachute container is held closed by a single pin. The reserve ripcord handle is made of metal and fits in a pocket on the left-hand main lift web.

The reserve system accepts two popular automatic activation devices—the SSE Sentinel MK 2000 and the FXC Model 12000.

## HARNESS

The harness is constructed of Type 7 and Type 8 Mil-Spec webbing and new—not reconditioned—hardware.

## WARNING

Sport parachuting is a hazardous activity that can result in injury or death.

Parachutes sometimes malfunction, even when they are properly designed, built, assembled, packed, maintained and used. The results of such malfunctions are sometimes serious injury or death.

The U.S. Parachute Association estimates that there are about 30,000 skydivers in the U.S., and these jumpers made approximately 2 million jumps in 1984. The Association reported 33 skydiving fatalities that year, meaning the probability of dying on a skydive is approximately 1 in 61,000. It also seems that the more experienced a skydiver is, the less likely he is to be killed while jumping.

Experts estimate that hundreds of people are also injured. Some of these deaths and injuries are the result of equipment malfunctions.

If you use your Wonderhog Vector, or if you allow someone else to use it, you are

acknowledging sport parachuting's risks and accepting the fact that the Wonderhog Vector or its components may malfunction.

If you are not willing to accept the risks of sport parachuting, or if you aren't willing to accept the possibility that your Wonderhog Vector or components may malfunction and perhaps cause you to be injured or killed, then you may return your Vector for a full refund before it is used. Details on how to do this are printed below.

## DISCLAIMER—NO WARRANTY

Because of the unavoidable danger associated with the use of this harness and container assembly, the manufacturer makes no warranty, either express or implied. The rig is sold with all faults and without any warranty of fitness for any purpose. Manufacturer also disclaims any liability in tort for damages, direct or consequential, including personal injuries, resulting from a malfunction or from a defect in design, material, workmanship, or manufacturing whether caused by negligence on the part of the manufacturer or otherwise.

By using this rig, or allowing it to be used by others, the buyer waives any liability for personal injuries or other damages arising from such use.

If the buyer declines to waive liability on the part of the manufacturer, buyer may obtain a full refund of the purchase price by returning the parachute harness and container, before it is used, to manufacturer within 30 days from the date of original purchase with a letter stating why it was returned.

## ABOUT MODIFICATIONS

It is common for jumpers to "improve" their rigs by altering them. A high percentage

of these alterations cause malfunctions or make the rig harder to use correctly.

Typical alterations include conversion to a "pull-out" pilot chute, changing the dimensions of the harness, changing the length of the bridle, installing automatic activation devices, and so forth.

Check with the Relative Workshop before you make any changes to your Vector. It was designed and built the way it is after years of testing and development. There are reasons for having things the way they are, reasons that might not be apparent at first. Check with us before you allow any changes to be made; even "insignificant" alterations may have very negative and unforeseen effects.

## **SECOND-HAND VECTORS**

If you obtained your Vector second-hand from a private party, be sure it is airworthy before using it. Have a rigger or loft inspect it first.

If you prefer, the Relative Workshop will inspect your second-hand Vector. There is a reasonable charge for this service.

If you obtain replacement parts from a source other than a Relative Workshop dealer, be sure they exactly match the parts they replace. For example, be sure the reserve ripcord is long enough. Consult a rigger or loft whenever you replace any component of your Vector.

## **COMPONENTS SUPPLIED:**

The Vector comes complete with these components:

- Harness and container
- Hand-deploy main pilot chute
- Main pilot chute bridle
- Main deployment bag
- Main locking loop
- Spring-launched Vector reserve pilot chute and bridle
- Reserve ripcord
- Reserve locking loop
- Reserve pilot chute bridle
- Main risers and steering toggles
- 3-Ring release handle
- The Wonderhog Vector Owner's Manual

Once you are sure you have these components, check to be sure the containers are sized properly for your main and reserve canopies. Refer to the TSO label on the data card pocket or to the data panel located behind the warning label to determine the size of the containers. Refer to the Compatibility Chart in Appendix A (a separate sheet of paper supplied with this manual) to determine what canopies will fit in your Vector. (You'll find the packing data card pocket under the Vector monogram by lifting the reserve pin protector flap. The warning label is a large orange piece of material sewn to the back pad of the rig. The TSO information is on a separate strip under the orange warning label. Not all Vectors have warning labels.)

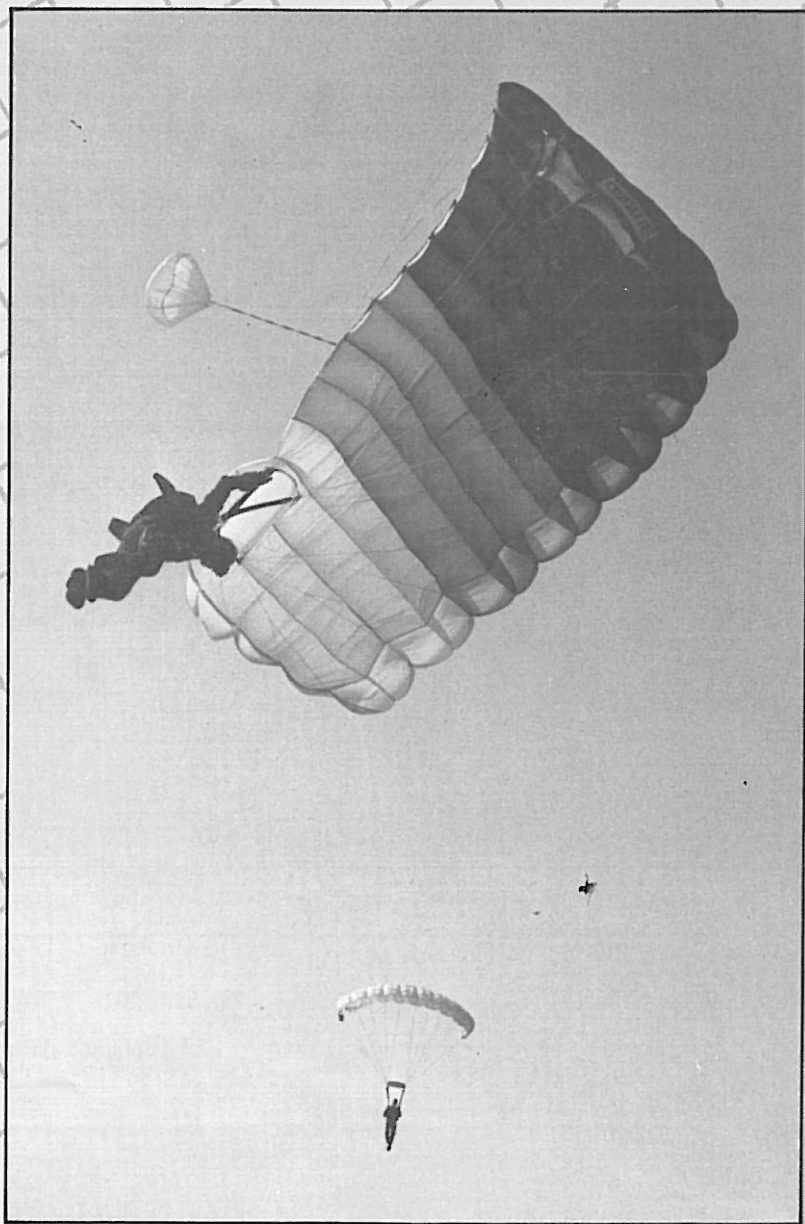
If you use components that were not supplied with the harness and container, be sure they have the correct dimensions and are made of the same materials. For instance, be sure the breakaway cables are of the proper length.

Replacement components for the Vector are readily available from the Relative Workshop.

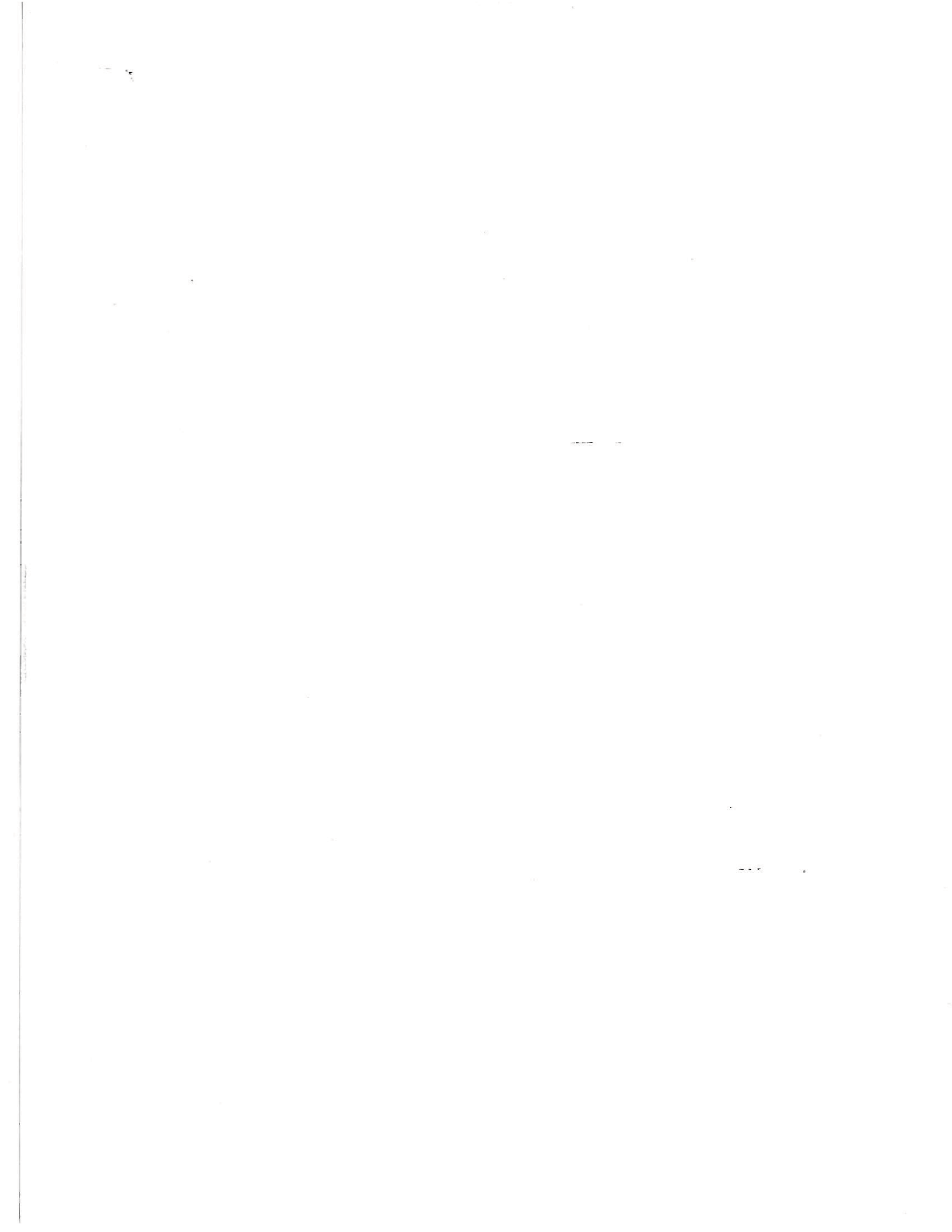
Federal Aviation Administration regulations require that the reserve parachutes be inspected, maintained, assembled and packed by an appropriately rated Senior or Master Parachute Rigger. Other countries may have similar regulations.



# The Main







## **ASSEMBLING & PACKING MAIN PARACHUTE**

### **Introduction**

The Vector is compatible with practically any main parachute that will fit into the container. This manual does not provide specific instructions for folding all of the various main canopies on the market—that information must be obtained from the owner's manual for each canopy.

### **Assembling the Main Parachute**

Carefully inspect the main parachute for wear or manufacturing defects.

Attach the main parachute to the main risers included with the Vector. Be sure the canopy is facing forward and that the lines extend from links to canopy without crossing over each other. Leaving the risers on the harness while attaching the canopy will help prevent confusion.

If the canopy uses #5 Rapide links, make sure the barrel nuts completely cover the threads.

If slider bumpers were not supplied with your main canopy, you may want to install them. Slider bumpers protect the slider grommets on ram-air canopies. Slider bumpers also keep the barrel nuts on the links from working loose. Bumpers may be made from practically any 3/4-inch inside diameter flexible tubing. A rigger can show you how to make and install them.

It's important to check that the ram-air main canopy steering lines can't jam between the slider bumpers and the slider grommets. If they jam, the parachute will be rendered unsteerable.

Attach the steering toggles to the control lines of the main canopy according to the instructions below.

### **Attaching the Main Canopy Steering Toggles**

The Vector is supplied with steering toggles for the main canopy that are compatible with the Vector risers. It is important that the toggles and risers be compatible to prevent malfunctions.

It is also important that the toggles be located along the steering lines so the canopy is in a true no-brake mode when the toggles

are resting against the guide ring. If not, the canopy won't glide or land correctly.

Likewise, if the toggles are mounted too far down the steering lines, the canopy will be less responsive and the jumper might not be able to apply full brakes or stall the canopy. This can make it hard to flare the canopy properly for landing.

These situations are likely to occur when a main canopy is hastily switched from one set of risers to another. If the guide rings on both sets of risers are not located the same distance from the connector links, the steering toggles must be moved to another location on the steering line.

It is also important to securely attach the toggles to the steering lines. Although most canopies may be adequately controlled by using the rear risers, a "lost" toggle can be hazardous in some circumstances.

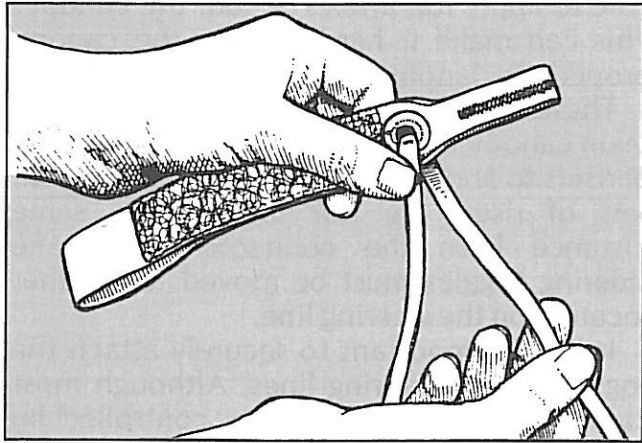
### **Installing Steering Toggles**

#### **Ram-Air Canopies**

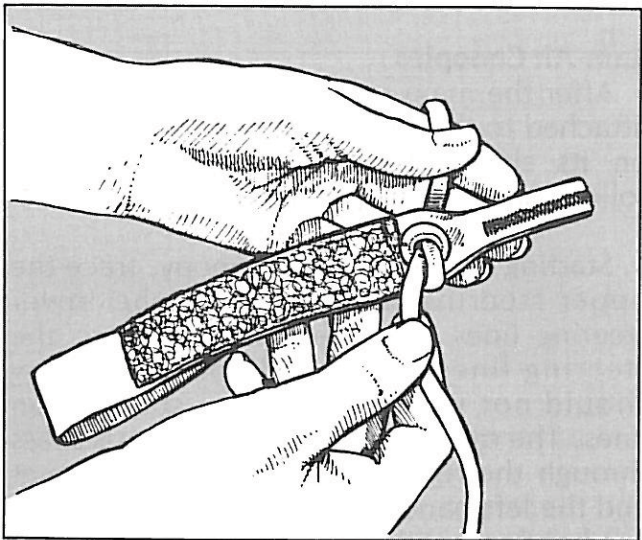
After the main canopy has been properly attached to the risers and while it is still laid on its side, attach the toggles to it by following these steps:

1. Starting at the tail of the canopy, trace the upper steering lines down to the lower steering lines. The idea is to be sure the steering lines are routed correctly; they should not wrap around any suspension lines. The right-hand steering line must pass through the right-hand rear slider grommet and the left-hand line must pass through the left-hand rear slider grommet.
2. If the main canopy is already equipped with toggles, mark each steering line where it is knotted to the toggle. The purpose of this mark is to insure the toggle is installed at exactly the same point on the steering line.
3. Remove one of the old toggles and pass the steering line through the keeper ring on the riser.

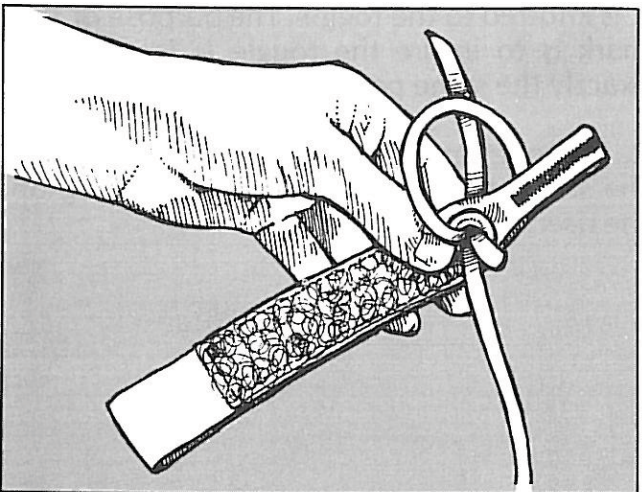
4. Pass the end of the steering line through the grommet in the toggle, starting from the Velcro side as shown. Adjust line so that the mark rests directly on the inside of the grommet.



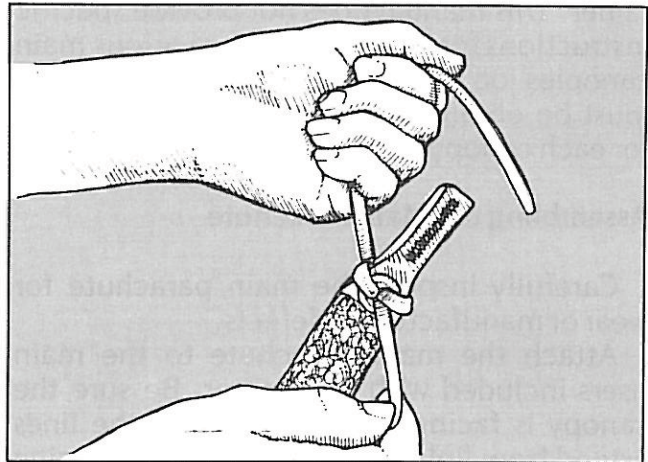
5. Loop the line around, pass it through the grommet again and pull snug. Make sure that the mark remains in the correct place.



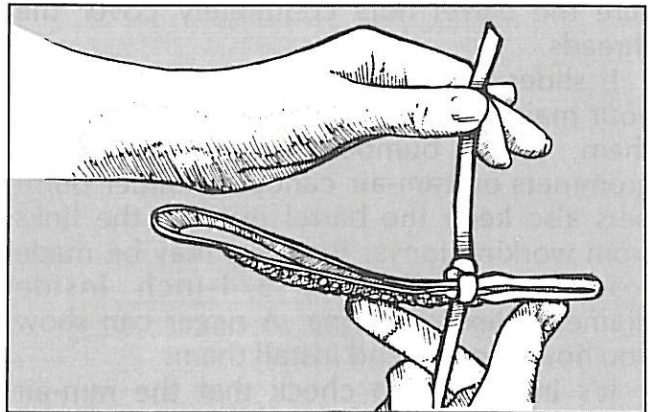
6. Loop the line around the other side of the toggle as shown and pass it through the grommet once again.



7. Grasp both ends of the line and pull tight. Note that the line originates on the Velcro side of the toggle, does a figure-8 through the grommet and exits on the smooth side of the toggle. Check to be sure the mark on the line is still in the correct position.



8. Tie an overhand knot on the free end of the line and tighten it right down to the toggle. This knot will hold the toggle onto the steering line, so be sure that it is snug.



9. Check the canopy with the deployment brakes both attached and unattached to be sure the canopy is correctly configured. The owner's manual of the canopy provides the proper brake settings and steering line lengths; there are no standardized dimensions. Unless the steering lines are of proper length, the canopy may not open or fly correctly.

10. Once the measurements have been verified, tighten the overhand knot at the toggle. It is generally not a good idea to cut off the excess steering line, as you might want to adjust the toggles after the canopy has been jumped. Any excess line should be daisy chained on itself.

11. Inspect the installation. Check to be sure the steering lines are routed correctly.

## Setting the Deployment Brakes—Ram-Air Canopies

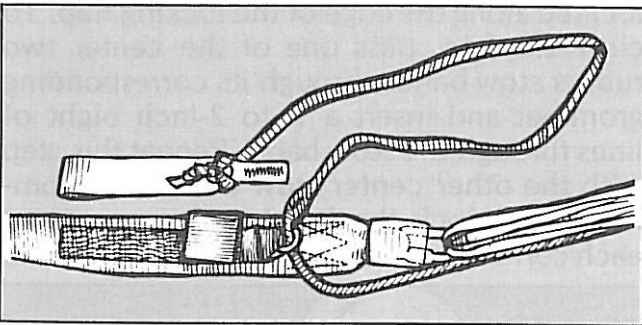
Every ram-air canopy on the market today is equipped with “deployment brakes” to make it open more gently and reliably. The brakes work by keeping the tail of the canopy pulled down several inches during deployment. This prevents the canopy from surging forward as it inflates and begins flying.

As mentioned previously, malfunctions and poor deployments can result if the brakes are not set during packing, or if they are set incorrectly, or if one or both releases before the canopy is completely inflated and stabilized. Combining incompatible toggles and risers can also create the same problems.

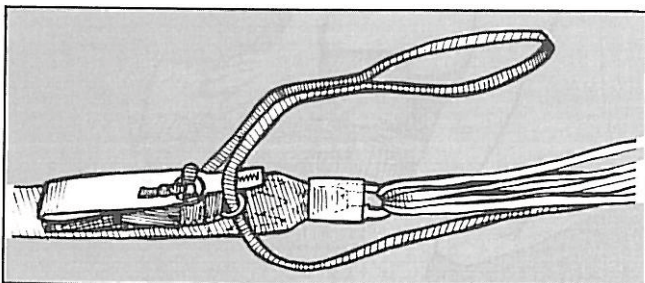
Not all rigs have risers that are configured like those shipped with the Vector. Different designs require different procedures, and an instructor or rigger should be consulted for the correct one.

### Setting the Brakes—Ram-Air Canopies

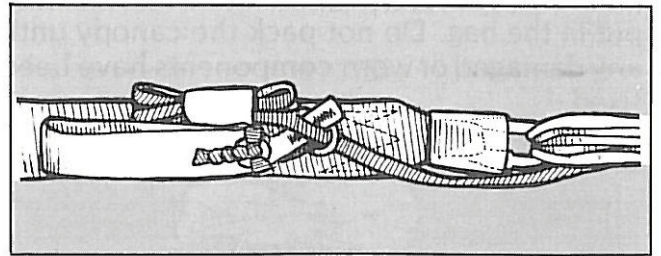
1. After the canopy is inspected, flaked and folded, use the toggle to pull the right-hand steering line down until the brake loop just passes through the guide ring.



2. Insert the tapered end of the toggle all the way into the loop. Pull on the steering line above the guide ring to seat the toggle against the ring. Mate the toggle Velcro with that on the riser. Check to be sure the tapered end of the toggle is completely seated in the loop. (It shouldn't be inserted past the end of the taper, or it may be difficult to extract in the air.)



3. Fold the bight of line between the toggle and loop with 3-in. folds and stow it in the Velcro tab next to the toggle.



4. Repeat the procedure for the left-hand toggle.

## Round Canopies

The toggles supplied with the Vector may or may not be suitable for use with a particular round canopy.

Always consult a rigger before putting a round canopy in a Vector. The proper packing procedure for any round main must be obtained from the canopy owner's manual.

Inspect the canopy installation to make sure the risers aren't reversed or twisted. Then install the deployment bag and the pilot chute to the top of the canopy. The ring stop on the bridle must lie between the grommet in the deployment bag and the pilot chute.

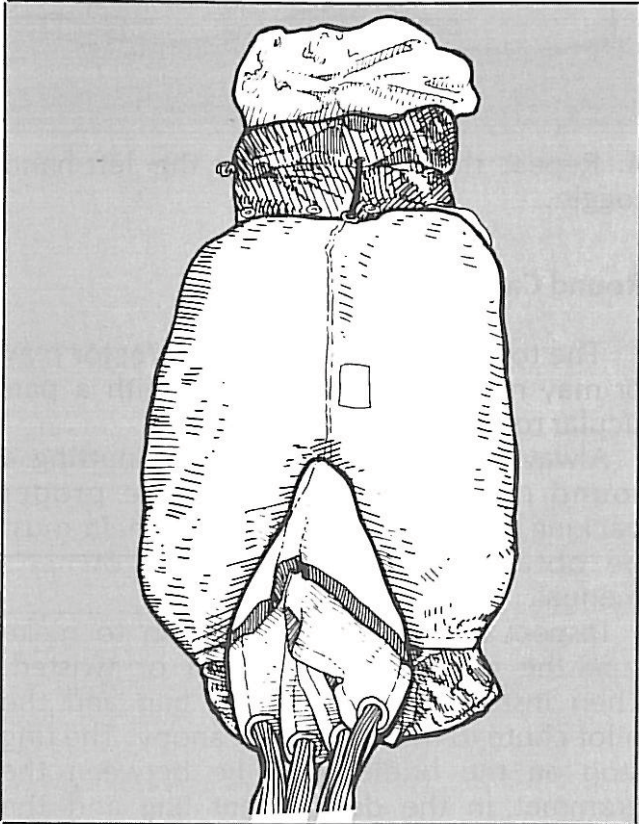
## MAIN CANOPY PACKING INSTRUCTIONS

Instructions for packing specific main canopies are published by the canopy manufacturer and are beyond the scope of this manual.

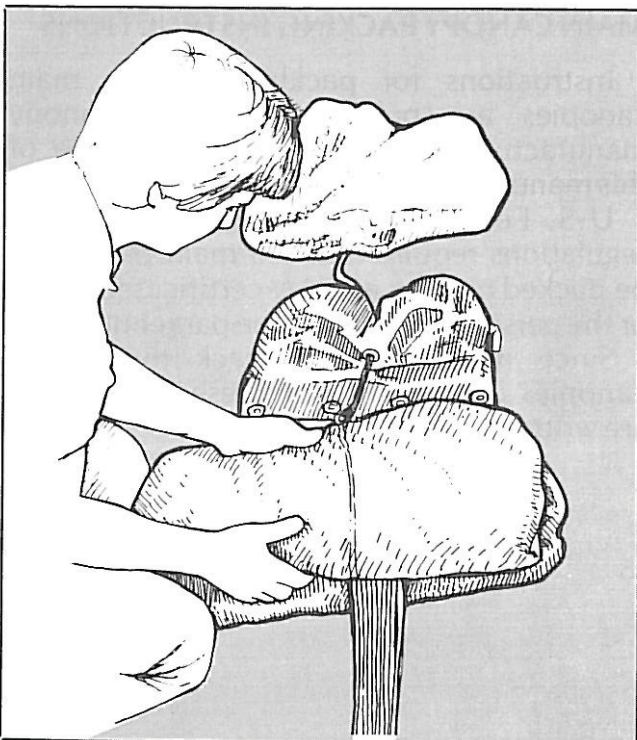
U.S. Federal Aviation Administration regulations require that the main parachute be packed only by an FAA-certificated rigger or the person who will use the parachute.

Since most skydivers pack their main canopies on the ground, these instructions are written for that method.

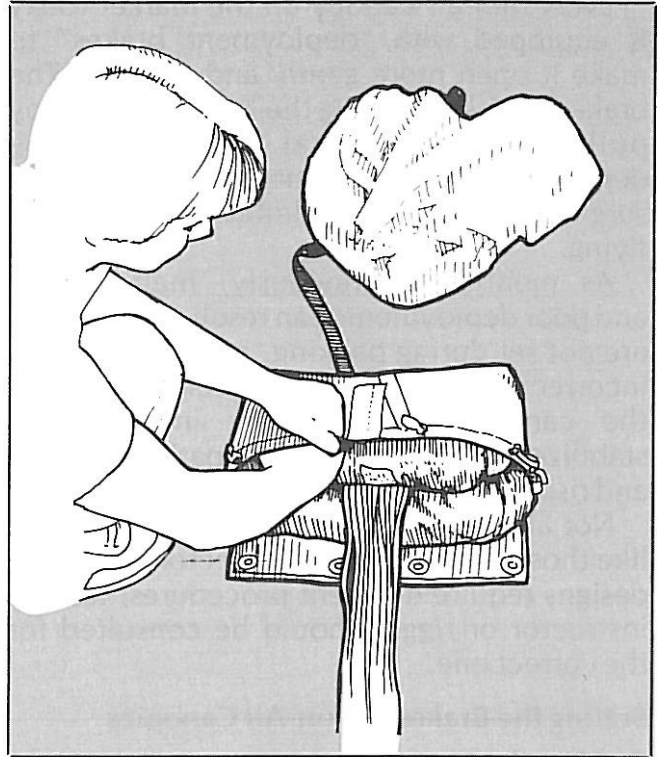
1. Lay out, flake and fold the canopy according to the canopy manufacturer's instructions. Be sure the canopy is folded as wide as possible so that it will fill the corners when put in the bag. Do not pack the canopy until any damaged or worn components have been fixed.



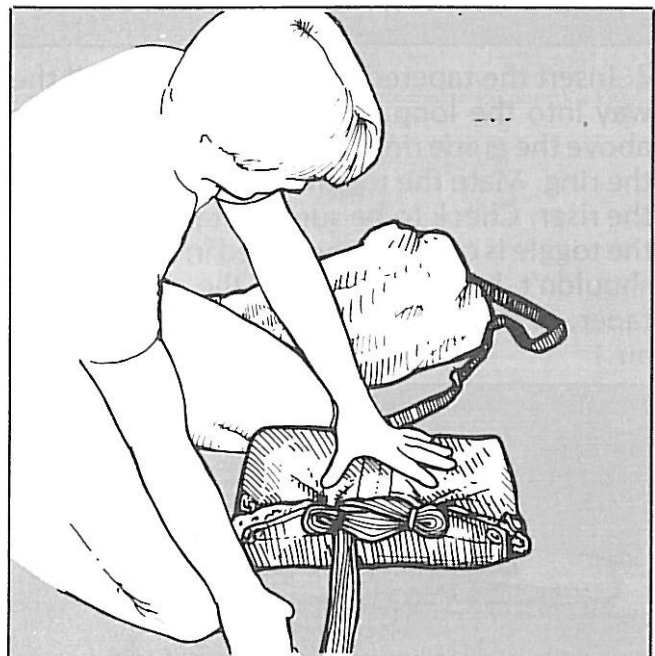
2. Stack the canopy on itself so that it is about the depth of the bag.



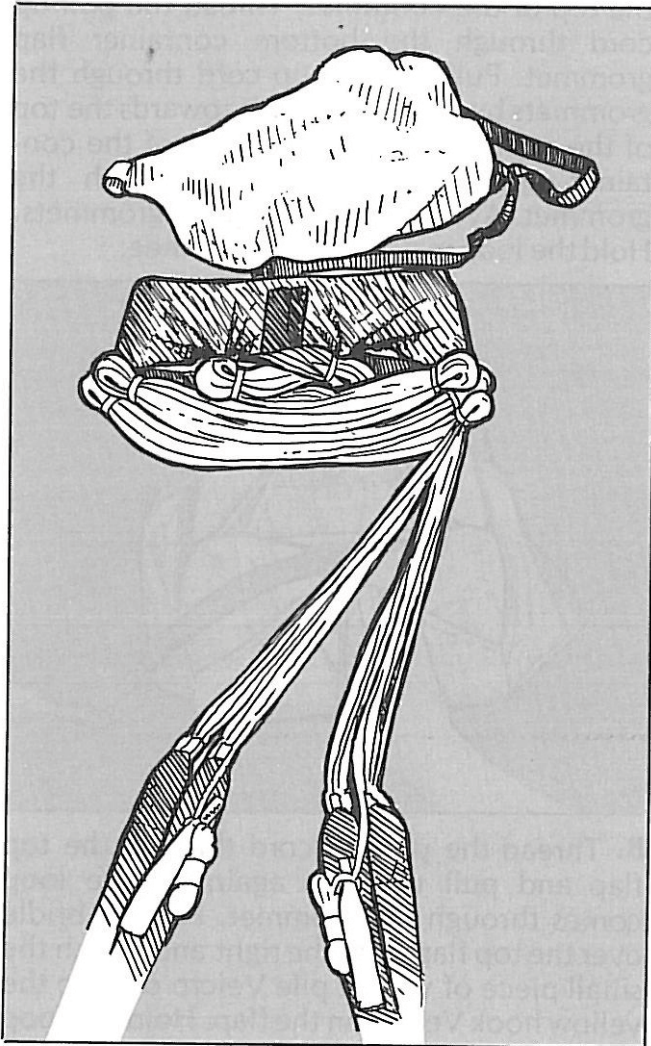
3. Slide the canopy into the deployment bag, being sure to fill the corners completely.



4. The bag is held shut by four rubber bands located across mouth of the bag; each of these rubber bands pass through a grommet located along the edge of the locking flap. To close the bag, pass one of the center two rubber stow bands through its corresponding grommet and insert a 1- to 2-inch bight of lines through the stow band. Repeat this step with the other center stow band and grommet. Then lock the band and grommet at each corner.



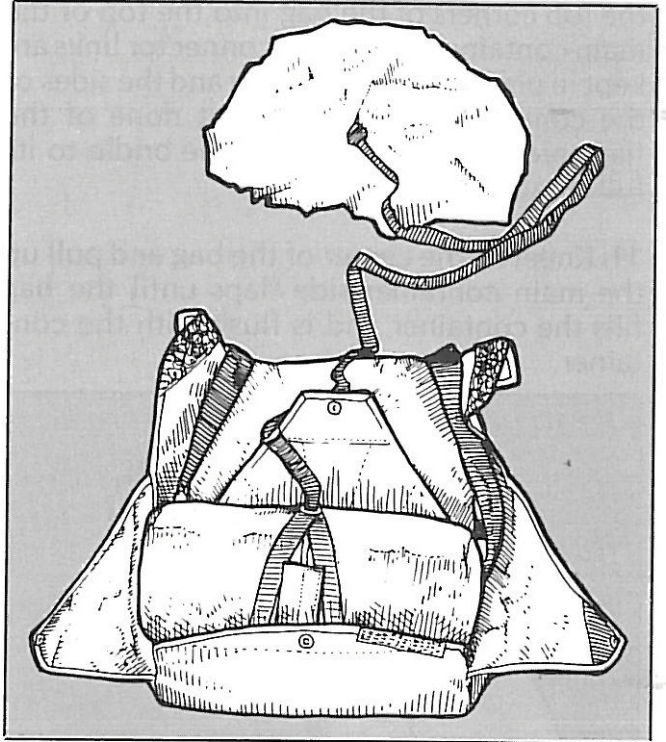
5. Stow the remainder of the lines across the bottom of the bag in the rubber bands. Keep the bights of lines 1 to 2 inches long. Leave no more than 15 inches of lines unstowed between the bag and the connector links.



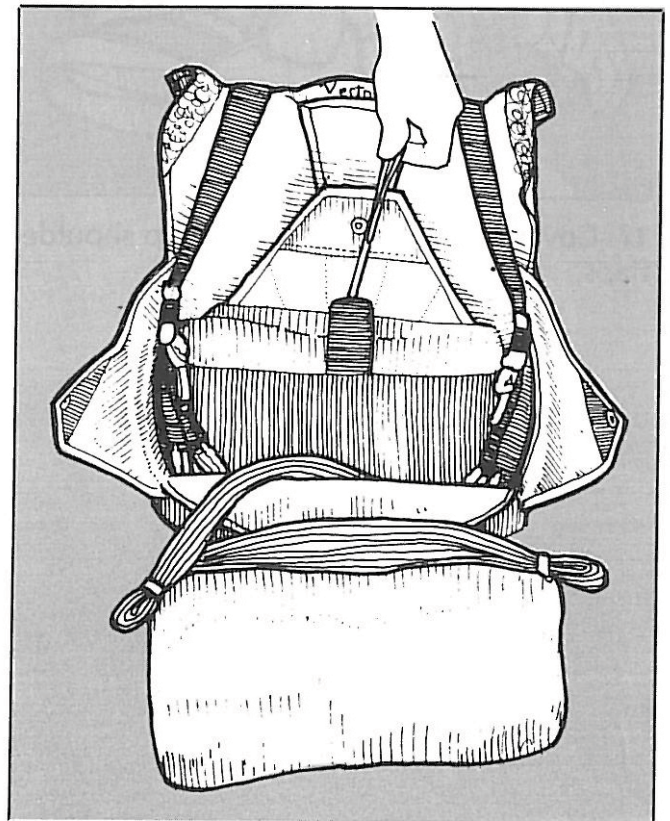
6. Pull the pilot chute bridle out of the top of the bag until you seat the canopy's metal ring against the grommet in the bag. Push any canopy fabric from the ring and grommet back into the bag with your finger; this keeps it from being damaged.

7. Use your knees or feet to "walk" on the bag, squeezing air out and distributing the bulk until the middle is no fatter than the sides.

8. Pick the bag up by its sides and set it into the container on its line stows.

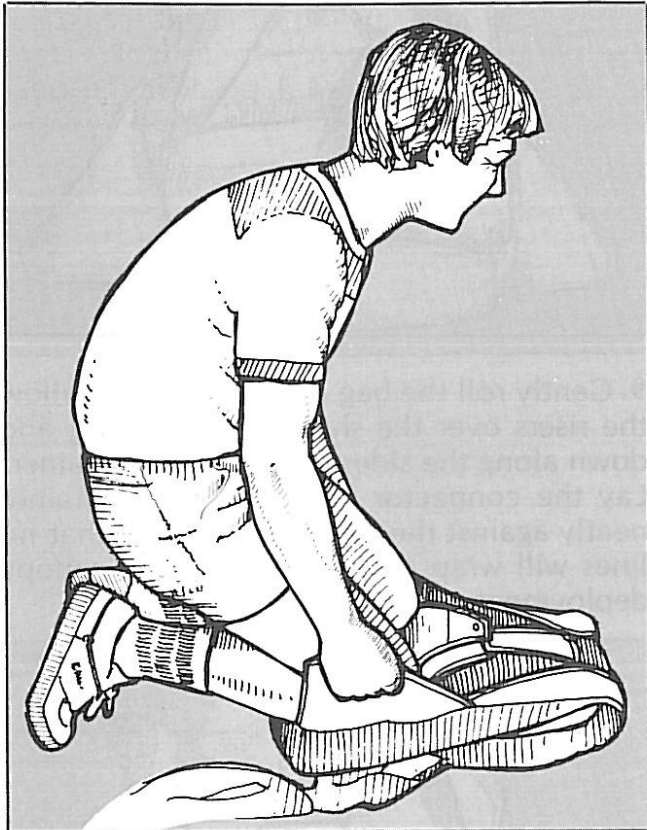


9. Gently roll the bag out of the way. Follow the risers over the shoulders of the rig and down along the sides of the main container. Lay the connector links into the container neatly against the sides making sure that no lines will wrap around them during canopy deployment.



**10.** Lay the bag down in the container with the line stows against the bottom flap. Push the top corners of the bag into the top of the main container so that the connector links are kept in place between the bag and the sides of the container. Make sure that none of the flaps are under the bag. Pull the bridle to its full length.

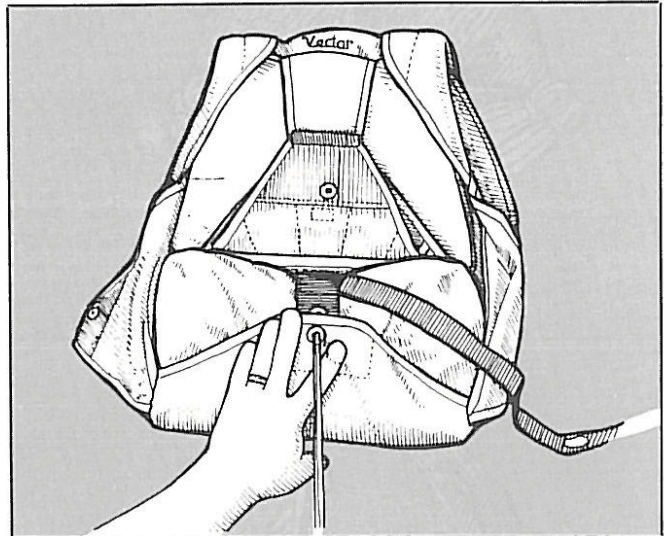
**11.** Kneel on the center of the bag and pull up the main container side flaps until the bag fills the container and is flush with the container.



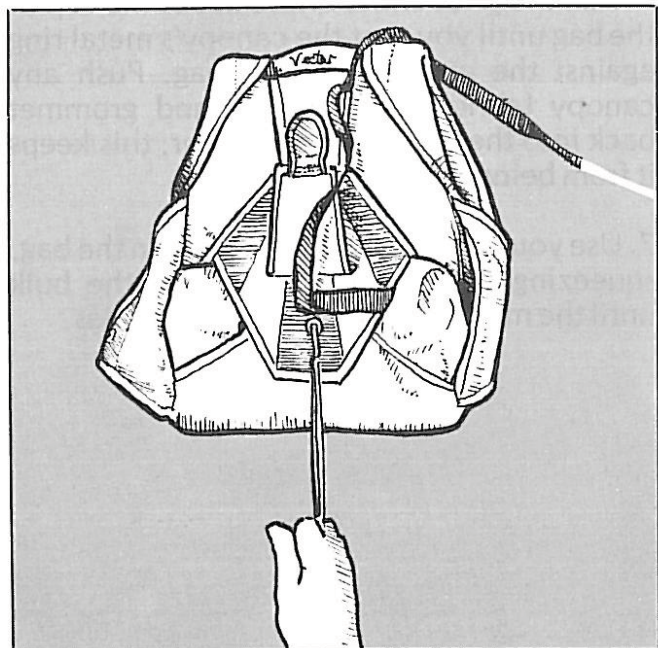
**12.** Cover the risers with the Velcro shoulder flaps.

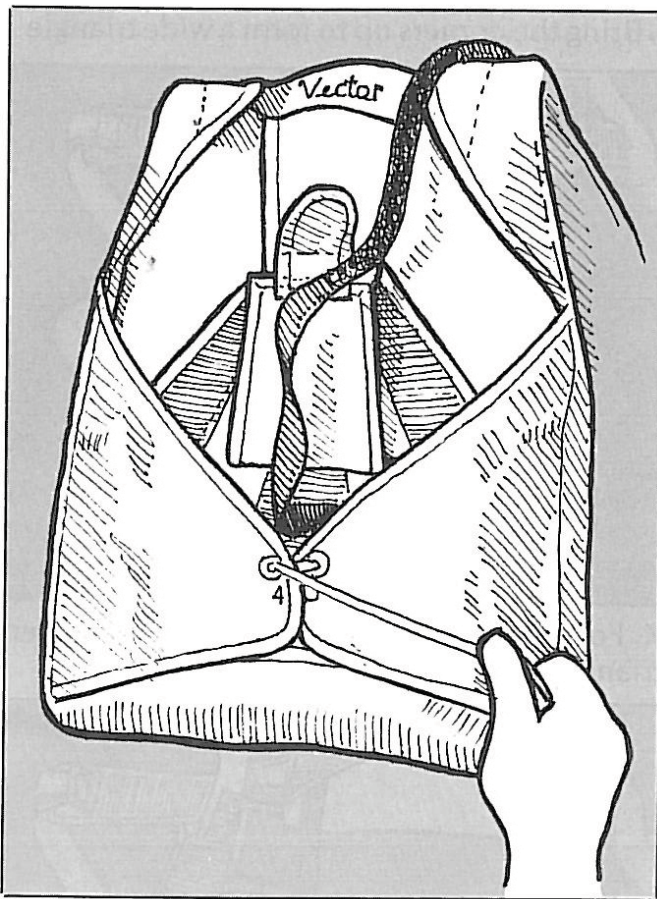
## Closing the Container

**A.** Insert a pull-up cord through the loop at the top of the main container. Route the bridle to the right of the pull-up cord and out the top of the container. Thread the pull-up cord through the bottom container flap grommet. Pull the pull-up cord through the grommets by pulling upwards towards the top of the container. Pat the bottom of the container until the loop comes through the grommet. Avoid overstressing the grommets. Hold the loop in place with your knee.

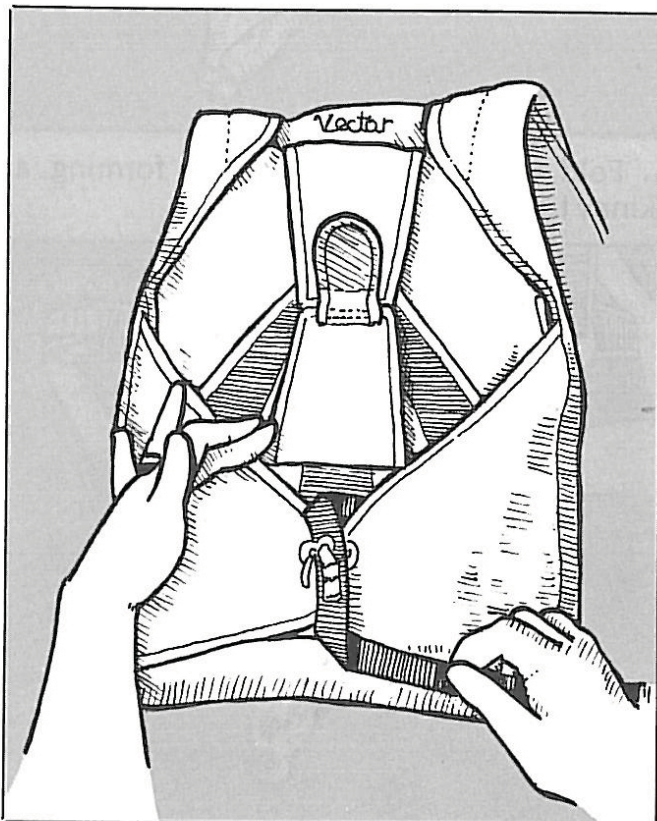


**B.** Thread the pull-up cord through the top flap and pull upwards again till the loop comes through the grommet. Put the bridle over the top flap from the right and attach the small piece of yellow pile Velcro on it to the yellow hook Velcro on the flap. Hold the loop again with your knee if need be.





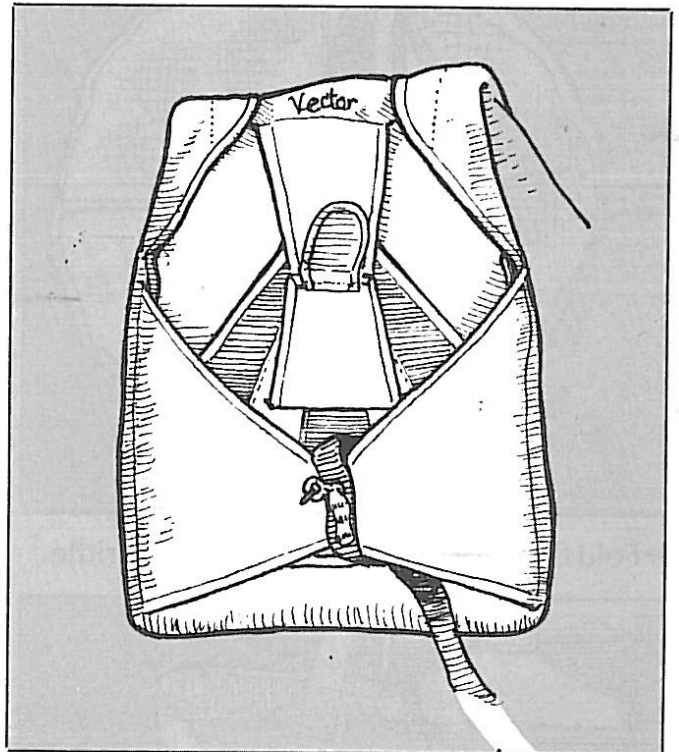
C. Thread the right-hand then left-hand side flaps using the same patting technique. (The flaps must be closed in that order.) Insert the curved pin on the pilot chute bridle through the locking loop from right to left.



D. Slowly remove the pull-up cord to prevent excess friction from damaging the locking loop. It's best to pass the pull-up cord under the curved pin while extracting it, as doing so will reduce wear on the loop.

E. Be sure the little yellow patch of Velcro on the bridle is mated to the corresponding patch on the top flap near the locking pin. If the bridle is too tight to allow the two patches to mate easily, make a little extra slack by gently pulling the bridle out of the main container.

F. Tuck the excess bridle under the bottom edge of the right side flap. The pile Velcro on the bridle attaches to a strip of hook Velcro located on the bottom flap under the right flap.



**Remove the pull-up cord or the container won't open.**

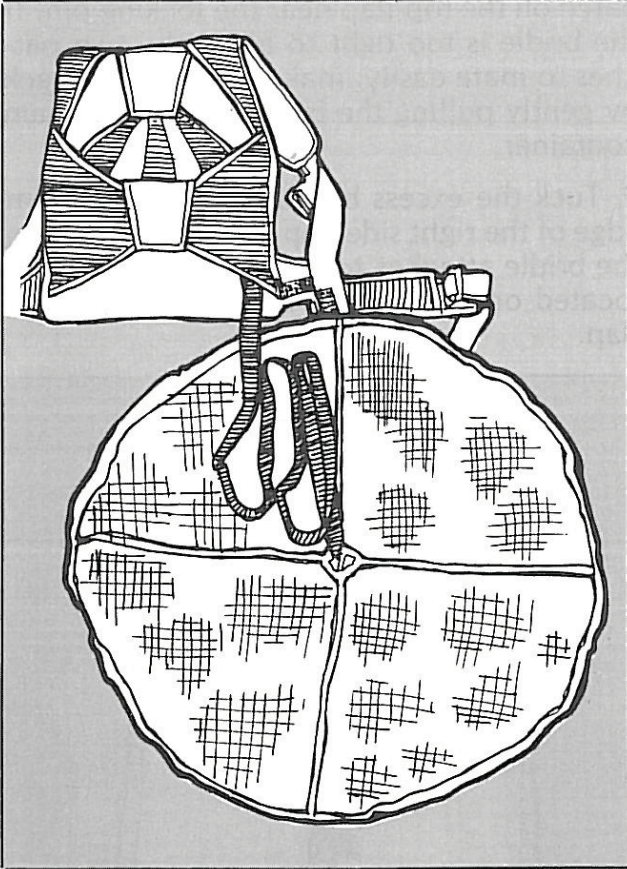
Note: It may be necessary to adjust the length of the locking loop to make the flaps mate properly. The curved pin should be held firmly in place, but a force of no more than 12 lbs. should extract it and open the container.

G. Check to be sure the bridle extends from the locking pin to the pilot chute without passing through the harness. Then mate the Velcro on the bridle to that on the bottom flap; you'll have to tuck the bridle under the right-hand side flap to do this.

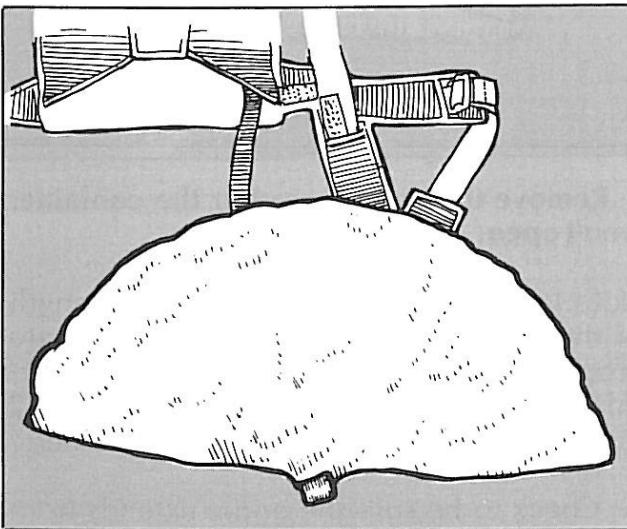


## Folding the Pilot Chute

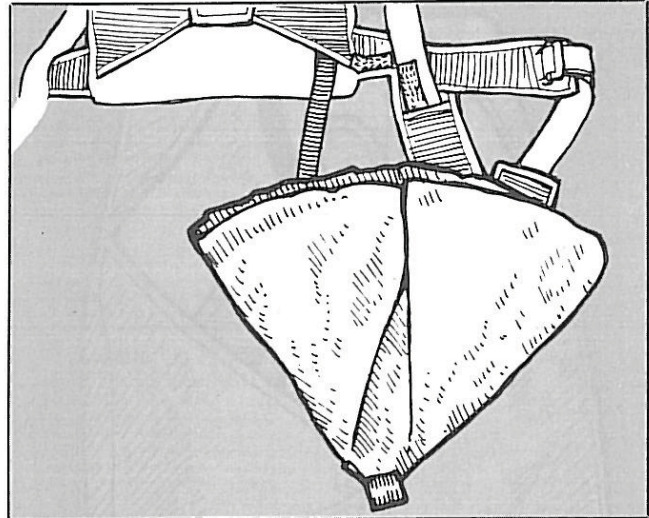
H. Lay the pilot chute out over the leg strap, mesh side up, so the edge of the circle is at the mouth of the Spandex pouch. S-fold the bridle on the half of the pilot chute over the pouch.



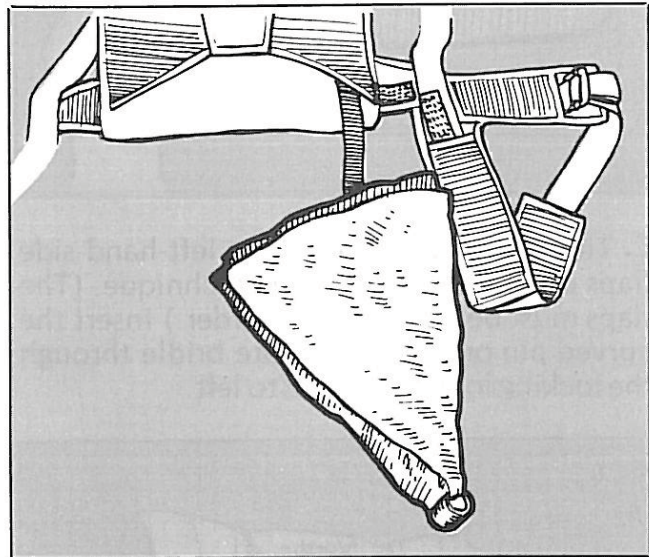
I. Fold the pilot chute in half over the bridle.



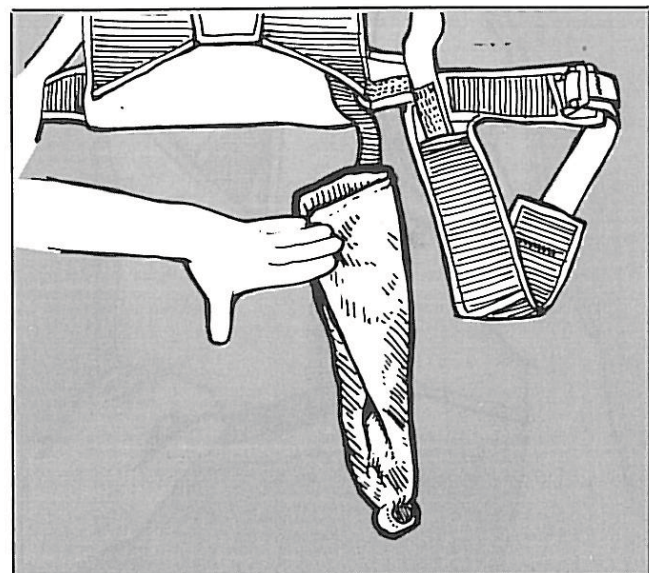
J. Bring the corners up to form a wide triangle.



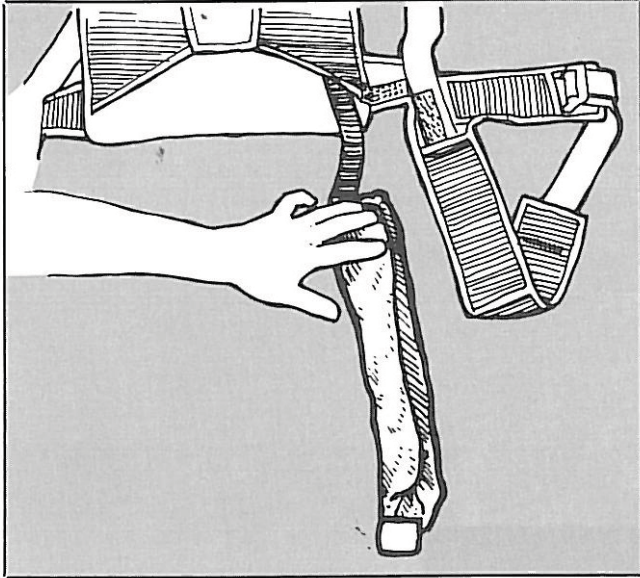
K. Fold the triangle in half, forming a smaller triangle.



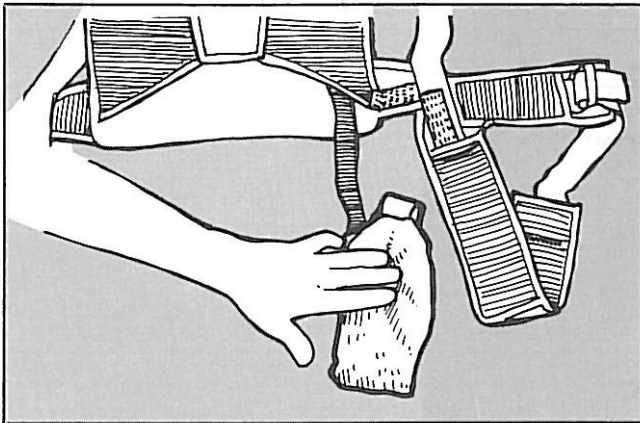
L. Fold the triangle into thirds forming a skinny triangle.



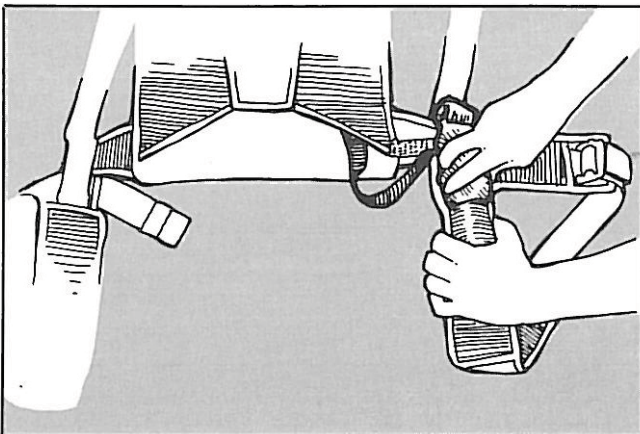
**M.** Fold once more in half, making a very skinny triangle.



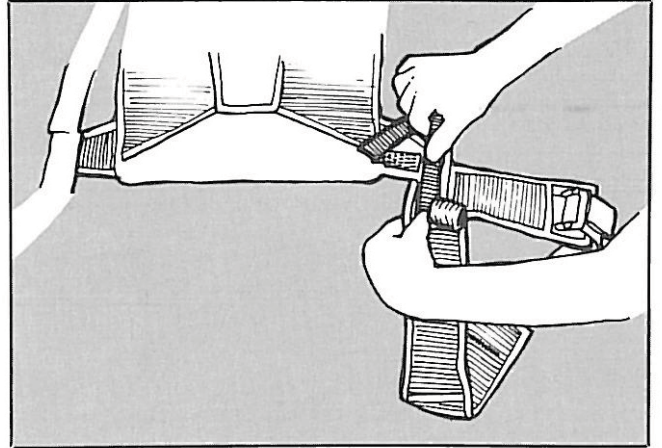
**N.** Fold the pilot chute in half so that the handle is even with the skirt.



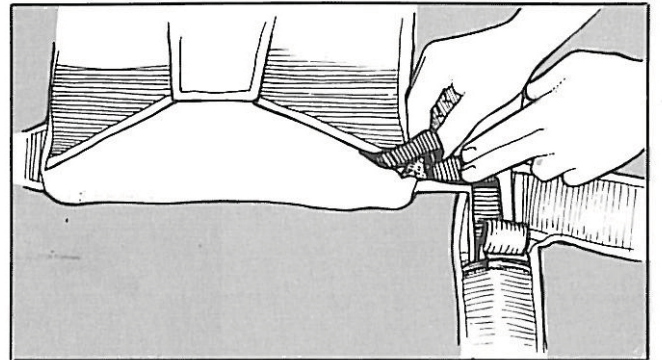
**O.** Stuff the folded pilot chute into the Spandex pouch, making sure only the handle sticks out.



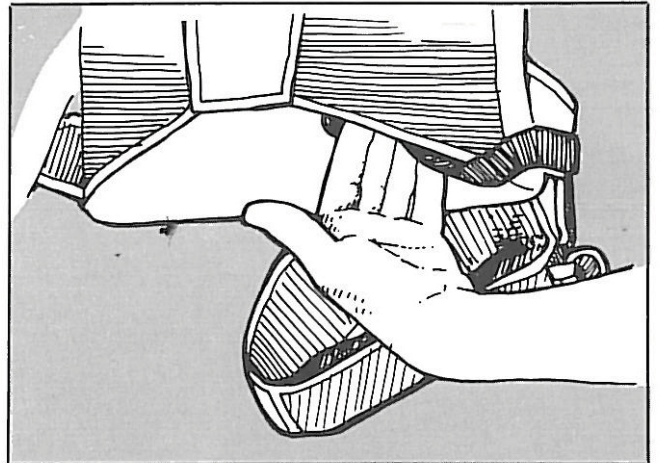
**P.** Mate the Velcro on the bridle to that on the container starting at the mouth of the pouch.



**Q.** Fold the bridle over at a right angle where the leg strap meets the diagonal and continue mating the bridle to the container.



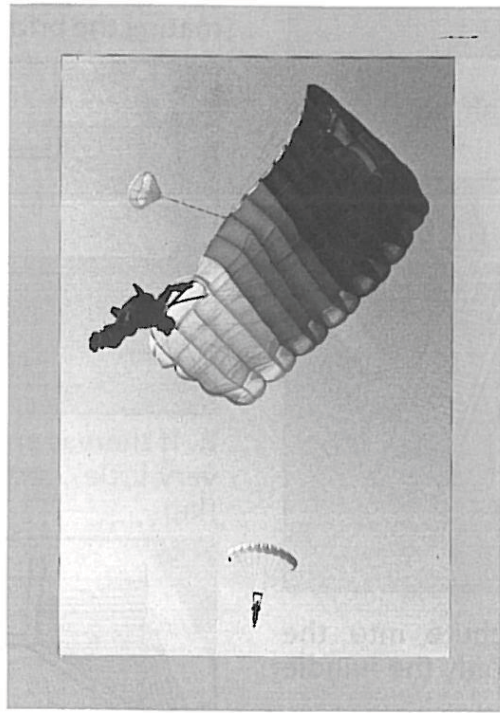
**R.** If there is any extra bridle (there should be very little), stow it under the right main side flap.



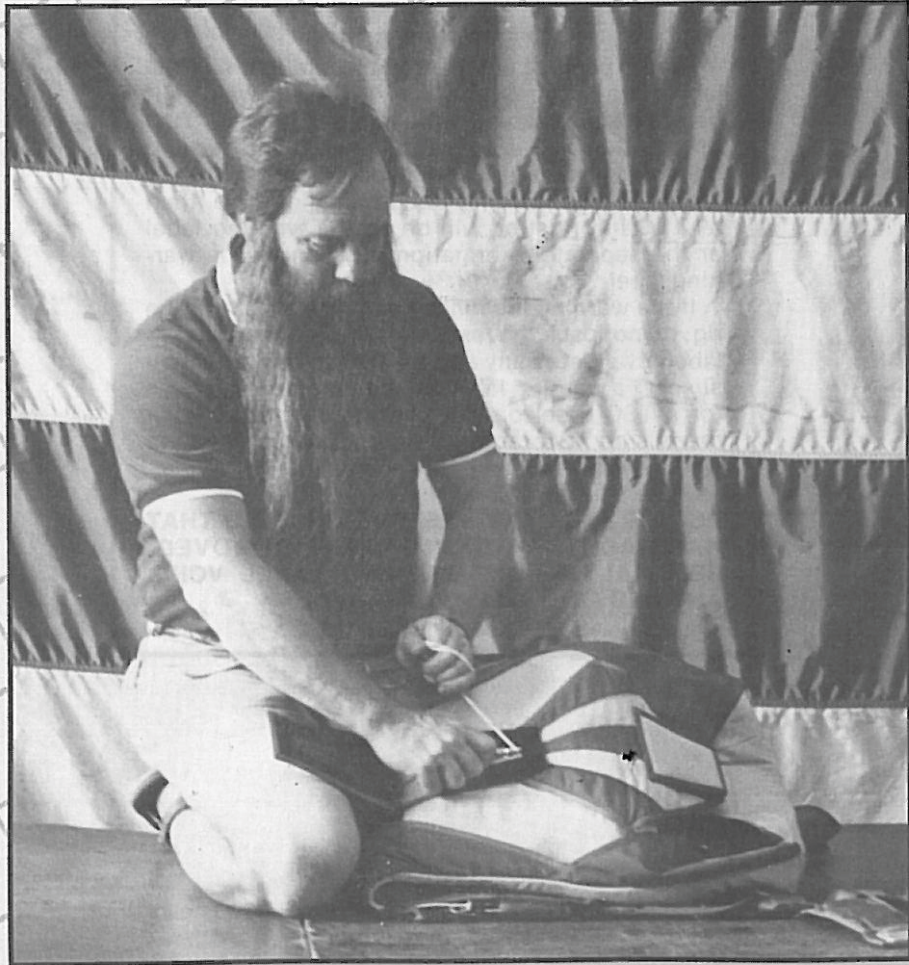
### WARNING

The force needed to extract the curved pin must not exceed 12 lbs. Adjust the length of the locking loop accordingly.

The small patches of yellow Velcro on the bridle and the top container flap must be mated. Failure to do this may result in a pilot-chute-in-tow malfunction.



# The Reserve



#### **ATTENTION RIGGERS**

Before packing any Vector, be sure that all TSO labels are properly in place. If the rig was built before warning labels came into use, then all TSO information will be on the tag sewn to the packing data card pocket (under the Vector logo). If the rig was built after warning labels came into use, then all TSO information will be on the warning label or the separate information strip under the warning label.

If the warning label has been removed from the rig, **do not pack the reserve**. Removal of a warning label invalidates any and all TSO approval. If you suspect a warning label has been removed, check for a TSO label on the packing card pocket. If there is no TSO tag on the card pocket, then the warning label has probably been removed.

**DO NOT PACK ANY RESERVE ON A RIG THAT HAS HAD ITS WARNING LABEL REMOVED. REMOVAL OF THE WARNING LABEL VOIDS ANY AND ALL FAA TSO APPROVAL.**

## RESERVE PACKING INSTRUCTIONS

### Introduction

The first part of this chapter describes procedures for packing round reserve canopies into the Vector while the second part covers ram-air reserves.

An FAA Senior or Master rigger certificate is required to pack any reserve parachute that will be carried for use in the U.S.

If the rig is to have an FXC 12000 or SSE Sentinel MK 2000 automatic activation device, see the instructions later in this chapter.

### For Round Reserves:

Because of the wide variety of reserve canopies on the market, this manual does not contain instructions on inspecting, assembling and folding the reserve parachute canopy. The rigger must refer to the packing instructions provided by the canopy manufacturer for this information.

### Required Tools:

- One temporary pin
- One pull-up cord (48 in. of 550 cord sheathing)
- One packing paddle

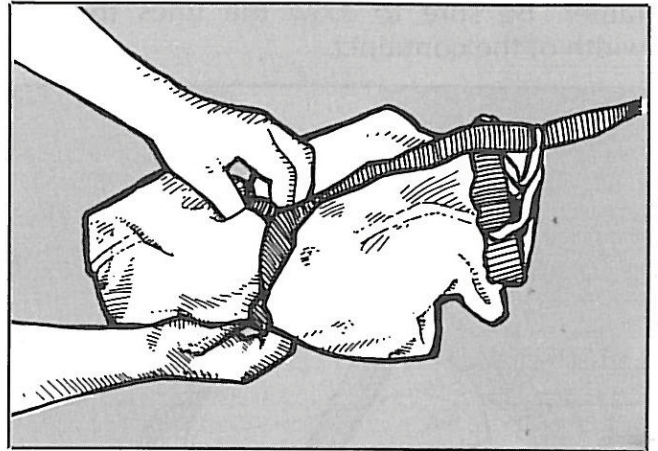
The reserve flaps are numbered 1 through 6 for reference. Close them in that sequence.

It's a good idea to read all of these instructions before starting to pack the reserve.

1. Attach the canopy to the risers with the steering modifications and/or data panel facing to the wearer's rear. If using L-bar links, make sure their screws are thoroughly tightened. If using Rapide links, tighten them to snug, plus a quarter-turn.

2. Follow the canopy manufacturer's instructions to set up the steering system.

3. Attach the Vector reserve pilot chute to the apex of the canopy using the bridle provided. The smaller loop of the bridle wraps around the apex lines and the larger attaches to the pilot chute. Do not substitute other bridles because the length of this bridle is important for fast deployment. Do not substitute another pilot chute for the Vector reserve pilot chute.



4. Inspect the entire reserve system carefully, beginning with the pilot chute and ending with the harness.

5. Flake the reserve canopy according to the manufacturer's instructions.

6. If your reserve canopy does not have a diaper or other deployment device, fold the skirt up parallel to the radial seams, then long fold the canopy into fifths.

7. If your canopy is equipped with a diaper or similar device, close it according to the manufacturer's instructions.

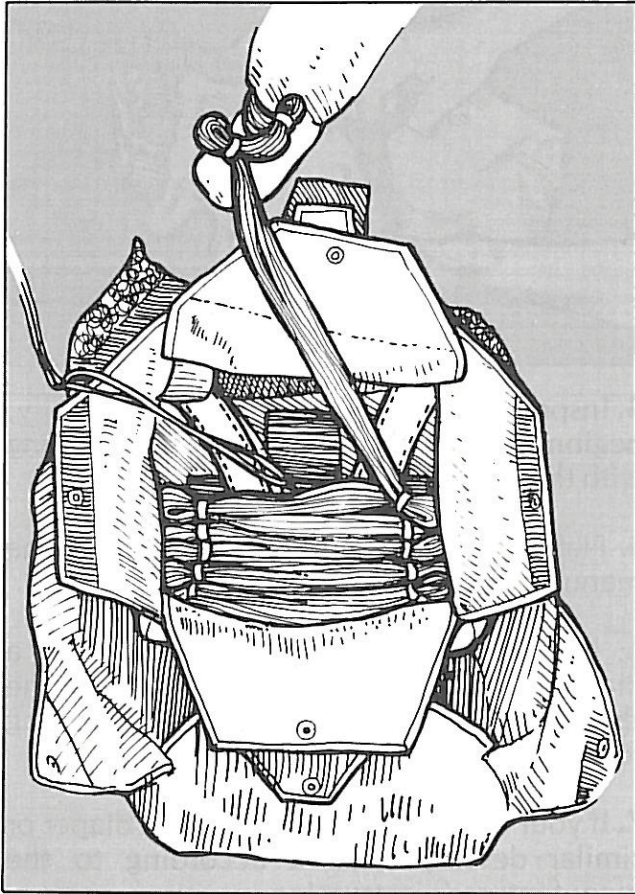
8. Placing the canopy in the pack tray.

A different packing procedure is used if the Vector is equipped with an FXC 12000 AAD. Follow the instructions under (A) or (B) below:

### A. Without FXC AAD

Place the reserve risers into the reserve container with the links lying between the line-stow loops and the grommet stiffener plate. Fan the riser ends out rather than stacking them on top of each other.

Make the first stow of suspension lines at the bottom and stow the lines from left to right, working toward the top of the container. Be sure to stow the lines the full width of the container.

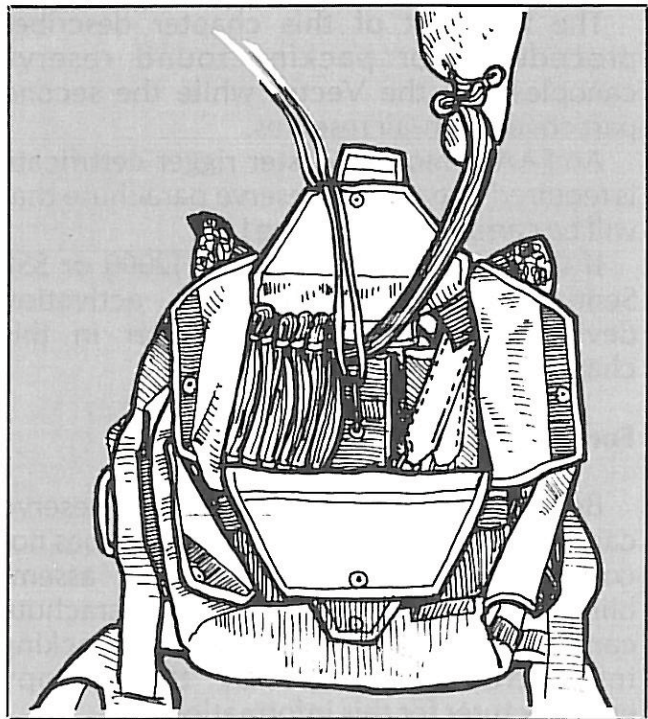


*(Skip the next section and continue with Step 9 below.)*

### B. With FXC AAD

Place the reserve risers into the reserve container with the links lying between the line-stow loops and the grommet stiffener plate. Fan the riser ends out rather than stacking them on top of each other.

Stow the lines vertically on the opposite side of the FXC power unit, starting from the outside and working toward the middle of the container.



Note: If the canopy has a diaper with all the lines stowed on it (a "full-stowage" diaper), then stow the lines on the diaper instead of stowing them in the pack tray. Then lay the diaper and lines on the opposite side of the container from the power unit.

9. Check the length of the reserve closing loop. The length from the stiffener plate to the end of the loop should measure approximately 2 to 2¼ inches for small canopies like the Pioneer K-XX and the National Phantom 22 canopies. For other canopies, the loop will have to be lengthened accordingly.

Two factors determine the correct loop length. First, it should not take an excessive amount of effort to close the last flap (Flap #6).

And when the container is closed, you should not be able to compress the pack more than ¼ inch when you push down on the top of the pilot chute.

If excessive play in the spring has developed after the reserve has been packed for awhile, open the container and shorten the loop.

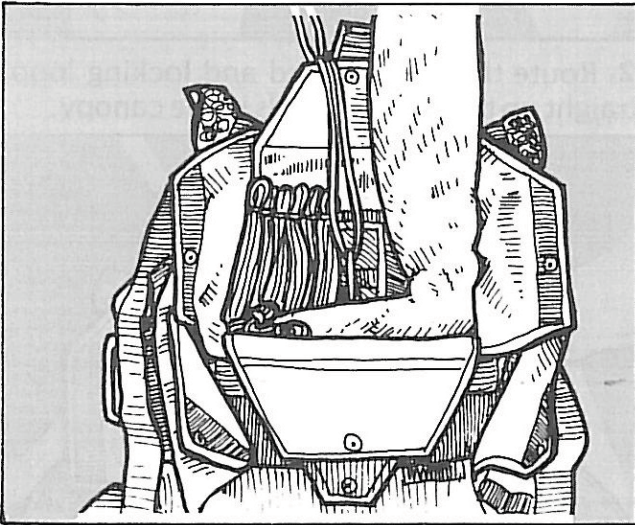
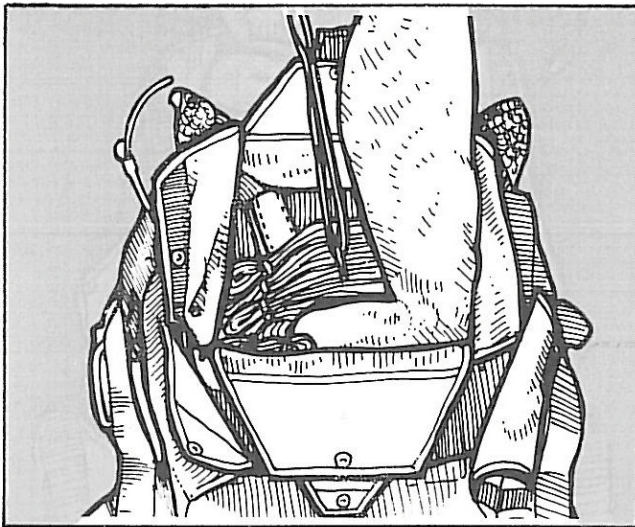
10. Insert the pull-up cord through the reserve locking loop.

## 11. Fold the canopy into the container.

### A. The First Fold:

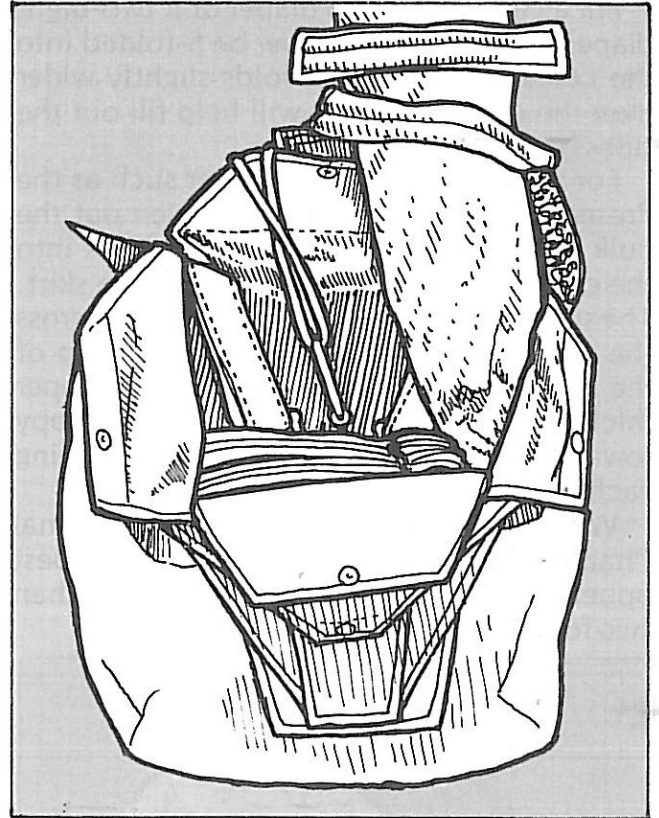
For a canopy without a diaper, place the canopy skirt into the bottom left-hand corner of the container and lay the first fold of canopy from left to right across the bottom of the container.

For a canopy with a two-bight diaper (such as those built by Strong Enterprises and Pioneer), place the diaper-enclosed skirt in the bottom left-hand side of the container with the line stows facing towards the top (wearer's head end) of the container. Lay the first fold of the canopy from left to right across the bottom of the container.

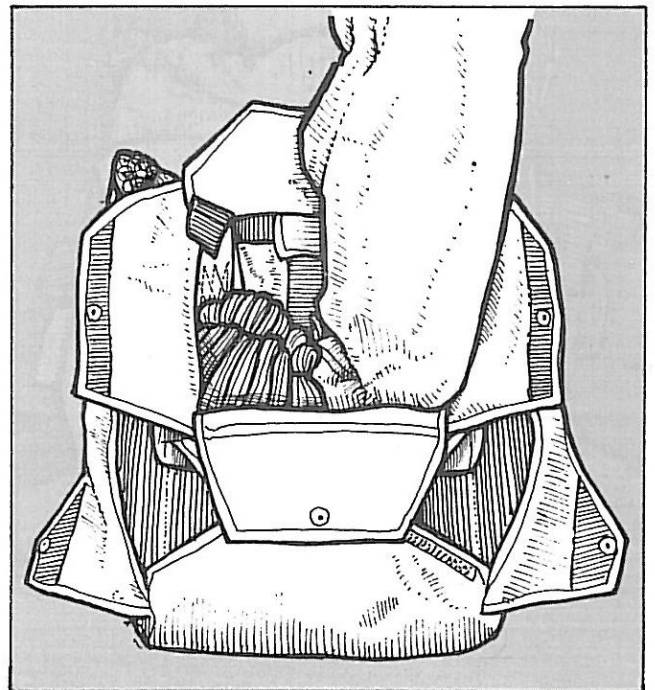


For a canopy with a full diaper on which the lines stow vertically (such as the Strong Enterprises Lopo Lite), lay the diaper-enclosed skirt in the bottom left-hand corner of the container against the dividing wall between the reserve and main containers. The stows should face up (towards the wearer's head).

Lay the first fold of canopy from left to right across the bottom of the container.



For a canopy with a Piglet-style diaper (full diaper with the lines stowed horizontally), fold the diaper enclosed skirt lengthwise for about  $\frac{1}{3}$  of its length, and place it in the bottom left-hand corner of the container against the wall that divides the reserve and main containers. Lay the first fold of canopy from left to right across the bottom of the container.



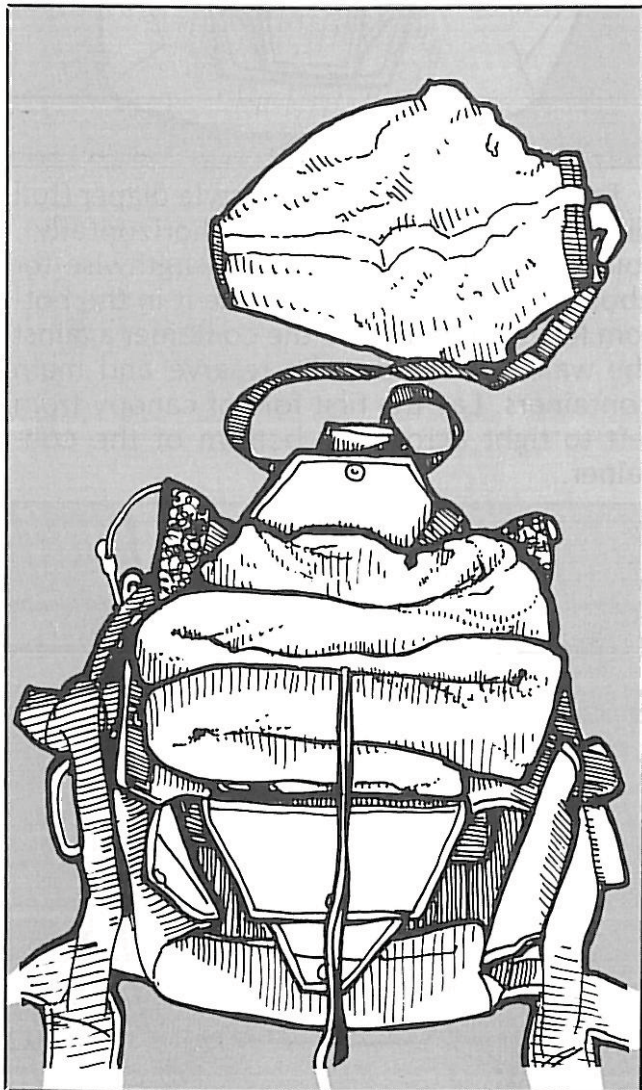


## B. The Remaining Folds:

For a canopy with no diaper or a two-bight diaper, the canopy can now be S-folded into the container. Make the folds slightly wider than the container. This will help fill out the sides better.

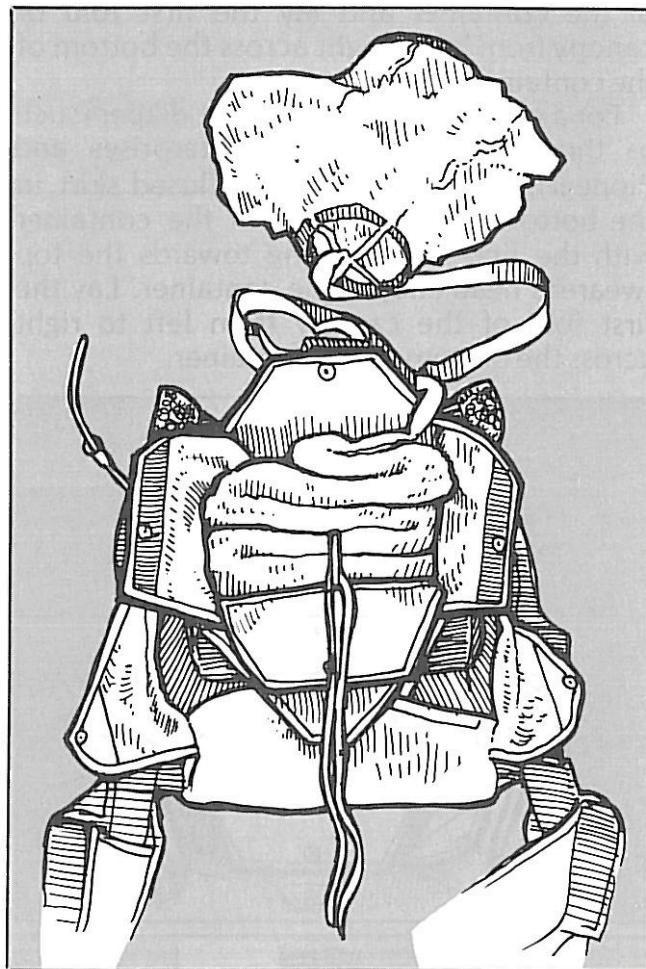
For a canopy with a full diaper such as the Preserve 3 and the Featherlite, even out the bulk by making one (or two) short folds into the container corner opposite from the skirt. The subsequent fold can then be made across the entire width of the container, on top of the diaper to give the container its proper thickness. Then S-fold the rest of the canopy toward the top of the container, making each fold slightly wider than the pack tray.

With small canopies such as the National Phantom 22 and the Pioneer K-XX, the best appearance results from having no more than two folds above the loop.

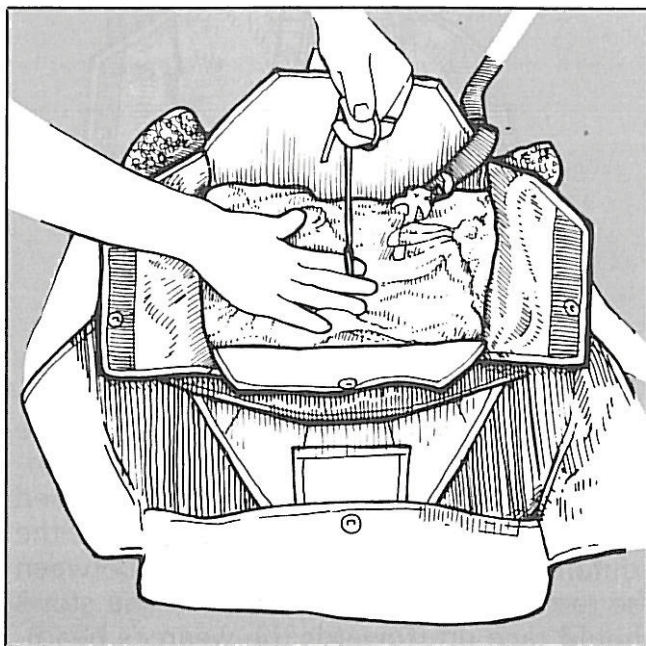


With larger canopies, it may be necessary to fold extra canopy above the loop, as well as to lengthen the loop.

Make the folds above the closing loop slightly wider than the container to fill the space under the side flaps.

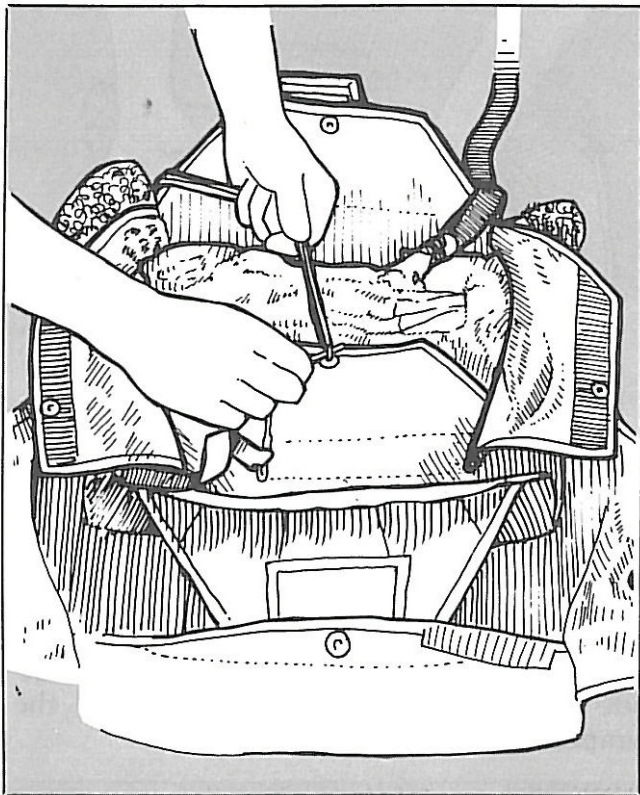


12. Route the pull-up cord and locking loop straight up through the folds in the canopy.

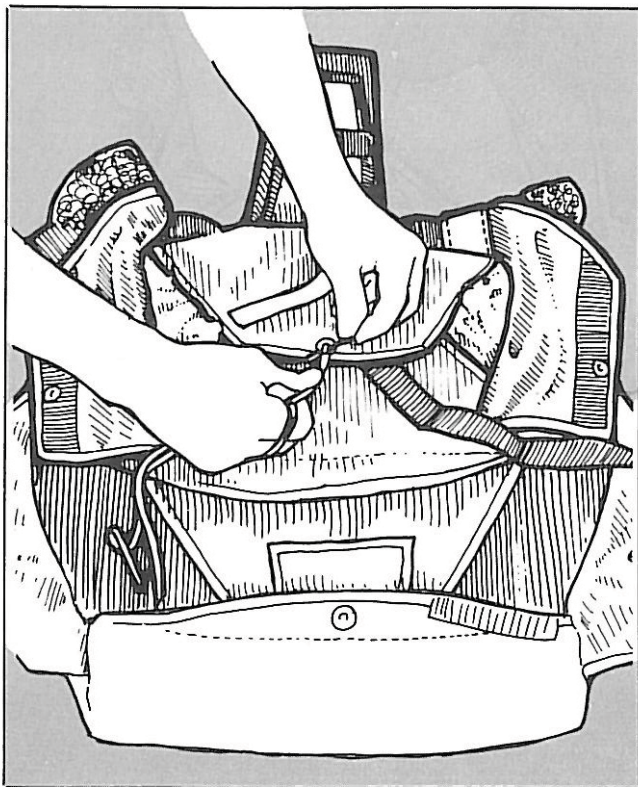


### 13. Closing the Flaps

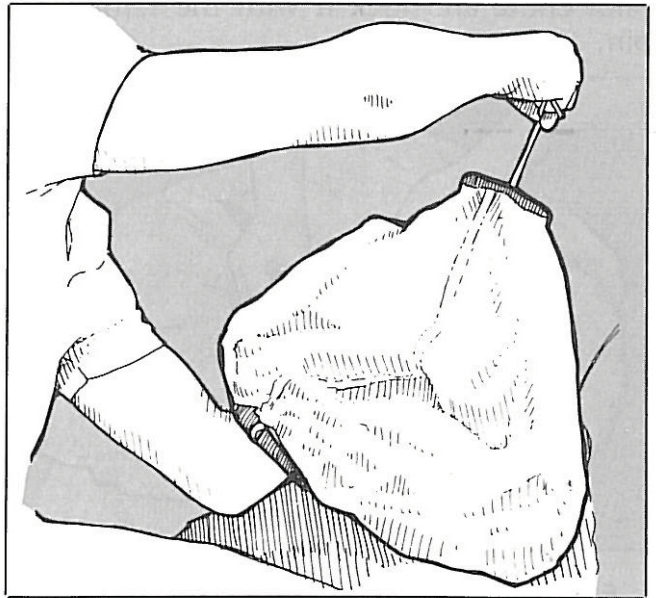
A. Close the inside bottom flap first (Flap #1) and secure it with a temporary pin.



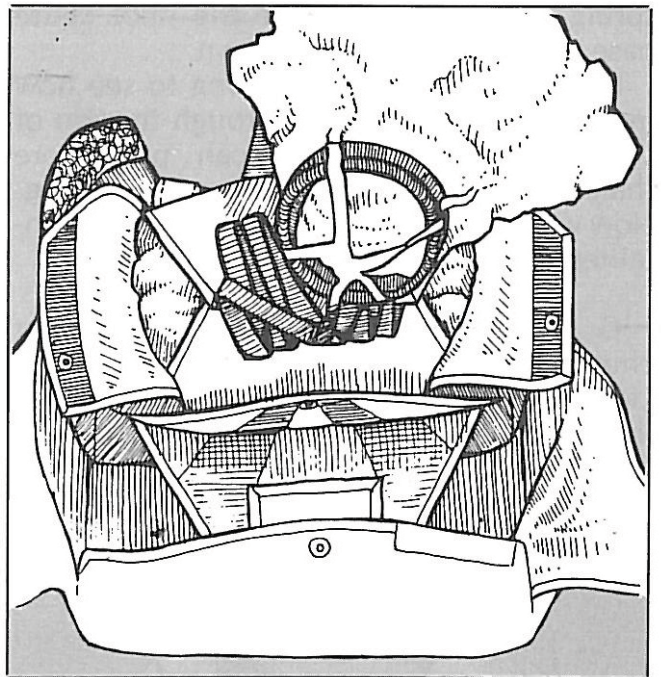
B. Route the reserve bridle toward the bottom right-hand side of the container and close the inside top flap (Flap #2), securing it with a temporary pin.



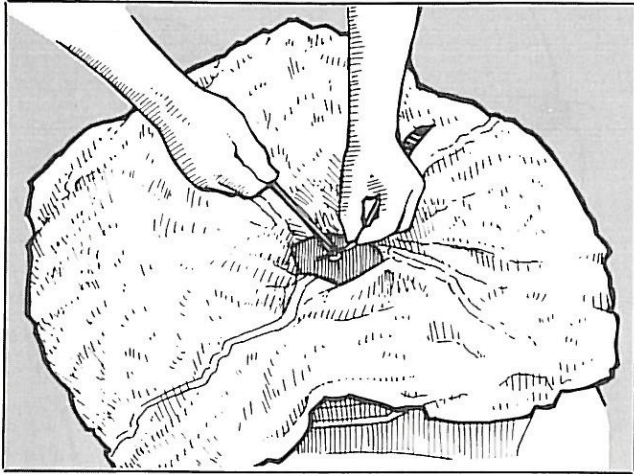
C. Thread the pull-up cord up through the bottom of the pilot chute and out the top.



D. S-fold the bridle up and down on top of the two flaps, so that it will be under the base of the pilot chute without fouling the closing loop.



E. Make sure the base of the pilot chute is centered over the loop. Then collapse the pilot chute and lock it with the temporary pin.

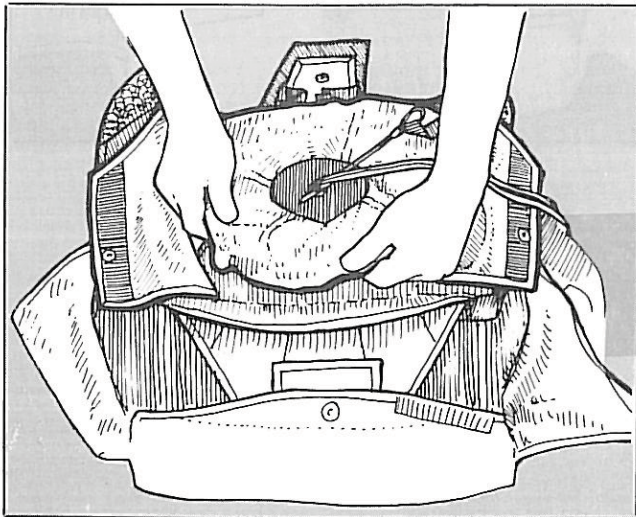


F. Pull all the canopy fabric out from between the spring. Folding the fabric—rather than stuffing it between the coils—reduces the bulk of the packed container.

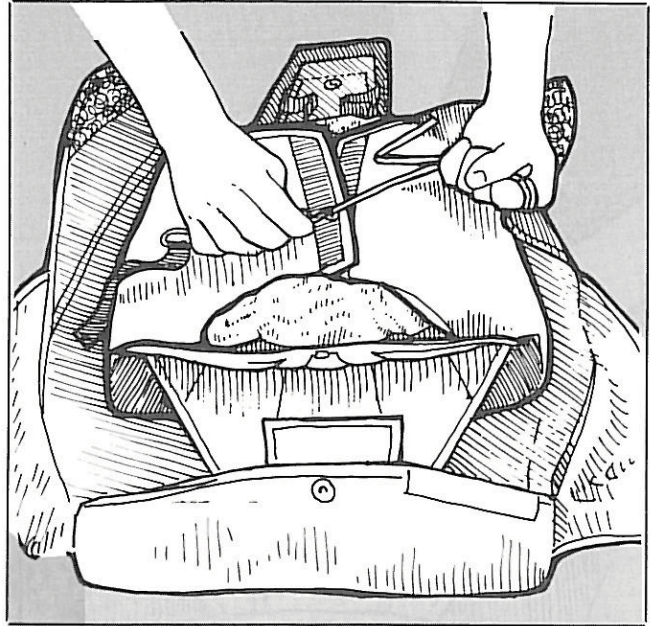
After pulling the fabric from between the spring, check to make sure the pilot chute base is centered under the crown.

Now fully collapse the spring to see how much loop can be pulled through the top of the pilot chute. If you can pull more than  $\frac{1}{2}$  to  $\frac{3}{4}$  in. through, the loop is too long. Now would be the best time to open the container and shorten the loop.

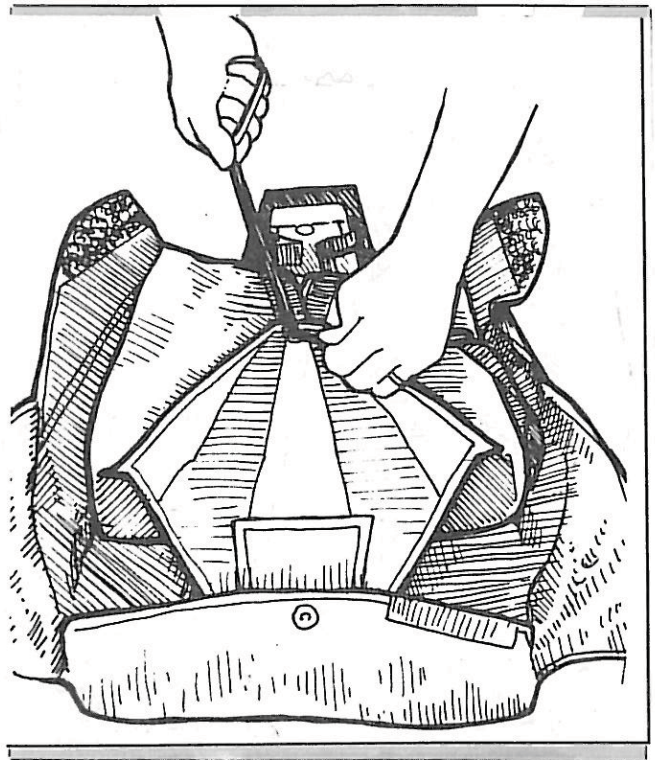
G. Lay the fabric flat all around the pilot chute and fold it under in wide folds to the center. Fold the top and bottom under first, then the sides. Keep the fabric folds of the pilot chute out from under the open reserve flaps.



H. Thread the pull-up cord through the side flaps (Flaps #3 and #4) and close and secure with a temporary pin. Make sure that the folds in the pilot chute stay flat and neat.



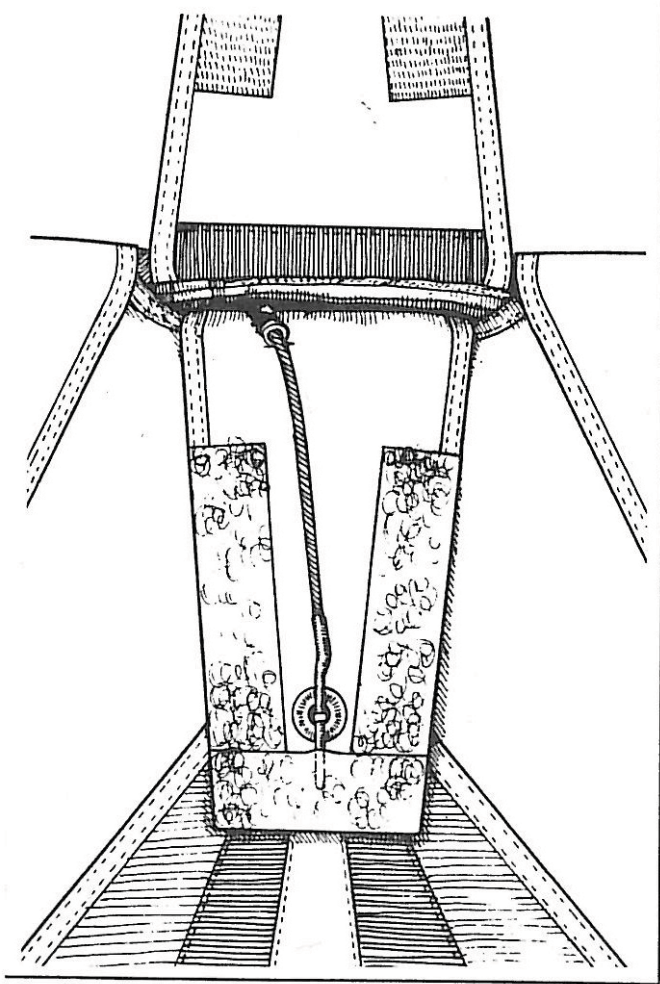
I. Thread the pull-up cord through the outside bottom flap (Flap #5) and insert the temporary pin.



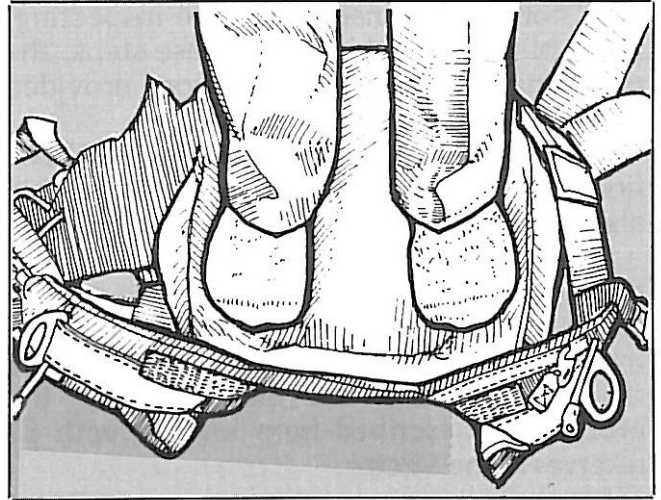
**J.** Thread the pull-up cord through the outside top flap (Flap #6) and insert the temporary pin. If the force necessary to close the last flaps seems excessive, your loop may be too short. Use a scale to check the force required to extract the pin. With the canopy packed properly and the right-sized loop, 8 to 12 lbs. of force should extract the pin.

**K.** Replace the temporary pin with the reserve pin. Insert the ripcord handle into its pouch on the main lift web.

**L.** Roll back Velcro at bottom of reserve flap and gently push reserve pin under it.



**14.** Place the rig on a clean surface with the backpad facing up and walk on it with stocking feet or clean shoes to help expel air from the container and make it flatter.



**15.** Dress the container, seal, sign and log the reserve.

**16.** Count your tools.

## For a Ram-air Reserve with the Vector Free Bag, Bridle and Pilot Chute System

Because of the wide variety of ram-air reserve canopies available today, this manual does not contain instructions on inspecting, assembling and flaking. For these steps, the rigger must follow the instructions provided by the canopy manufacturer.

Two packing methods are shown here. The first is preferred, although the second will also yield satisfactory results.

The procedures required to pack a ram-air reserve into a Vector and its free bag are different than those specified by Para-Flite, Inc., for the free bag system it supplies with its ram-air reserves. **Para-Flite approves the procedures described here for use with its reserves in the Vector.**

See the instructions later in this chapter for installing the FXC 12000 and SSE Sentinel Mk 2000 automatic activation devices.

### REQUIRED TOOLS:

- One temporary pin
- Pull-up cord (About 6 ft. long)
- One packing paddle

### Part One: Packing the Canopy

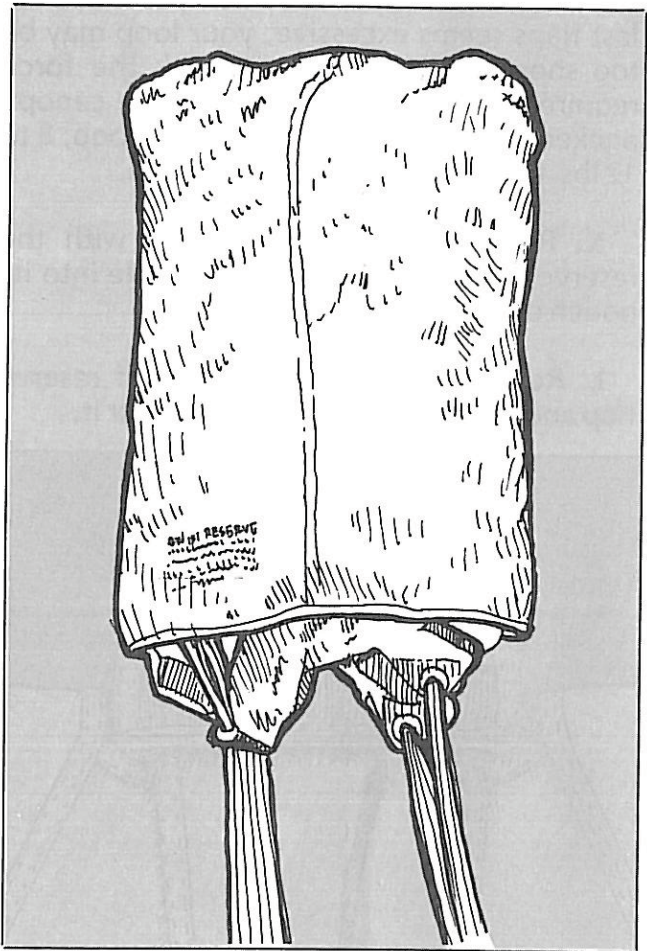
1. Thoroughly inspect the pilot chute, bridle, deployment bag, canopy, lines, links, locking loop, risers, container and harness.

2. Follow canopy manufacturer's instructions for:

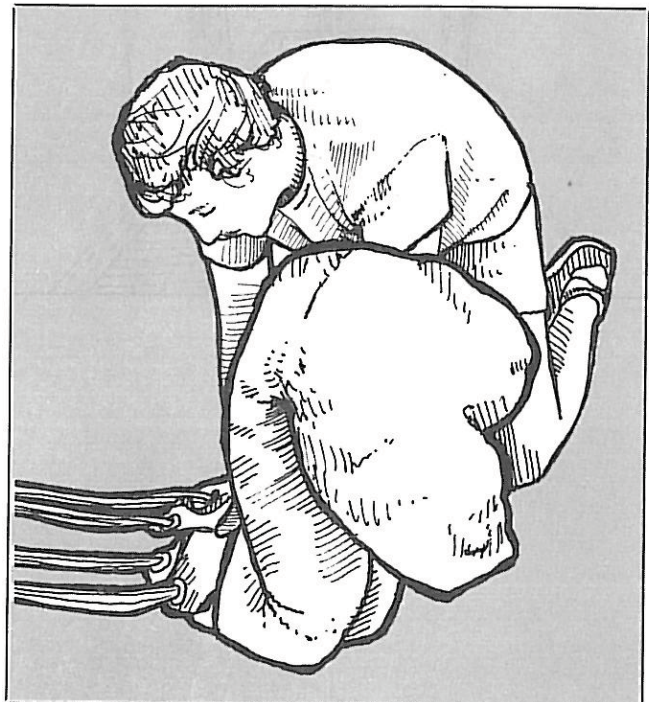
- A. Attaching the canopy to risers
- B. Attaching toggles and/or steering lines.
- C. Flaking the canopy.
- D. Folding the nose and canopy.
- E. Setting deployment brakes.
- F. Splitting the tail.
- G. Stowing the slider.
- H. Dressing the canopy.

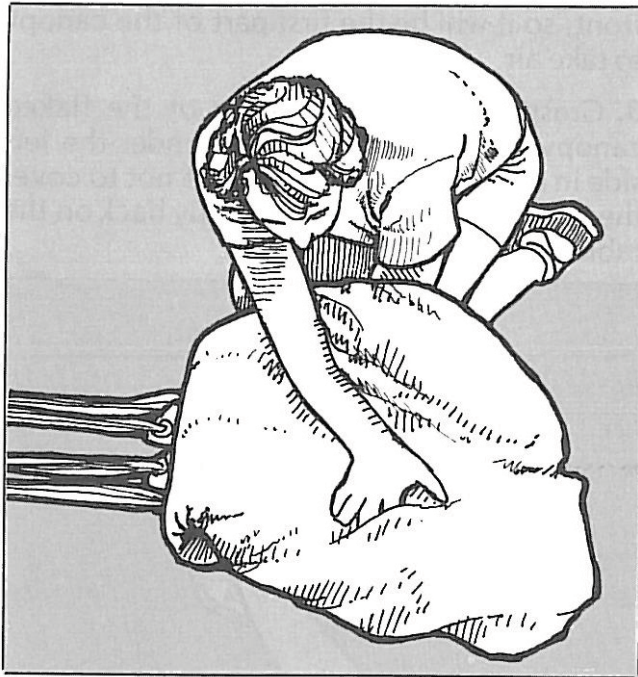
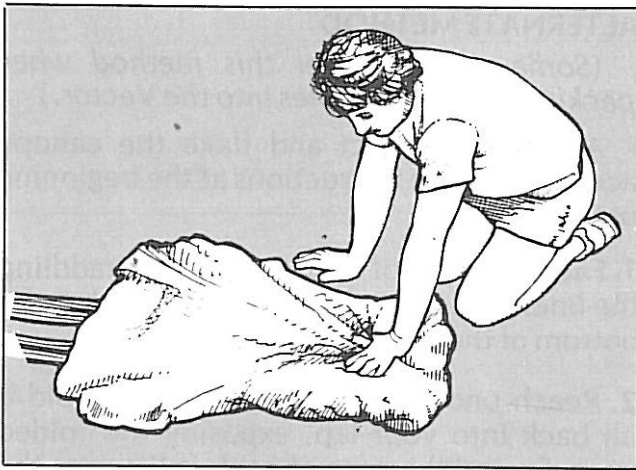
3. Prepare the free bag so that it is ready to be packed. To do this, insert one end of a pull-up cord through the grommets in the top and bottom of the bag. Tie it to the other end so it won't slip out during the packing procedure. (Note: some riggers prefer to use a T-bar instead of a pull-up cord, inserting it through the bag from the bottom.) The T-bar or pull-up cord will be used later to pull the locking loop through the bagged canopy.

4. Dress the canopy to a width 4 in. wider than the bag (2 in. on each side).



5. Stack the canopy on top of itself, making each fold no longer than the distance from the mouth of the bag to the grommets in the center of the bag.

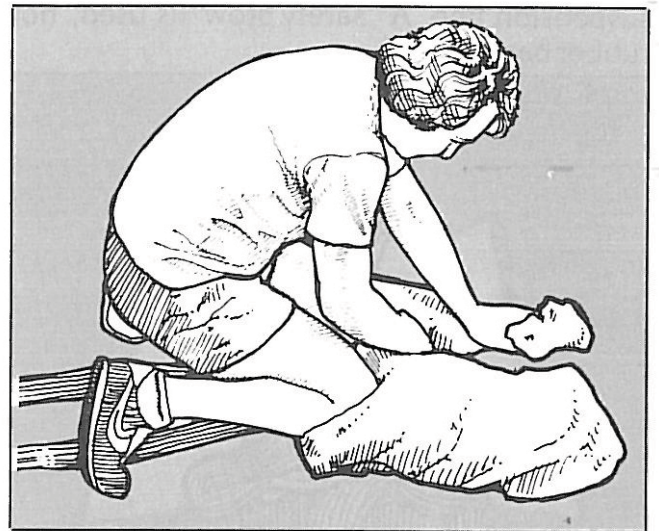




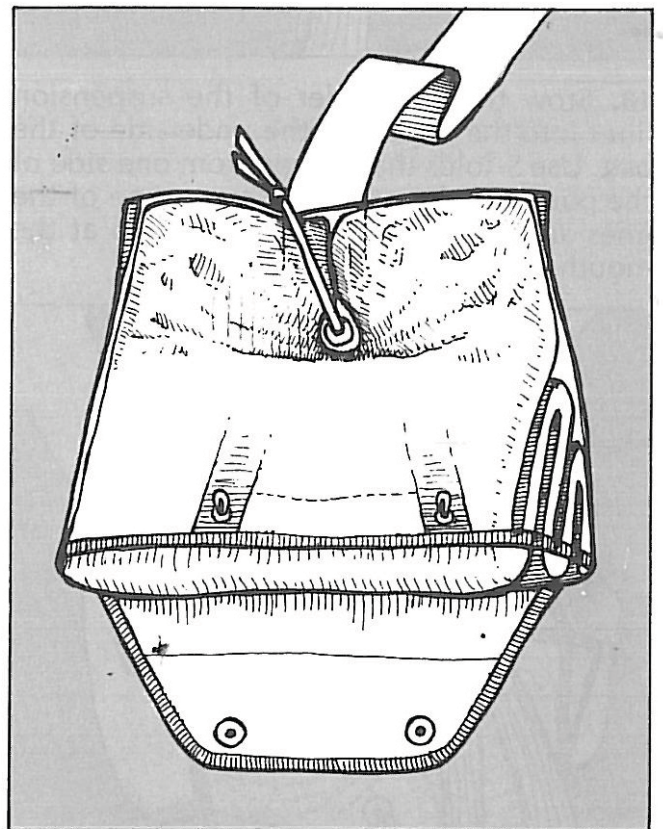
6. After the canopy is stacked on itself, unfold the top portion into two sections or "ears."



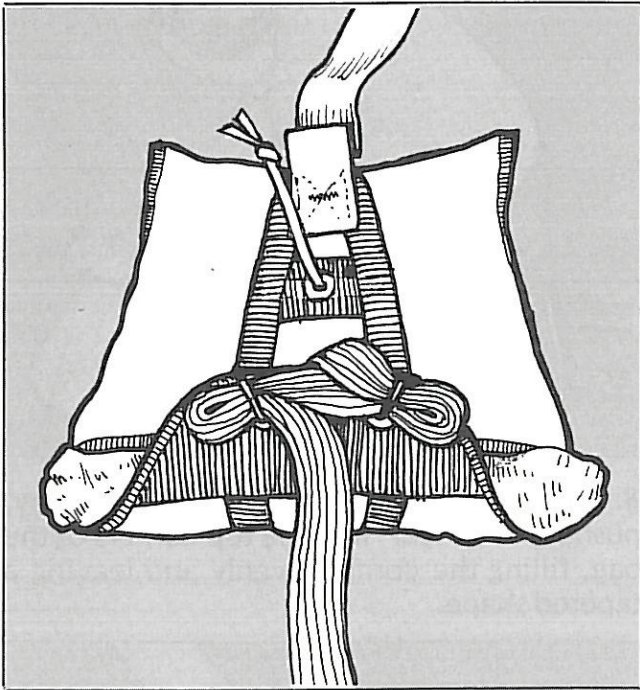
7. Dress each section neatly.



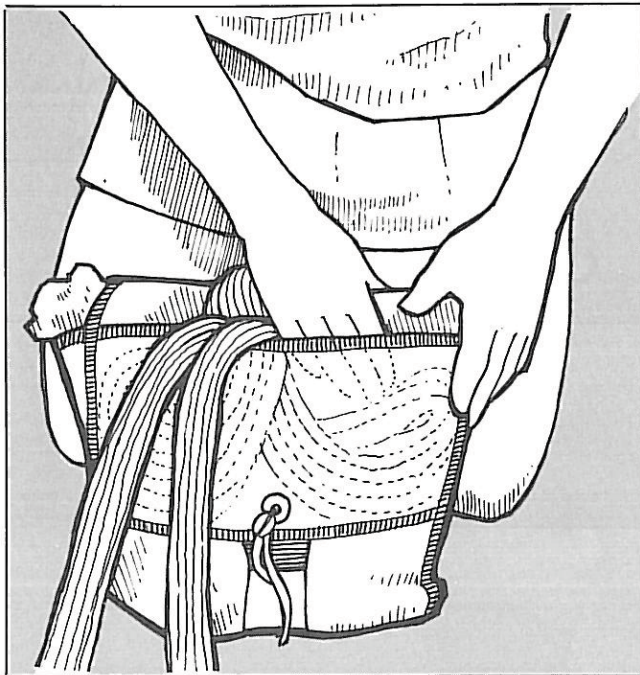
8. Carefully slide the bag over the canopy, pushing each "ear" into the top corners of the bag, filling the corners evenly and leaving a tapered shape.



9. Lock the bag closed with two bights of suspension line. A "safety stow" is used, not rubber bands.



10. Stow the remainder of the suspension lines into the pouch on the underside of the bag. Use S-folds that extend from one side of the pouch to the other. Be sure none of the lines are trapped between the Velcro at the mouth of the pouch.



(Skip the following section titled "Alternate Method" and continue with "Part 2: Placing the Bag into the Container," which follows the Alternate Method.)

## ALTERNATE METHOD

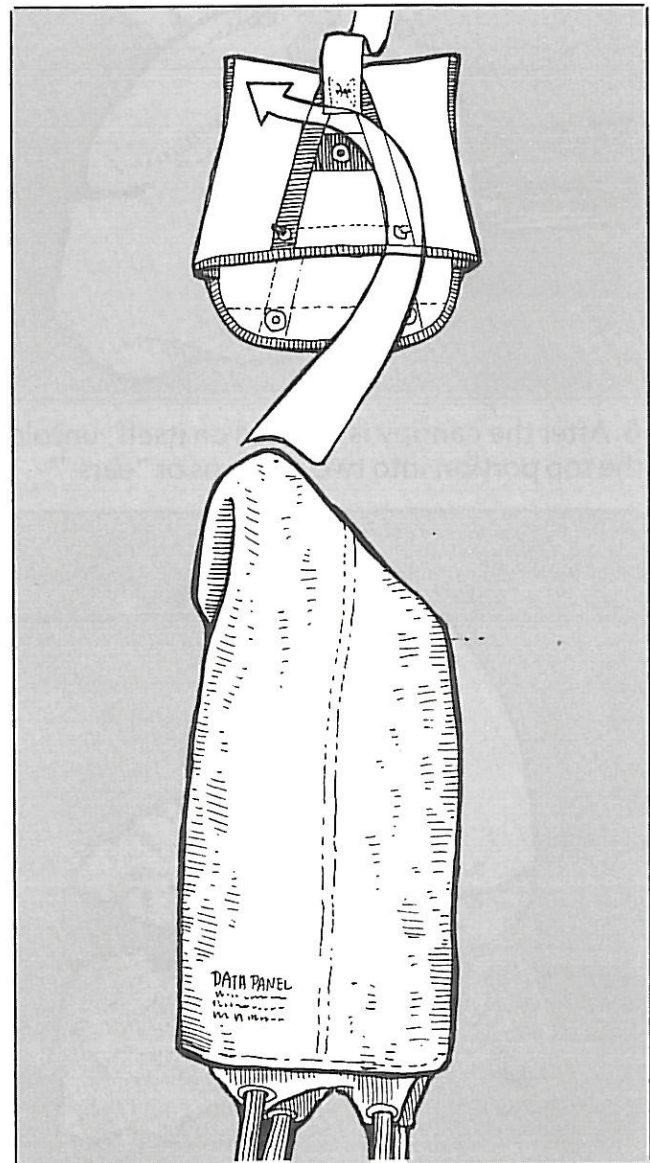
(Some riggers prefer this method when packing smaller canopies into the Vector.)

Assemble, inspect and flake the canopy according to the instructions at the beginning of this section.

1. Facing the top of the canopy and straddling the lines, kneel on the edge of the tail at the bottom of the canopy.

2. Reach underneath the canopy and fold it all back into your lap, exposing the folded nose. Spread the nose of each cell across the front, so it will be the first part of the canopy to take air.

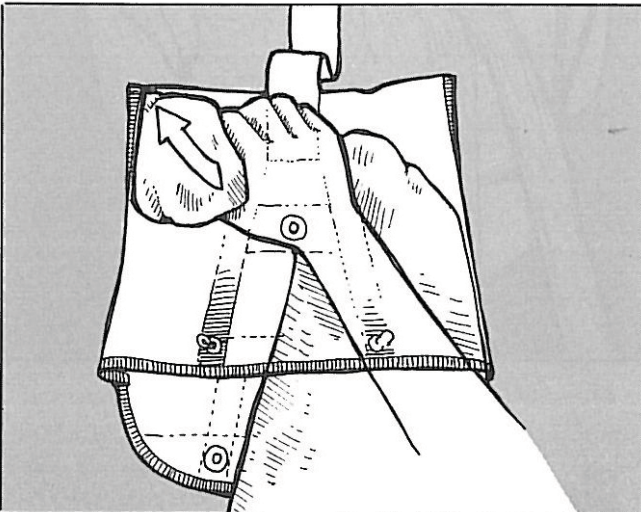
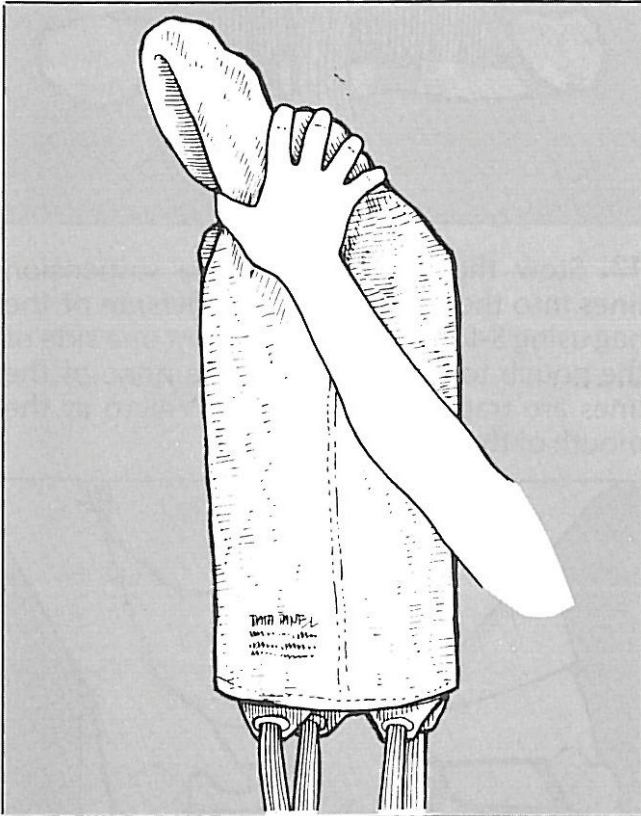
3. Grasp the top right corner of the flaked canopy and fold it across and under the left side in a 45-degree angle. Be sure not to cover the exposed nose. Lay the canopy back on the table.



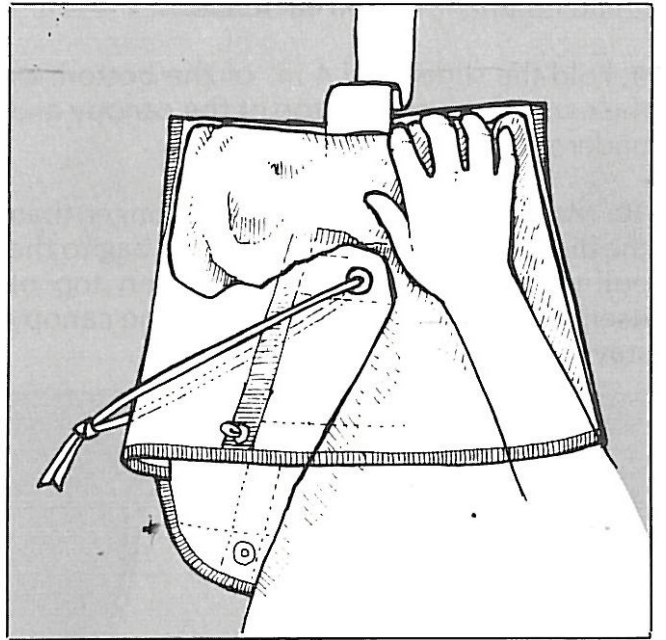
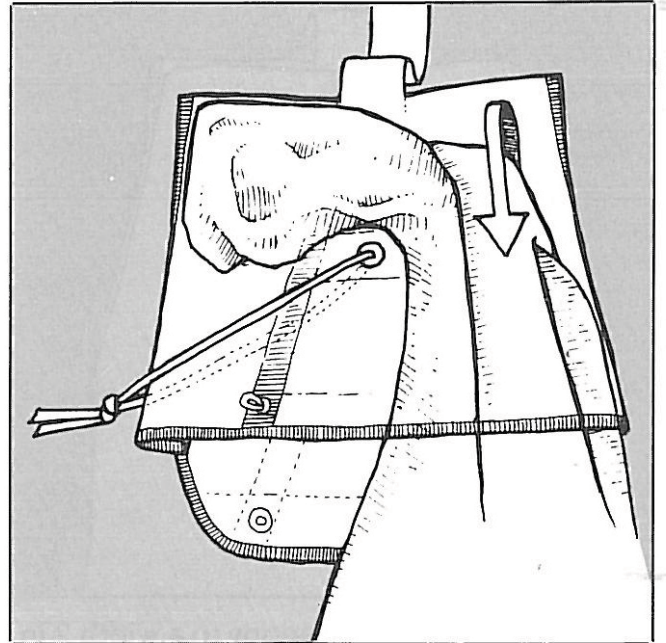
4. Insert one end of the pull-up cord through the grommets in the top and bottom of the bag. Tie it to the other end so it won't slip out during the rest of the packing procedure. The T-bar or pull-up cord will be used later to pull the locking loop through the bagged canopy.

(Note: Some riggers prefer to use a T-bar instead of a pull-up cord, inserting it through the bag from the bottom. A pull-up cord is easier and is therefore recommended.)

5. Kneeling as before, grasp the top left corner of the flaked canopy and going around to the right of the pull-up cord, place the corner of the canopy into the top left corner of the bag. Be sure to fill the corner.

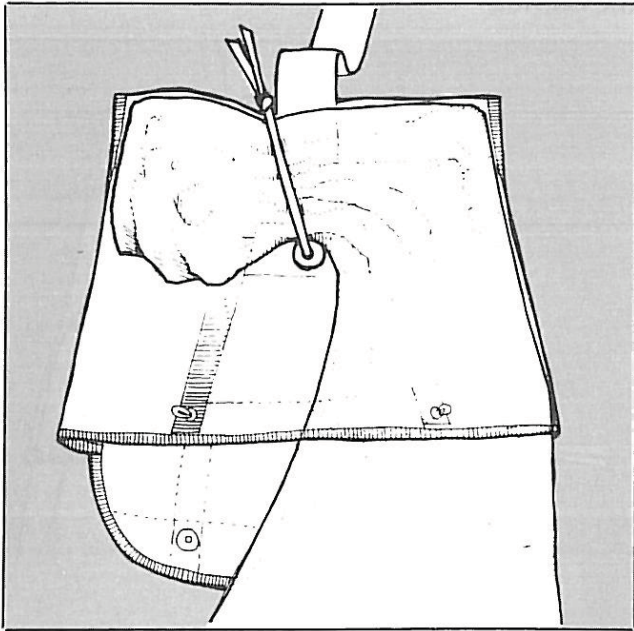


6. Without pulling the left corner free, reach into the bag and over the canopy to grasp the previously folded right corner under the canopy. Maneuver this corner of the canopy into top right corner of the bag. Be sure to fill the corner.





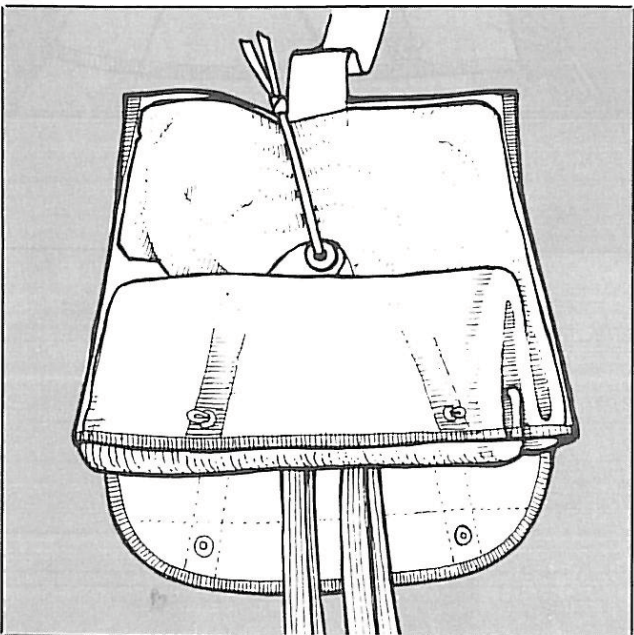
7. Retie the pull-up cord tightly around the top S-fold until the top and bottom grommets are no more than 1 in. apart. This retains the S-fold in the top of the bag throughout the rest of the packing procedures.



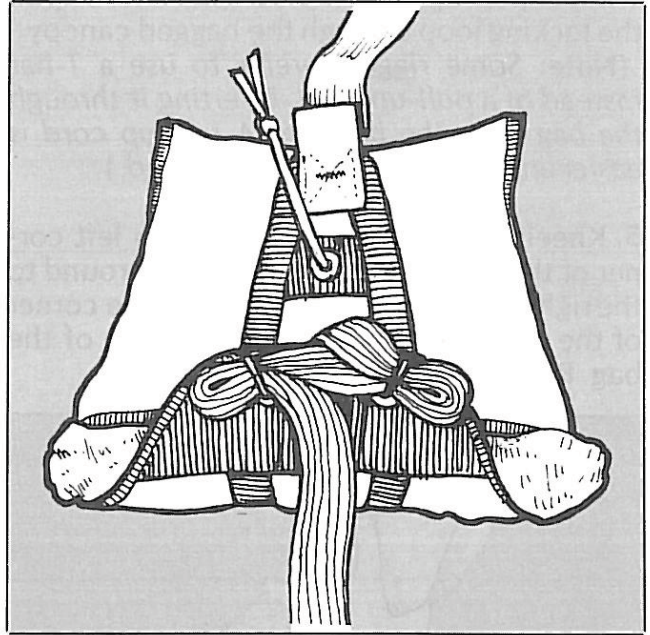
8. Dress the remaining canopy to a width 2 in. greater than the bag on each side.

9. Fold the slider and 4 in. of the bottom of the canopy toward the top of the canopy and under the tail.

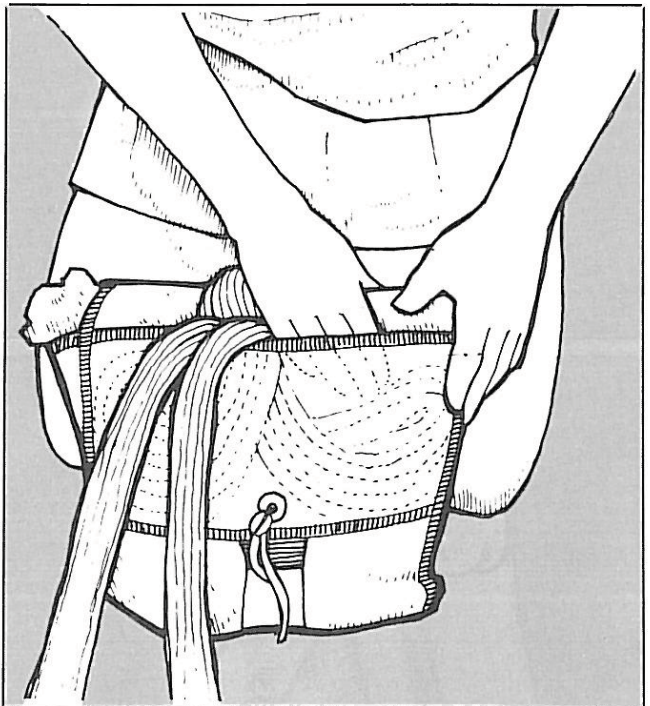
10. Making very short folds—no longer than the distance from the mouth of the bag to the pull-up cord—stack the canopy on top of itself. Be sure the top (first) fold of the canopy stays in the bag.



11. Carefully place the stacked canopy into the bag. Close the bag with the two locking stows. (A safety stow is used, not rubber bands).

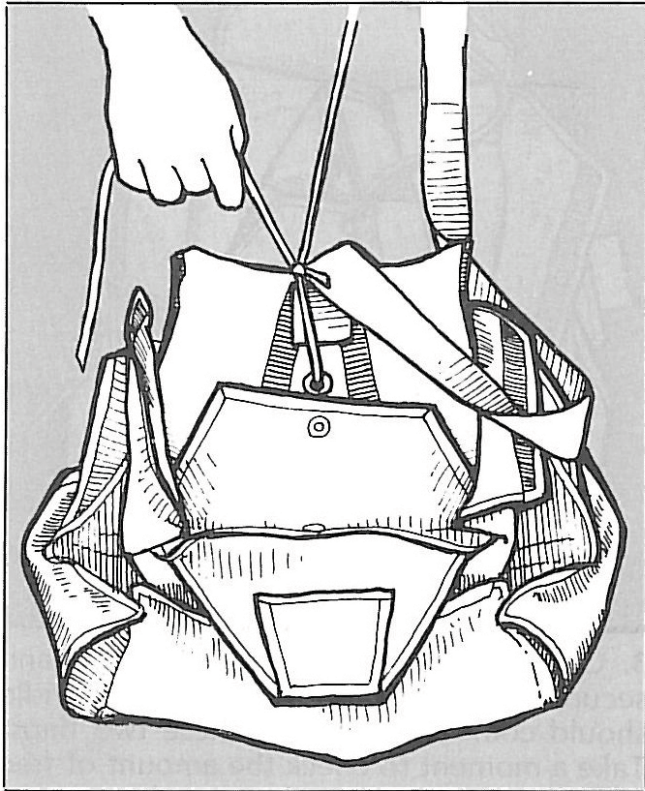


12. Stow the remainder of the suspension lines into the pouch on the underside of the bag using S-folds that extend from one side of the pouch to the other. Be sure none of the lines are trapped between the Velcro at the mouth of the pouch.



## Part Two: Placing the Bag into the Container

1. Set the bagged canopy on the main container and position the reserve risers in the reserve pack tray. Fan the links rather than stacking them on each other, placing the rear links to the outside. Be sure to place the reserve risers far enough in the pack tray so they will lie flat over the shoulders.



2. Pass the other pull-up cord through the reserve locking loop.

If a T-bar was passed through the bag, thread the ends of the pull-up cord through the hole in the end of the T-bar. Remove the T-bar from the bagged canopy, pulling the locking loop and pull-up cord through it.

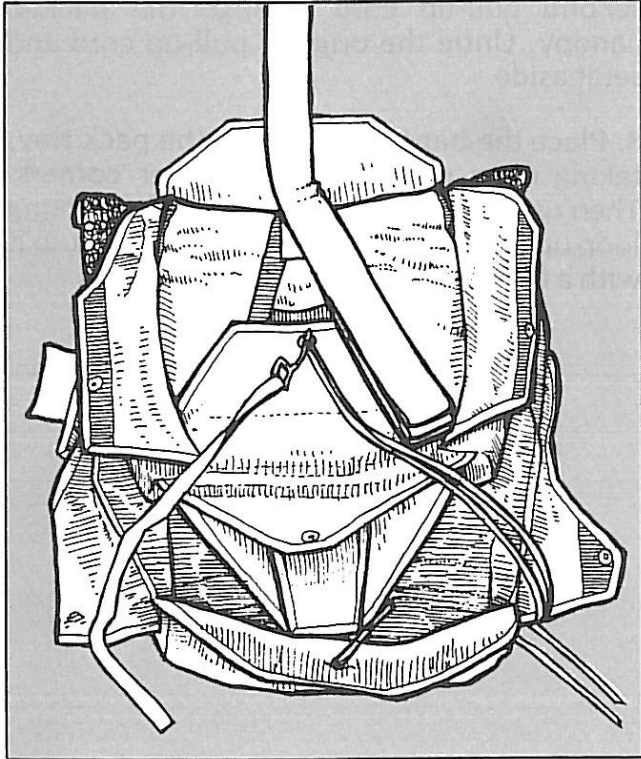
If the pull-up cord was passed through the bag, untie it and tie the end protruding from the underside of the bag around both ends of the second pull-up cord that has been passed through the locking loop. Carefully pull on the other end to pull the locking loop and second pull-up cord through the packed canopy. Untie the original pull-up cord and set it aside.

3. Place the bagged canopy in the pack tray, taking extra care to fill the lower corners. Then use the pull-up cord to pull the locking loop up through the bagged canopy. Secure it with a temporary locking pin.

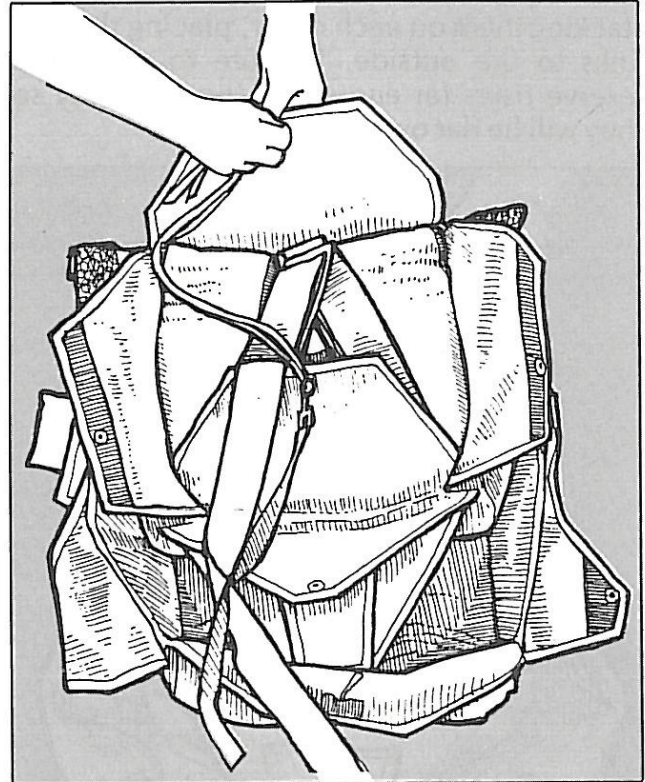
### Part Three — Closing the Reserve Container

Regardless of what procedure was used to place the canopy in the bag, the same procedure is used to close the container.

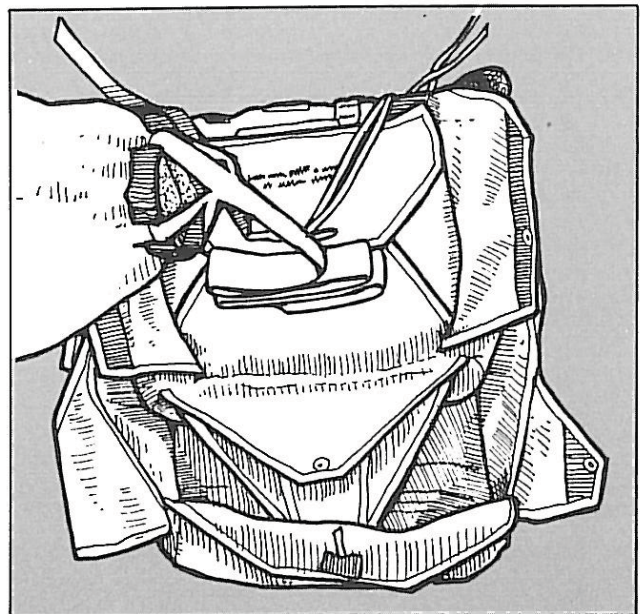
1. Close the inside bottom flap (Flap #1) and secure it with a temporary pin. Make long S-folds with the bridle from the top of the bag to the bottom right hand corner of the reserve container as shown. Carefully tuck the bottom of the S-folded section under the inside bottom flap (Flap #1).



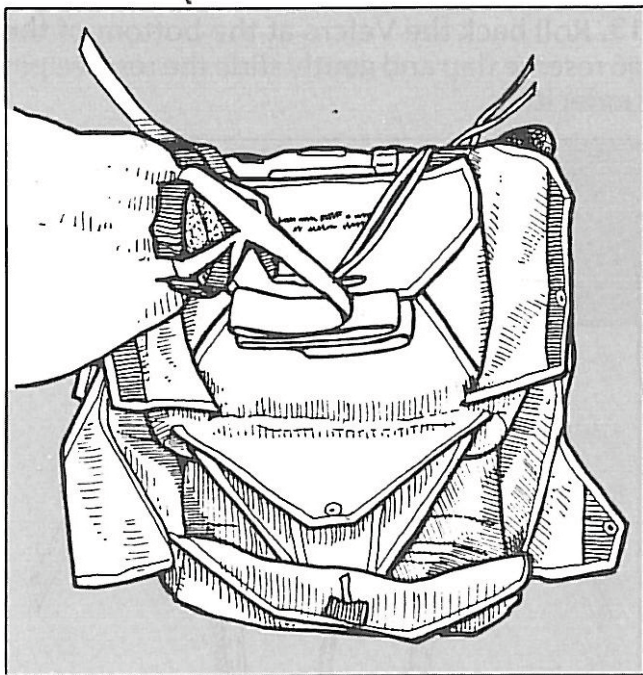
2. Repeat this process on the left side: make long S-folds in the bridle from the top of the bag to the left hand corner of the container and tuck under the inside bottom flap as shown.



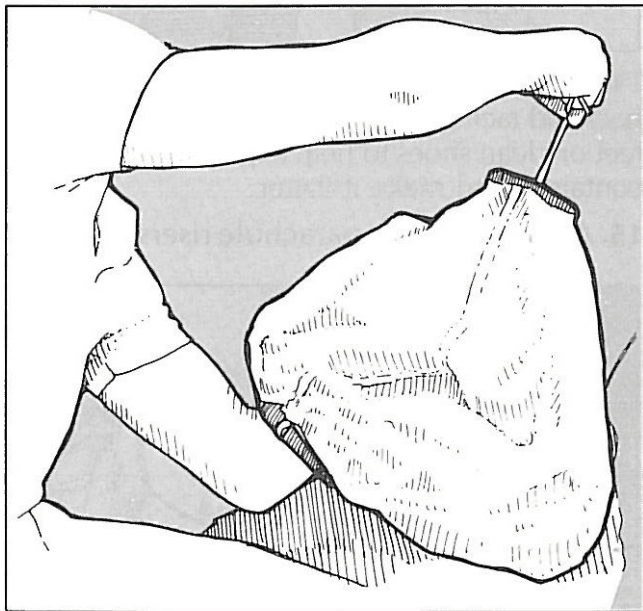
3. Close the inside top flap (Flap #2) and secure with a temporary pin. The bridle should come out between these two flaps. Take a moment to check the amount of free bridle at this point. There must be at least five feet left from the junction of the closed flaps to the base of the pilot chute. If the excess bridle is too short, release the inside top flap and redo the S-folds.



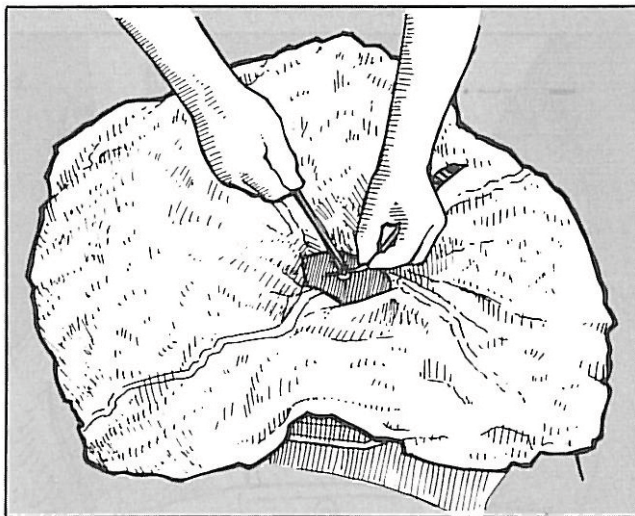
4. Fold the bridle to the left and make a series of short S-folds right up to the base of the pilot chute.



5. Thread the pull-up cord up through the bottom of the pilot chute and out the top. Center the base of the pilot chute over the two flaps.



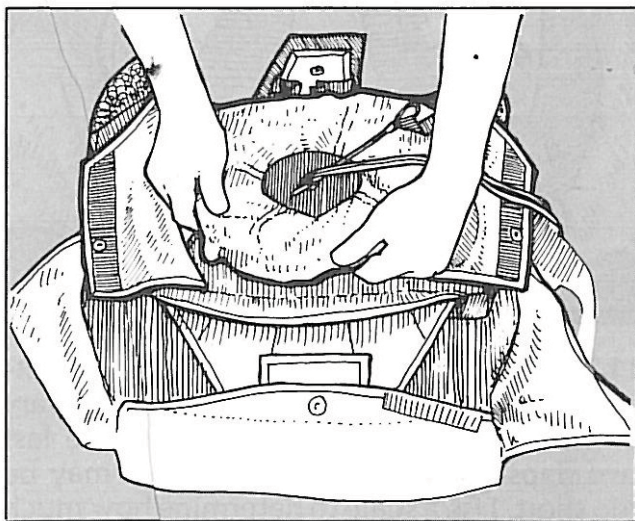
6. Make sure the base of the pilot chute is centered over the loop, then collapse the pilot chute and lock it with a temporary pin.



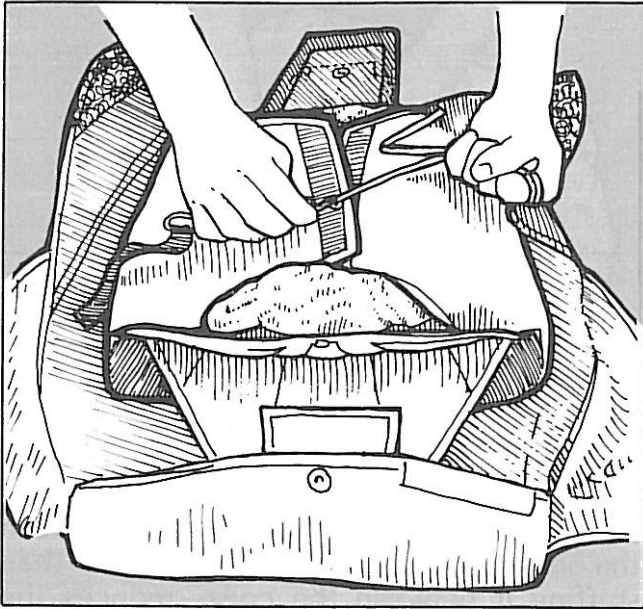
7. Pull all the canopy fabric out from between the spring. Folding the fabric—rather than stuffing it between the coils—reduces the bulk of the packed container. After pulling the fabric from between the spring, check to be sure the pilot chute base is centered under the crown.

Now fully compress the spring to see how much loop can be pulled through the top of the pilot chute. If you can pull more than  $\frac{1}{2}$  to  $\frac{3}{4}$  in. through, the loop is too long. Now would be the best time to open the container and shorten the loop.

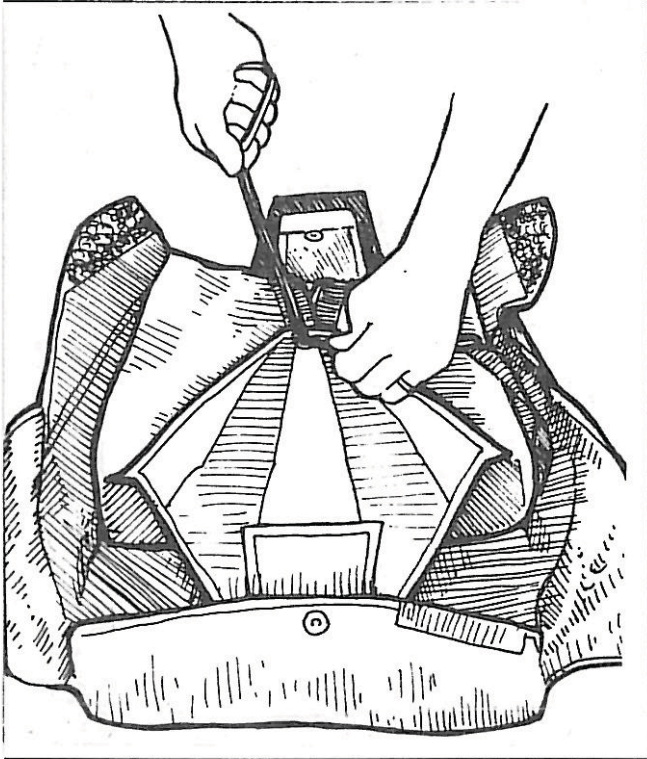
8. Lay the fabric flat all around the pilot chute and fold it under in wide folds to the center. Fold the top and bottom first, then the sides. Keep the fabric folds of the pilot chute out from under the open flaps.



9. Thread the pull-up cord through the side flaps (Flaps #3 and #4) and close and secure with a temporary pin. Make sure that the folds in the pilot chute stay flat and neat.



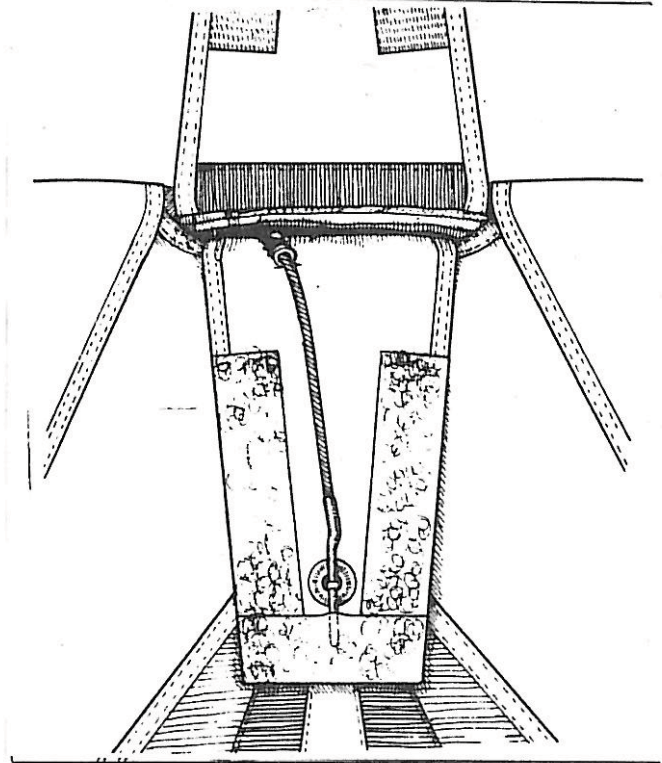
10. Thread the pull-up cord through the outside bottom flap (Flap #5) and insert the temporary pin.



11. Thread the pull-up cord through the outside top flap (Flap #6) and insert a temporary pin. If the force necessary to close the last two flaps seems excessive, the loop may be too short. Use a scale to determine how much force is needed to extract the pin; 8 to 12 lb. is the correct reading.

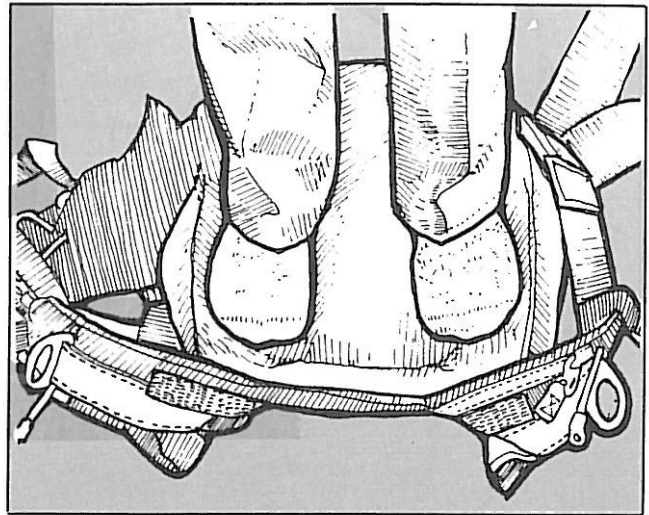
12. Replace the temporary pin with the reserve pin. Insert the ripcord handle into its pouch on the main lift web.

13. Roll back the Velcro at the bottom of the #6 reserve flap and gently slide the reserve pin under it.



14. Place the rig on a clean surface with the backpad facing up and walk on it with stocking feet or clean shoes to help expel the air from the container and make it flatter.

15. Attach the main parachute risers.



16. Dress the container, seal, sign and log the reserve.

17. Count your tools.

## INSTALLING AUTOMATIC ACTIVATION DEVICES

The FAA classifies the installation of an AAD as a major alteration. Therefore, it must be done by a Master Rigger.

Two AADs are currently approved for installation on the Vector: the Pin Puller version of the SSE Sentinel Mk 2000 and the FXC Model 12000. Although other AADs can probably be safely installed on the Vector, the Relative Workshop had not yet developed the methods to do so.

Because both the Sentinel Mk 2000 and the FXC 12000 are manufactured and serviced by companies not associated with the Relative Workshop, the owner must direct questions on calibration, use, maintenance, testing and upgrades to the AAD manufacturer. Nothing in this manual is meant to contravene any instructions or advice from the manufacturers of these devices.

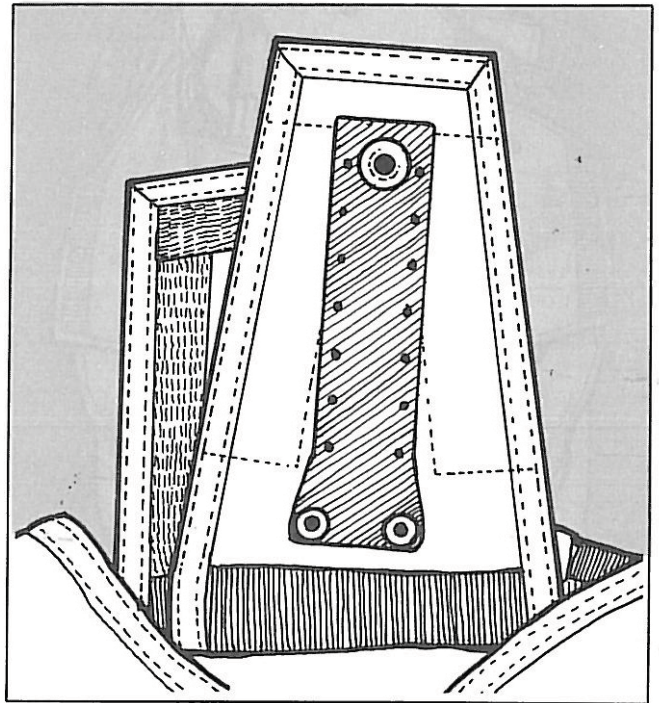
An AAD is a back-up emergency device that, like any complex mechanical instrument is subject to failure or malfunction. It is not a substitute for proper training and supervision.

Both the Sentinel Mk 2000 and the FXC 12000 are delivered with installation kits that contain various brackets, screws, mounting plates and terminal ends to accommodate various types of parachutes. These components must be used to correctly install these devices on the Vector.

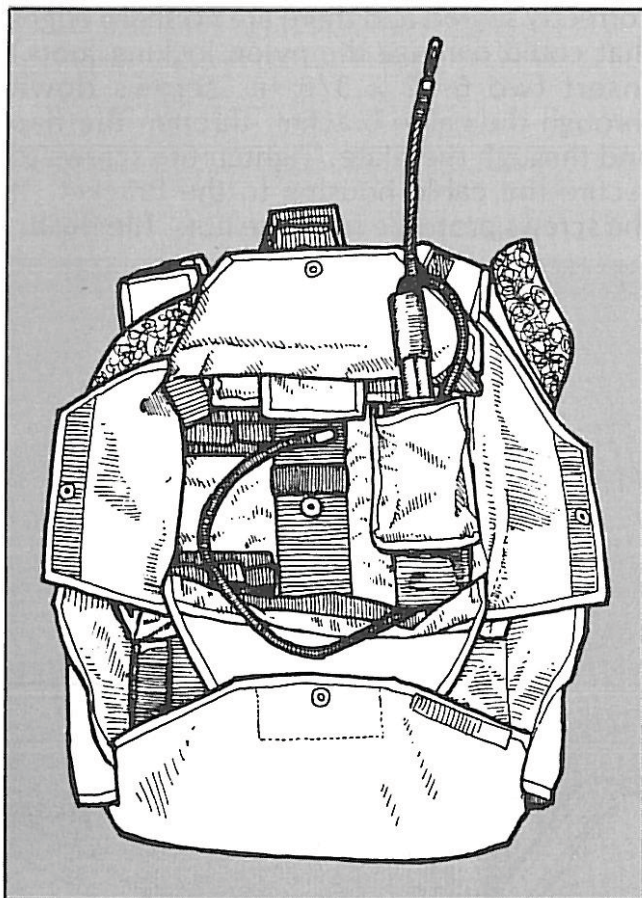
### Installing the Pin Puller Version of the SSE Sentinel Mk 2000

1. Inspect the entire AAD assembly. Perform a calibration check to insure the pyrotechnic charge is in good shape.
2. Remove the grommet from the top reserve flap (Flap #6).
3. Position the mounting plate on the top of the top reserve flap (Flap #6) so that its larger hole is centered over the flap's grommet hole and the plate is along the center line of the flap. Use a pen or pencil to mark the two bolt holes in the other end of the plate. Use a 1/16-inch drill bit to drill holes for the bolts.

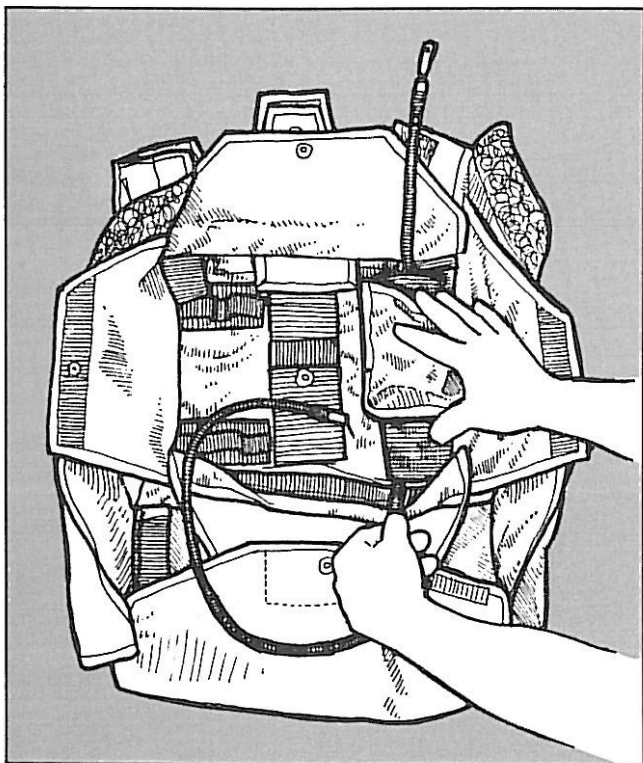
4. Position the mounting plate on the underside of the top reserve flap (Flap #6) and attach with a size O roll rim grommet with flat washer. (Be sure the grommet is correctly seated and there are no sharp edges that could damage the nylon locking loop.) Insert two 6-32 x 3/8 in. screws down through the cable bracket, through the flap and through the plate. Tighten the screws to secure the cable housing to the bracket. If the screws protrude from the nuts, file flush.



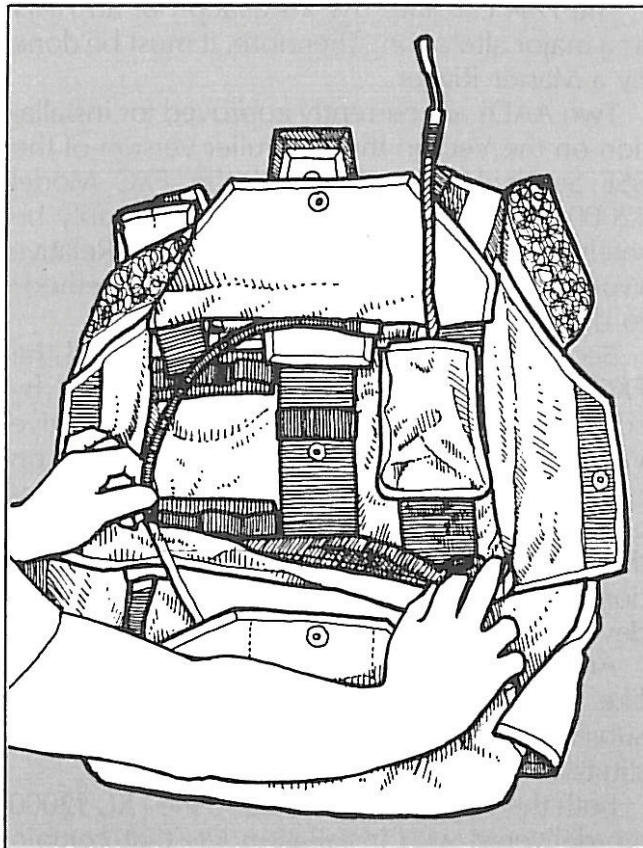
5. Thread the activation unit cable through the long thin Pin Puller pouch on the right side of the reserve pack tray and out the bottom. Slide the activation unit into the pouch.



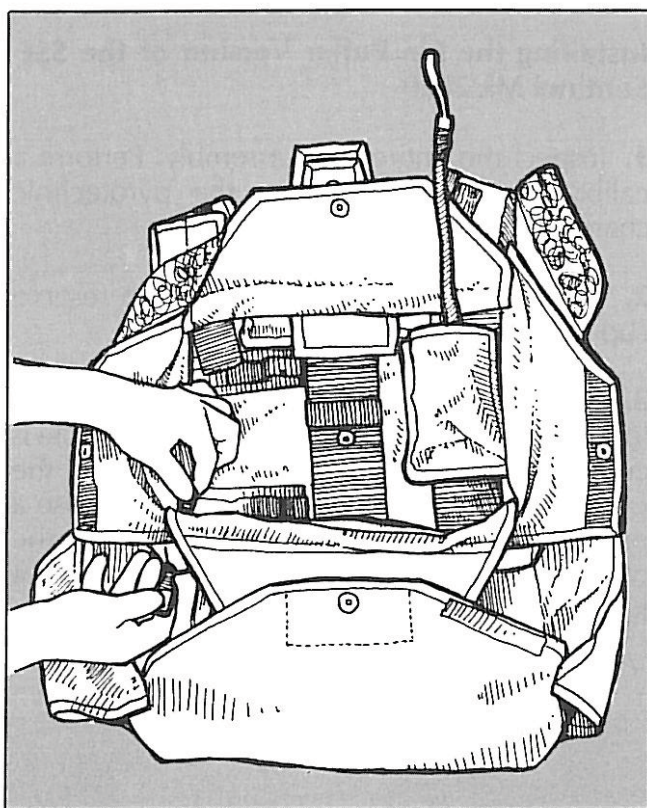
6. Pull the cable gently to seat the unit in the pouch and remove any slack in the cable.



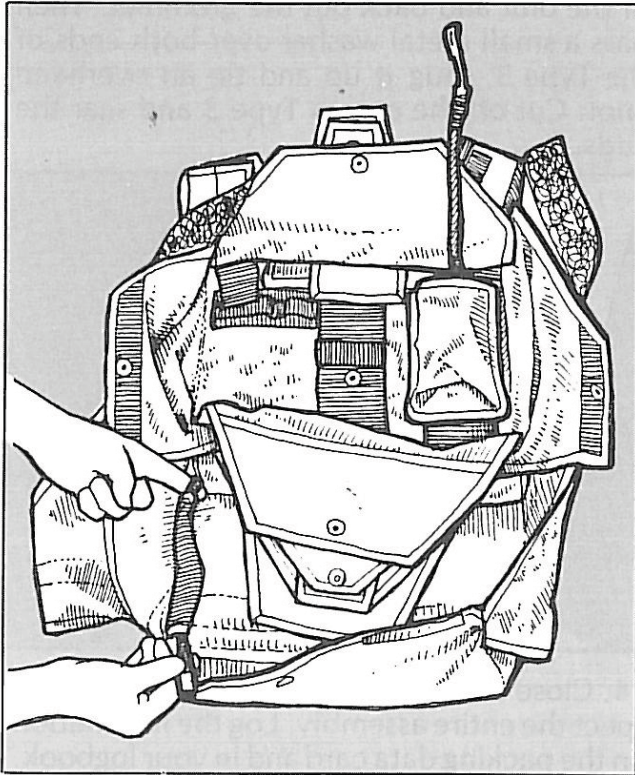
7. Thread the activation unit cable carefully from right to left through the channel that runs along the bottom of the reserve pack tray.



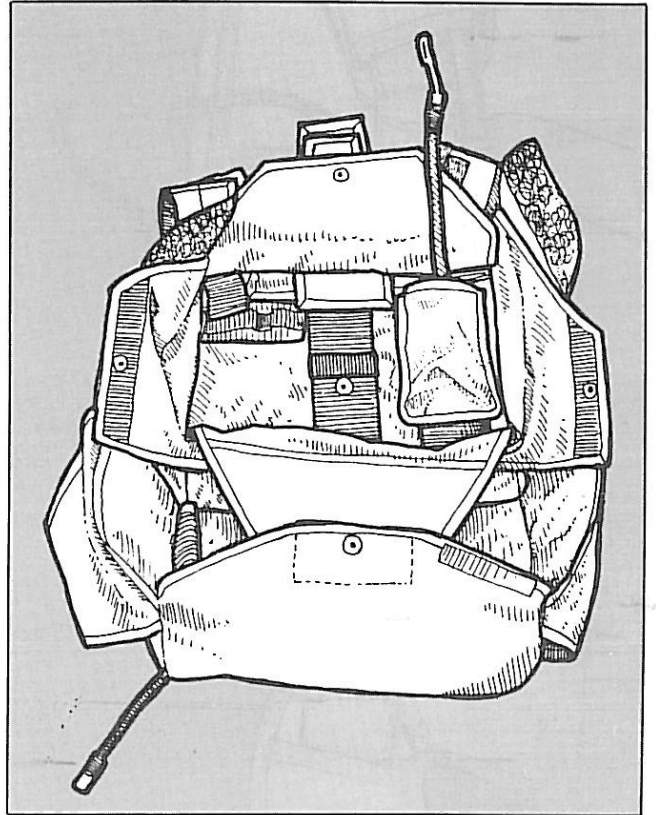
8. Next, route the activation unit cable through the small hole in the bottom left hand corner of the reserve pack tray.



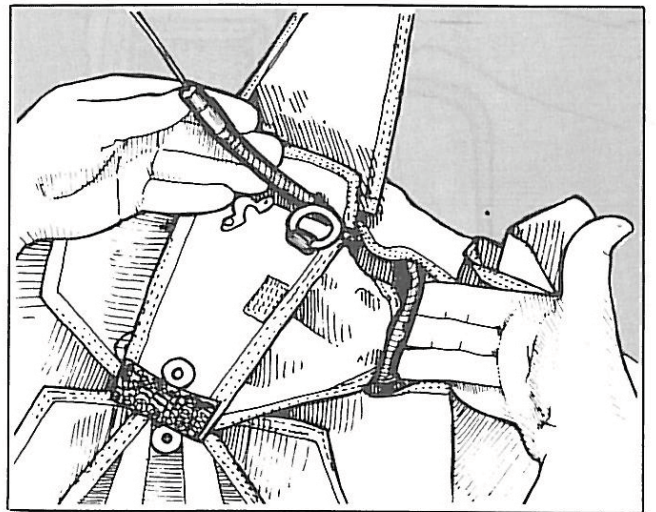
9. Thread the activation unit cable through the channel that runs along the left side of the main pack tray.



10. Route the activation unit cable through the hole in the lower left hand corner of the main container. Attach the activation unit cable you have just threaded to the sensing unit cable.

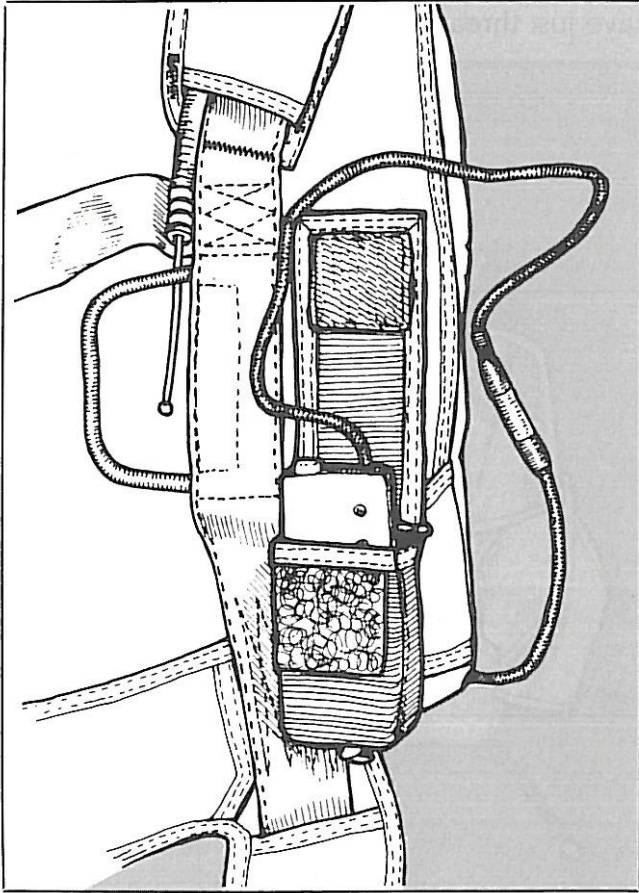


11. Thread the cable housing at the top of the activation unit from right to left through the small slot in the container yoke near the upper corner of the reserve pin protector flap.

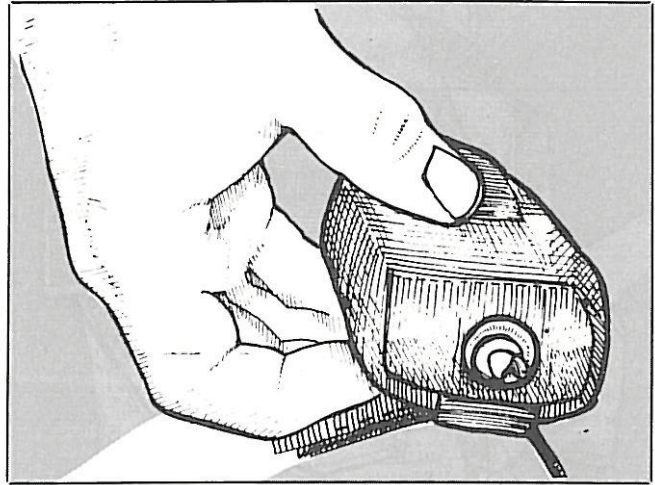




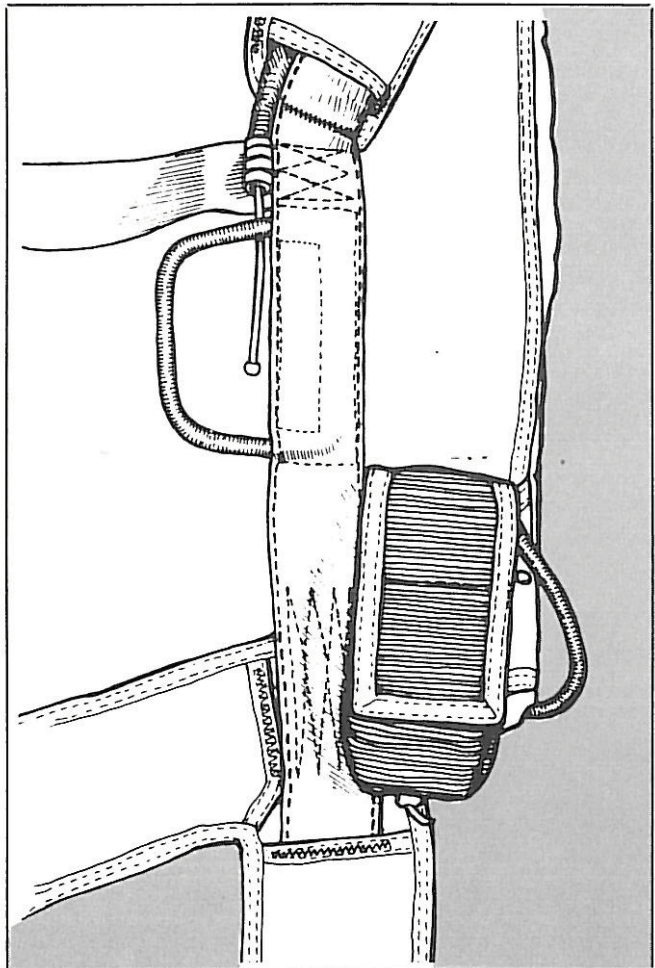
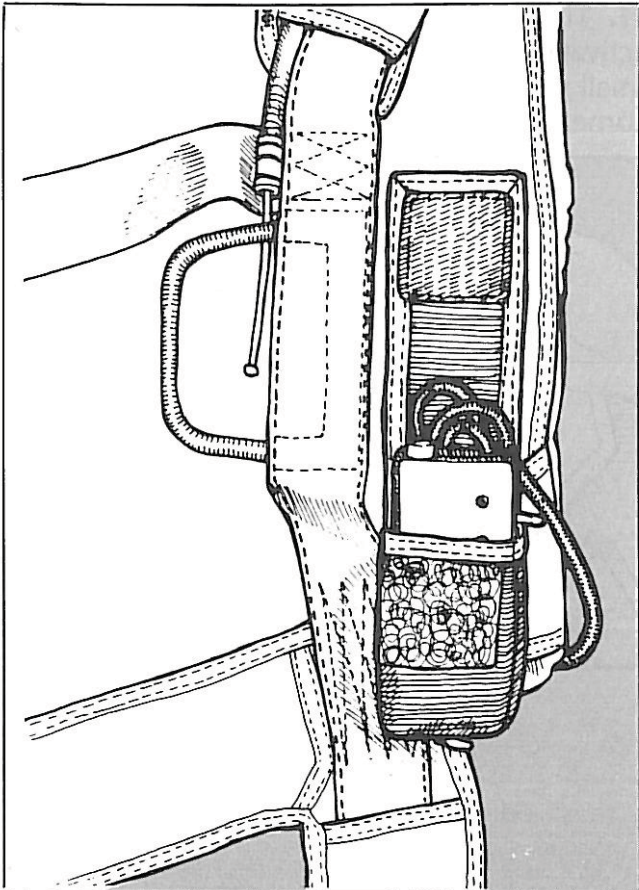
12. Using the pouch provided, mount the sensing unit to the diagonal strap. Coil the extra cable and tuck it into the pouch.



13. Secure the sensing unit into the pouch with a piece of Type 3 sheathing by passing one end through the grommet in the bottom of the pouch, through the hole in the bottom of the unit and back out the grommet. Then pass a small metal washer over both ends of the Type 3, snug it up and tie an overhand knot. Cut off the excess Type 3 and sear the ends.



14. Close the Velcro flap on the pouch. Inspect the entire assembly. Log the installation on the packing data card and in your logbook.



## Installing the FXC Model 12000 AAD

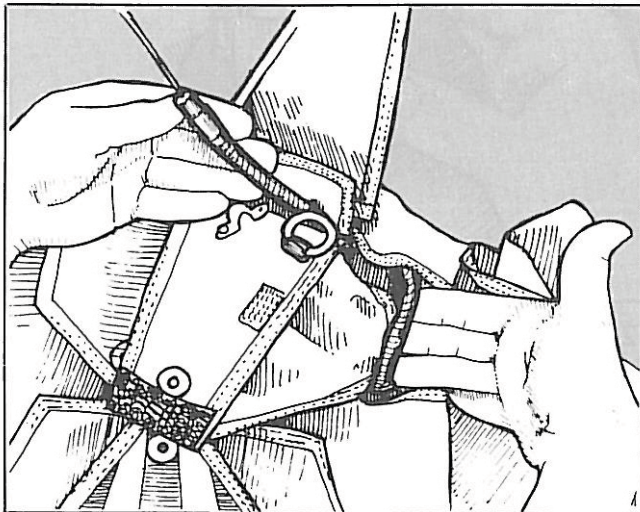
1. Installation of the FXC Model 12000 on the Vector requires a small-hole terminal fitting on the activation cable and longer screws. This fitting is available from either FXC or the Relative Workshop; it is not routinely provided with each Model 12000 sold.

2. Inspect entire AAD assembly. Cock unit.

3. Modify the mounting plate by using a hacksaw to cut the "tail" off the T-shaped plate. (Only the crossbar of the plate will be used.) Smooth any rough edges with a file.

4. Insert activation unit into pouch on the wearer's right-hand side of the reserve container. The activation cable should extend towards the right and the sensing cable to the left.

5. Route the activation cable along the right side of the pack tray. The cable end is threaded from right to left through a small slot in the container yoke near the upper corner of the reserve pin protector flap.



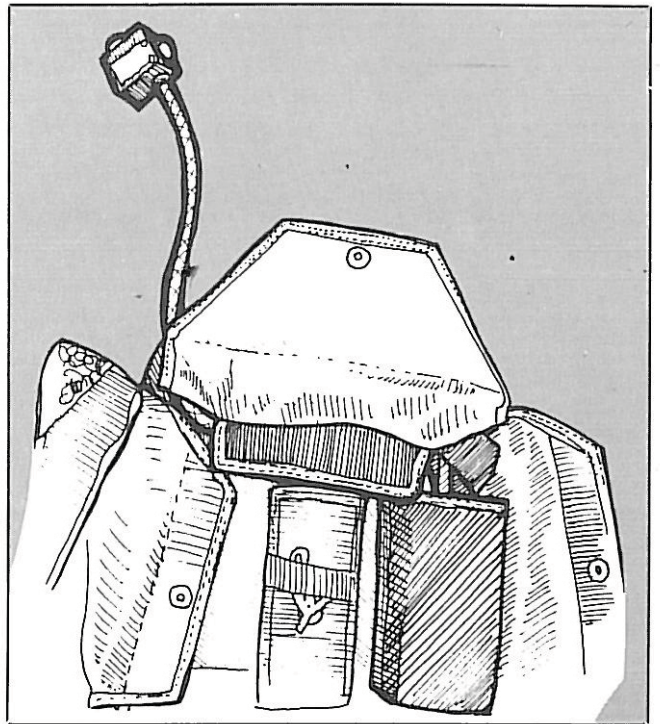
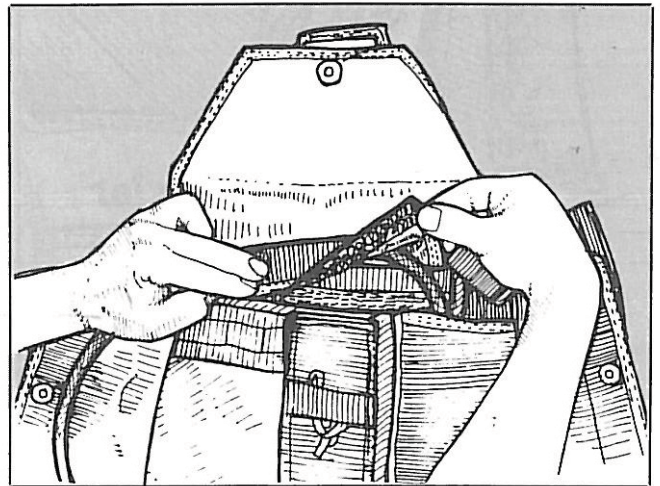
6. Measuring along the center line of the reserve top flap (Flap #6), measure up 4 inches from the center of the grommet and mark. This mark indicates the lower edge of the mounting bracket.

**NOTE:** If the bracket is mounted too closely to the grommet, the ripcord pin may not be completely withdrawn from the locking loop when the AAD fires and the container will stay shut.

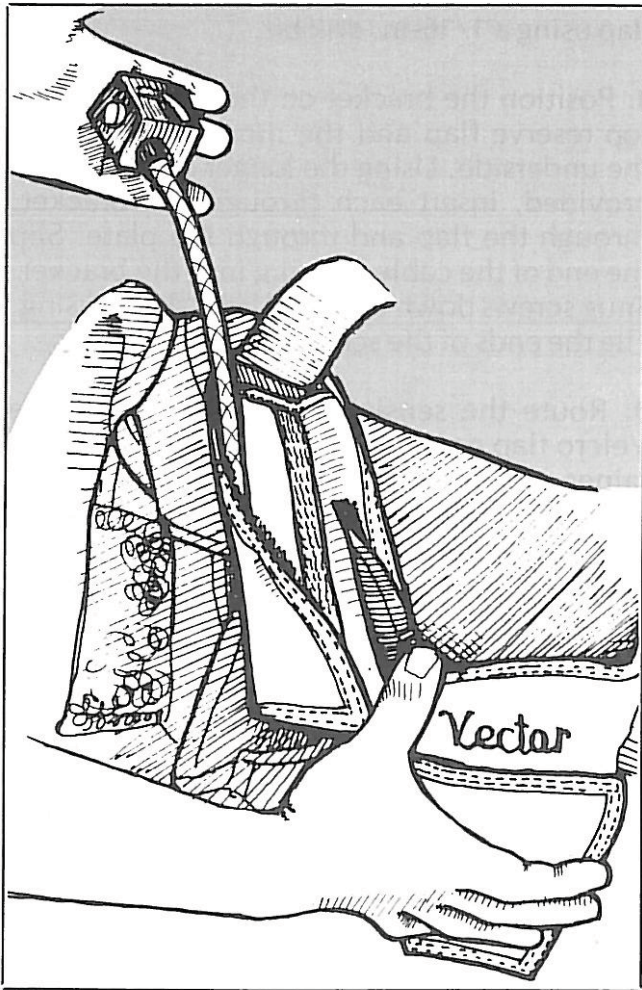
7. Place bracket on center line of top reserve flap and use a pencil or pen to carefully mark holes. Remove bracket and drill holes in top flap using a 1/16-in. drill bit.

8. Position the bracket on the outside of the top reserve flap and the mounting plate on the underside. Using the longer of the screws provided, insert each through the bracket, through the flap and through the plate. Slip the end of the cable housing into the bracket. Snug screws down to firmly hold the housing. File the ends of the screws flush if necessary.

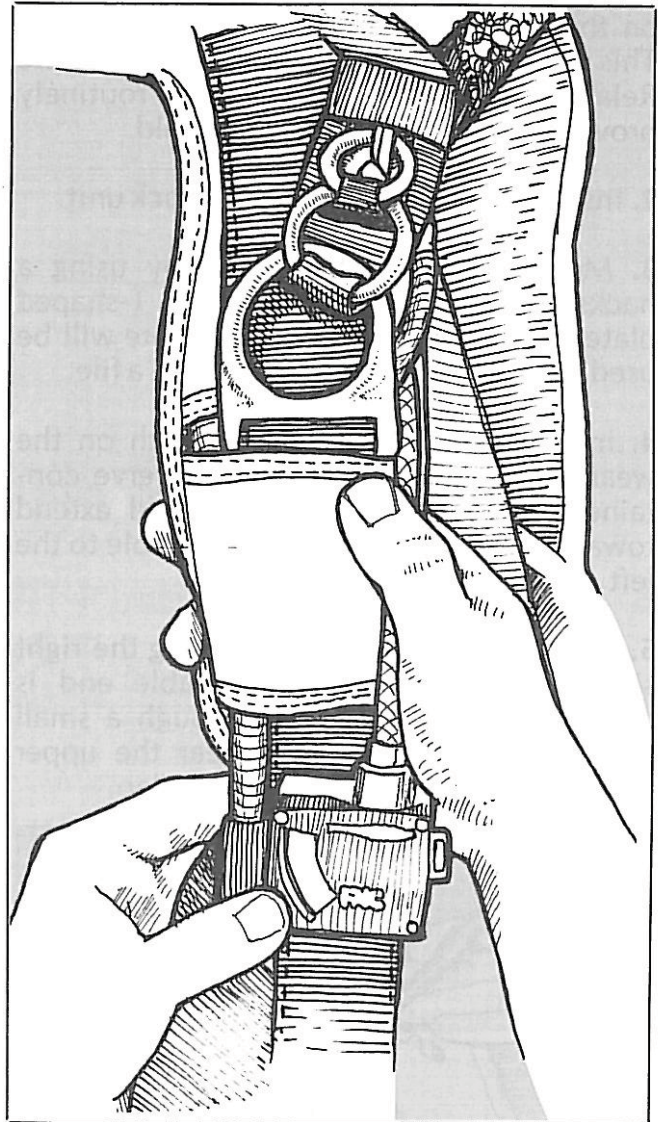
9. Route the sensing unit cable under the Velcro flap across the top of the reserve container and under the Velcro flap on the left side (where the reserve risers will be placed).



10. Route the sensing unit cable under the Velcro flap on the left hand shoulder yoke.



11. Attach the sensing unit to the Type 17 loop provided on the fabric panel below the large harness ring.



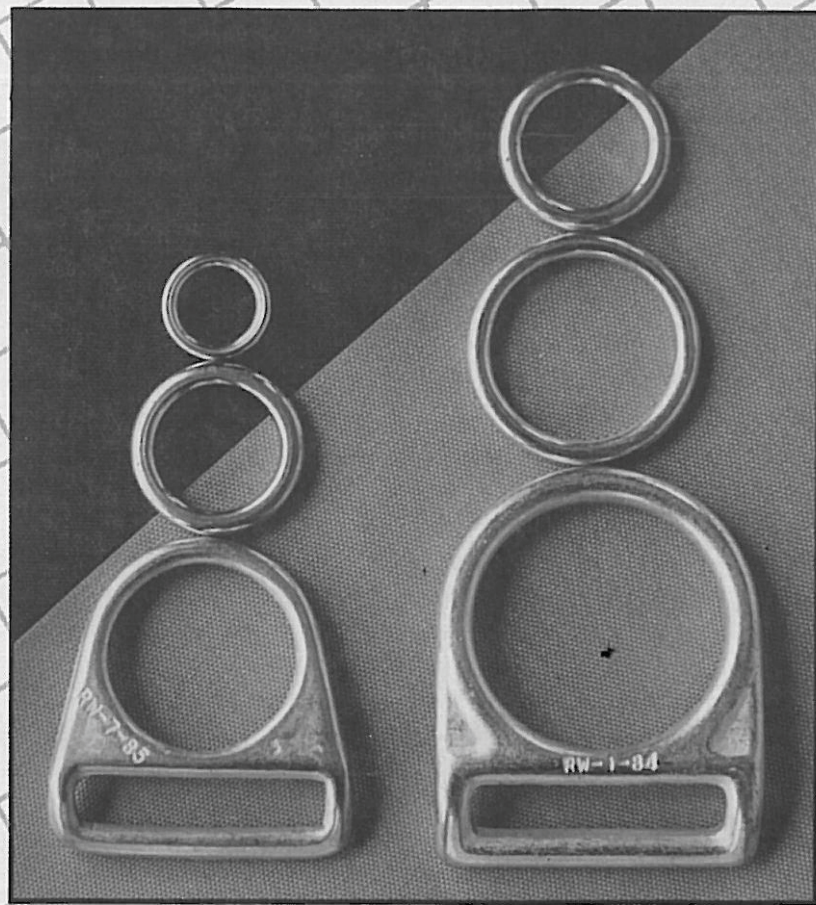
12. Inspect the entire assembly. Log the installation on the packing data card and in your logbook.

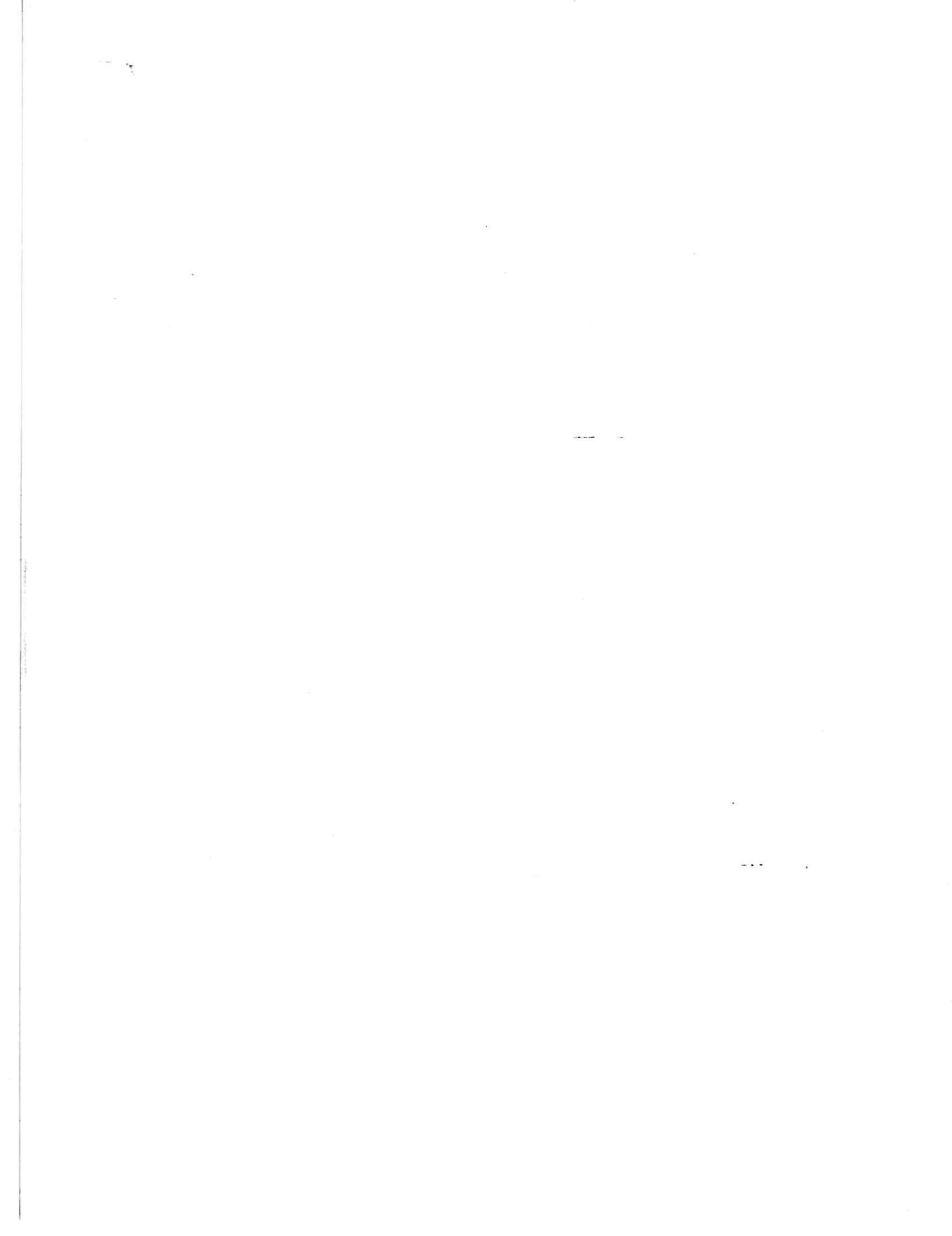
### Altitude Testing Chamber

Because AADs are reliable only if they are properly installed and maintained, anyone who purchases a Vector must have access to an altitude testing chamber. The FXC chamber costs more than the one from SSE, Inc., but it tests the entire system rather than just the sensor.

It is possible to construct an inexpensive altitude chamber using readily available components. These "home-made" devices can fail, however, endangering those nearby. Caution must be used when using any altitude chamber.

# The 3-Ring Release





## THE 3-RING RELEASE SYSTEM

### Introduction

The 3-Ring Release System was invented by the Relative Workshop in 1976. It was the first practical release that allowed parachutists to jettison their main canopies in one motion by simply pulling a single handle.

Not only is the 3-Ring easier to operate than previous canopy release systems, it is also more reliable. Failures of a properly built and assembled 3-Ring system are virtually unknown.

Once the main is jettisoned, the only things left on the harness are two smooth rings that cannot snag a deploying reserve. Some other popular release systems can—and have—interfered with the deploying reserve.

### MODIFYING THE 3-RING RELEASE

The great reliability of the 3-Ring system results from the proper functioning of every one of its individual components. Therefore, the owner should not modify the system in any way, nor should he replace genuine 3-Ring parts with others.

These modifications (among others) will cause the system to not work properly:

- Substituting risers that don't have Type 2 sheathing for the locking loop. Don't use risers that have loops made of Kevlar or solid cord.

- Not using a breakaway handle with cable with the special yellow coating. This Teflon-impregnated coating is important; other plastic coatings may cause the cables to bind in the housings or loops, making it difficult or impossible to jettison the risers.

- Using a breakaway handle with cables of the wrong length. The length of the cables is critical to insure each riser releases in the proper sequence. Replacement handles are available from the Relative Workshop.

The 3-Ring Release is now found on other rigs besides Vectors as the Relative Workshop has licensed its use to other manufacturers.

### GETTING TO KNOW THE 3-RING

Knowing how the 3-Ring release works will help you assemble and inspect it properly.

Begin by peeling the release handle from the Velcro on the harness. Peeling, rather

than pulling, makes it easier to separate the handle from the webbing.

Look behind the risers near the harness and observe the movement of the yellow cable as you pull the handle. When the cable clears the white loop, the release is disengaged.

Now slowly pull one of the risers off the harness. As you pull, you'll notice that the white loop gets pulled through the grommet by the action of the smallest ring.

Each ring forms a lever with a ten-to-one mechanical advantage as it passes through the other. A force of 1,000 lb. on the large harness ring exerts a force of only ten pounds on the white loop. (Opening shock usually totals about 1,000 lb., or 500 lb. on each riser.)

Because of the mechanical advantage provided by the 3-Ring design, only a force of approximately a pound on the top ring keeps the release together.

That's why it's important to keep foreign matter like bits of grass and sticks out of the 3-Ring assembly. A small stick in the white loop could prevent a riser from releasing.

It is also important to understand one of the properties of the nylon components of the system.

When nylon stays in the same position for a long time, it begins to conform to that position, or take a "set." If the 3-Ring release system stays assembled for too long, the nylon can become so stiff that the low drag from a malfunction (such as a streamer) won't pull the riser off the ring.

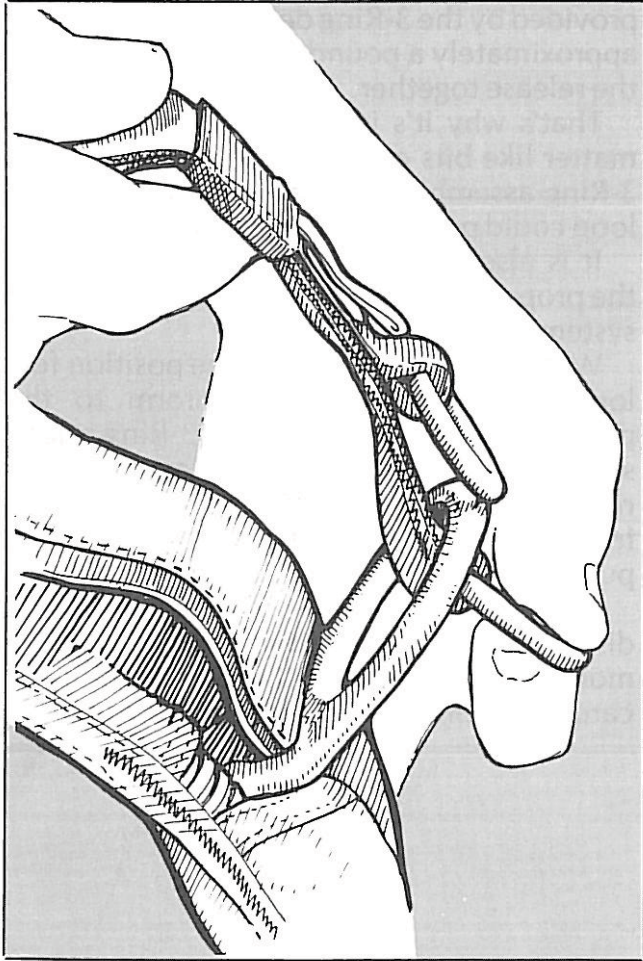
The 3-Ring release system must be disassembled, flexed and inspected every month. Procedures for this are listed in the care and maintenance chapter of the manual.

## ASSEMBLY

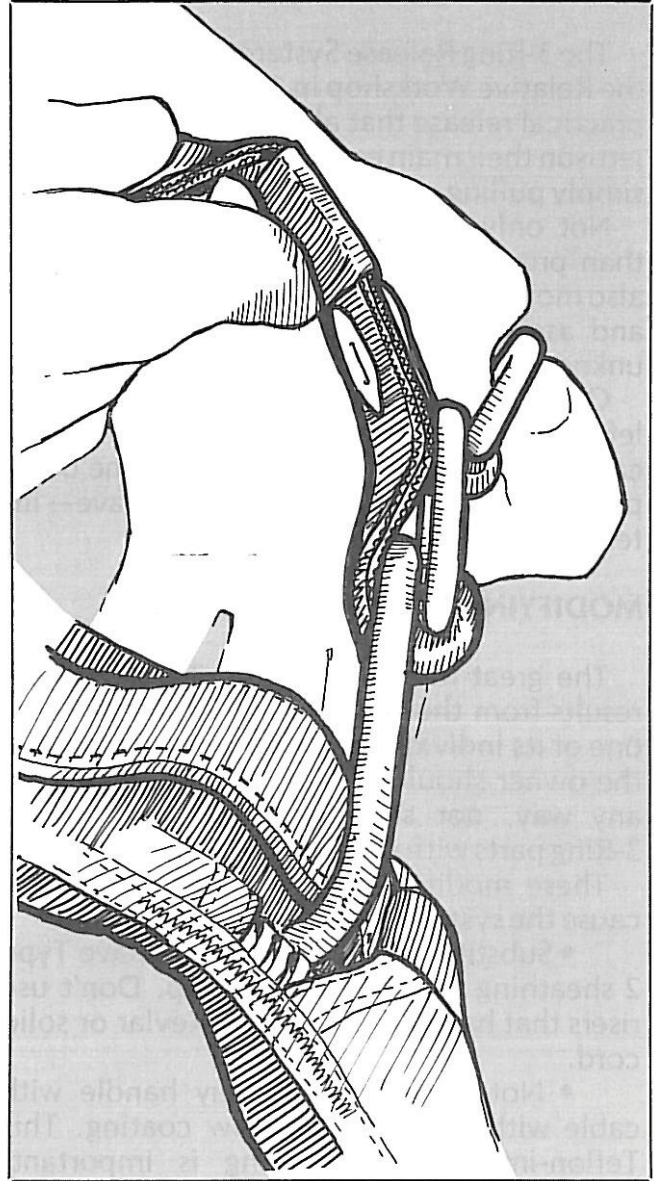
Before assembling the 3-Ring release, make sure the risers aren't twisted or reversed. Lay the Vector face down, as you would to pack it.

1. Thread each cable into its housing and stick the handle to the harness. The handle should be positioned as close to the ends of the housings as possible so that no cable is exposed.

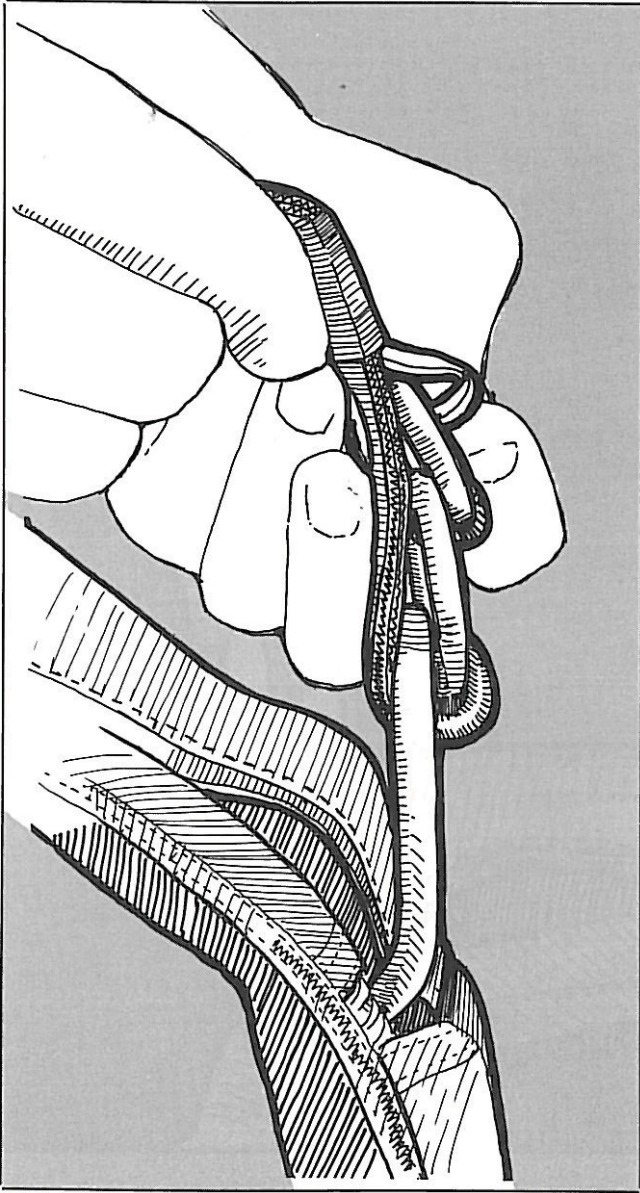
2. With the rings of the riser facing toward the floor, pass the ring on the end of the riser through the large harness ring from above. Fold it back toward the canopy and risers.



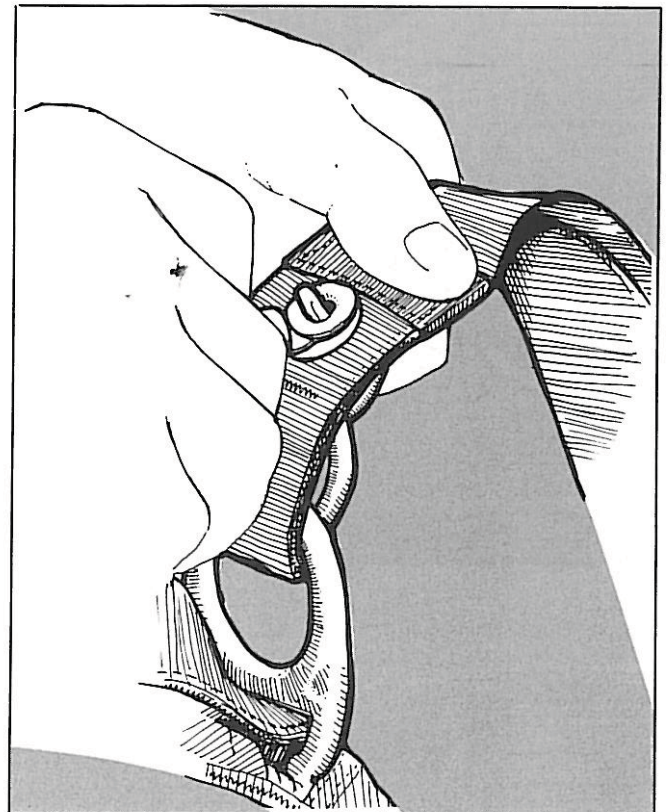
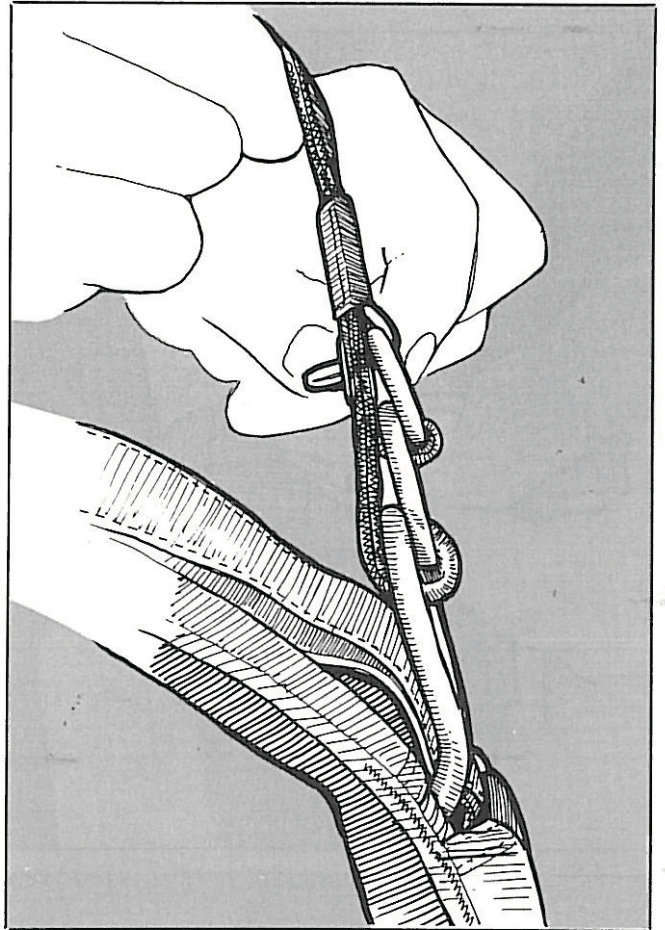
3. Thread the smallest ring through the middle ring in the same way, but make sure it doesn't pass through the large ring.



4. Bring the white loop over the small ring only and then through the riser grommet so it pokes out the back of the riser.

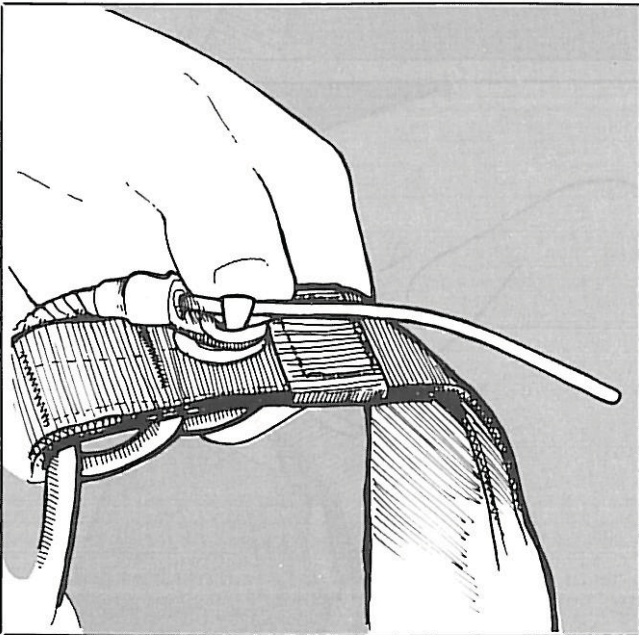
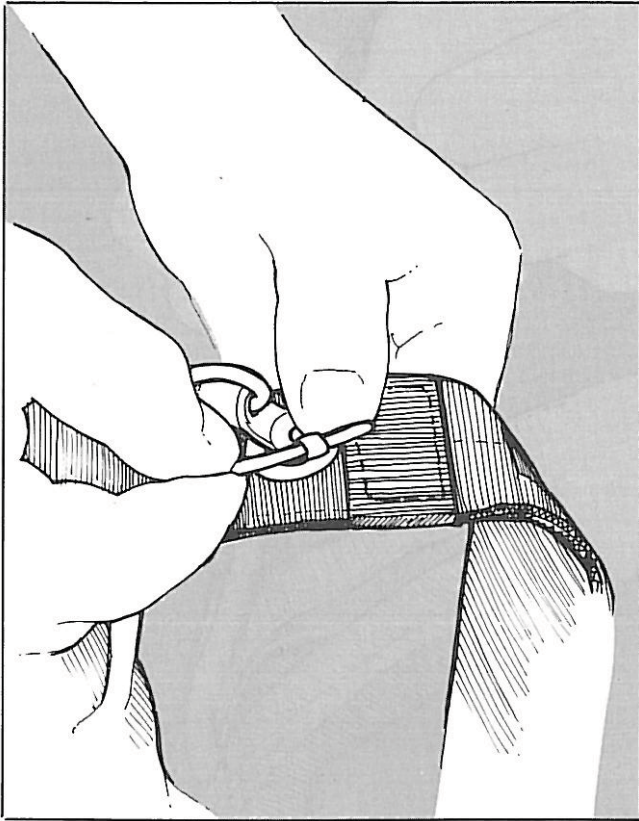


5. Continue threading the white loop through the grommet on the end of the cable housing. The flat side of the cable housing grommet should be against the riser.

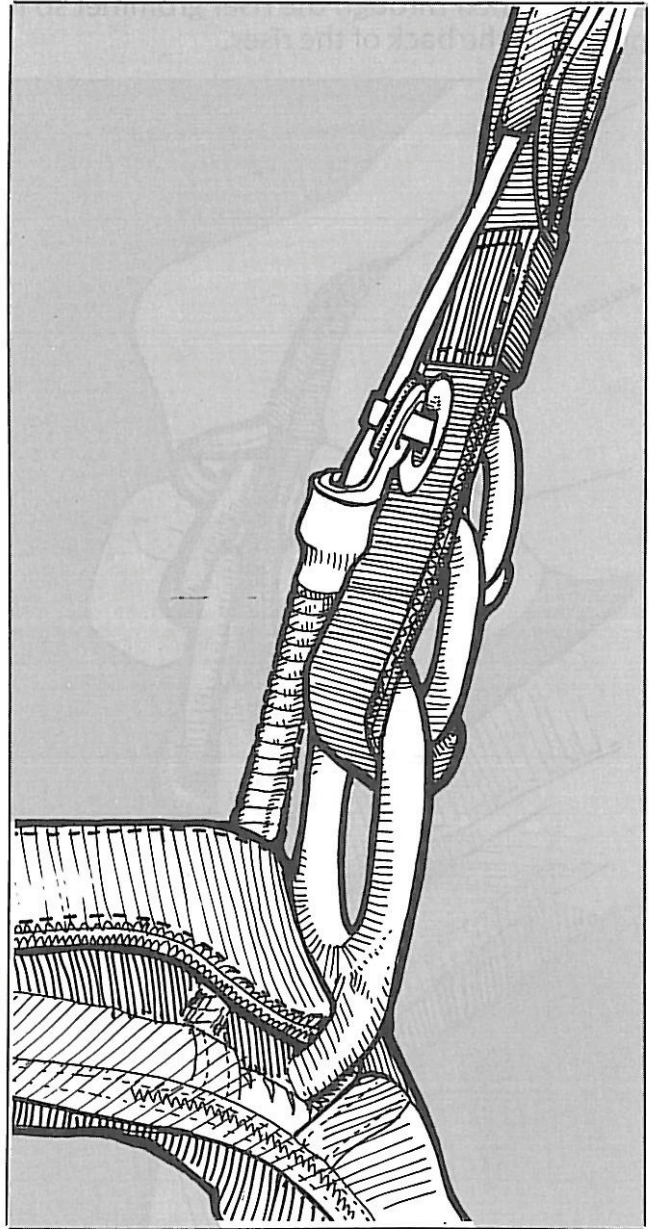




6. Thread the yellow cable through the white loop, making sure the loop isn't twisted. Be careful with the cable so you don't bend it too sharply or kink it. Insert the free end in the channel on the back of the riser.



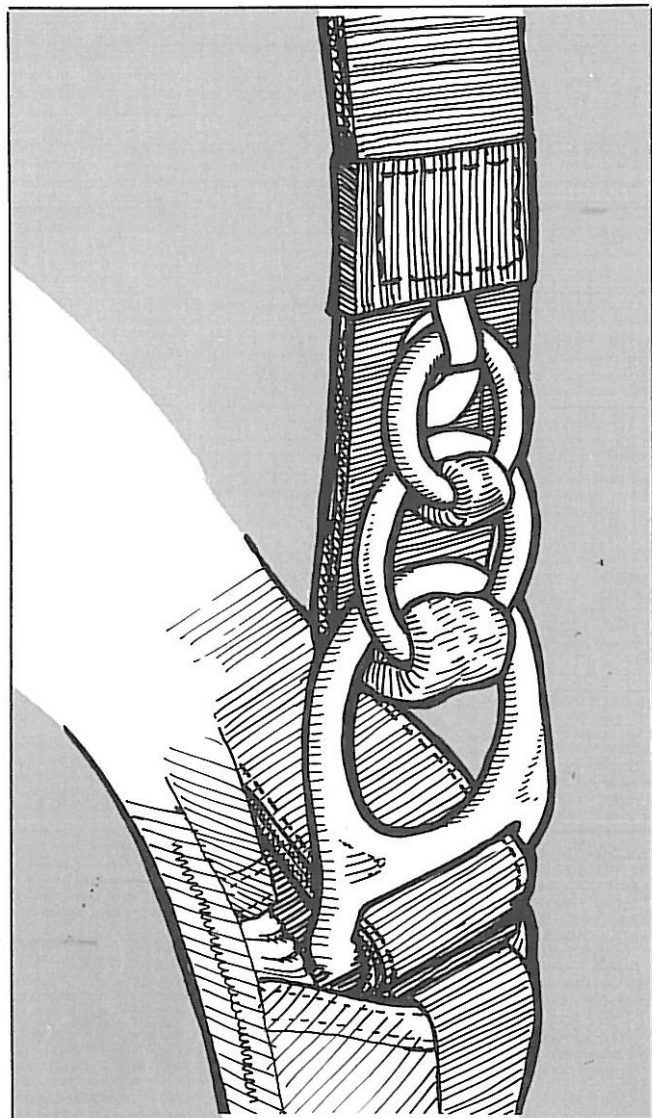
7. Repeat the above steps with the other riser.

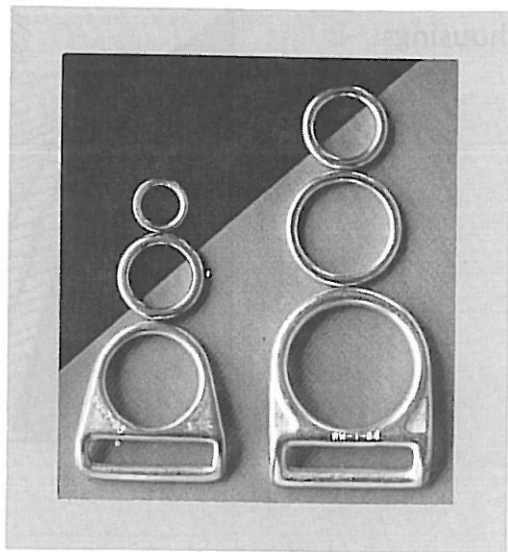


## PRE-JUMP INSPECTION

Before jumping the Vector, check the 3-Ring release system for the following:

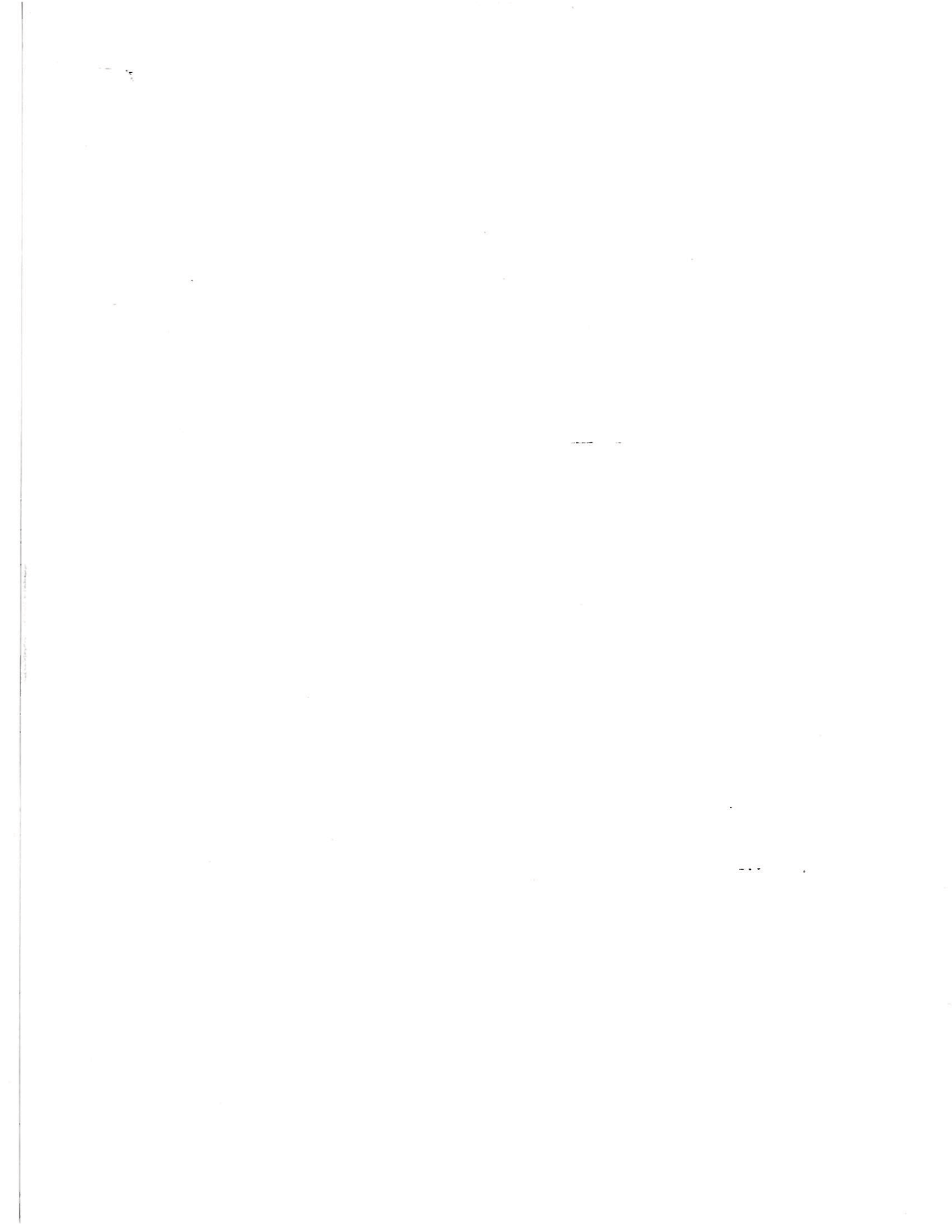
1. Each ring passes through only one other ring.
2. The white loop passes through only the small ring.
3. The white loop passes through the grommet on the end of the cable housing without twisting.
4. Nothing passes through the white loop except the yellow cable.
5. The 3-Ring release handle is securely stuck to the harness, and no cable is visible between the handle and the cable housings.





# Care & Maintenance





## INTRODUCTION

Your Vector will last longer, look better and function correctly if it is maintained. A Vector actually requires very little maintenance unless it is subjected to unusual conditions such as a jump into salt water or a muddy landing.

## INSPECTION

The best approach in maintaining your rig is to periodically spend a few minutes examining every detail on it. This inspection should be done at least every month. If any wear or damage is found, fix it immediately. Putting off repairs might result in a malfunction.

In addition to inspecting the rig yourself, ask your rigger to inspect the entire assembly every time the reserve is repacked.

Particular attention should be given to these areas:

**1. Breakaway System.** Refer to the 3-Ring section in this chapter for detailed information on inspecting the canopy releases.

**2. Reserve System.** This includes the reserve ripcord, locking loop, pins, handle, housing, container and associated sewing. You should not attempt any repairs or modifications to any of these items unless you are a rigger. You can, however, spot little problems before they become major.

**3. Harness.** The harness should be inspected periodically for broken stitching or frayed webbing.

**4. Main Container.** Inspect the plastic stiffeners in the container flaps and replace any that are broken. Replace any grommets that are badly deformed or are pulling out of their setting.

**5. Main Pilot Chute.** Check the center line (a length of nylon tape inside the pilot chute that extends from the handle to the base) of the main pilot chute. It must be firmly sewn at each end; there must be no broken stitches or torn fabric.

Inspect the seam that joins the pilot chute mesh to the pilot chute fabric. If the mesh is torn or badly frayed, replace the pilot chute.

**6. Locking Loop.** The main container is held shut with a locking loop made of nylon suspension line sheathing. This loop is subject to wear. If it wears out and breaks, the main canopy may release prematurely and a malfunction may result. Replace the loop with a duplicate if wear is noticed.

## CAUTION

**Never jump a Vector with a worn locking loop.**

**7. Velcro.** Velcro tape has many applications in parachuting. However, it wears out and loses its adhesive ability after a while. It also gets "clogged" with dirt and bits of grass and should be cleaned occasionally. Check the riser keepers or riser covers (on the shoulders) and the main protector flap to see if the Velcro is adequately tacky. Velcro on the main pilot chute bridle should be replaced after several hundred jumps, too.

## CARE

Your Vector is manufactured mostly from nylon. Nylon is very durable, but is susceptible to damage from several sources:

**1. Sunlight.** The ultraviolet rays in sunlight quickly and permanently weaken nylon. Keep your Vector out of direct sunlight as much as possible.

**2. Acids.** Nylon is also damaged by acids. Keep your Vector away from hangar floors, dirty car trunks and similar areas where acids may be found. If such contamination does occur, immediately and thoroughly wash the rig with plenty of warm soapy water. Until a rig can be washed, baking soda will quickly neutralize most acids. If acid damage occurs or is suspected, a rigger should thoroughly inspect your Vector.

**3. Oils and Grease.** Most petroleum compounds do not weaken nylon; they simply stain it. Such stains should be promptly removed by a rigger using the proper petroleum solvent.

**4. Water.** Water will not damage your Vector, but may cause some fabric colors to run. Salt water will rust the hardware if not promptly and thoroughly washed off with plenty of fresh water. Your rig will maintain its new appearance longer if it is kept dry.

**5. Soil.** Soil will not damage your Vector. Brush off the soil after it has dried and gently wash with warm soapy water. Be sure that the soil is not in the housings, snaps, 3-Ring release or reserve ripcord pins or loops. Consult a rigger if your rig is heavily soiled or extremely dirty.

**6. Abrasion.** Nylon quickly frays if dragged over concrete or other rough surfaces. Do not drag your rig on concrete while packing.

FAA regulations require that reserves worn in the USA be repacked every 120 days by a certificated rigger.

## REQUIRED PERIODIC MAINTENANCE FOR THE 3-RING

The Booth 3-Ring Release System has been in use for many years with excellent results. Although the system is as durable as the rest of the harness/container assembly, it requires periodic maintenance and inspection to ensure proper operation.

Generally, it is NOT recommended that the risers be attached to the harness when new and "forgotten." Like all skydiving gear, the 3-Ring Release should be carefully inspected and operated on a regular basis.

The procedures below should be done at least every month. This is especially important if the rig has not been used for a month or more, such as during the winter. Immediate inspection is required if it has been subjected to some abuse such as a drag across the runway, a water landing or exposure to a lot of dust or sand.

**1.** Every month operate the 3-Ring release system on the ground. Extract the cable completely from the housings and disconnect the risers.

**2.** While the system is disassembled, closely inspect it for wear. Check the white locking loops (the ones that pass over the smallest ring and through the grommet) to be sure they are not frayed.

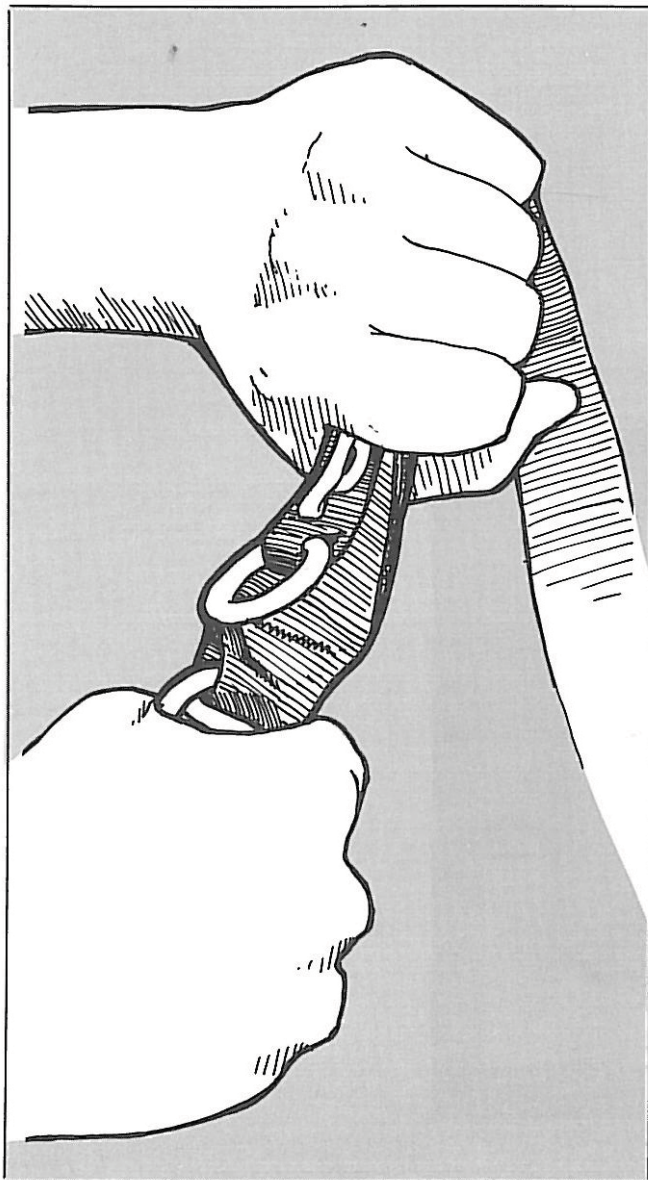
**3.** Check the Velcro on the breakaway handle and main lift web to be sure it is clean and adequately holds the handle.

**4.** Check the cable ends for a smooth finish. The ends are finished at the factory to have a smooth, tapered surface. This prevents the cable from hanging up in the loop. Check the cable ends and consult a rigger or the manufacturer if a burr or "hook" is present.

**5.** Check the stitching, including that which holds the large rings to the harness.

**6.** Pull downward on the housings. They shouldn't move downwards more than 1/2 inch, but should be free to move upwards 1 to 2 inches.

7. Take each riser and vigorously twist and flex the webbing near where it passes through each ring. The idea is to remove any set or deformation in the webbing. Do the same thing to the white loop.



8. Check the housings for dents or other obstructions. Use the cable to do this.

9. Clean and lubricate the release cable with a light oil such a "3-in-1" brand. Put a few drops on a paper towel and firmly wipe the cable a few times. A thin, invisible film should remain—too much will attract grit and dirt, or the oil could become tacky in cold weather. Too much oil will require more force to extract the cable during a breakaway.

10. Inspect the fittings at the end of each housing. If one of these fittings were to come off the housing, a riser might release prematurely.

11. If any wear is found, consult the manufacturer or a rigger before using the Vector.

12. Reassemble the system. Double check it. Make sure the risers aren't reversed.

The Relative Workshop appreciates any comments from users that relate to the safety, operation or maintenance of the 3-Ring release.

It's important to maintain the system even more frequently in humid, muddy or freezing conditions. If the Vector becomes immersed in mud or muddy water, clean the 3-Ring release system with a mild solution of soap and water. Any rusted components must be replaced.

## REPLACEMENT PARTS

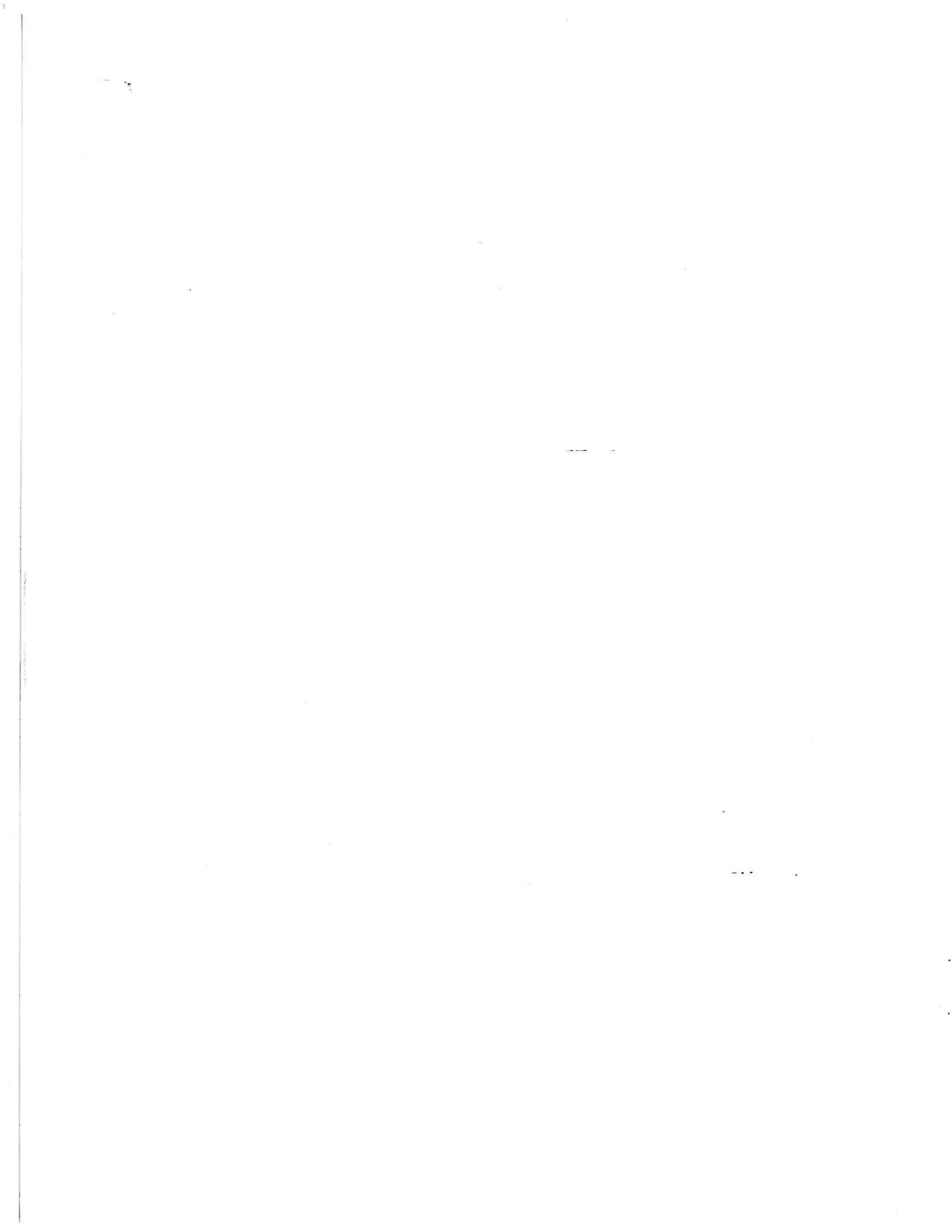
The Relative Workshop supplies replacement parts for its rig at a reasonable cost. When ordering parts for your rig, include the serial number, type and date of manufacture of your Vector so the proper items can be quickly supplied. This information is written on the label on the data card pocket located under the Vector monogram found by lifting the reserve pin protector flap, or on the data label located under the orange warning label which is sewn to the back pad. Not all rigs have warning labels.





# Using the Vector





## INTRODUCTION

This section provides specific procedures for using the Vector. It is not a training syllabus.

It is the responsibility of the owner to insure he knows everything necessary to make a safe parachute jump, including how to use his equipment. This knowledge can be gained only by personal instruction.

## SUGGESTED EQUIPMENT

### Training Harness

It is essential that a new Vector jumper practice normal and emergency procedures on the ground before jumping the rig for the first time. This practice should be done using training aids that duplicate the equipment to be used in the air.

The Relative Workshop can provide a Vector training harness. It is equipped with simulated breakaway, reserve and main deployment handles that are located in the same positions as on the Vector. If you build your own practice harness, make sure the main, reserve and breakaway handles are located in the same positions as on the Vector.

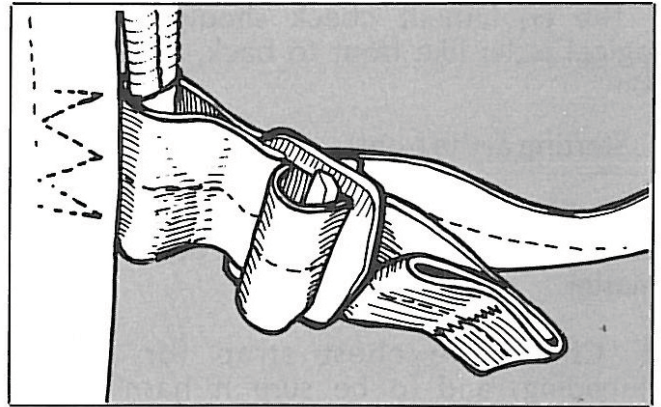
## DONNING AND ADJUSTING THE VECTOR

The Vector is designed so that it fits snugly, yet comfortably when the harness is properly adjusted.

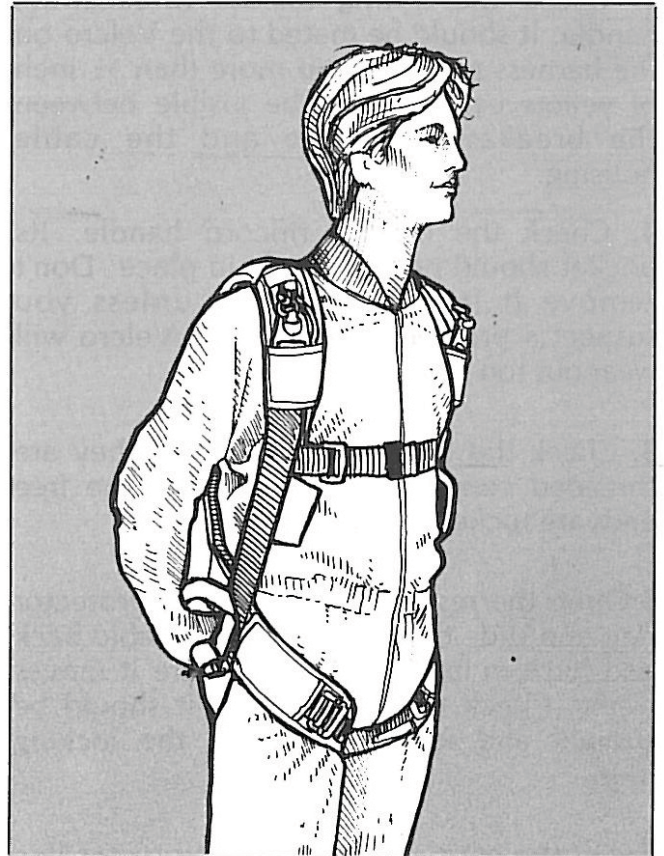
1. Pick up the Vector by grabbing it by the main lift web where the 3-Rings are. Put it on as you would a coat.
2. Check the leg straps for twists before threading them. Be sure to route the webbing correctly, then tighten them until they are snug. Stow the extra strap in the pockets on the pads so it won't flop around in the air.
3. Thread the chest strap. (If an altimeter is worn on the chest strap, put it on now.) The strap enters the adjuster from behind (the

wearer's chest side), around the sliding bar, and back through between the bar and the end of the adjuster. Adjust it so the main lift webs are parallel when the chest strap is tight.

An improperly threaded chest strap will not hold the jumper in the harness.



Your Vector is now ready for an equipment check.



## SUMMARY

To summarize the above adjustment procedure:

- Put the packed rig on over your jumpsuit.
- Hook the leg straps, checking that they are not twisted, and position the comfort pads properly.

- Tighten the leg straps until snug.

- Stand up straight and close the chest strap; it should not be cinched too tightly.

## **PRE-JUMP EQUIPMENT CHECK**

The equipment check should follow a logical order like front to back, top to bottom.

Starting at the front:

1. Make sure the 3-Ring system is assembled properly and free of dirt and other foreign matter.

2. Check the chest strap for proper threading, and to be sure it hasn't been threaded through the reserve ripcord handle.

3. Check the 3-Ring release (breakaway) handle. It should be mated to the Velcro on the harness properly. No more than ½ inch of yellow cable should be visible between the breakaway handle and the cable housing.

4. Check the reserve ripcord handle. Its pocket should hold it firmly in place. Don't remove it from the pocket unless you suspect a problem, because the Velcro will wear out too soon.

5. Check the leg straps to be sure they are threaded correctly, snug and that the free ends are tucked in the leg pads.

6. Open the reserve container pin protector flap and slide the reserve ripcord cable back and forth in its housing to be sure it moves freely. Check the reserve pin; it should be straight and seated well into the locking loop.

7. Lift the main container pin-protector flap and check the curved pin. It must be at least halfway through the locking loop. Be sure the yellow Velcro patches on the bridle and container flap are mated.

8. Be sure the bridle is routed correctly from the locking pin, under the right-hand flap along the main lift web and into the pilot chute pouch. Routing the bridle around the

leg strap will cause a pilot-chute-in-tow malfunction.

9. Calibrate and arm the AAD (if installed) according to the instructions provided by its manufacturer.

## **JUMPING THE VECTOR**

### **INTRODUCTION**

This section contains recommended procedures for operating the Vector.

### **DEPLOYING THE MAIN PARACHUTE**

Before a jumper uses a hand deploy system, he should first practice the procedure on the ground under an instructor's supervision. These procedures are used in the air:

1. While falling in a stable position, if possible, look at the hand deploy pilot chute handle.

2. Firmly grasp the handle with your right hand while compensating for stability with the left.

3. Extract the pilot chute from its pouch and throw it into the airstream away from your body.

It's not enough to simply release the pilot chute into the airstream; it must be thrown out and away from your body. Otherwise it may blow back into the turbulent air behind you and cause a malfunction. The motion of your arm should be parallel to the ground. If it isn't, the pilot chute and bridle may pass under your arm, possibly causing a malfunction.

Any wave-off procedure should be completed before pulling the hand deploy pilot chute. Waving off with the pilot chute in hand could cause a premature pack opening and possibly a malfunction.

Many jumpers watch the pilot chute inflate and begin extracting the main canopy, then lower their heads while the main inflates.

### **DEPLOYING THE RESERVE PARACHUTE**

This section is not a detailed course in coping with parachuting emergencies. It discusses the causes of some total and partial malfunctions and how a jumper wearing a Vector might react to them.

## Total Malfunction

A total malfunction exists when the main canopy is still in its container after some effort has been made to deploy the main pilot chute. The pilot chute may or may not be trailing behind the jumper.

A total malfunction may result from a variety of causes, most of which can be prevented by proper packing, maintenance and use of the Vector.

Because the jumper is descending at a high rate of speed, he has little time to attempt to correct a total malfunction.

The reserve ripcord should be pulled using a "Look, reach, pull," procedure. The ripcord should be grasped with both hands and pulled until the arms are completely extended.

When presented with a total malfunction, it is usually not prudent to jettison the risers before pulling the reserve ripcord. Doing so wastes the limited time and altitude available.

Typical total malfunctions and the jumper's response include:

**1. Pilot chute hesitation.** The pilot chute may become trapped in the turbulent air over a jumper's back and stay there, uninflated. (One cause: not throwing a hand deploy pilot chute vigorously to the side.)

**RESPONSE:** The jumper should roll over on his side momentarily. This should blow the pilot chute off his back or out of the turbulent air. If it doesn't leave immediately, the jumper should roll back over and assume a flat and stable position and pull the reserve ripcord. Because simultaneous deployment of the main and reserve canopies can occur in this situation causing both to malfunction, before pulling the reserve, the jumper should try all possible methods to free the main pilot chute, while maintaining altitude awareness.

**2. Towed pilot chute.** The pilot chute is out behind the jumper and is inflated, but does not extract the main canopy for some reason. (Causes include misrouting the hand deploy bridle during packing, not mating the yellow Velcro patches on the bridle and flap, and others.)

**RESPONSE:** When you have determined that the malfunction is a pilot chute in tow (pilot

chute is inflated and bridle is at full extension, but does not open container), assume a flat and stable position and immediately pull the reserve ripcord. It is unlikely the jumper would be able to identify or correct the cause of a pilot chute in tow before impact with the ground.

**3. Lost or stuck deployment handle.** Jumpers will sometimes be unable to locate the deployment handle or, if they do locate it, will not be able to pull it.

**RESPONSE:** The jumper should look at the deployment handle. If he cannot see it or feel it in a couple seconds, or if a couple hard pulls on it won't extract it from its pouch, he should assume a flat and stable position and pull his reserve.

## Partial Malfunctions

A partial malfunction results when the main canopy comes out of the container and extends above the jumper but does not open correctly. Most partial malfunctions result from incorrect packing or problems with the canopy itself.

Some partial malfunctions can be corrected by the jumper in the air. These might not require the use of the reserve parachute and can be landed safely. Identifying and dealing with such situations is the responsibility of the jumper.

Some jumpers delay several seconds between jettisoning their main and pulling the reserve ripcord. This allows them to achieve stability before the reserve deploys. However, such a delay can be fatal if the jumper is too close to the ground.

And some jumpers put one hand on the breakaway handle and the other on the reserve ripcord handle and then attempt to pull them both simultaneously or in rapid succession. There have been incidents, however, where this technique resulted in the reserve deploying before the risers were jettisoned—a dangerous situation.

Therefore, experience has so far shown that the "two-step" method is usually best.

Note that the procedures for dealing with malfunctions do not consider the installation of an AAD. Since it is a back-up device, the jumper should act as if it wasn't there.

**RESPONSE:** When presented with a partial malfunction that requires the use of the reserve, the jumper should arch his back and tuck his legs behind him. He should then look down and locate the reserve ripcord handle and the breakaway handle. Grasp the breakaway handle and peel it away from the main lift web. Look at the reserve ripcord handle. Then pull the breakaway handle down towards the knees until the arm is completely extended. Throw it away and immediately grasp the reserve ripcord with both hands and pull it until the arms are completely extended.

### **AAD Malfunctions**

A jumper may find himself under his reserve canopy if his automatic activation device on the Vector malfunctions, or if it was improperly calibrated, or if he has descended below the preset altitude at a high rate of speed.

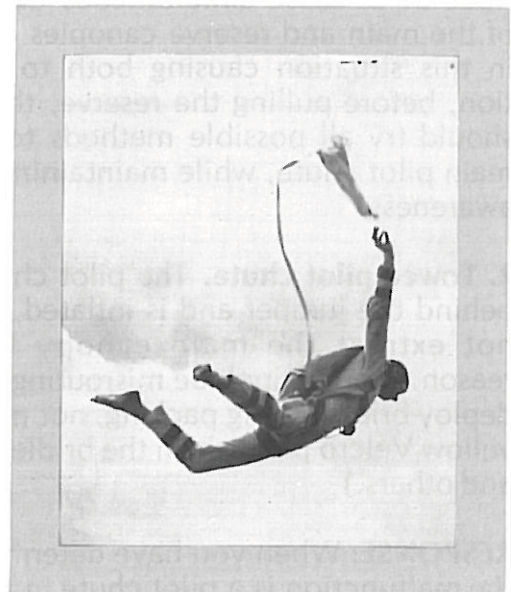
If the main container is still closed, the jumper should land under the reserve canopy.

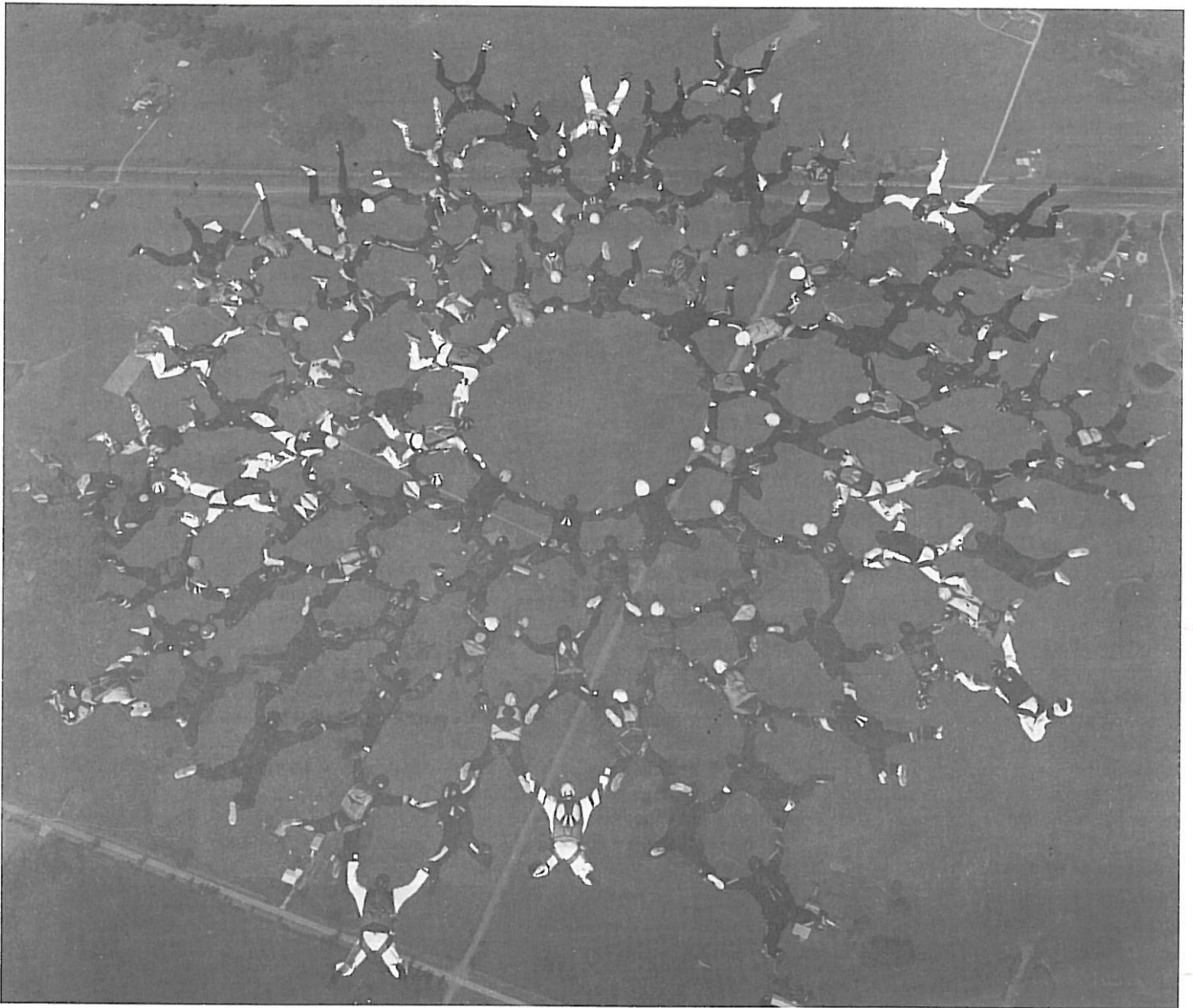
If the main container is open but the main canopy is not inflated, it should be jettisoned using the breakaway handle.

If both the reserve and main canopy are open and inflated, the jumper should respond as he was trained by his instructor. (If the main canopy is a ram-air, many instructors teach their students to jettison it and land under the reserve. Procedures for round main canopies depend on a number of factors—such as the exact type of main—that are beyond the scope of this manual.)

### **Other Emergencies**

A skydiver may be faced with any number of emergencies not listed here, including those in the aircraft, during climb out or exit, in freefall, under canopy, and during landing. As stated above, training for any and all emergencies must be provided by an instructor or drop zone.





World record 100-way formation, built July 5, 1986, over Muskogee, Oklahoma. Almost half the rigs on this dive were Vectors. Photograph by Norman Kent.

## Relative Workshop

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The world champion DeLand Air Bears 4-way team wore Vectors. Here the team exits a Soviet-built helicopter at the 1985 World Championships in Yugoslavia. Photograph by Norman Kent.

