SIGMA

Tandem System Owner's Manual

TANDEM VECTOR OWNER'S MANUAL

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 US Parachute Association estimates that there are about 35,000 skydivers in the U.S., and these jumpers made approximately 2.2 million jumps in 2001. The Association reported 35 skydiving fatalities that year, meaning the probabilityof dying on a skydive is approximately 1 in 64,000. It also seems that the more experienced a skydiver is, the less likely he or she 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 Vector Tandem System, or if you allow someone else to use it, you are acknowledging sport parachuting's risks and accepting the fact that the 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 Vector Tandem System or its components may malfunction or perhaps cause you to be injured or killed, then you may return your Vector Tandem System for a full refund beforeitisused. Details on how to do this are printed below.

DISCLAIMER - NO WARRANTY

Because of the unavoidable danger associated with the use of this parachute system, the manufacturer makes no warranty, either expressed or implied. The rig is sold with all its 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 waiver liability on the part of the manufacturer, buyer may obtain a full refund of the purchase price by returning the parachute system, before it is used, to manufacturer within 30 days from the date of original purchase with a letter stating why it was returned.

Neon and fluorescent colored fabrics and tapes fade rapidly. Color brilliance may be lost within a year of manufacture. Uninsured UPT assumes no responsibility for this condition.

WARNING

Read this information carefully and understand it completely. Any jump that utilizes the Tandem Vector System is considered a "tandem jump': Using this system outside the student/ Tan-dem Instructor training environments considered a violation of federal law (FAA exemp&on No. 4943)

Examples of violations: demonstration jumps; stunt jumps; intentional water jumps; night jumps; jumping with any student less than 18 years of age; any tandem jump that takes place off of a designated drop zone. (These restrictions do not apply to military Tandem applications).

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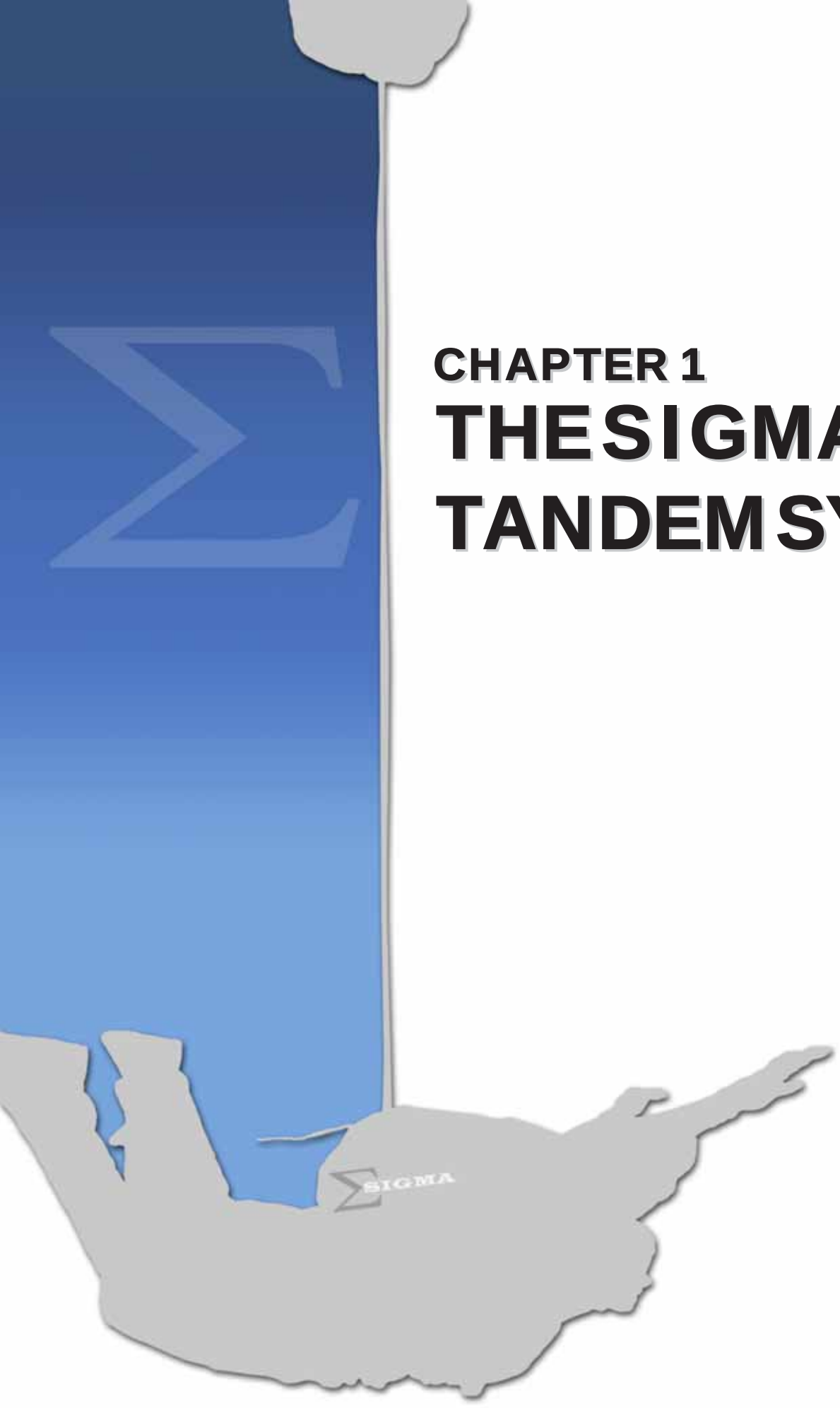


CHAPTER 1
THE SIGMA TANDEM SYSTEM

INTRODUCTION

The Sigma Tandem System represents a giant leap forward in safety, comfort, and convenience. Unlike other tandem systems, where the drogue was simply "added on" to existing container system designs, the Sigma Tandem System was designed "from the ground up" as a drogue deployed tandem rig. It utilizes a drogue attachment system that is integral with the main container closing system. That is to say, they are one in the same. When you close the main container, you also attach the drogue. There is no 3-Ring to hook up and no pouch to close. When the main container opens, the drogue is released. One cannot happen without the other. Once the main container is closed, the drogue is then stowed exactly like a bottom-of-container hand-deploy pilot chute. Except, on this system, snagging the main bridle will not cause an accidental container opening.

On all other tandem container systems, the main container closing and the drogue attachment are two separate systems, at two different locations. While not unreasonably dangerous, such container systems have inherent problems. They are complex and time consuming to pack, and this complexity sets up the possibility of multiple packing errors. But by far the most important problem is, that these systems allow the possibility of the main container accidentally opening, while the drogue is still attached. Since 1989, this scenario has killed 9 tandem pairs. It is the leading single cause of tandem fatalities, accounting for almost one third of the total. By combining the container closing and drogue attachment systems, the new Tandem Sigma eliminates this deadly malfunction.

And because the drogue is attached at the center of the main container, instead or either above or below it, as on other tandem systems, the tandem pair's body position during drogue fall is not too head high or head low, but much closer to the normal face-to-earth freefall position of a solo jumper. This makes the Sigma Tandem System a more realistic training aid for future skydivers.

THE DISK RELEASE SYSTEM
(PATENT ISSUED)

At the heart of this system is a specially designed 5-inch diameter disk with a 1-inch flanged "chimney" at its center, through which the drogue bridle passes. This disk is connected to the bridle, about 3 feet from the deployment bag, with a locking pin, which passes through the chimney and a loop on the bridle.

To close the main container, and anchor the drogue, you simply place the main bag in the container, and the disk on top of the bag. You then pass the closing loop, which starts on the bottom flap, through custom D-rings on the other three flaps, and then through a grommet back on the bottom flap, in a circular fashion, drawing the flaps snugly around the disk chimney, thus capturing the disk under the four container flaps. The flanged chimney keeps the disk centered in place and allows the drogue bridle to exit the container. The closing loop is secured with an eyeleted metal pin through which two lengths of 1000 lb. Spectra line are looped and then secured a few inches below the final grommet to form a pulley. The other end of each Spectra ripcord passes through its own metal housing, one to the right, and the other to the left. Each drogue release ripcord is atached to a spherical ripcord handle by a loop-through-loop connection, making ripcord replacement in the field quick and easy, without any tools. The system is durable and fail-safe, in that total failure of one ripcord would not affect the function of the other.

THE RECOIL RIPCORD SYSTEM
(PATENT ISSUED)

A single 13-inch piece of bungee cord passes through both housings and elastically connects the handles to each other. This holds them firmly against the end of each housing, and causes each handle to recoil back into place after being pulled, or accidentally snagged. This means the handles

will always be where you expect them to be. There is no more stowing of loose handles after opening, and no more looking for handles at packing time. For further security, each ripcord handle is countersunk, so that it snugly slides 3/8 of an inch over the end of its housing. Each ripcord has 3 inches of slack built in, so that it takes a 5- inch pull, on either handle, to release the drogue.

THE SAFETY PIN
(PATENT PENDING)

The system also incorporates a special "safety pin" on the drogue bridle, which locks the main container pin in place until the drogue is deployed. On all other systems, if you snag a drogue release ripcord moving around the aircraft, or on exit, or if you accidentally pull the wrong handle after exit, you end up with a main canopy as soon as you throw your drogue. The unique safety pin prevents this scenario.

HOW THE SYSTEM WORKS

In tandem, the force exerted by the deployed drogue at terminal velocity is roughly equal to half of the suspended weight. This force, transferred through the disk, is shared (divided) equally by the four main container flaps. Because both ends of the container closing loop are attached to the same (bottom) flap, the closing pin end of the loop only receives half of the force exerted on the bottom flap, or one-eighth of the total force exerted by the drogue. So, if the drogue deployed above a 400 pound tandem pair exerts a force of 200 pounds on the disk, then the container closing pin receives one-eight, or 25 pounds of force. A stainless steel pin, moving through a Spectra loop, over a stainless steel grommet, has a mechanical advantage of about five to one. So a pull of 5 pounds is all that is necessary to move the pin. But, the Spectra ripcords are set up as 2-1 pulleys, so theoretically a force of only 2½ pounds at the ripcord handle should move the pin. However, tension from the bungee recoil system, plus eyelet and housing friction, add about 7 pounds of resistance back into the equation, yielding a total pull force, at the handle, of about 10 pounds.

A NEW DROGUE
(PATENT PENDING)

While the drogue canopy is essentially unchanged, the bridle and kill line have been redesigned. The 1¾ " Kevlar outer bridle extends past the disk all the way to the main deployment bag. The kill line is now 1,000 lb. Vectran/Spectra and also terminates at the bag. Because the lower ends of both the bridle and the kill line end at the same place, it is impossible to twist one independently of the other. This means no more time consuming untwisting of the kill line. Because both bridles are now made of non-stretch materials, no "stop ring" is required on the inner bridle. This means less wear, and that the kill line can be easily replaced in the field. And because both the bridle and the kill line share the bag lift-off forces (On all other systems either the kill line or outer bridle takes it all alone) if either the bridle or the kill line breaks, deployment still happens more or less normally, and you don't lose your expensive drogue.

A NEW MAIN DEPLOYMENT BAG

The Sigma Tandem main deployment bag has also been redesigned, eliminating the grommet at the top of the bag, and replacing it with a continuous loop of tubular nylon. This prevents canopy damage caused by trapping canopy fabric between the bag's grommet and the canopy attachment point.

A NEW COLLINS' LANYARD
(PATENT# 6,056,242)

The Sigma Tandem now integrates our proven "Collin's Lanyard" System into the yoke for a totally hidden installation. This system automatically releases the other main riser if the RSL-side main riser breaks, or releases prematurely for any reason. This prevents a potentially fatal main/reserve entanglement. You can only get this important safety system on a Vector.

NEW THICKER PADDING

Both the Tandem instructor and student harnesses feature our exclusive ½ " thick "Wonderfoam" padding for a more comfortable canopy ride.

A NEW STUDENT HARNESS

The New Sigma student harness is designed to be far more comfortable, while at the same time offering more control on exit, and forcing the student's legs forward and upward under canopy. This means fewer students will get sick or pass out under canopy. It also means fewer landing injuries, a greater return and progression rate, and a better review of their tandem jump to friends, which in turn means more, and happier students.

EXTERIOR VIEWING WINDOWS FOR THE RESERVE PIN AND CYPRES

Now you can view your reserve locking pin, and turn your Cypres on and off through clear windows, without opening your reserve pin cover flap. The reserve pin window is made of Lexan, and simply slides into place for easy replacement if it becomes badly scratched. The Cypres window is just above the reserve pin cover flap, so a pin check, and Cypres condition check can be accomplished at a glance, even while you are wearing the rig.

SYSTEMS BORROWED FROM THE VECTOR III SOLO RIG

Sigma Tandem Systems also share many features with our Vector III solo systems. Riser covers, and both main and reserve pin cover flaps, incorporate tuck-tabs instead of Velcro. The main container side flaps wrap around the bottom of the container to provide positive bridle protection. These systems set the industry standards for superior pin and main bridle protection, as proven by years of field-testing and use.

SUMMARIZING THE ADVANTAGES OF THE SIGMA TANDEM

1. It takes fewer steps, with fewer potential errors, to close the main container.
2. Accidentally snagging the drogue bridle will not open the container.
3. Out-of-sequence deployments are eliminated.
4. Its center-of-main-container drogue connection gives a more "natural" and comfortable drogue-fall position than other Tandem systems.
5. The drogue release ripcords are automatically retracted after use, or accidental snagging, so that they are always where they should be, cannot be lost, and don't have to be stowed after pulling.
6. It has two redundant, fail-safe drogue release ripcords, one on the right, and one on the left.

7. The drogue release/container opening pin is "locked" until you throw the drogue, preventing accidental high openings.
8. No more time consuming untwisting of drogue kill line during packing. Kill lines can be easily replaced in the field.
9. You still get a more or less normal deployment if the kill line breaks, and you don't lose your drogue.
10. It's improved deployment bag means less canopy damage.
11. It has an improved student harness, which means safer and more comfortable students, and their positive word- of-mouth advertising will increase your tandem business.
12. The "Collin's Lanyard," and all its advantages, is available only on a Vector.
13. It has tuck-tab main, reserve, and riser covers.
14. Clear plastic windows make reserve pin checks and Cypres operation easier.
15. It has "Wonderfoam" padding throughout.

CHAPTER 2
APPLICANT & COURSE INFORMATION

APPLICANT QUALIFICATIONS

Before an applicant may attend a tandem certification, the following criteria must be met:

1) Currently possess, or at one time been issued, a USPA Coach, a USPA static-line instructor, or USPA AFF jumpmaster or instructor rating. (Or the foreign equivalent)

2) Have logged at least 500 ram-air jumps.

3) Hold a current FAA Class I, II or III medical certificate. (Or foreign equivalent)

4) Hold a current USPA D license. (Or foreign equivalent)

5) Be at least 18 years of age.

6) Three years in sport.

Note: Each candidate has the responsibility to inspect the credentials of the Tandem examiner. Certification paperwork, filed by any examiner who is not a current Tandem Instructor, will be considered invalid by the United Parachute Technologies. *BE SURE YOUR EXAMINER IS HOLDING A VALID, CURRENT TANDEM EXAMINER LICENSE.*

COURSE REQUIREMENTS

Each candidate is required to bring the following items to a Tandem certification course:

* USPA Expert license or foreign equivalent-valid
* Jumpmaster/instructor ratings
* FAA Medical certificate-valid
* Logbooks
* Jumpsuits (slow fall & fast fall)
* Wrist altimeter
* Goggles
* Notepad and pen
* Certification fee

In addition, it would be wise to bring along a fellow jumper who has at least 100 jumps experience to act as a Tandem student during some of the certification jumps.

COURSE SCHEDULE / ACTIVITIES

A. Paperwork Time: 20 Min.
Fill out the applicant data on the blue "United Parachute Technologies Tandem Instructor Rating Form" and the yellow "Tandem Vector Training Logbook" with the required information.

B. Course Fee
Pay the required course fee to the examiner. This fee generally includes: Classroom/theory; ground-training; jump costs for the examiner and staff; and the rental of the gear to be used during the certification. The course fee does not include the candidates personal jumps or the cost of the experienced student who rides with the candidate during certification.

C. Classroom/Theory Time: 3-4 Hours
This portion of the course will run approximately four hours. The "Tandem Training Video" will be shown module by module with continued discussion after each module.

D. Ground Training Time: 2-3 Hours
Ground training covers: Student harness fitting; gear check and donning the Tandem system; hooking up the student; practice climb-outs, controlling the student's movements; exits; throwing the drogue; drogue-fall maneuvers; main canopy deployment; special features of the canopy's toggle system; student canopy control training techniques; landing procedures; and main canopy packing.

E. Certification Jumps
Each candidate will perform at least one solo jump with the Tandem system, or as many as necessary to become comfortable with the operation of the system. A minimum of four jumps will then be performed from the Tandem Instructor position. On at least one of these jumps, the candidate must ride in the student position, either with the examiner or an appointed Tandem evaluator.

The record of each certification jump will be logged on the blue sheet and yellow logbook. The examiner will observe/ critique the packing of the main canopy, and issue the candidate instructions for the next jump. The examiner must be present, on the DZ or in the air, during all certification jumps.

The number of certification jumps that must be made by each candidate during the course will depend entirely on the performance level during the first five jumps. It is up to the examiner's discretion as to whether the candidate should make additional jumps to qualify. In some situations, the examiner may recommend that the candidate withdraw from the course due to poor performance/skills or bad judgment, etc..

If the candidate is successful and has completed the certification course, the examiner will file the necessary paperwork with the United Parachute Technologies. The candidate will retain the yellow logbook and continue to log future jumps until the minimum 25 probation jumps have been completed.

The course examiner will inform the United Parachute Technologies of any candidate who fails to complete the course and the reasons for the failure.

PROBATION

As outlined in the yellow "Tandem logbook," the probation period will be in effect for a minimum of 25 jumps. The first 5 jumps are for certification. The remaining 20 jumps are divided into 3 sections, each with its own special guidelines. Refer to the Tandem Vector Training Logbook for specific guidance.

The logbook, when complete, must be verified by a Tandem examiner or a Tandem rig owner. If the applicant is a Tandem Vector owner, then he must submit to theUnited Parachute Technologies a video tape of at least 3 of the final 10 probationary jumps along with the training logbook.

The TM must send the logbook and license fee to the United Parachute Technologies, whereupon an official Tandem Instructor license will be issued.

CURRENCY REQUIREMENTS

In addition to yearly recertification, Tandem Instructors are expected to maintain currency during the yearly recertification period.

A. If any currently rated Tandem Instructor has not made a Tandem jump in the preceding 90 days, he must make one Tandem jump with an experienced jumper acting as a student before taking a student student. The experienced jumper/ student must first be briefed on how to respond to Tandem emergencies.

B. If any currently rated Tandem Instructor has not made a Tandem jump within the last 180 days, he must complete recurrent training before taking a student student.

C. If any Tandem Instructor during probation has not made a Tandem jump within the last 30 days he must make one Tandem jump with an experienced student who has been briefed on how to respond.

RECERTIFICATION

Renewal Procedures: Tandem Instructor ratings must be renewed every year.

To apply for the renewal of your Tandem Instructor rating, you must have made at least 25 Tandem jumps within the preceding 12 months, at least three of which have been made within the preceding 90 days.

If you have fulfilled the above requirement, you need only:
1) Have a Tandem Instructor Recertification form verified and signed by either a United Parachute Technologies Tandem Vector owner or United Parachute Technologies Tandem Examiner, and

2) Send the endorsed form and the license fee to the United Parachute Technologies. As soon as the applicant has mailed the renewal form and the check to the United Parachute Technologies, the rating is considered renewed; you do not have to wait for the response by the company, though you are required to keep a copy of the form to prove

your currency.

3) If a Tandem Instructor has a USPA Tandem Instructor Rating, it is not required that he renew with RWS as long as he meets the requirements to maintain his USPA Rating.

If you have not fulfilled the above requirements, you must take recurrent training.

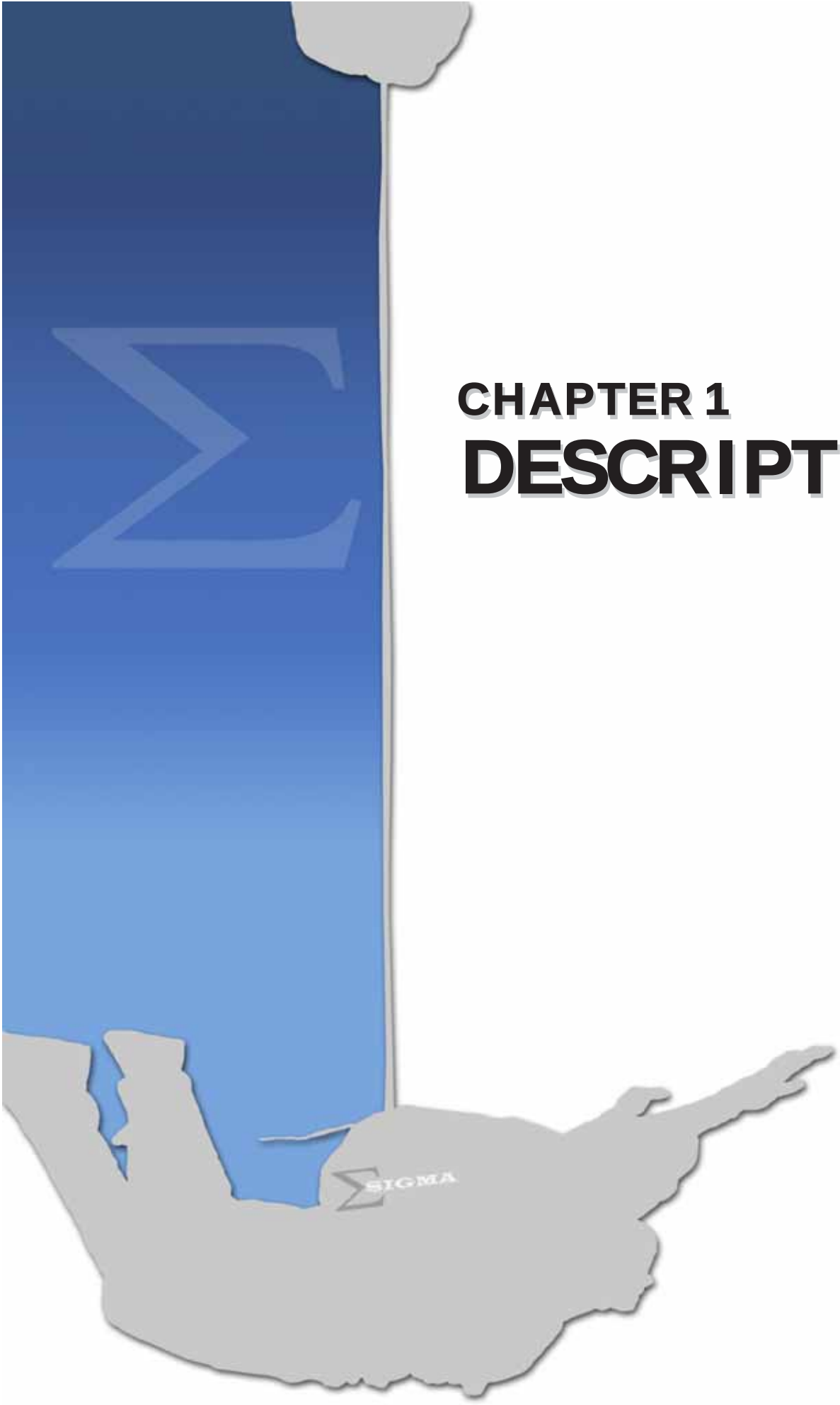
RECURRENT TRAINING

Recurrent Training consists of one solo drogue jump and one Tandem drogue jump with an experienced student. During the Tandem drogue jump, the applicant must make a stable exit from at least 10,500 feet, with drogue deployment within 10 seconds and opening by 4,500 feet. Applicant must demonstrate the ability to control heading during drogue-fall by making at least two opposite 360-degree turns. Applicant must also perform dummy ripcord pulls to both drogue release handles and the reserve ripcord. Landing must be stand-up (wind permitting) within 50 meters of the target.

These two jumps must be witnessed and signed off by a United Parachute Technologies Tandem rig owner or United Parachute Technologieshop Tandem Instructor Examiner. (If you are an owner or an examiner, you can sign yourself off).

FOREIGN TANDEM RATINGS

Foreign tandem ratings alone are not valid in the United States of America. A Foreign National wishing to perform tandem jumps in the USA must possess the originalUnited Parachute Technologies tandem rating. USPA also offers tandem ratings in conjunction with tandem manufacturers.



CHAPTER 1
DESCRIPTION

CONTAINER

Cypres Inspection Window
Turn Cypres on or off through clear window. Cypres condition can be checked at a glance.

Reserve Pin Inspection Window
Lexan window allows pin check at a glance, without opening reserve pin cover flap.

Primary Drogue Release Handle
Left hand pull, located on bottom of main container. Blue golf ball.
Pull approximately 6" will release drogue.

Drogue Deployment Handle
Right hand pull, located on bottom of main container. Plastic ball attached to top of drogue.

HARNESS

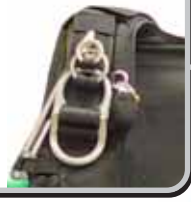
Auxiliary Reserve Ripcord / Integrated Lanyard (Dual Purpose)

A. Auxiliary Reserve Ripcord: Right hand pull. Ball handle on reserve static line next to 3-Ring on right hand side of rig. To be used if left hand is incapacitated in any way, and unable to pull reserve ripcord. Ball must be pulled straight up to release RSL connectoin and initiate reserve activation.

B. Integrated Lanyard: RSL can be used prior to landing in the event of high ground winds.

No Crytal Ball

If the system has a Skyhook installed there will be no Crystal Ball.



Top Student Attachment Point

Two D-rings mounted inverted under the large harness ring on both sides of the main lift web.

Reserve Ripcord

Left hand pull. Either a webbing loop handle (or soft pillow handle) attached firmly to the left main lift web in an outboard position. Handle color is red.

Cutaway Handle

Right hand pull. Soft pillow handle (or loop-style handle) attached firmly in an outboard position on right main lift web. Handle color is green.

Bottom Student Attachment Point

Consists of two RW-8 rings mounted sideways, threaded through each diagonal on the left and right sides.

Secondary Right Hand Drogue Release Handle

Right hand pull. Orange golf ball.

Main Lift Web Adjustment Points

Webbing is adjusted through a pair of three bar adapters.

THE STUDENT HARNESS

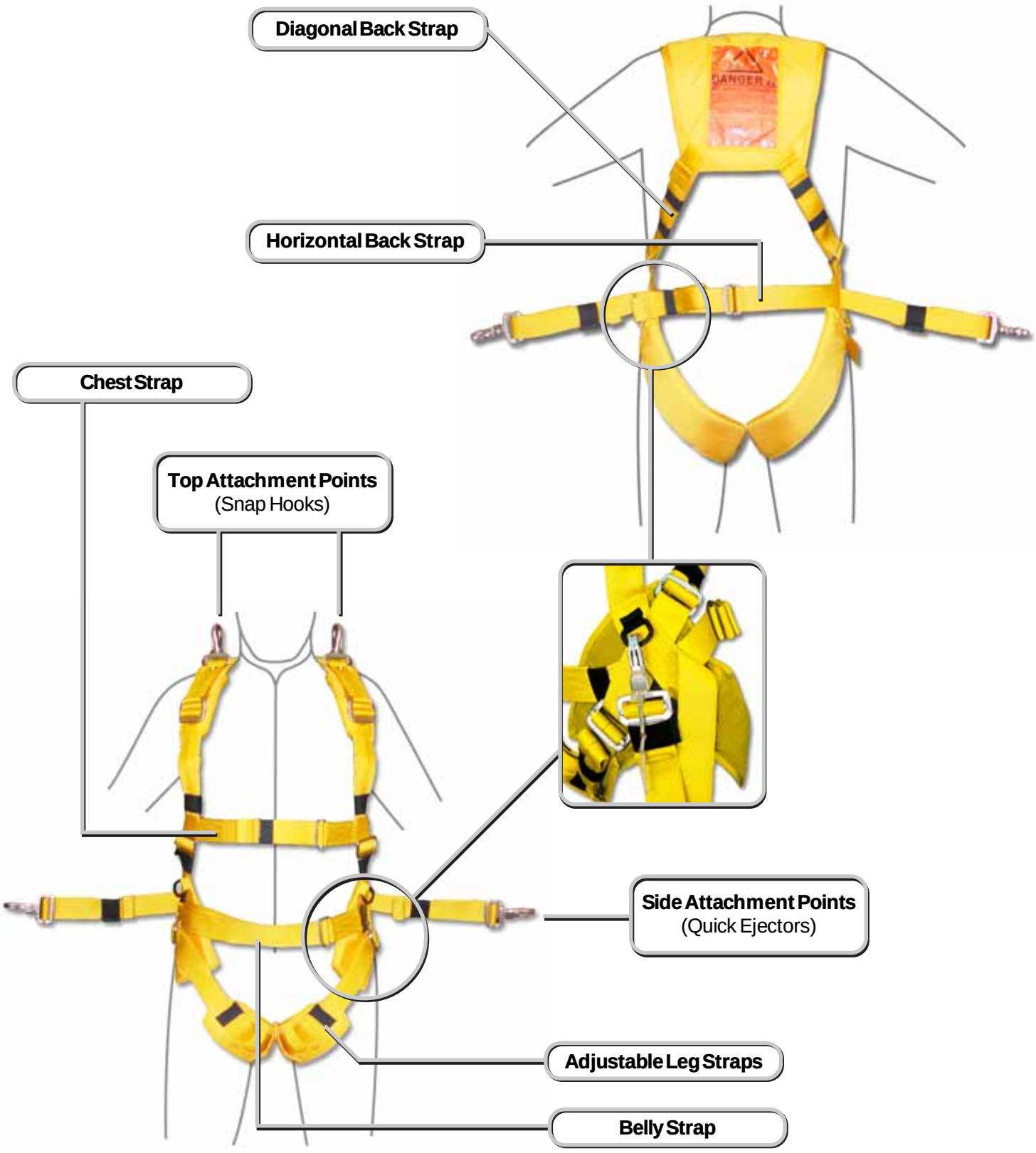
The Sigma / Vector Student Harness is quite a departure from previous tandem student harnesses. It was designed, with the help of a cardiologist, to safely contain the human body without cutting off normal blood flow. Disrupted blood flow is why almost all students on older student harnesses were uncomfortable, and why some got sick or even passed out.

A hip-hugging horizontal back and belt strap combination allows the main lift webs to be positioned, and held, more toward the front of the upper body than on other designs. This prevents the "squeezing" of the upper body and the inside of the upper legs which can cut off blood flow. It also automatically lifts the legs up and forward after opening, putting them in a safer position for landing.

The Student Harness was designed to comfortably and safely fit a wide range of body sizes and types. To accomplish this, it has **thirteen (13)** points of adjustment. This wide range of adjustment means that it is possible to give a tandem student a truly comfortable experience on their tandem skydive. However, **the harness must still be adjusted securely to fit the student's body to prevent them from falling out in extreme situations and unusual body positions.**

While fitting this harness on a tandem student is not difficult, it is different from other harnesses you may have used in the past. The most important point to consider is the security of the student. You must insure that all straps are comfortably snug against the student's body.

THE STUDENT HARNESS



THE MAIN CANOPY

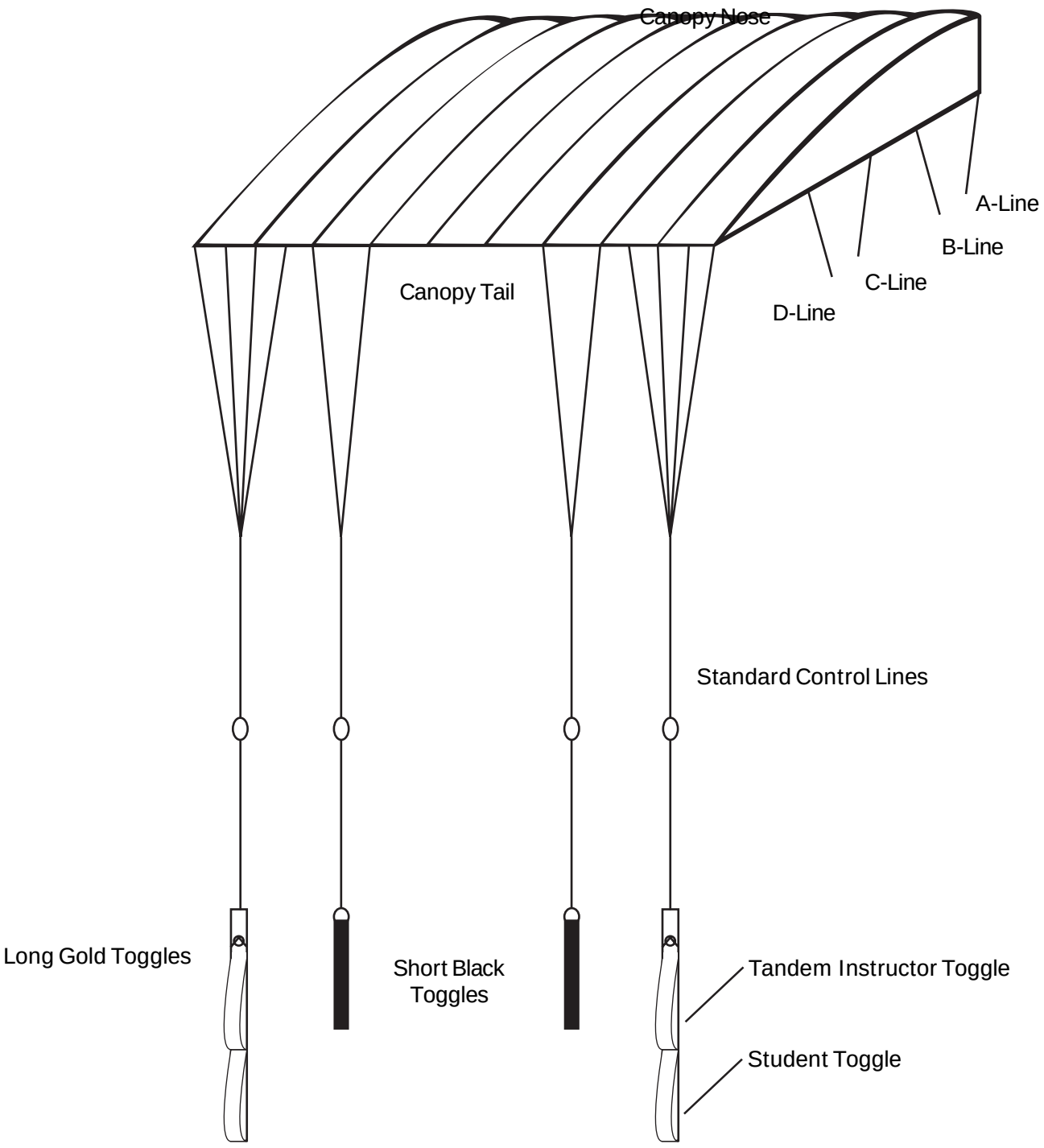


Diagram shows loaded ribs only

SUMMARIZING THE ADVANTAGES OF THE SIGMA TANDEM

1 It takes fewer steps, with fewer potential errors, to close the main container.

2 Accidentally snagging the drogue bridle will not open the container.

3 Out-of-sequence deployments are eliminated.

4 Its center-of-main-container drogue connection gives a more "natural" and comfortable drogue-fall position than other Tandem systems.

5 The drogue release ripcords are automatically retracted after use, or accidental snagging, so that they are always where they should be, cannot be lost, and don't have to be stowed after pulling.

6 It has two redundant, fail-safe drogue release ripcords, one on the right, and one on the left.

7. The drogue release/container opening pin is "locked" until you throw the drogue, preventing accidental high openings.

8 No more time consuming untwisting of drogue kill line during packing. Kill lines can be easily replaced in the field.

9 You still get a more or less normal deployment if the kill line breaks, and you don't lose your drogue.

10. It's improved deployment bag means less canopy damage.

11. It has an improved student harness, which means safer and more comfortable students, and their positive word-of-mouth advertising will increase your tandem business.

12. Skyhook RSL with intergrated Collin's Lanyard.

13. It has tuck-tab main, reserve, and riser covers.

14. Clear plastic windows make reserve pin checks and Cypres operation easier.

15. It has "Wonderfoam" padding throughout.

THE SIGMA IS MADE TO THE HIGHEST QUALITY STANDARDS IN THE INDUSTRY BY

UNINSURED UNITED PARACHUTE TECHNOLOGIES

DROGUE DEFINITIONS

Exterior – Top Down

1. **Handle** – The 1-5/8in ball, connected to the apex of the drogue envelope, used to deploy the drogue.

2. **Envelope** – The fabric and mesh portion of the drogue. Its top is called the apex, its bottom the base.

3. **Bridle** – The doubled, 1¾ ", 4,000 lb. Kevlar section that leads from the envelope to the deployment bag connection loop.

4. **Safety Pin** – A compound-curved pin connected to the bridle, designed to prevent accidental main container openings.

5. **Disk** – A 5" aluminum disk, with a 1" flanged chimney.

5.5 Disk Cover – Designed to protect disk..

6. **Disk Attachment Loop -** A loop on the Kevlar drogue bridle to which the disk is attached with a stainless steel pin, held in place with two flat head screws. A 3/32" hex drive is required to tighten or loosen screws. (inclosed)

7. **Drogue Bridle Loop –** The loop at the end of the Kevlar drogue bridle, to which the deployment bag is attached.

8. **Bag Attachment Loop** – A loop of tubular Nylon at the top of the main deployment bag where both the bridle and kill line are attached by means of a #5 stainless rapid link.

Interior – Top Down

9. **Kill Line Attachment Bridle** – A 9" length of 1" Nylon tape that serves as an attachment point for the kill line, and limits the degree of collapse if a kill line is accidentally made too short.

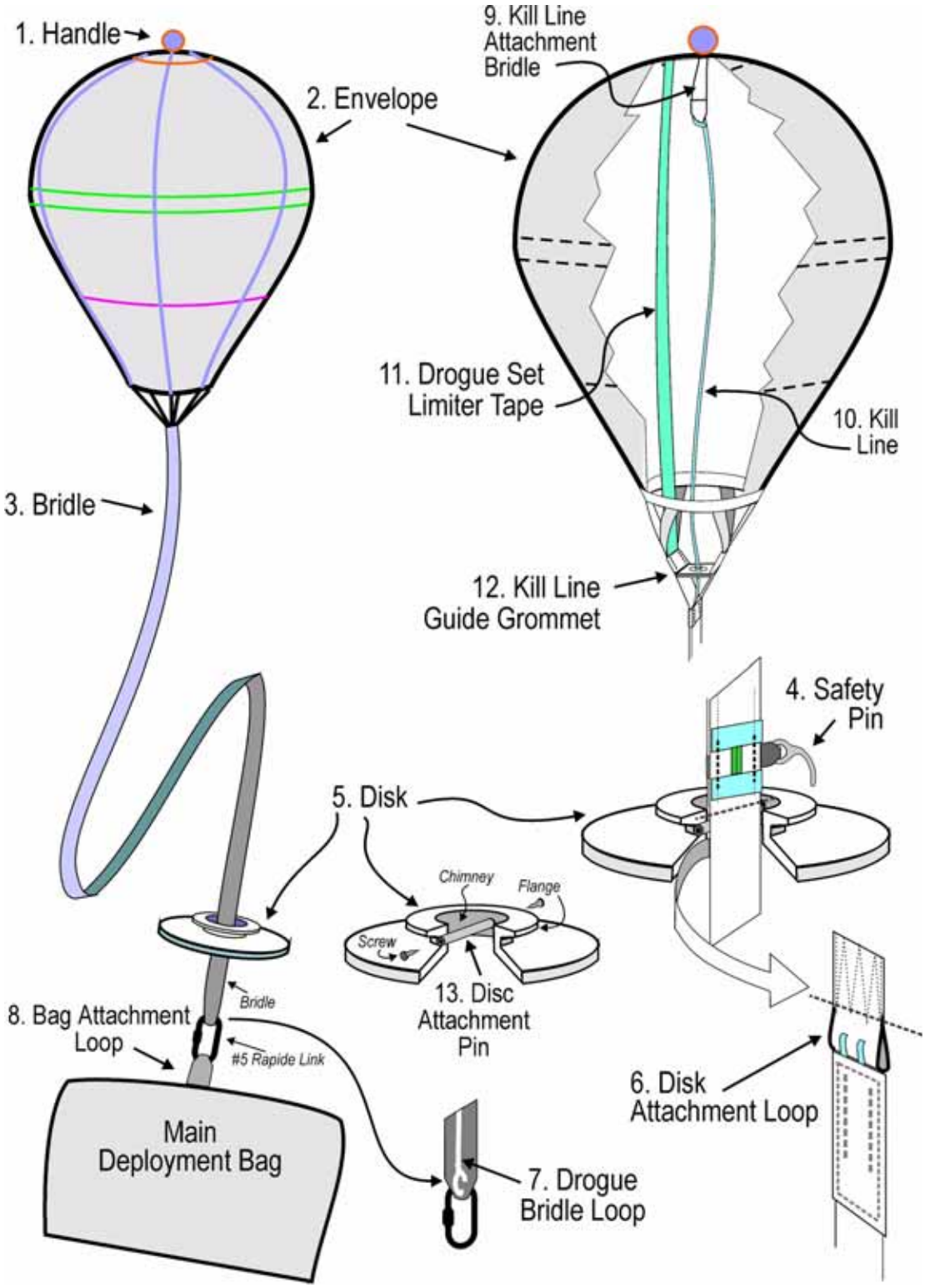
10. **Kill Line** – A length of 1,000 lb. Vectran/Spectra line, with a 1" loop at each end, that runs inside the Kevlar drogue bridle from the kill line attachment bridle to the rapid link at the bag attachment loop.

11. **Drogue Set Limiter Tapes** –Two pieces of 1" Nylon tape that run from the drogue apex to the drogue skirt. This saves wear and tear on the drogue bridle and kill line by limiting the distance they slide on each other during drogue collapse.

12. **Kill Line Guide Grommet** – A "0" stainless steel grommet at the base of the drogue envelope which directs the kill line into the Kevlar drogue bridle preventing wear. It also serves as an emergency stop for the kill line attachment bridle if the kill line is accidentally made too short.

13. **Disk Attachment Pin** – A threaded stainless steel rod, used to attach the disk to the bridle, using 2, 3/32" hex drive screws.

THE DROGUE


1. Handle
2. Envelope
9. Kill Line Attachment Bridle
11. Drogue Set Limiter Tape
10. Kill Line
3. Bridle
12. Kill Line Guide Grommet
4. Safety Pin
5. Disk
Chimney
Flange
Screw
13. Disc Attachment Pin
Bridle
8. Bag Attachment Loop
#5 Rapide Link
Main Deployment Bag
7. Drogue Bridle Loop
6. Disk Attachment Loop

THE SIGMA DROGUE COLLAPSE SEQUENCE

The collapse sequence on the Sigma drogue is the same as on previous Vector drogues. The drogue partially collapses, at a controlled rate during bag lift-off, yielding just the right amount of force for an orderly deployment. However, the method of collapse is slightly different.

The drogue bridle and kill line now both end at the same place, a rapid link connected to the top of the deployment bag. When the drogue is set (or cocked) during the packing sequence, the Kevlar drogue bridle below the disk is "scrunched up", effectively making the bridle shorter than the kill line. When the drogue is deployed, it can inflate because the kill line is longer than the bridle. When a ripcord is pulled to end droguefall, the container opens and the disk is released, allowing the "scrunched up" section of the bridle below the disk to extend to its full length, thus making the bridle longer than the kill line. This inverts the drogue apex, collapsing the drogue.

Because both the drogue bridle and kill line are made of non-stretch materials, the drogue collapse sequence is "stopped" automatically, at just the right point. No ring, slamming into a "stop ring" at high speed is needed, and the bridle moves over the kill line for a much shorter distance than on the previous design. This means less friction is generated, so everything lasts longer. And with no stop ring, the kill line is much less complicated and easier to replace. Also, because both the drogue bridle and kill line end at the same place, it is impossible to twist one independent of the other. This means no more time consuming untwisting of the kill line at pack time.

HOW TO CHECK IF YOUR DROGUE KILL LINE IS THE CORRECT LENGTH

For this system to work correctly, a precise relationship between the length of the drogue bridle and the length of the kill line must be maintained. To check this relationship:

Anchor the rapid link at the deployment bag end of the drogue bridle. Both the drogue bridle and kill line should be connected to this link.

Extend the drogue bridle fully.

Put a finger on either side of the kill line guide grommet at the base of the drogue, and apply about 10 lbs. of tension against the Kevlar bridle.

With the other hand apply the same tension on the kill line by pulling on the kill line attachment bridle or the drogue handle. The larks head knot at the bottom of the kill line attachment bridle should be 1½ " above the kill line guide grommet.

You can notice this relationship less formally each time you pick up your drogue after landing.

If this distance is more than 2" greater, the drogue may not fully collapse, yielding a higher snatch force, increased chance of malfunction due to line dump, and increased chance of canopy damage. **If you notice a kill line that is over 2" too long**, a simple overhand knot, tied within the finger-locked section of the kill line, *at the deployment bag end*, will effectively shorten it almost 2", and bring your drogue collapse system back into trim.

If this distance is more than 1" less, the larks head knot will impact the guide grommet at high speed, quickly causing damage to both. However, in this instance, deployment, while slightly slower, will still happen more or less normally.

Drouge collapse is calibrated for average weight and fall rates, if you feel the drouge is collapsing to far with longer than normal "trap door" you may Larkshead a PD Slink onto the bottom of the kill line to reduce the amount of collapse.

UNDERSTANDING THE MAIN RECOIL RIPCORD SYSTEM

The Recoil Ripcord System for the Tandem Sigma drogue consists of:

1 A single length of 1,000 lb. Spectra line with finger locked loops at each end, and near the center.
2 A single length of 1/8" bungee cord, finger locked between the loops at each end of the Spectra line.
3 Two, specially prepared, solid core ball handles.
4 One stainless steel, eyeleted, ripcord pin.
5 Two stainless steel ripcord housings.

One ripcord handle is located at the bottom left corner of the main container, and the other on the right leg pad, allowing the tandem instructor to release the drogue with either hand. The right handle is positioned on the tandem instructor's harness so as to simulate a Bottom of Container (BOC) position for the student. You don't have to hook it up to the student harness before each jump. It is automatically in the right position.

There are no "ripcord pockets" per say. Each ripcord handle "plugs into" the end of the housing, and is held in position by a combination of friction, and the pull of the bungee cord retract system.

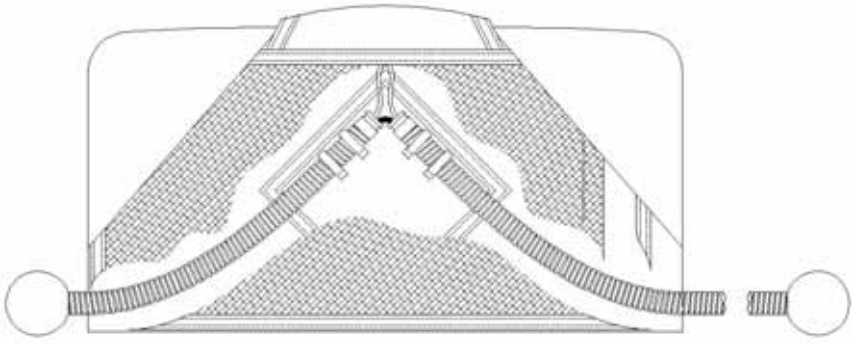


FIGURE 1
RELEASE HANDLE SYSTEM
(Cross section view of spandex for clarity)

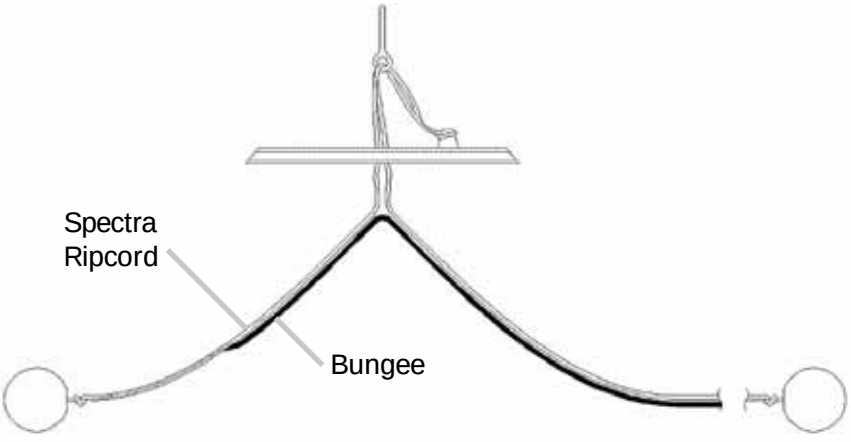


FIGURE 2
RIPCORD DETAIL
(Housings, et., removed for detail)

Pulling either handle about 5" pulls the single ripcord pin, opening the container and releasing the drogue. Notice that each ripcord is set up as a 2-1 pulley, so that a pull of 5 pounds at the handle translates into a pull of 10 lbs at the pin, resulting in easy pulls every time.

Once the drogue is released, as evidenced by the "trap door effect," you can simply let go of the handle. It will automatically return to its position on the end of the ripcord housing. Although the housings are double clamped into position under the drogue pouch for maximum security and long life, excessive pulling on the ripcord handles after drogue release might eventually damage these housing connections. You don't have to baby the system, but pull only as far as necessary to release the drogue, and then let go of the handle.

The advantages of this system are obvious. The spherical shape of the ripcord handles, and their method of attachment, makes snagging highly unlikely. If dislodged, they automatically return to position, so no more searching for "floating" ripcords. And the unique "Safety Pin," connected to the drogue bridle, makes it virtually impossible for a snagged ripcord handle to cause an accidental container opening. And let's not forget, you no longer have to waste time and effort stowing the handles after opening, or searching for them at packing time.

Because this system is new (The first production rigs went into service Summer 2000), we don't yet know how long the recoil ripcord system will last under actual field conditions. Although bench tests show that the ripcord system can last for over 1,000 jumps, you should inspect the whole system often for signs of wear.

Look for wear at the junction of the Spectra ripcords and the handles, and around the pin area. The Spectra is 1,000 lbs. strong, and the force required to pull the pin is less than 10 lbs. That's over a 100 to 1 safety margin, so a small amount of fraying should not be cause for alarm. Besides, the ripcord system is designed to be redundant. If one side were to break or jam for any reason, the other side is still fully functional.

Also notice if the recoil system is doing its job properly. With the rig packed, each ripcord should snap back into place when pulled a few inches and released. But please realize, if you pull and release each ripcord handle several times before each jump, you will shorten the life of the system by a factor of three. Inspect, but don't play with the system incessantly if you want maximum life from your ripcords.

UNDERSTANDING THE SIGMA SKYHOOK RSL COLLINS' LANYARD

The Collins' lanyard was designed to prevent a main-reserve entanglement, by releasing the left (non-RSL side) main riser, in the event that the right (RSL side) main riser breaks or prematurely releases by itself, for any reason. On the Sigma, it is integrated into the RSL with no external lanyard. This is accomplished by threading the left riser 3-ring release cable through a loop in the reserve static line (RSL). As the right riser leaves, the RSL automatically pulls the left cutaway cable as it pulls the reserve pin, yielding an almost simultanious breakaway and clean reserve deployment.

A standard RSL does one thing. It pulls the reserve ripcord pin automatically after a breakaway. The Skyhook RSL does this, and then goes two steps further.

A. It automatically releases the Left (non-RSL) riser, if the right (RSL) riser releases prematurely for any reason (Collins. Lanyard). (You wouldn.t want your reserve container opened with one riser still attached, would you?)

B. It then uses your departing main canopy as a super .pilot chute. to get your reserve to line stretch faster than ever before. Breakaway, to canopy-out-of-bag times are between ½ and ¾ of a second, depending on the size of your reserve canopy. This is up to three times faster than a pilot chute can do it alone.

If you have a main total malfunction, or your AAD fires, the Skyhook Lanyard automatically releases, and therefore does nothing to hinder normal reserve deployment.

CHAPTER 2
OPERATION

OPERATION

NOTE: This section will explain the special operational requirements of the different components on the Tandem Sigma. The components which will be explained are:

Main Activation
Reserve activation
Canopy brakes and steering system

The Tandem Sigma is a very different system from any sport skydiving system. There are more handles on the Tandem Sigma, and they are all in different places. In particular, the reserve and cutaway handles are mounted outboard (otherwise they'd be blocked by the student). Because of this, no amount of jumps on solo sport gear will prepare a jumper for the Tandem Sigma.

Every Tandem Instructor, no matter the number of jumps, must practice reaching for handles repeatedly on the ground and in the air. It is further recommended that the Tandem Instructor reach in and touch both drogue release handles, cutaway handle and the reserve ripcord handle during droguefall on each and every jump. This will help with memorization of exact locations and assist the Tandem Instructor in identifying problems while there is still plenty of time to deal with them. (See fatality reports.) We highly recommend you grab each handle as if you intend to pull it.

RESERVE ACTIVATION

A. Cutaway and reserve handle practice

A. Cutaway and reserve handle practice:
The breakaway and reserve handles are in slightly different positions and are more securely held in place than on solo rigs. Therefore, it is mandatory that each Tandem Instructor practice several handle disengagements on the ground. Please note that the handles peel away easily in certain directions but are much harder to pull in others.

For an easy pull, the reserve and breakaway handles must be peeled upward and outward and THEN pulled down. This technique MUST be practiced on the ground so you will not be surprised in a real emergency.

The reserve handle/pocket configuration was chosen because conventional D-handles are easily knocked out of their pockets; especially when mounted out-board. While a floating handle on a solo rig may be fairly easy to find and pull, the same task is considerably more difficult on a Tandem rig. In Tandem, the student's body is directly in the way, meaning it is very difficult to see any handle, and even harder to reach across for anything.

MAIN ACTIVATION

Intro to the drogue
Deploying the drogue
Handles familiarization

Introduction to the drogue

Before discussing the procedures for using the drogue, it helps to understand how the drogue functions.
The purpose of the drogue is to reduce Tandem freefall velocity, not to aid in stability. When fully inflated, it provides enough drag to give a Tandem pair the terminal velocity of an average solo jumper (120 mph). Without a drogue, a Tandem pair will accelerate in 18 seconds to 170 mph, risking hard opening shocks and canopy damage, as well as making freefall photography difficult.
When using the drogue always keep this one point in mind:
NO DROGUE - NO MAIN!!!

Deploying the Drogue

1) Reach for the handle with palm forward and thumb out.
2) With the hand in the same position, take a firm grip on the handle or drogue canopy just below the handle.
Note: Not an issue with Sigma Drogues.
3) The force required to extract the drogue can be substantial, especially when the pouch is new, so grip and pull firmly. You may need to place your elbow against the side of the rig and use the leverage gained for added power.
4) Deploy the drogue with one continuous motion of the arm: Pull the drogue out aggesively in a sweeping arc, as your arm reaches its fullest extension at shoulder height, throw the drogue at the finish of the arc.
Do NOT hold onto or wave off with the drogue. The bridle is very long and may cause problems if allowed to deploy before the drogue.
As you are deploying the drogue, turn your head slightly to the right and watch it inflate. Full inflation takes about 2-3 seconds.

Handles familiarization

Prior to continuing, let's stop here and practice locating and pulling the handles.
Start by gearing up and practicing extracting the drogue and pulling the drogue release handle. This should be done both in the standing and prone positions. Alternate the use of both the left and right drogue release handles each time you throw the drogue.

Now let's continue with the emergency systems.

NOTE: It may be helpful to substitute the handles with mock handles or have a rigger place temporary pins in to close the reserve so that both the reserve handle and auxiliary reserve handle can be pulled during practice.

Perform a thorough emergency drill, locating the cutaway handle and reserve handles, pulling the cutaway and then pulling the reserve handle. Perform this drill enough times to ensure that the movements become a natural reaction. Remember to peel and pull the handles correctly (see pg 11 reference to pulling handles up - not against velcro).

VERTICAL SUSPENDED HARNESS DRILLS

After you have performed the above described emergency drills, have a partner act as a student and suspend yourselves in a hanging Tandem harness. Repeat the emergency procedures enough times to ensure that the movements become natural and instinctive. Take note of the different positions of the handles while in a suspended mode. (Statistics have shown that the Tandem Vector's most common malfunction mode is a typical main canopy malfunction where the control lines are entangled with the rear riser lines with a possible slider hang up. This problem can be avoided by proper packing, maintaining good line tension throughout, and the use of proper stow bands to prevent line dump.)

DO NOT TAKE THIS DRILL LIGHTLY. If you should ever experience a malfunction, this practice will give you the skills needed to deal with the problem effectively.

By ordering an extra pair of Tandem main risers and toggles, one can easily setup a training harness with an actual Tandem system. Remove the entire main canopy assembly (from risers to drogue) and suspend the system using the extra pair of risers. To prevent excessive wear of the Tandem system, order or produce your own training harness to be used exclusively for training and recurrency work.

CANOPY BRAKES AND STEERING SYSTEM

Deployment brake release

1) Grasp main steering toggles and pull outwards away from the riser, unsnapping the toggles. Use the student toggle position during brake release.

2) Pull toggles down to release the brakes. Do not pull on the small black flare toggles - leave them attached to the risers.

Double brake system for the Tandem Vector canopy

The United Parachute Technologies Double Brake System is an innovation in the steering line set up on Tandem systems that provides reduced toggle pressure and faster turns during normal flight while at the same time producing extra stopping power in low wind conditions.

As shown in Illustration #2/1-5 on page #10, there are seven steering lines (EZ425, 384 & Sigma 370, 395, 340 models) on each side of the canopy. Unlike most canopies, the lines are a ttached at the full cell junctions, rather than at the half cell point. When so much of the canopy tail is pulled down for landing, it makes for an exceptional flare, and therefore, a softer landing. For normal flight and turns, the inside lines are not needed. In fact, they are a hindrance during turns, increasing toggle pressure, and slowing turn rate. To deal with this situation, the double brake system has been set up so that the inside "extra" lines are used only during the flare for landing.

During main canopy opening, reach up and grab the right and left gold, lower student toggles only (do not touch the black flaring toggle). Peel the toggles in a rearward direction for easy toggle and brake release. If toggles are pulled straight down, their release will be difficult or impossible due to the amount of velcro and the additional snap holding them in place, and you may cause damage to both components.

For normal flight, from opening altitude down to approximately 500 feet, use only the gold toggles. Prior to landing, reach up and take the black flaring toggles by inserting four fingers and closing your grip. Now you are ready to land. The black toggles lay flat and may be difficult to access

quickly. We recommend that sometime during main canopy flight, that the black toggles be peeled off the velcro and then reattached so the loop opening is easier to access later when needed.

Toggles familiarization

Stop at this point and practice the release of the brakes and the set up of the "Double Brake System". Practice by releasing the toggles and brakes as well as reassembling them. Do this with the rig outstretched on the floor as well as with a suspended harness if available.

STUDENT HARNESS ADJUSTMENT GUIDE

The Sigma / Vector Student Harness is quite a departure from previous tandem student harnesses. It was designed, with the help of a cardiologist, to safely contain the human body without cutting off normal blood flow. Disrupted blood flow is why almost all students on older student harnesses were uncomfortable, and why many got sick or even passed out.

A hip-hugging horizontal back and belt strap combination allows the main lift webs to be positioned, and held, more toward the front of the upper body than on other designs. This prevents the "squeezing" of the upper body and the inside of the upper legs which can cut off blood flow. It also automatically lifts the legs up and forward after opening, putting them in a safer position for landing.

The Student Harness was designed to comfortably and safely fit a wide range of body sizes. To accomplish this, it has **twelve** points of adjustment. This wide range of adjustment means that it is possible to give a tandem student a truly comfortable experience on their tandem skydive. However, **the harness must still be adjusted securely to fit the student's body to prevent them from falling out in extreme situations and unusual body positions.**

While fitting this harness on a tandem student is not difficult, it is different from other harnesses you may used in the past. The most important point to consider is the security of the student. You must insure that all straps are comfortably snug against the student's body.

Please use the following guide to keep your students safe and comfortable.

HARNESS ADJUSTMENT

Loosen the harness before donning.

Rotate the harness on the student's shoulders so the Top Attachment Snaps will be easy to hook up.

Adjust the chest strap loosely.

Adjust the Belt Strap so the main lift webs are positioned as shown. The Horizontal Back and Belt Straps should be tightened firmly around the hips.

Adjust the Main Lift Webs and Diagonals so the harness's Hip Junctions are resting squarely on the student' hips.

Tighten the Leg Straps.

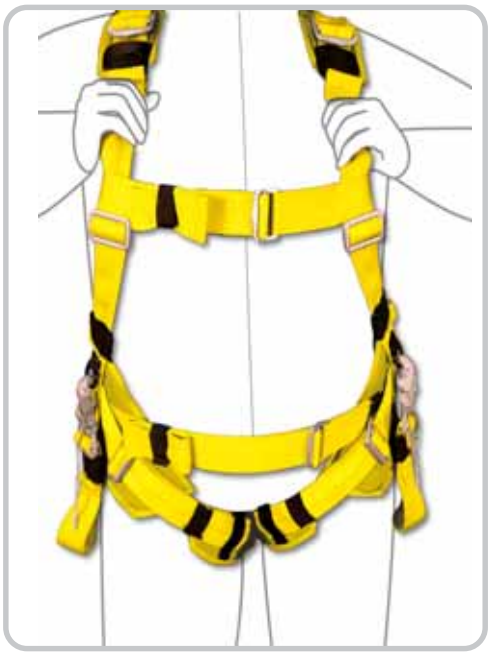
Slide the Chest Strap vertically into the correct position and tighten.

Tip: It's recommended to hook up and pre-hang your student so the harness conforms to the student's body. Release the student and check all adjustment points. You may find it necessary to tighten the harness a bit more.

The Horizontal Back Strap must be positioned low and securely tightened. This is what keeps the student from falling backwards out of the harness on a hard opening.

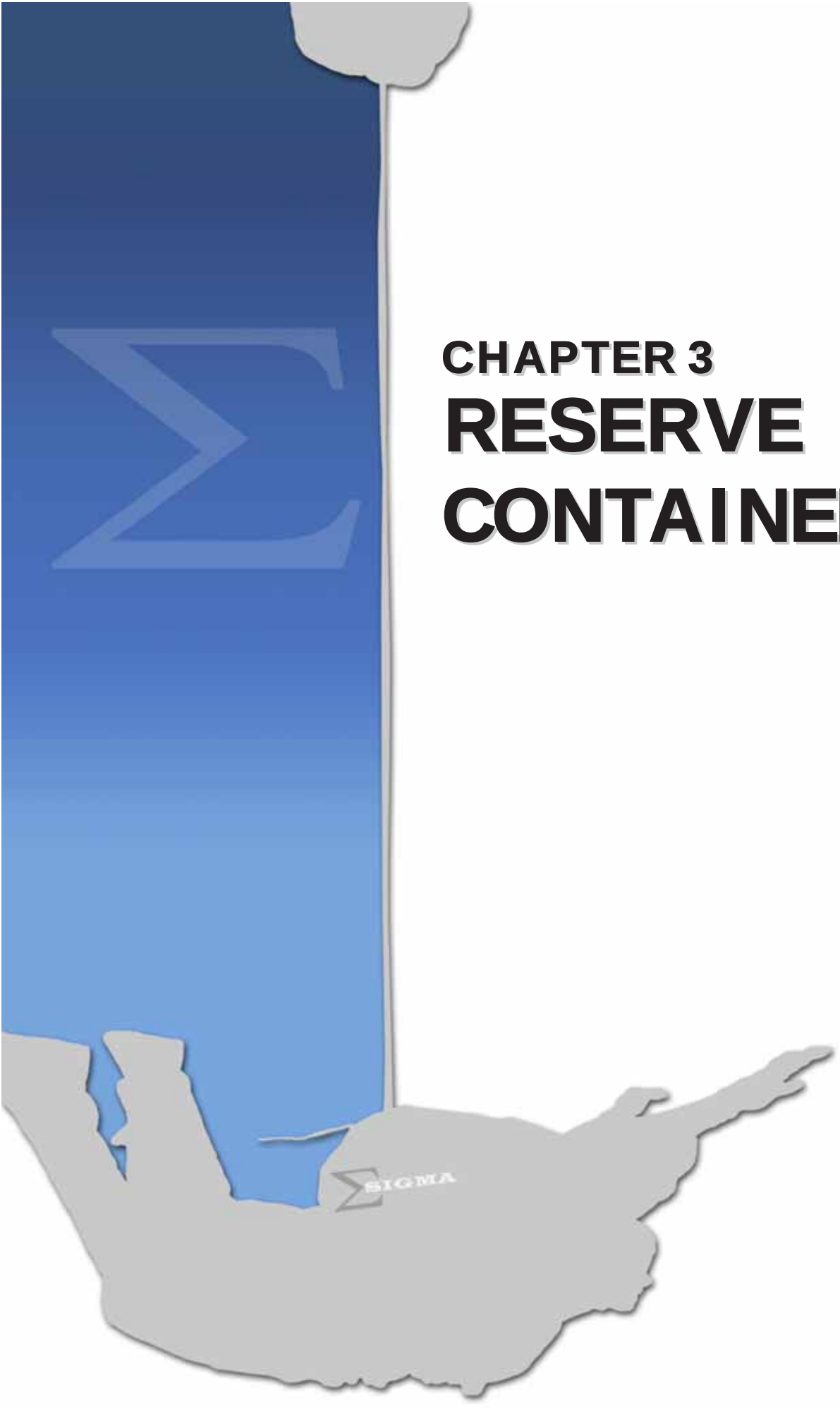
On anyone with a larger body frame the Main Lift Webs should be positioned further apart than on a smaller person.

There is no single right way to fit every size or shape of the human body. The harness has 13 points of adjustments. Use them to totally surround and contain the student's body.



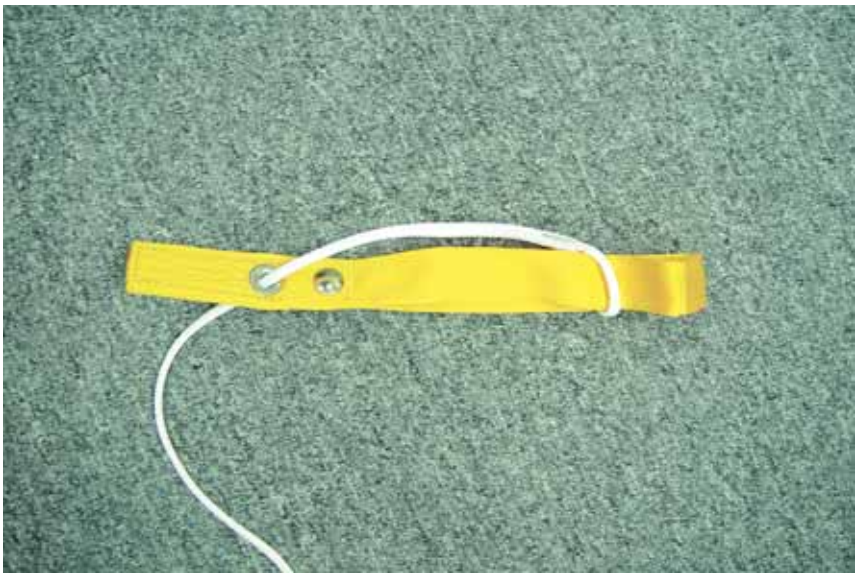
Notice how the main lift web is positioned more toward the side of the body than it would be on a smaller person. From this position, six straps, going in every direction, totally contain the pelvic area. This containment appears appropriate on this person when the Main Lift Webs are further apart.

CHAPTER 3
RESERVE CONTAINER



Once the canopy has been correctly attached to the risers and while it is still laid on its side, begin to attach the reserve steering toggles using the following steps:

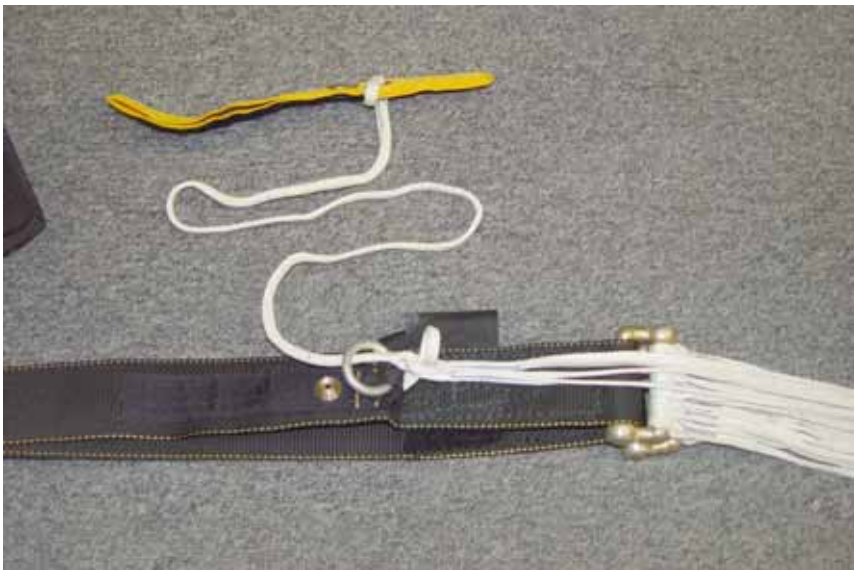
Pass steering line through grommet from back side.



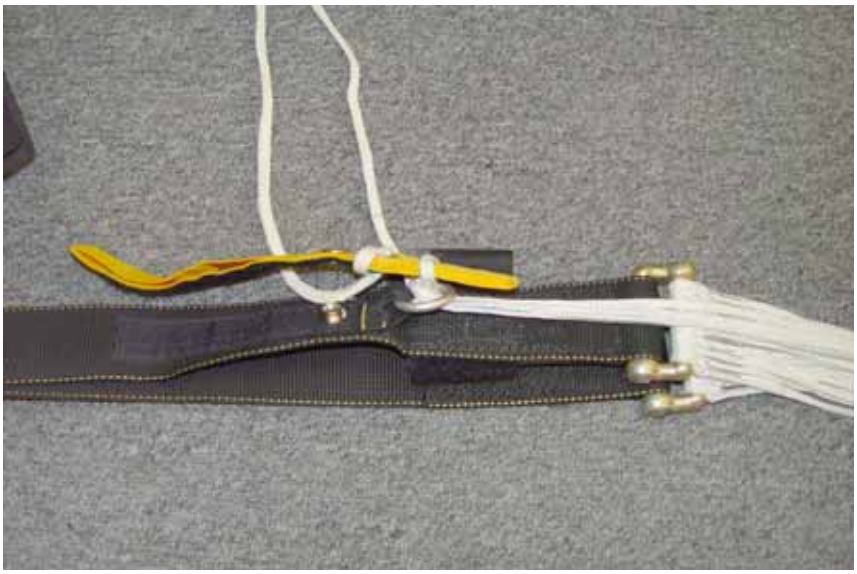
Thread toggle tip through loop at end of steering line.

Pull steering line tight to secure Larks Head connection.

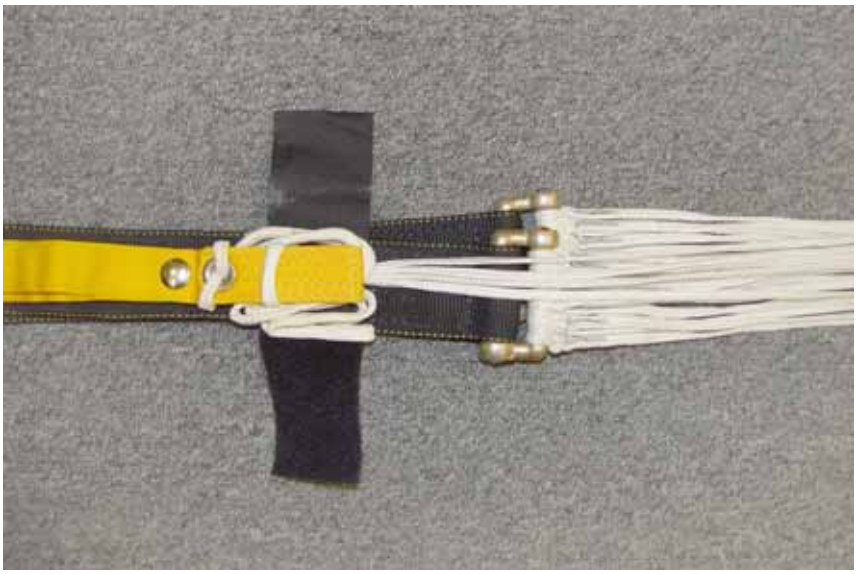
End of steering line is passed through the grommet and looped over the toggle tip.

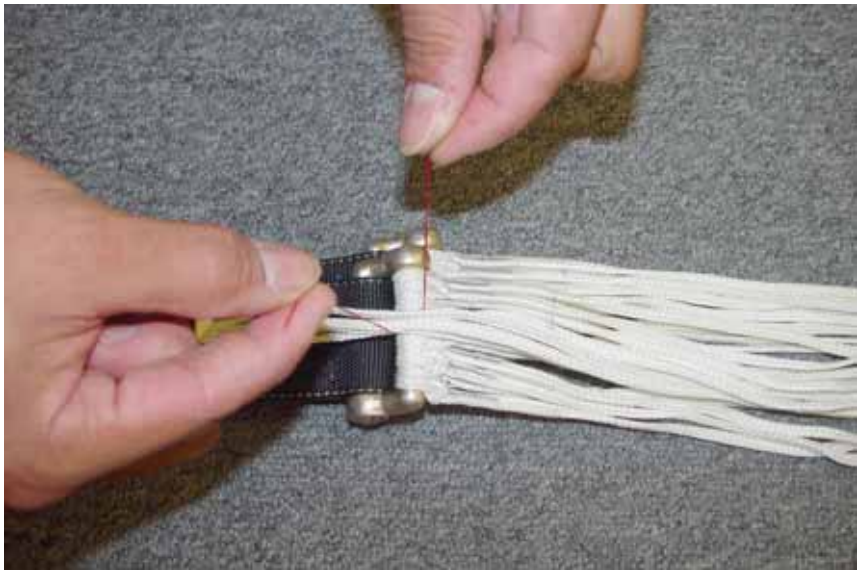


Pull steering line break setting through the guide ring. Pass the brake setting loop through the steering line cats eye and insert the toggle tip.

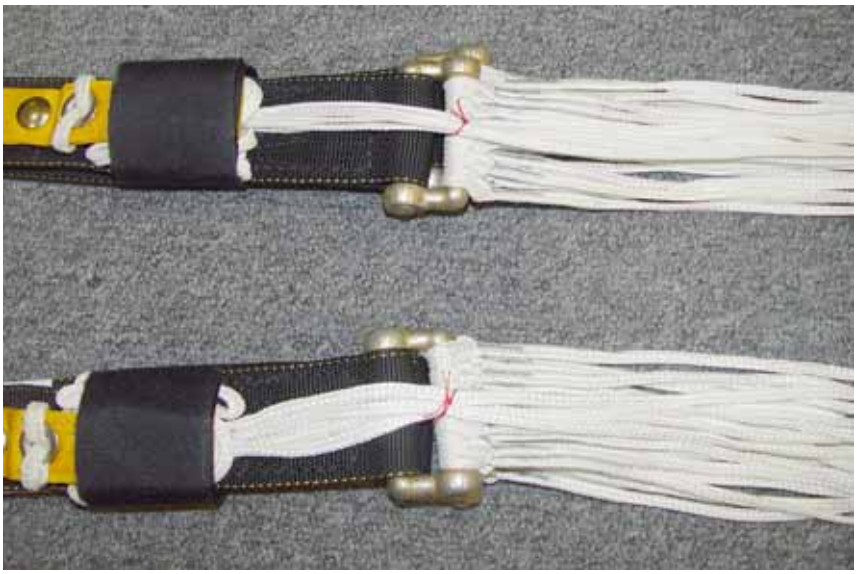


Mate the snap and the Velcro to secure the toggle. Stow the excess break line along side the toggle tip and secure with the velcro cover.





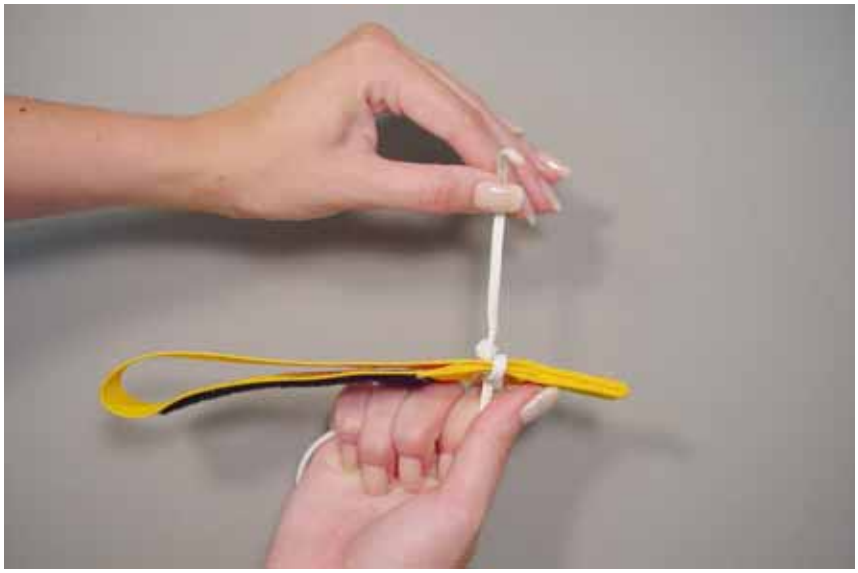
Route two turns of seal thread around top, middle part of L-Bar, and all steering lines in preparation for safety tie.



Repeat for opposite side, and secure with riggers knot.

Perform a thorough inspection of all components of the reserve parachute system. Reserve Pilot Chute, Reserve Bridle, Freebag, Safety Stow, Reserve Canopy, lines, slider, and links. Follow the canopy manufacturer's reserve packing instructions.

Pick up the front, rear and steering line groups in the left and right groups respectively.



Walk up to the canopy keeping the line groups separated. The line groups must be clear up to the canopy. Ensure that the slider has all the lines in each line group passing through each respective slider grommet.

Flaking the Canopy: With the lines passing over the shoulder start with the end cell nearest your legs, begin flaking the nose of the canopy. Pull each cell completely out, and keep it in your hand. Then, pick up the next, taking care not to miss any until all the cells are in your hand. When you have the entire nose flaked, tuck it between your knees and hold it there. Clear the stabilizers. Flake the material between each line group out toward the stabilizers, keeping the line groups stacked together in the middle of the pack job. Clear the tail, flaking the material between each steering line toward the outside of the pack job.

Flake the leading edge of the canopy with an even number of cells to the left and the right leaving the center cell fully exposed in the middle.

Hold the lines in one hand and use your free arm to support the canopy fabric, while gently placing the canopy on the packing surface.

Place a packing weight at the base of the canopy to maintain line tension use your hand to keep lines centered while you are flaking the canopy.

Staring at one side of the canopy, carefully lift the folds of material back towards the center of the pack job until the nose is exposed. Clear the cells to the outside of the center cell and flake this section of the nose toward the outside of the pack job.

Flake the material between the A and B lines away from the line channel in the center of the pack job. Be sure that all of the T-seams to the outside of the center cell are neatly flaked. Find the bottom seams to the outside of the center cell and flake them out toward the stabilizer. Make sure the B lines are grouped together and stacked neatly on top of the A lines. Smooth out the fold between the A and B lines.

Fold the flaked A to B material in half towards the center of the pack job. Do not go beyond the line attachment points.

Repeat the previous steps to flake the material between the B and C lines. Continue flaking process for the material between the C & D lines.

Flake the material between the upper control lines toward the outside of the pack job, leaving the control lines stacked neatly on the top of the A, B, C, and D lines.

Repeat the above steps for the other side as performed previously. Make sure the line channel in the center of the pack job is clear. Note: the exposed split nose to each side of pack job.

Prepare the center cell material to cocoon the canopy.

Fold the Flaked tail section of the canopy under to achieve the same width as the rest of the canopy. Use the center cell material to cocoon around the tail section.

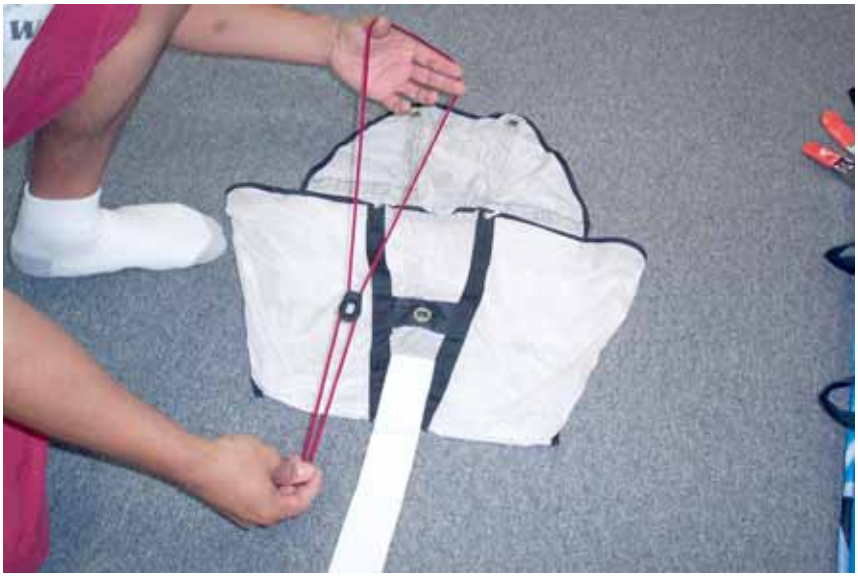
The Flaked tail section folds and center cell material are folded around the B to D material and tucked in behind the A to B material. View of cocooned left side.

Fold the leading edge of the exposed cell openings back and parallel to the cocooned canopy.

Once nose is neatly flaked on it's side, count off top four cells, rolls these till equal to fold line, and place into center cell, then do same for bottom four cells.

Then fold the nose under with the fold line established at the edge of the cocooned canopy.

When the nose folds are complete, the leading edge should be even with the edge of the cocooned canopy.



Prepare the reserve bag to receive the canopy. Insert the locking pull-up cord, to maintain a "loop channel" as the canopy is placed into the bag.

The dressed width of the canopy should be 1 to 2 inches wider than the width of the reserve pack tray.

The use of packing paddles to make S-folds will help maintain line tension and precise fold lines as seen in the next photo.

Pack job view after the half S-fold.

Press down and hold tension on lines over 1st S-fold. Reach under top of cocooned canopy to bring on next S-fold

Fold cocooned canopy over 1st S-fold.

Dress center cell to the width of the pack job.

Place the reserve bag in position above the canopy.

Use a packing paddle to establish the fold line for the remaining half of the S-fold.

Both S-folds should be even at the bottom.

Make sure 2nd and top S-fold lines up even with 1st/bottom S-fold, and remove long bars.

Split the remaining part of the canopy into 2 ears. Be careful not to roll fabric in front of the leading edge.

Fold the ear under to prepare it for insertion into the reserve bag.

Insert into the reserve bag. Repeat the previous two steps for the other side of the canopy.

Use a needle fold of bridle material to secure one end of the safety stow to allow you make the first locking stow.

Locking stow line bight should be 3" long.

Dress the pack job to the finished shape desired. 2" to 3" of canopy material protruding from the mouth of the bag will help fill the reserve container corners.

Do not rely on the container to shape the pack job or hide poor bulk distribution!
The bagged canopy should reflect the desired shape of the rig for best results.
It should be square at the bottom, wedge shaped in profile, and thin at the top.
When pressing down on the pack job, it should be firm at the mouth of the bag and get progressively softer as you get closer to the bridle attachment point.

Place two velcro protectors on the line stow pouch.

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 hook and loop fastener at the mouth of the pouch. Remove the two velcro protectors from the bag.

If the container is equipped with a Cypres, create an indentation in the center of the pack job to accommodate the unit.

Place the risers to the sides of the reserve tray with the ends fanned to reduce bulk. Insert a pull-up cord in the reserve closing loop.

Pull the Pull-up cord through the reserve bag from the bottom and out of the top.

Pull the reserve closing loop through the reserve bag and secure with a temp pin. Ensure that no canopy material has pulled through the grommet.

Place cypress into indentation previously made, and place the lower corners of the reserve pack job into the reserve container.

Fill bottom corners of reserve container with bagged canopy

Thread the pull-up cord through the bottom kicker flap (flap #1). If equipped with a Cypres be sure to pass through the cutter before passing through flap #1.

You may evaluate the length of your closing loop by the following method: Press the #1 flap firmly down while pulling with adequate force on the pull-up cord. The top of the closing loop should extend beyond the bound edge of flap #1 by a 1/4" to 1/2". This will help ensure the proper length closing loop is being used. Secure flap #1 with temp pin.

Fold the bridle vertically along both sides of the center grommet and place these folds under flap #1. Leave approximately 5' of bridle unstowed below the pilot chute.

SKYHOOK PACKING INSTRUCTIONS

A standard RSL does one thing. It pulls the reserve ripcord pin automatically after a breakaway. The Skyhook RSL does this, and then goes two steps further.

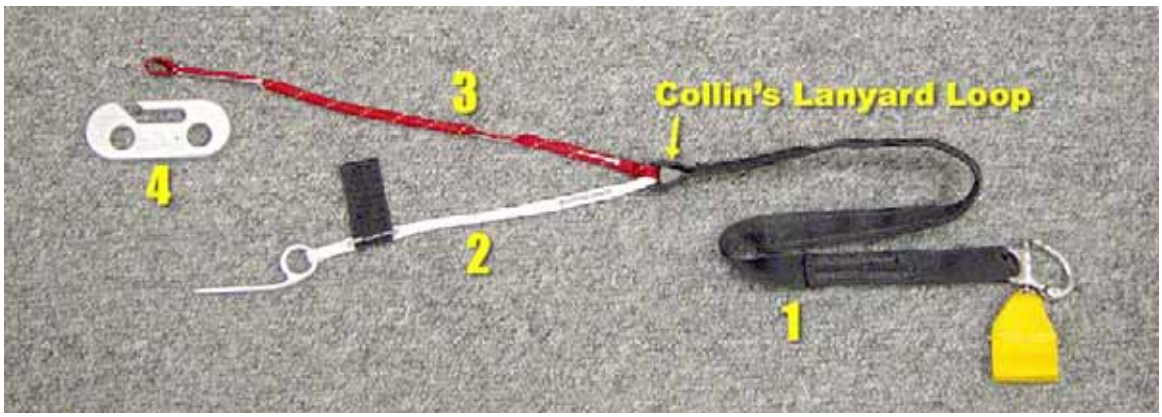
A. It automatically releases the Left (non-RSL) riser, if the right (RSL) riser releases prematurely for any reason (Collins' Lanyard). (You wouldn't want your reserve container opened with one riser still attached, would you?)

B. It then uses your departing main canopy as a super "pilot chute" to get your reserve to line stretch faster than ever before. Breakaway, to canopy-out-of-bag times are between ½ and ¾ of a second, depending on the size of your reserve canopy. This is up to three times faster than a pilot chute can do it alone.

If you have a main total malfunction, or your AAD fires, the Skyhook Lanyard automatically releases, and therefore does nothing to hinder normal reserve deployment.

The Skyhook RSL System has four parts:

1. The RSL Lanyard (5/8 or 1", black webbing) with a snap shackle that connects to your right main riser at one end, and the Collins' Lanyard loop at the other.
2. The White Ripcord Lanyard, with one end sewn to the RSL loop, and the reserve ripcord pin at the other.
3. The Red Skyhook Lanyard, also sewn to the RSL loop, with the Skyhook attachment loop at its free end.



4. The Skyhook itself, which is sewn to the reserve pilot chute bridle.
(Because the RSL Lanyard, Collins' Lanyard, and Skyhook Lanyard are all part of one integrated system, pulling the yellow tab on the RSL snap shackle inactivates all three.)

SKYHOOK II ADDENDUM

Your rig is equipped with the new Skyhook II. It differs from the original Skyhook in the following ways:

1. It is anodized blue.
2. The "To Pilot Chute" instruction is laser etched on the top surface.
3. There is a holographic serial number label under the surface.
4. There are two Lexan cover pieces – on each side.
5. The Lexan pieces have small holes drilled in them for safety tie thread.
6. The upper attachment tape is red.
7. The label on the rig has been updated to reflect some of these changes.

The Skyhook II'S dimensions are exactly the same, and it functions in exactly the same way as the original Skyhook. Therefore, it is fully compatible with any United Parachute Technologies rig set up for the original Skyhook.

Reasons For The Changes

1. The blue anodizing makes it easier to see damage to the hook section, while the second Lexan cover piece better protects the hook from any damage.

2. The laser etching is much easier to read, and the holographic serial number seal makes it much easier for us to keep track of different Skyhook batches. Please notice that while the arrow on the Skyhook II points the same way as the original Skyhook, the "to pilot chute" text is flipped to make it "right side up" when viewed from the top of the rig.

3. Sealing the Skyhook lanyard with a single piece of red rigger seal thread passed through the holes in the two Lexan cover pieces (instead of tacking the red lanyard to the freebag bridle, as was done in the original Skyhook) results in far greater percentage of freebags still attached to the broken away main all the way to the ground. There is no chance of needle damage to the bridle from successive tacking with a dull needle.

4. Making the upper (toward the pilot chute) Skyhook attachment tape red makes it even less likely that someone, will some day sew a Skyhook to the bridle backwards.

WARNING

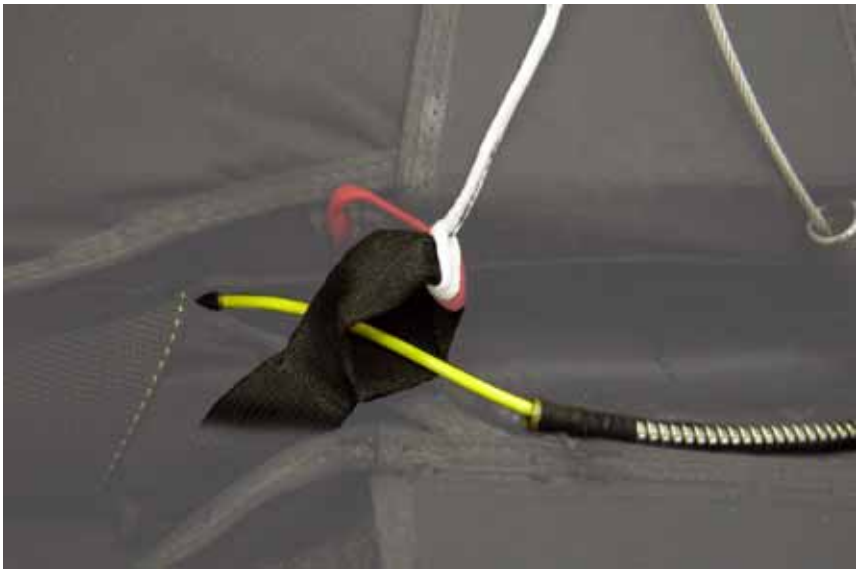
Before Packing: There is no RSL guide Ring on flap #6 on Skyhook equipped rigs. Make sure the RSL guide ring has been removed on converted rigs. It was never really necessary, and someone might pass the Skyhook lanyard through it some day, causing a reserve total.

Mate pile velcro from RSL to hook velcro on container.

Insert RSL pin into pocket.

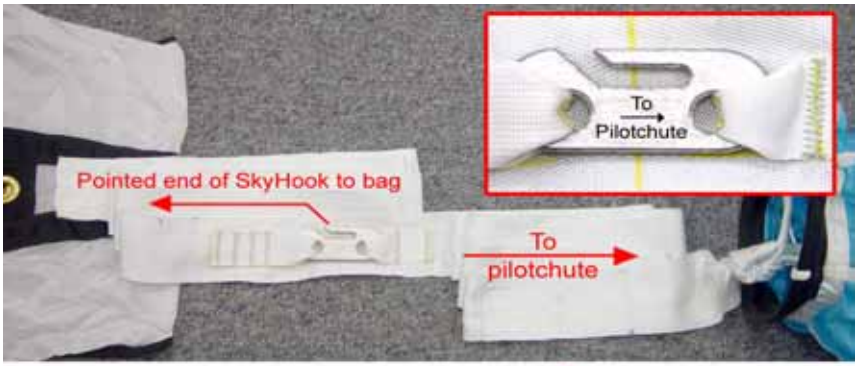
NOTE: IT IS VERY IMPORTANT THAT THE PIN IS INSERTED IN TO THE POCKET.

Close RSL pocket by mating velcro on container.



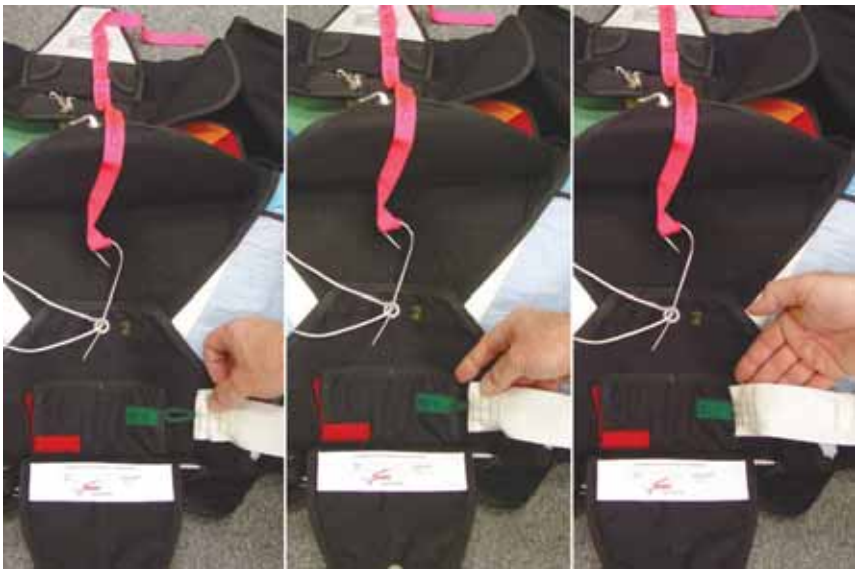
Make sure the left hand (exposed) yellow breakaway cable passes through the Collins' Lanyard loop at the end of the RSL. The Skyhook should not be used without a Collins' lanyard.

Make sure that the Skyhook is sewn to the reserve freebag bridle correctly, with the pointed end of the hook facing toward the bag. If the Skyhook were sewn on the bridle facing the wrong way, a reserve pilot chute in tow would result if the reserve were pulled in response to a main total. (This pilot chute in tow could be cleared by pulling the yellow tab to release the RSL.) Remember, this malfunction can only occur if the Skyhook is SEWN to the bridle incorrectly. It cannot be caused by a packing error.



S-fold the 7-foot section of freebag bridle (up to the Green flex-tab) under pilot chute kicker flap #1, in the normal manner. Close flap #2, and secure with the reserve closing loop and temporary pin. Make sure the remaining bridle exits the closed kicker flaps to the wearer's LEFT (Right in photos) of the #2 (upper) flap, with the flex-tab side up.

Attach the RED Skyhook lanyard to flap #2 by folding the stiffened section of the lanyard in half, and inserting it completely into the RED pocket on the flap. You may have to open the pocket a little with a pencil before inserting the flex-tab.



Fold the bridle over the edge of flap #2, and insert the GREEN flex-tab on the freebag bridle into the GREEN pocket on the #2 flap.

Lay the bridle over flap #2 with the Skyhook facing up. Lift the Lexan cover slightly, rotate the Skyhook enough to slip the loop on the end of the red Skyhook lanyard over the Skyhook, and rotate back into position. The Skyhook should be held firmly in place between the two pockets with less than ¼" of play. (Note: It should take a force of 5-7 lbs. to pull the red or green flex-tab out of its pouch, at a 180 degree angle to the mouth of the pouch.)

The Skyhook has a Lexan cover piece designed to:
1. Hinder anything but the Skyhook Lanyard from entering the Hook-slot.
2. Lower the chance that the hook area might be damaged by use or misuse
Make sure this cover is in good condition and the hook area is smooth and free of burrs.

Close the Skyhook cover flap (2A) over the Skyhook assemblage, pass the reserve closing loop through its grommet, and secure with the temporary pin.

Pass the pull-up cord through the base of the reserve pilot chute and out the grommet in the center of the pilot chute cap. Ensure that the pull-up cord did not pass around any of the spring coils inside.

Apply tension to the pull-up cord and hold the base of the reserve pilot chute centered over the closing loop.

Compress the reserve pilot chute…

…and secure with the temp pin.

Pull all of the reserve pilot chute material out of the spring coils and ensure that the pilot chute base is centered under the cap.
S-fold the pilot chute material to within 1" of the edge of the pilot chute cap.

Close the center flap (flap #3) over the pilot chute and secure with the temp pin.

Repeat the S-fold for the rest of the pilot chute.

Close the reserve side flap (flap #4) and secure with the temp pin.

Close the reserve side flap (flap #5) and secure with the temp pin.

Close reserve flap #6 and secure with reserve pin. Carefully remove the pull-up cord. Inspect the closing loop to ensure that no damage has occurred during packing. Dress the container. Install the Rigger seal if applicable. Complete all necessary paperwork. Be sure to count all your tools when finished.

CHAPTER 4
MAINCONTAINER

SELECTING THE PROPER STOW BANDS

Band types for:
1**)** All Dacron lined canopies
2) Microline

NOTE: If you run out of all specialized Tandem rubber bands (2" x 3/4"), it is possible to use two regular rubber bands for each line stow. Be sure the combined width of the two rubber bands does not exceed 3/4 inch in width. Any substandard bands should be replaced with Tandem bands as soon as possible.

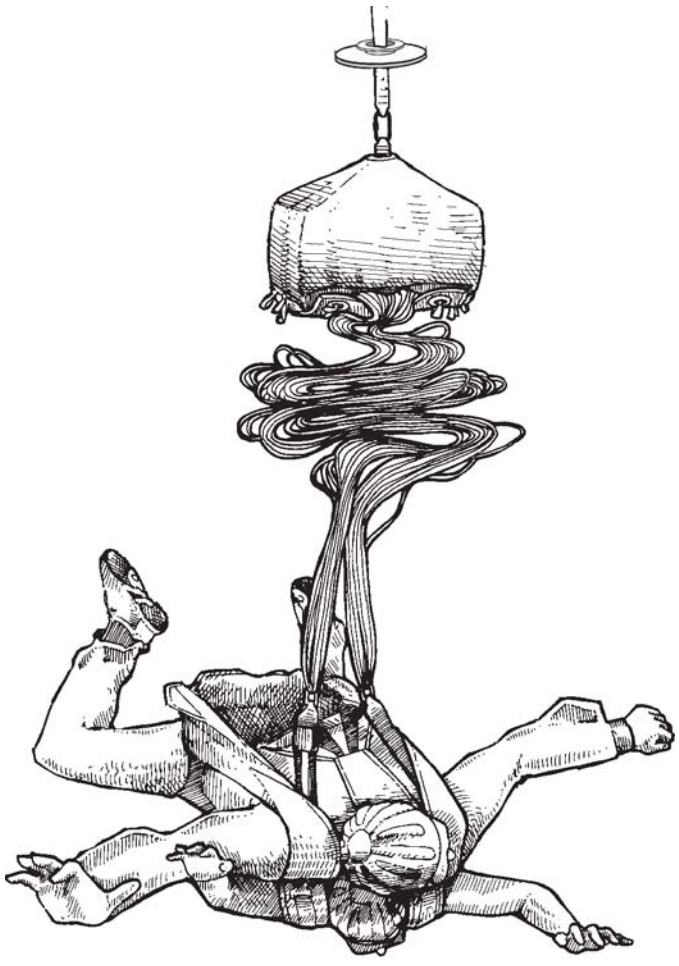
TANDEM TUBE STOWS

LINE DUMP

Definition: During bag lift-off, the rapid acceleration of the main bag can cause the entire line stow group to fall off the bag due to loose or weak stow bands.

The stow bands used on the Tandem Sigma are very important. Even more so than sport rigs, as the Tandem main bag is lifted out of the container at a more rapid rate. The Tandem Sigma must have the suspension lines securely stowed. Be cautious of bands which are too weak or stretch too much as they can cause deployment problems. Because of the increased weights involved in carrying two people, the forces on the bag at deployment time can be enough to cause line dump if the bands are not tight enough. On the other hand bands that are too tight may cause problems disrupting the even sequencing of the deployment.

Line dump can lead to partial malfunctions as the loose suspension lines quickly come under tension, and will at times form pressure knots, causing lines to entangle.



INSPECT MAIN CLOSING LOOP

The main container-closing loop is also constructed of 1,000 lb. Spectra line, and finished to a set length. Spectra is used because of its low surface friction. **Any other line** (other than Teflon, which is too weak) **would cause a hard or impossible pull in this applicatio**n.

The "sewn to button" construction technique is used because knots in Spectra slip, and there is only one correct length **(8½** ") for the closing loop anyway. However, Spectra has a low melting temperature, so the pull-up cord used to close this rig must also be Spectra.

Friction caused by the use of Nylon or Dacron pull-up cords, even when extreme care is taken, will very quickly damage the container closing loop. Replace any loop, which is badly worn. It is not necessary to replace a loop that is just slightly fuzzy. With proper care a loop can last 100 jumps or more. If you insist on using nylon pull up cords, your closing loop must be replaced every few jumps. This can get expensive. **Spare loops and pull-up cords are stored in the main top flap pouche**s.

WARNING:
Do not fabricate your own closing loops.
Do not use anything but Spectra as a pull-up cord.

INSPECT THE DROGUE RELEASE RECOIL RIPCORD SYSTEM

Make sure the eyeleted stainless steel pin is straight and free of burrs. Pull all slack Spectra ripcord up out of the housings, remove any twists, and check for wear. Each ripcord is independent of the other; over 1,000 lbs. strong, and only sees 10 lbs. in use. So a small amount of wear is nothing to be concerned about. Pull each ripcord handle to check the recoil function, and examine the loop-to-loop connection at each handle for wear. Make sure the ripcord housings are secure.

INSPECT THE CANOPY

1) bridle attachment point on top and inside of canopy
The bridle attachment point at the top of the canopy is a very high wear point and should be checked for any signs of damage occurring to the stitching both on top and inside of the canopy.

2) canopy cells, panels and seams
As you flake the canopy, take a good look at each panel for any tears, burns or broken stitches. After every 25 jumps inspect the canopy more closely to include looking inside the cells as well as inspecting all of the reinforcing tapes through-out the canopy.

3) line condition and attachment points
During the flaking of the canopy, take a look down the length of the lines watching for any damage or deformities. Every so often walk down the length of the lines inspecting all cascade points and looking for any burns or broken stitching.

4) steering lines, brake lock loops and toggle attachment
While inspecting the steering lines watch for damage especially at the brake lock loops, the toggle attachment points and at the attachment points at the canopy.

5) slider condition
Check the slider grommets for any wear (dings, nicks, sharp surfaces). Check the entire slider for holes, burns or fraying.

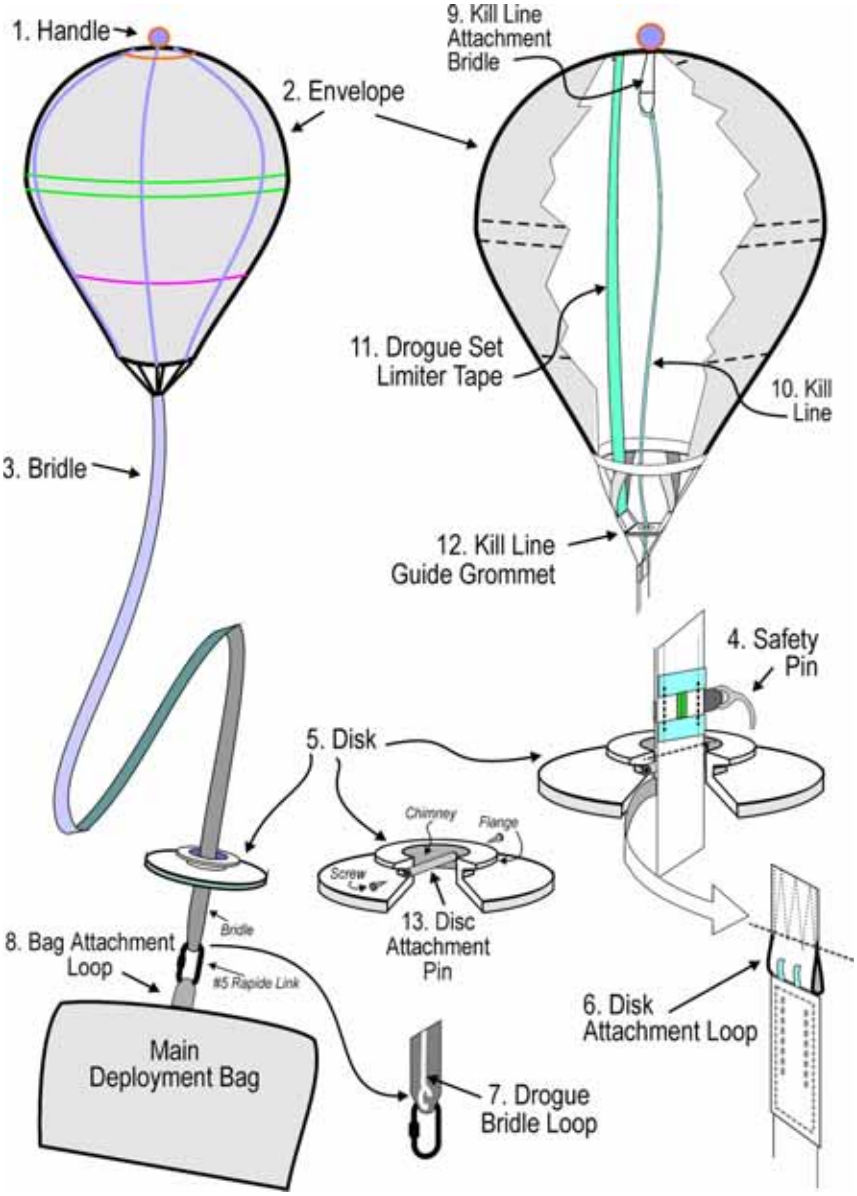
6) connector links
Ensure that the link protectors are secure. If no link protectors are present then check to ensure that the omission is intentional and that the connector link barrels have not loosened.

Rigger Note: Using "Mechanics Loc-Tite" on the barrel threads, and marking the barrel and link with a brightly colored paint line may help to insure the barrels tightness and speed up link inspection.

SEQUENCE CHECKLIST

Main Canopy Assembly Inspection Guide

- drogue chute handle attachment
- drogue chute fabric and seams
- drogue chute center line
- drogue chute bridle attachment point
- drogue kevlar bridle
- Disk to drogue attachemnt pin
- drogue bridle/ canopy attachment point
- deployment bag
- canopy fabric and seams (top, bottom, skin and ribs)
- canopy reinforcement tapes
- lines and cascades
- steering lines and brake loops
- slider and grommets
- connector links
- risers
- 3-Ring release system



INSPECT THE DROGUE

Check the envelope for tears and snags. Tiny holes can be ignored for a few jumps, but medium to large size tears must be repaired before the next jump.

Check the outer Kevlar bridle for signs of wear or broken stitches.

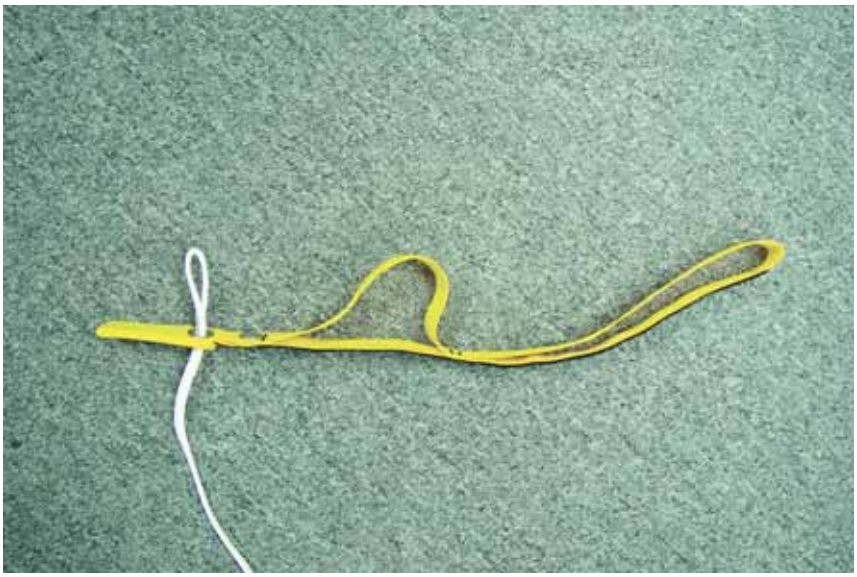
Check the inner Vectran/Spectra kill line for signs of wear. Common wear points are the upper and lower 30 inches of the bridle. The mid-section tends to outlast the ends. Although a kill line can last 100's of jumps, sandy or salty conditions can lower its life. Make sure **both** the kill line and the outer Kevlar bridle are attached to the bag loop with a correctly tightened #5 stainless rapid link. Because both the kill line and the bridle are attached at the same place, you no longer have to untwist the kill line before setting the drogue.

Check the disk for nicks, which can be caused by improper ground handling. **A deep, sharp nick could damage either the container or canopy** on the next jump, and should be sanded or buffed out. (Your main container top flap has Velcro pouches with spare parts, including Emory cloth and a 3/32" Allen wrench.)

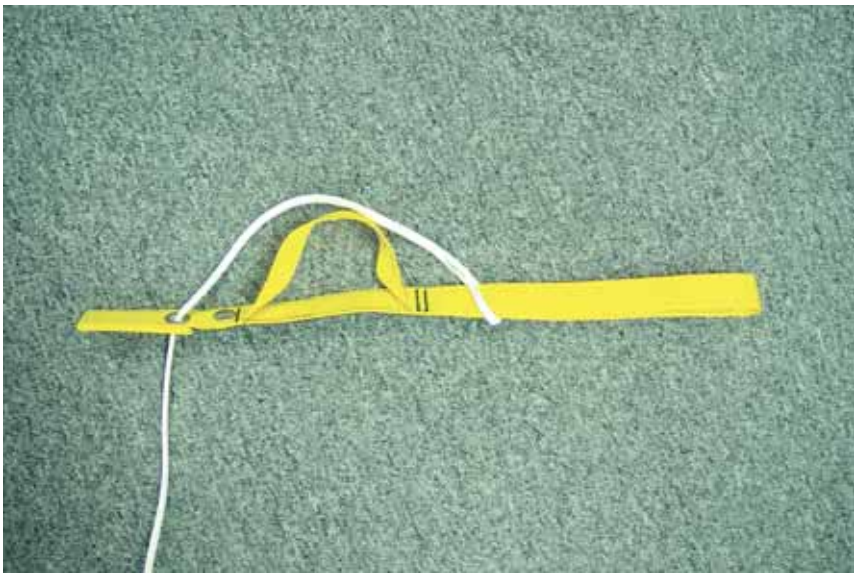
Check that the disk attachment pin is threaded through its loop on the drogue bridle, and that the screws are tight. Tighten with a 3/32" Allen wrench if necessary. A loose screw could damage or snag the closing loop. A missing screw could cause the pin to slip out of the disk chimney, which would cause premature collapse of the drogue. **A little dab of blue Loc-Tite on the screws will help keep them in place.**

TOGGLE ATTACHMENT

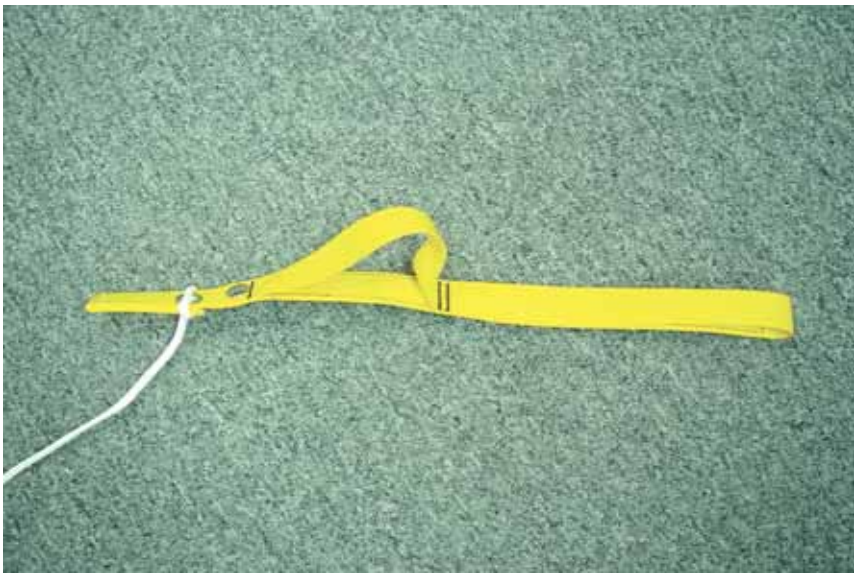
Pass steering line through grommet from bottom side.



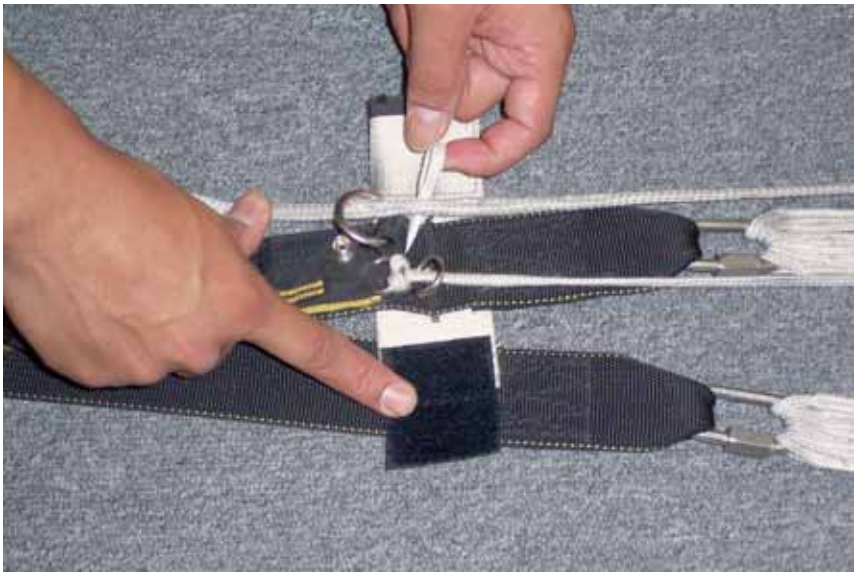
Thread toggle tip through loop at end of steering line.



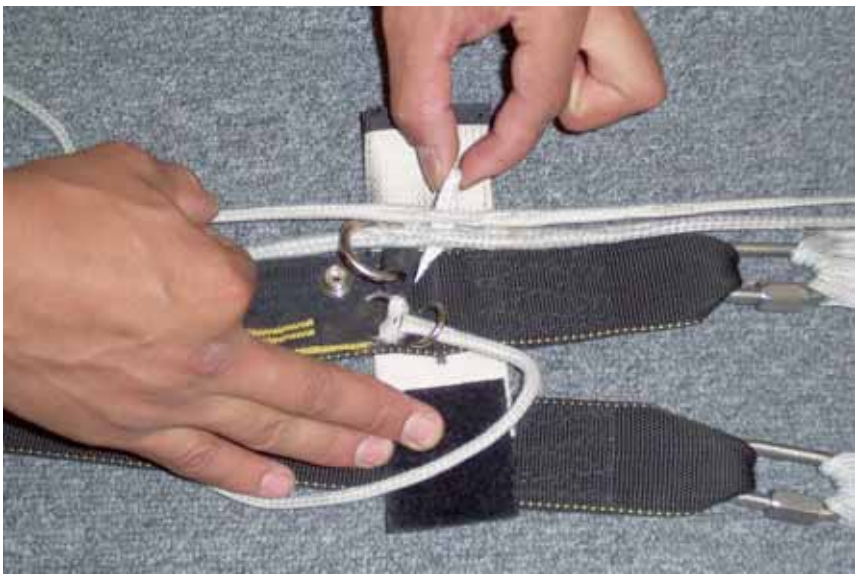
Pull steering line tight to secure Larks Head connection.



Stowing main dual brakes; position and stow the secondary toggles.



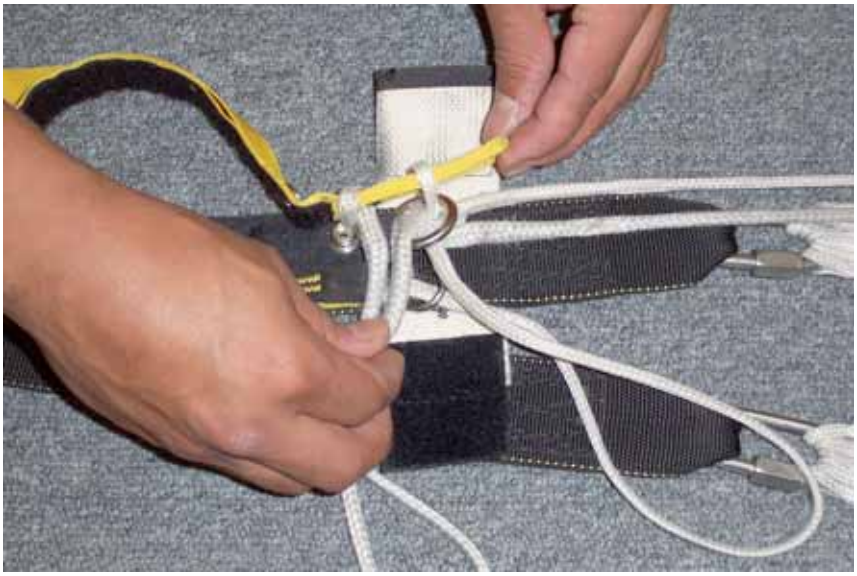
Feed the stow loop through the cats-eye on primary brake line.



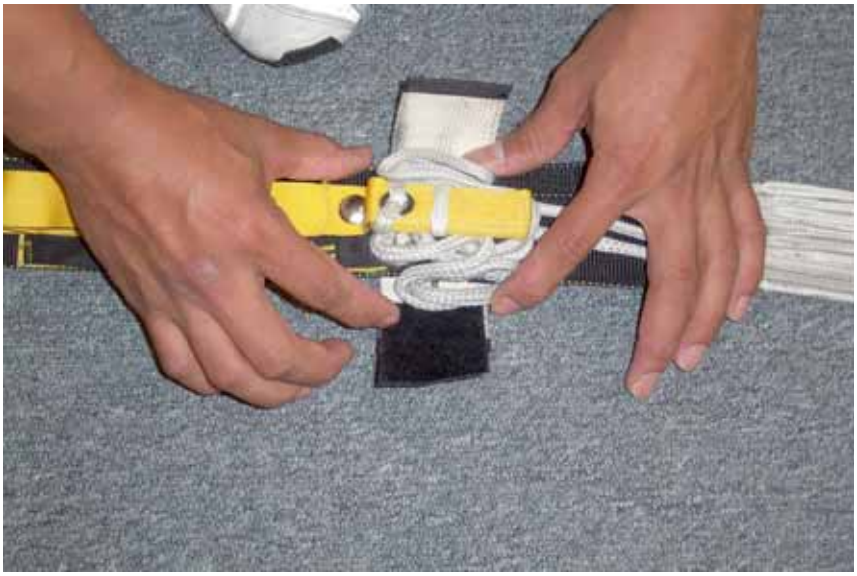
Feed stow loop through cats eye on secondary brake line. NOTE: Do not pull secondary brake line through guide ring.

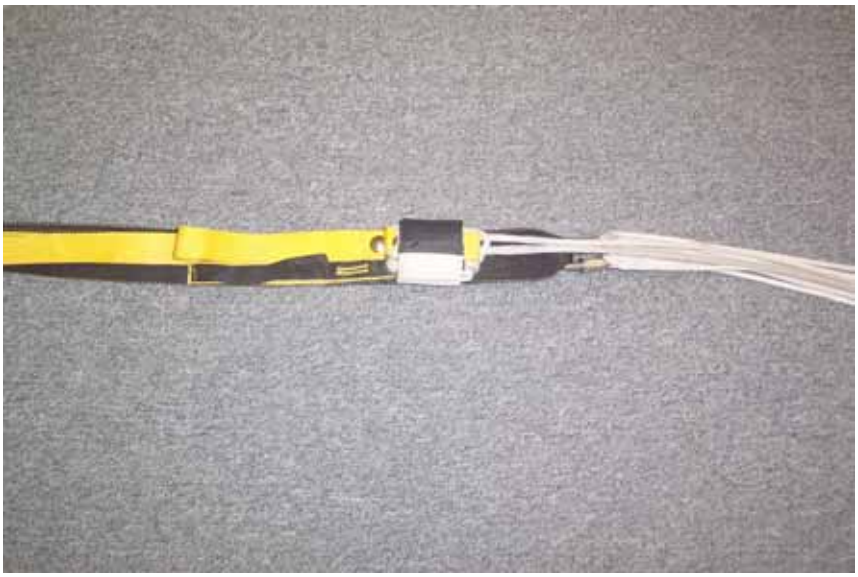
Pass stow loop through primary guide ring as shown.

Pull head of primary toggle through the stow loop; stowing brakes.



Mate the snap and appropriate Velcro. Neatly S-fold remainder of lines next to primary toggle.





Secure S-Folded lines with Velcro cotton wrap. Ensure the Velcro is fully mated to reduce Velcro damage to the suspension lines.

Divide the line set between fingers as shown.

Walk your fingers up the lines to the slider making sure there are no twists, flip throughs, etc.

Count the nose making sure you have all cells in your hand.

After shaking the canopy once, or twice secure the nose between your legs.

Flake canopy in an accordian fashion from nose to tail making sure the line groups run down the middle of the canopy, and the canopy fabric is pushed to the outside and quarter slider.

Making sure the D-lines are taught, find center of tail and bring it over the slider.

Leaving the nose exposed will cause the canopy to open quicker, maybe harder.

Folding/tucking the nose in will cause the canopy to snivel longer. You may choose the method that works best for your particular canopy.

Roll tail around nose 3-5 times.

Neatly set canopy on floor. Carefull not to drop canopy on floor.

Purge or squeeze all air out of the canopy.

Up fold canopy bringing lines back to center.

Repeat for opposite side.

Extract center cell.

Bring center cell out and around canopy.

Cocoon the canopy.

Once cocooned purge out the rest of the air.

Prepare bag to accept canopy.

Make first S-fold according to depth of bag.

This fold will lock the slider in place, so be sure slider grommets are all the way up to the slider stops.

Hold down first S-old with knee.

Reach underneath canopy in preparation for second S-fold.

Making second S-fold.

After 2nd S-fold tuck ears underneath and above 1st S-fold to depth of bag.

Secure S-fold with D-bag. Insert that half of the canopy into the D-bag

Repeat previous 2 steps for other side.

Bring bag around S-folded canopy.

Secure D-bag with first 2 stows. Use tandem Tude stowes here to reduce the chance of line dump.

Stow the remainder of lines. Leave about 2 feet between the last stow and the risers.

Stow your main risers along side of the reserve container. Make sure the risers are not underneath tuck tab flap over shoulder.

Close and secure riser cover tuck tab.

Neatly S-fold remainder of lines in the main pack tray, and not over top main flap #2.

Place D-bag in container with line stows to bottom of container.

Arrow on disk should be pointing up towards reserve container.

Thread main closing loop through chimney of disk, and secure with main pin, as shown in picture. Doing so will allow you to immobilize the disc for cocking.

Cock the drogue in the normal fashion.

Notice that the Kevlar bridle on the left side of the container is scrunched up after you cock your drogue.

Position and keep the scrunched Kevlar bridle on the left side and on top between the D-bag and reserve container.

Using a length of 725lb or 1000lb spectra pull-up cord. Thread through D-rings and around the disk to close container.

Diagram of closing sequence is provided on main pin cover flap.

Pass pull-up cord through grommet on bottom flap. As the four (4) flaps are drawn together, keep the disk centered with arrow pointing to the reserve container.

Secure with pin. be sure the flap D-Ring and closing loop are below the flange.

Once secure, remove the pull-up cord.

Insert safety pin (attached to drogue bridle) into main pin eyelet and ensure that it enters the grommet.

Secure drogue bridle underneath right main side flap. Secure the 2 small tuck tabs on pin flap underneath main plate flap.

Close main pin cover flap into center flap.

Layout drogue in a nice flat, circular fashion.

Fold drogue in half down towards the bridle.

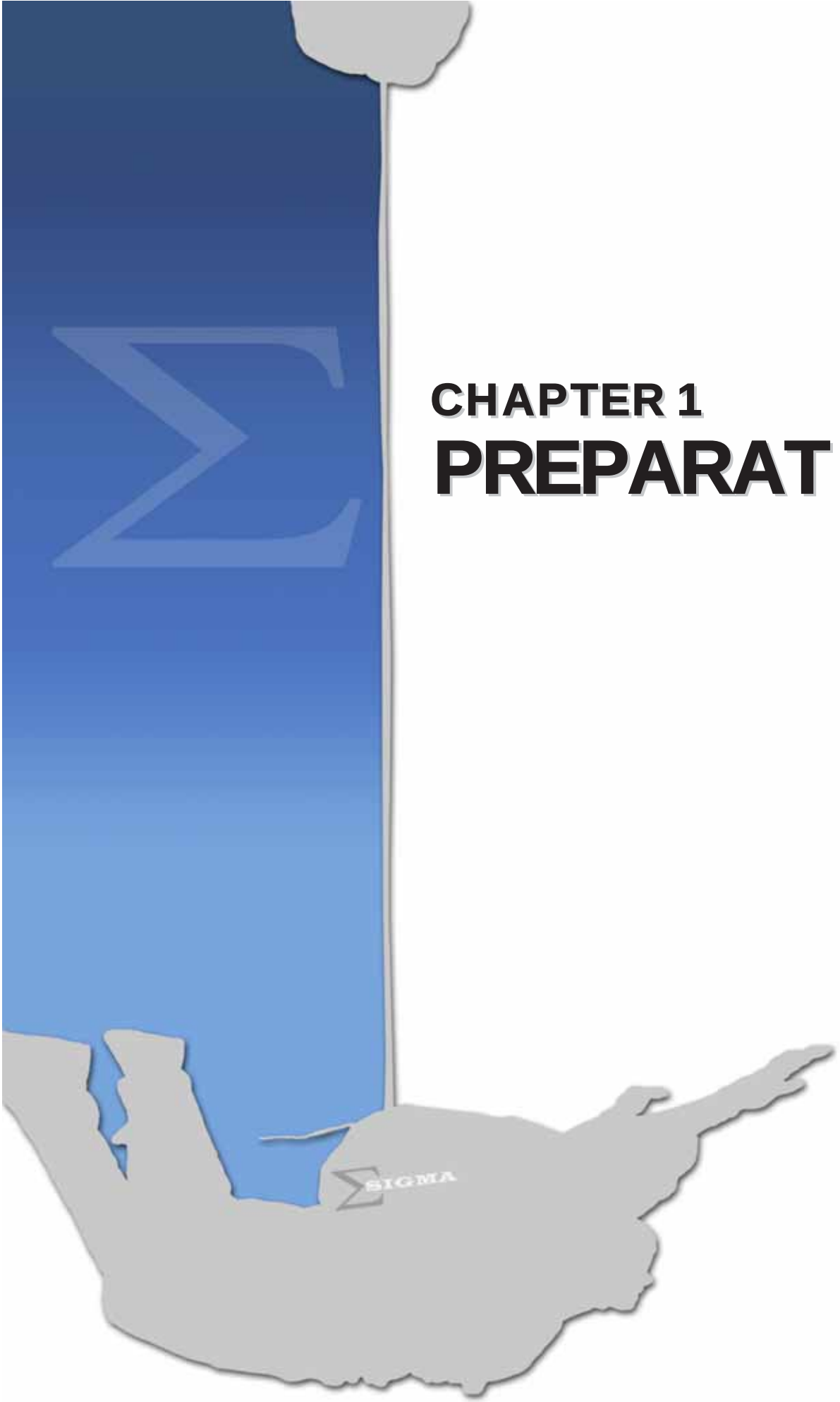
Fold drogue and bridle up towards ball.

S-fold remainder of bridle on top of each other leaving approximately 15" of loose bridle.

Fold canopy over/across bridle in 3rd's.

Fold across once more making the folded drogue approximately 15" x 6".

Insert drogue in its pouch and tuck bridle away so it is not visible.



CHAPTER 1
PREPARATION

CRITERIA FOR JUMPING

The following is the minimum criteria to be followed and will be discussed under the headings of:
A. Personal
B. Geographical

A. Personal requirements:
Age
Physical condition
Weight
Size

Before any Tandem jump, it is important to determine that the student meets a few basic criteria. There are very few restrictions on who may jump, but the few guidelines put forth here must be followed carefully in order to protect yourself, the student, and the entire Tandem program. The four student requirements are:

1) Age: The student must be considered an "adult" in the jurisdiction in which the jump is being made. In other words, the student must be able to legally enter into a contract. In most cases, the age for this is 18. **Warning:** It is the responsibility of the drop zone and the Tandem Instructor to insure the student is of legal age.

2) Physical condition: There is very little that precludes someone making a Tandem jump. One of the great advantages of the Tandem program is that people who would never have been able to skydive may now enjoy the thrill of the sport. Basically, the student should be in fairly good shape, not be suffering from extreme frailty or extreme old age, and have no heart condition or other debilitating ailment.

3) Weight: This is an important consideration, and there are a number of factors to be considered. First, the total combined weight of the Tandem Instructor and the student (not including gear) should not exceed 450 lbs. Tandem Instructors should increase weights 15 pounds at a time while gaining experience.

4) Size: There are two considerations here; Instructor/student size ratio and the aircraft being used.

a) Instructor/student size ratio: Basic common sense dictates that a small Novice Tandem Instructor should not take a large student. Follow these criteria when matching Tandem Instructor and student:

***** Tandem Instructor must be able to "handle" the student with whom he/she is jumping with. Consider the level of difficulty for the aircraft being used.

***** The newly licensed Tandem Instructor should be equal to or greater than the student in size and strength, and must be able to steer and flare the canopy without the help of the student. Only after considerable experience should a Tandem Instructor attempt to take students larger than himself.

b) Aircraft: If a large Tandem Instructor is taking a large student, it may be almost impossible for them to comfortably get out of a Cessna. However, the same pair could exit easily out of a Skyvan, Twin Otter , or similar aircraft. Aircraft availability must be taken into consideration when deciding if a student may jump.

B. Geographical requirements:
The following may play a part in how you decide who to take on a given day or at a specific location.
Weather
Terrain

1) Weather assessment:

a) Wind speeds:
For Tandem jumping, the optimum range for winds is 5 - 20 mph. All jumpers should realize that very high winds are unsafe to jump in. In the case of Tandem jumping, we need to realize that it may be equally unwise to jump in extremely low winds. It is a hard point to realize since sport jumping goes on in no wind conditions all the time, but it is a fact that Tandem jumping with heavy students in no wind conditions can produce final approach ground speeds which can make landings more difficult.

Heavy students with any physical malady which can prevent them from running or supporting their own weight should not be jumped in no-wind conditions.

b) Temperatures:
As the seasons change, the canopy's performance will vary as the air becomes cooler or warmer. Cooler air is always more stable and dense so the canopy's decent rate and flare performance is good. Warmer air is thinner and you may find that landings become harder. This can be noticeable even during the course of a day as the temperature rises on a hot summer day. The warmer air actually provides an effect in which the field elevation can be thought of as being barometrically higher than its geographical elevation. This effect is referred to as "density altitude". The hotter the day, the thinner the air, and the higher the density altitude, in other words, on a hot humid day, the canopy may land as if the field is at perhaps 6,000' rather than sea level - a BIG difference! On a very hot day, with a heavy student, density altitude is a factor you must take into account. Common sense, good judgment, and caution is often called for.

2) Terrain assessment:

a) Landing area selection:
If you are planning a Tandem jump at an unfamiliar spot, check the area before you jump. Note where the obstacles are, and keep track of other large open alternate landing areas. Turbulence can effect canopy flight as much as 1/4 mile away from tall obstacles. Keep these things in mind when making a note of wind direction and spotting. Think ahead and plan carefully!

b) Altitude:
When jumping at locations well above sea level, you must also take into account that the higher the ground elevation, the less effective your flare will be. If you find yourself making Tandem jumps at high field altitudes, choose lighter students till you have a good feel for the different flare characteristics the canopy will have at that location.

OVERVIEW OF THE JUMP

A) synopsis of the jump
B) video and assumption of risk agreement

A) Synopsis of the jump:
Before the first jump, it is important that the student understand what the jump will be like, and what is expected of him or her. Before the first jump, the student should have the Tandem concept explained by video, still photos, or direct observation. Inform them of the entire sequence and what to expect at each stage of the jump. Information such as exit altitude, length of freefall delay, and length of canopy ride are all motivating points of interest.

B) Video and assumption of risk agreement:
The student must view the waiver video and sign the waiver. Be careful to abide by all United Parachute Technologies & USPA provisions in the exemption, such as student's age, etc... If the video machine is out-of-order or the tape is lost, it is the same as if the aircraft is inoperative. NO ONE may make a Tandem jump without seeing the waiver video and signing the waiver.

STUDENT HARNESS ADJUSTMENT GUIDE

The Sigma / Vector Student Harness is quite a departure from previous tandem student harnesses. It was designed, with the help of a cardiologist, to safely contain the human body without cutting off normal blood flow. Disrupted blood flow is why almost all students on older student harnesses were uncomfortable, and why many got sick or even passed out.

A hip-hugging horizontal back and belt strap combination allows the main lift webs to be positioned, and held, more toward the front of the upper body than on other designs. This prevents the "squeezing" of the upper body and the inside of the upper legs which can cut off blood flow. It also automatically lifts the legs up and forward after opening, putting them in a safer position for landing.

The Student Harness was designed to comfortably and safely fit a wide range of body sizes. To accomplish this, it has **twelve** points of adjustment. This wide range of adjustment means that it is possible to give a tandem student a truly comfortable experience on their tandem skydive. However, **the harness must still be adjusted securely to fit the student's body to prevent them from falling out in extreme situations and unusual body positions.**

While fitting this harness on a tandem student is not difficult, it is different from other harnesses you may used in the past. The most important point to consider is the security of the student. You must insure that all straps are comfortably snug against the student's body.

Please use the following guide to keep your students safe and comfortable.

HARNESS ADJUSTMENT

Loosen the harness before donning.

Rotate the harness on the student's shoulders so the Top Attachment Snaps will be easy to hook up.

Adjust the chest strap loosely.

Adjust the Belt Strap so the main lift webs are positioned as shown. The Horizontal Back and Belt Straps should be tightened firmly around the hips.

Adjust the Main Lift Webs and Diagonals so the harness's Hip Junctions are resting squarely on the student' hips.

Tighten the Leg Straps.

Slide the Chest Strap vertically into the correct position and tighten.

Tip: It's recommended to hook up and pre-hang your student so the harness conforms to the student's body. Release the student and check all adjustment points. You may find it necessary to tighten the harness a bit more. The Horizontal Back Strap must be positioned low and securely tightened. This is what keeps the student from falling backwards out of the harness on a hard opening.

On anyone with a larger body frame the Main Lift Webs should be positioned further apart than on a smaller person.

There is no single right way to fit every size or shape of the human body. The harness has 13 points of adjustment. Use them to totally surround and contain the student's body.

Notice how the main lift web is positioned more toward the side of the body than it would be on a smaller person. From this position, six straps, going in every direction, totally contain the pelvic area. This containment appears appropriate on this person when the Main Lift Webs are further apart.

BRIEFING THE STUDENT

(for the first Tandem jump)

One great advantage of Tandem first jumps is that the student does not need to know nearly as much as when making their first solo jump. The student can therefore relax and enjoy the jump rather than worry about forgetting the hundreds of facts necessary to make a jump on their own. With the student more relaxed, their mind will be free to absorb the experience and pick up specific skills impossible to teach effectively in a classroom. If a picture is worth a thousand words, a Tandem jump is worth hours of classroom instruction. In other words it is possible to over train a student before a first Tandem jump. Emphasis should be on safety and awareness.
This section is broken into two sub-sections:

A. Conducting a skills practice
B. Briefing checklist practice

On subsequent Tandem jumps more time can be spent in preparation for the jump, and the student can be given more technical training under canopy. Remember, under this program, Tandem jumping is to be used as a student training aid, NOT for the purpose of giving "joy rides" to the general public.

A. Conducting a skills practice:
Your preparation of the student will make a great difference in how successful the jump is both in skill, performance and enjoyment. A well conducted practice will help the student in the following ways:
Eliminate confusion, make the program clear. This will make the experience an enjoyable one.
Increase the students confidence in the equipment, and in you, the Tandem Instructor.

Take note of the following tips. These will ensure that the practice is effective:
Clearly explain what will happen.
Practice with realism.
Repetition of skills results in instinctive performance of skills.
Obtain feedback from your student. This will let you know if further explanation is needed, and whether they are actually learning.
Practice until perfect, and remember:
What is performed on the ground will almost certainly be performed in the air.

B. Briefing checklist:
When performing a Tandem jump, your student must know the following information and drills prior to disembarking on their first jump. Complete details of these topics and more can be found in Section 5 under Student Briefing. The following will include a summarized list of key points:

Freefall body position drill
Exit practice and hookup procedures
Sit back drill
Steering and flaring the canopy
Landing practice

1) Freefall body position drill
Have student lie horizontally to practice realistically.
Have the student grasp the harness in the elbows back position.
The student's feet should be together with knees bent at 90 degrees.
Practice arm extension, prone, if you intend your student to do it.
Practice the signal, tap on the shoulder, with the arm extension drill.
NEVER REACH AROUND IN FRONT OF THE STUDENT FOR ANY REASON.

2) Exit practice and hookup procedures:
Perform drill at the aircraft or aircraft mock-up.
Practice the proper hand and foot placement and set up for the exit launch.
Have student practice solo as well as hooked up for realism.
Practice the whole sequence from exit.

3) Sit back drill: (For student comfort)
This drill must be practiced on the ground
Practice with the student's harness attached to your own to simulate tension.
Have student sit the harness.

4) Steering and flaring the canopy:
Display steering toggles to your student so they understand what they are and how to grasp them. This would best be done prior to the jump.
Explain how the canopy is steered. Explain how turns are initiated and stopped (no countering necessary), what position is full flight as well as what flaring is and how it is performed. This may be done during the canopy flight.

5) Landing practice:
If the student is to assist with the landing flare, in-air practice is a must. We recommend at least three good repetitions.

PRE-FLIGHT GEAR CHECK

A. Student equipment.
B. Tandem Master harness and containers.

A. Student equipment:
Start by checking to see that your student has a proper, tight fitting jumpsuit and any other items they may need such as a leather helmet, goggles, altimeter and/or gloves. When selecting goggles make sure that they are adjusted to be very snug. As students tend to leave them looser than practical. Students wearing contact lenses should use goggles with as few air vents as possible.

Again, check the fitting of the student's harness to make sure nothing has loosened and that all webbing running ends are tucked in. Check in the following order.

Upper snap position
Chest strap position and tension
Hip strap & back strap position and tention
Leg strap tension and dead-ends secured
Proper staging of side quick ejectors

B. Tandem Instructor equipment:
Prior to checking the system, select your jumpsuit, helmet, altimeter, goggles and any other accessory items you may need. When selecting a jumpsuit pick one that is looser in the arms and legs to help give you extra drag. This will enhance stability with light students and help to eliminate rocking in droguefall. It is recommended that you use a wrist mount altimeter. Chest-mount altimeters positioned between you and the student will probably not give an accurate reading.

Before putting on the Tandem Vector, perform a thorough and systematic gear check. Always start your gear check at the same point and systematically move from item to item until completed. An example of this would be: start at the drogue pouch working up the back of the rig then down the front. When performing the check you should cover the following points:

Drogue release handles
Main pin, closing loop and bridle routing
Disc, safety pin on bridle
Reserve pins and closing loop, RSL routing
3-Ring assemblies
Reserve static line shackle attachment & Collin's lanyard
Cutaway and reserve handles
Main lift web adjustment and symmetry
Pin protection flaps and riser covers
AAD

1) Drogue handles:
Check to see that the drogue deployment and drogue release handles are easily accessible. Each time the handle is checked, grasp as if you intend to pull it.

2) Reserve pin, closing loop, and RSL routing:
Open the reserve flap and make sure the pin is properly seated and that the condition of the closing loop is good. Don't push the reserve pin too far down into the loop (this will cause it to twist, making the eyelet of the pin stick up instead of lying flat). Illustration #3/1-101 shows the pin correctly seated. Check the RSL routing.

3) 3-Ring assembly:
Make sure the rings are hooked up in the proper sequence and that the locking loops are not frayed. The loop should pass through only the small ring, then through the riser grommet, and finally through the housing grommet, which is secured with the yellow cable as shown in illustration #3/1-102.

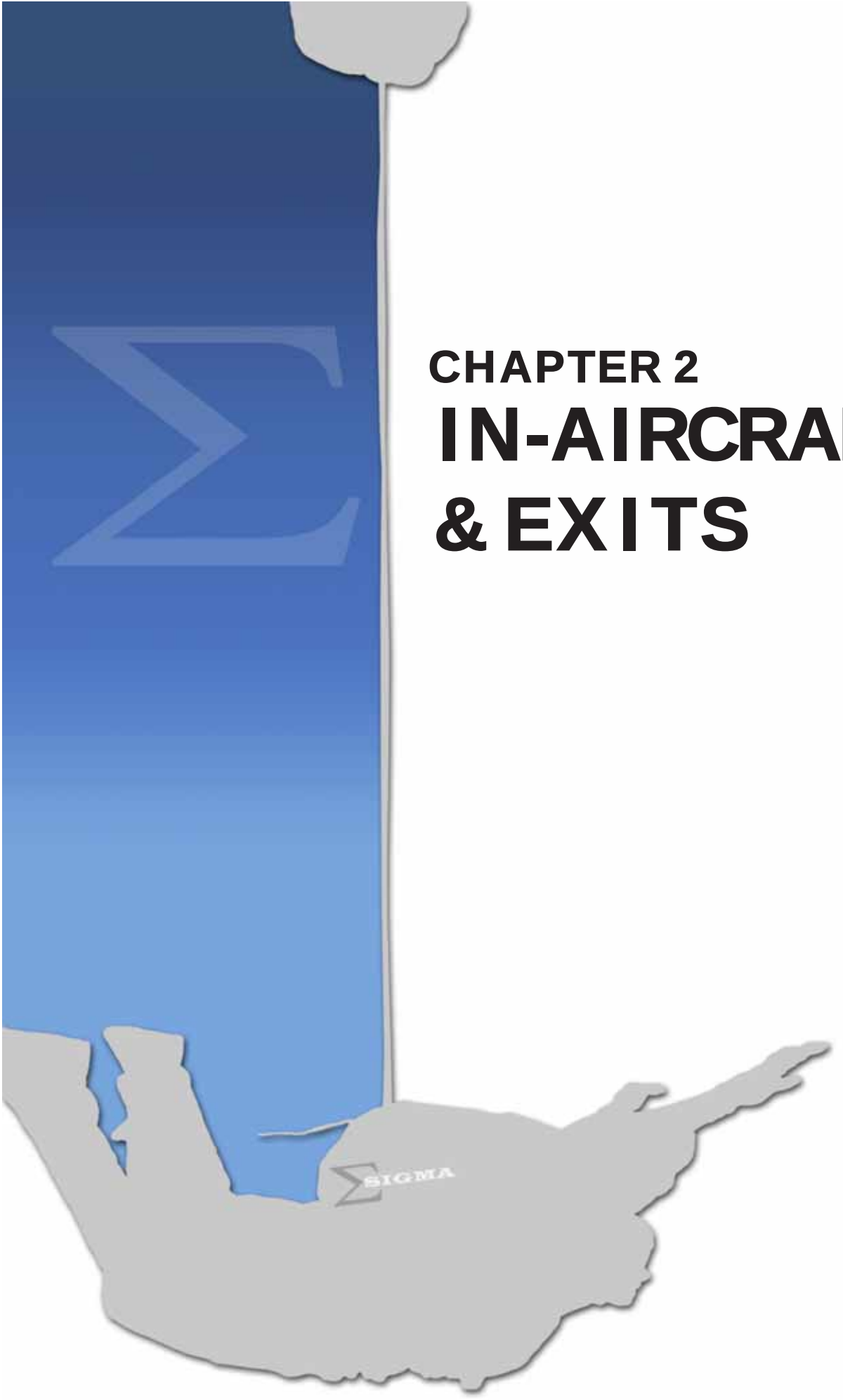
4) Cutaway and reserve handles:
Check that the handles are securely placed. The velcro attaching the handle should be fully mated, with the handle being placed up as close to the housings as possible to prevent excess exposed cable.

5) Main Lift Web (MLW) symmetry:
Adjust the MLW to the length that fits you best. Check both sides for symmetry.

6) Secure pin protector flaps on the main and reserve. Inspect the riser covers for proper alignment.

WARNING: Riser covers perform a vital job. Leaving the risers unprotected could result in a main/reserve canopy entanglement if improper emergency procedures are used during a total malfunction. Unprotected risers can also be a danger when moving around the cabin of small aircraft.

CHAPTER 2
IN-AIRCRAFT & EXITS



IN-AIRCRAFT GEAR CHECK

This section is split into areas of safety checks:

A. Pre-exit preparation
B. Pre-exit gear check
C. Drogue handle check

A. Pre-exit preparation:
While in the aircraft (before jump altitude is reached), verbally acknowledge the hookup of each top snap as it is clicked into place. Make sure the side attachment quick ejector snaps are secure and are comfortably tight. Make sure that student's chest strap is not overly tight.

B. Pre-exit gear check:
Plan ahead of time and brief someone on your load to do the final pin checks for main and reserve. Before exit, the Tandem Instructor should physically check the following items:

1) All snaps
2) All handles in order of use
3) Reserve static line
4) Student's chest strap, helmet, and goggles.

C. Drogue handle check:
Because the drogue release handle is located on the bottom left corner of the rig, it can be dislodged off it's housing by movement in the aircraft or during exit as you pass through the door. It is therefore recommended that the Tandem Instructor check the security of the handle just before exit and then again just after drogue deployment on every jump. It is better to realize you have a floating handle at 10,000' rather than 5,500'.

Always follow this process:
1) Check security of all handles.
2) Move to exit position.
3) Re-check security of the drogue, and drogue release handles.

EXITS

Exact exit procedure varies with different aircraft, but the basics remain the same: you must maintain total control of the student during exit and freefall. This section will deal with:

A. Exit techniques(2)
B. Exit tips
C. Exiting different aircraft

A. Exit techniques (2):
Two exit procedures are shown in this manual. The first, a poised exit, allows total control of the student body position during exit because the student assumes the correct freefall body position prior to exit. All the student has to do is stay put and you get a good exit almost every time. This poised exit can vary with different aircraft and door types. The similarity is that you will leave in a head high position after leaving the aircraft whether you are exiting in a crouched or backed-out standing position. This position can be done from, a tailgate (Casa), or a side door (Twin Otter, Porter).

The second procedure is a diving type exit. This requires the student to change body position immediately upon exit. If the student cooperates, then the Tandem Instructor's job is much easier. If the student gets into a less-than-ideal body position, then the Tandem Instructor will have to work harder to maintain stability. This exit can be done from kneeling, sitting or standing positions.

Diving exit:
This technique, for many aircraft, is most preferred as it limits the amount of time the Tandem pair spends at the open doorway, or hanging outside the aircraft. There have been many accidental deployments in the past due to student interference during climbout for poised or backout exits.

The diving exit will require a more intense arch by the Tandem Instructor to maintain stability. It's recommended that you spend a few extra minutes on the ground working on the student's body position as well. This means the student will have to transition to the freefall body position immediately after the exit.

Illustration #3/2-109 shows the Tandem pair sitting at the door edge of a Pilatus Porter with feet on the step, just prior to diving out.

B. Exit tips:

Ideally:
1) Spend as little time as possible while hanging onto the outside of the aircraft, or while near the door. The longer you spend there, the more you increase the chance of something going wrong.
2) The student must have a good grip on their own main lift web. A student with free hands can only get you into trouble.
3) The student's head should be back, body arched, feet together, and weight totally supported by you, before exit.
4) The actual exit should be so smooth that the student hardly notices the difference between hanging under you, outside the aircraft, or in freefall.
5) The fall away from the aircraft should be head high and very stable. The more unstable your exit and fall away, the more likely the student is to move, which will cause trouble.
6) If exiting from a small side door such as that found on Twin Beeches, Queen and King airs, etc... a kneeling, sitting or walkout exit is recommended. Do not use a standing back-out exit as the likelihood of an accidental activation is high.

C. Exiting different aircraft

Five classes of aircraft come to mind.
1) Cessna with step and strut.
2) Cessna, Piper, or Beech with small cargo door (one in which you can't stand up - usually no outside step).
3) Caravan or Twin Otter with large cargo door.
4) Skyvan, Casa, or other tailgate aircraft.
5) Helicopter with side door.

Before taking a student out of an unfamiliar aircraft the Tandem Instructor must first take an experienced jumper as student once or twice until he is comfortable with the climbout and exit from that aircraft.

It is difficult to over emphasize the importance of a stable exit on EVERY Tandem jump.

Note: A Tandem jump does not proceed directly from exit to drogue fall. There is freefall in between the time you leave the aircraft and the time the drogue deploys. This is where stability is gained from freefall body position and easily maintained without the drogue. Do not use the drogue to gain stability. Documented proof that a Tandem Instructor routinely uses the drogue to gain stability will quickly result in his rating being suspended.

CHAPTER 3
FREEFALL & DROGUE-FALL

ALTITUDE AND TIME RECOMMENDATIONS

When performing tandem jumps the following altitude recommendations apply:

A. Exit above 7,500 AGL.
B. Deploy drogue within 5 seconds after exit.
C. Minimum exit altitude is 4,500 AGL (not applicable during training or probationary jumps).
D. Minimum main deployment altitude is 4,000 AGL. (5,500 AGL is recommended)
E. Reserve initiation altitude is 2,500 AGL.

A. Exit aircraft above 7500 AGL:
It is important to exit with sufficient altitude to respond to a variety of situations.
The speed and altitude lost during unstable freefall without the drogue is hard to imagine for the uninitiated Tandem Instructor candidate. Unusual situations such as a collapsed drogue, or drogue in tow will eat up your altitude faster than you can imagine. Refer to Section 4: Emergencies and Malfunctions, for details on the possible problems you may encounter.

B. Deploy drogue within 5 seconds after exit:
This gives the Tandem Instructor time to feel the stability of freefall, but is before terminal velocity, saving wear and tear on the parachute system.
If the drogue is deployed during Tandem terminal (170+MPH), and functions properly it will take approximately 10 seconds to reduce your terminal velocity to normal (120 mph). Therefore, you should wait at least 10 seconds after deploying the drogue in this situation before you deploy the main by pulling the drogue release handle.
In other words, if you want to deploy the drogue after Tandem terminal is reached, you must allow two thousand feet after deploying the drogue for deceleration before pulling the drogue release handle and deploying the main. This is not to say that the system will not work if you release the drogue immediately after deploying it at Tandem terminal. It is to say that the faster you go, the harder the openings, which will surely reduce the life of the parachute system. Lastly, deploying the drogue approximately 5 seconds after exit will allow you time to assess a drogue malfunction situation, thus giving you ample time to deploy the reserve before Tandem terminal has been reached.

C. Minimum exit altitude is 4500 AGL:
For the same reasons stated in (A), this is the absolute lowest you should exit. If you experienced any problem from this altitude you would have to respond quickly and decisively to get the situation under control and still leave sufficient time to respond to malfunction situations. These lower exit altitudes should only be reserved for the most experienced Tandem Instructors.

D. Minimum main deployment altitude is 4,000 AGL and the recomended altitude is 5,500 AGL
This is a recommendation that should be taken very seriously. The added complexities of performing emergency actions as well as the speed with which you will pass through the remaining 4000 feet leave little time to deal with any other problem which may arise, such as student interference. The Tandem pair should always exit last due to this higher planned opening altitude. This will help prevent any traffic problems with other jumpers. Remember your AAD will "Fire" at approximately 2,000ft.

E. Reserve initiation altitude is 2,500 AGL
For all the reasons mentioned above, do not delay the execution of reserve procedures. If the situation calls for it, make a decision and carry it out. The following chart (Fig. 1) shows the difference between freefall and drogue fall. Notice the increase in speed and the decrease in available time.

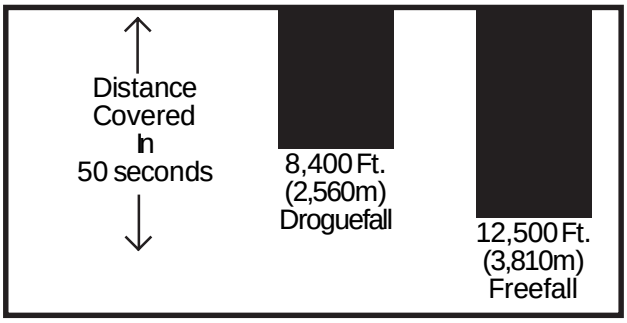


Fig. 1

STABILITY CONTROL

A. Arch
B. Anticipation
C. Manipulation

A. Arch:
What the Tandem Instructor does is more important than what the student does. The Tandem Instructor should concentrate on good training for the student in the proper body position, and then on his own body position on the exit with focus on using the relative wind to achive instant stability. If the Tandem Instructor attains a good arch right out the door, then chances are the pair will gain stability easily.

Incredibly enough, many instability problems are caused by a bad Tandem Instructor body position. Specifically, many problems start because the Tandem Instructor fails to throw a hard arch on exit, and ignore the relative wind .

While a poor exit resulting in instability is not inherently dangerous (except when it leads to unstable drogue deployment), it is nonetheless unnecessary and unacceptable. A poor exit is defined as any exit creating a combination of uncontrolled loops or rolls immediately after exit. It is not acceptable to loop an AFF exit, nor is it acceptable to loop an airplane on takeoff with a first time student, and Tandem is no different. While everyone will "blow" an exit every now and then, it should be the rare exception, and not the norm.

Ironically, the smallest students can be the most difficult to control.

Example: When you hit a badminton birdie, the weighted end always ends up below. The same can hold with a Tandem pair. If a large Tandem Instructor makes a poor exit with a small student, it is very possible for them to end up back to earth (with the heavier of the pair below).

B. Anticipation:
The key to keeping control is being able to recognize a potential problem prior to it becoming a real problem. Students sometimes do crazy things during the first few seconds after exit. Usually, after the initial shock of freefall their eyes will reopen and they will attain their body position assisting stability. Immediately following the exit launch, assess the student's body position as you arch to maintain stability. If the student remains in the folded de-arch position of the diving exit or attains a de-arched position after the exit launch, you may have to apply additional control techniques to maintain heading and stability.

C. Manipulation:
One such control technique is to physically manipulate the students body into an arch. To do this reach around with your arms and/or legs and pull him back into the correct position. Grab the arms only between the elbow and the wrist. This makes it hard for the student to grab you. Hold this interlocked or bodylocked position until you have ensured or regained stability. Manipulation should only be used as a last resort if the Tandem Instructor's hard arch is ineffective.

This technique must be used with caution as it increases the possibility that the student will grab your arms and prevent you from pulling. There is simply no telling what a student might do if presented with an "earth-sky-earth-sky" situation on his first jump.

DEPLOY DROGUE

The drogue may be deployed at any point during a freefall, from soon after exit to after Tandem terminal velocity (170 mph) is reached. It is recommended that if stable, the drogue be deployed in the first 5 seconds of freefall.

Recommended drogue jump scenario:
A. Exit aircraft above 7500' (2500m) AGL.
B. Ensure stability prior to deployment.
C. Drogue deployment.

A. Exit aircraft above 7,500' (2500m) AGL:
It is important to exit with sufficient altitude to deal with any potential problem ensuring main deployment by 4,500' (1500m) AGL.

B. Ensure stability prior to deployment:
Be stable and face to earth. Be sure that the student's body position is good enough to allow you to reach in and grab the drogue without losing stability. If the student's body position remains so bad that it causes a problem, FIX IT before throwing the drogue.

We cannot emphasize this point enough: **DO NOT USE THE DROGUE TO GAIN STABILITY.** Be stable before the drogue is thrown (unless there is no other alternative and altitude is getting low).

Using the drogue to get stable should be used only as a last resort since it is better than pulling the reserve while unstable.

NOTE: It is very important to retain stability throughout the exit sequence of every Tandem jump. In the past few years of the Tandem program, disturbing stories have come forth of Tandem Instructors having difficulty making stable exits or of keeping drogue fall smooth. There are even cases of the Tandem Instructor routinely using the drogue to gain stability after exit. The fact is, the ability to make a stable exit should be a very basic one for every Tandem Instructor.

Therefore, any Tandem Instructor who throws the drogue before being stable and face to earth should be immediately grounded. This is a potentially dangerous practice which cannot be tolerated. Likewise, anyone who witnesses such practices should immediately report the Tandem Instructor to the United Parachute Technologies and the USPA.

C. Drogue deployment:
As practiced in the equipment operations section of this manual follow these steps:
1) Locate drogue handle and grasp firmly using proper technique.
2) Pull drogue from pouch and throw aggresivley to your side at full arm extension.
3) Release immediately once forward of the line of your shoulders.
4) Watch drogue inflate over your right shoulder.
5) Once drogue is inflated immediately check the drogue release, both primary and secondary cutaway, and reserve handle position.

You may or may not feel the drogue deploy. We recommend you glance over your shoulder just after you've thrown it so you'll know it has deployed and inflated correctly.

DROGUE FALL CONTROL TECHNIQUES

The drag of the drogue on your harness will place your body in a certain attitude in freefall. The drogue will resist your efforts to change this attitude. If you try to change your pitch attitude (head high/head low) too much, you will rock up and down. Excessive rocking may be uncomfortable, unnecessary, and if it becomes extreme, can actually open the main container while the drogue is still attached. It can also cause the student's feet to become entangled with the drogue bridle.

There are four things you can do to minimize rocking:

1. Tandem Instructor corrects body position. The best way to stop rocking is for the Tandem Instructor to simply relax and lie still in freefall not moving the legs back and forth.

2. Teach the student correct body position on the ground (head back, hands on harness, back arched from shoulders to knees, and feet tucked up).

3. Wear a big, baggy jumpsuit and put a tight suit on your students. The air hits the student first. If the body position is not perfect, you cannot adequately control exit or drogue fall unless you wear a big suit. As you gain experience, suit size is much less critical.

4. Snug down the hip straps so they are comfortably tight. Straps that are too tight or too loose can cause the rocking action as well.

ARM EXTENSION
(OPTIONAL)

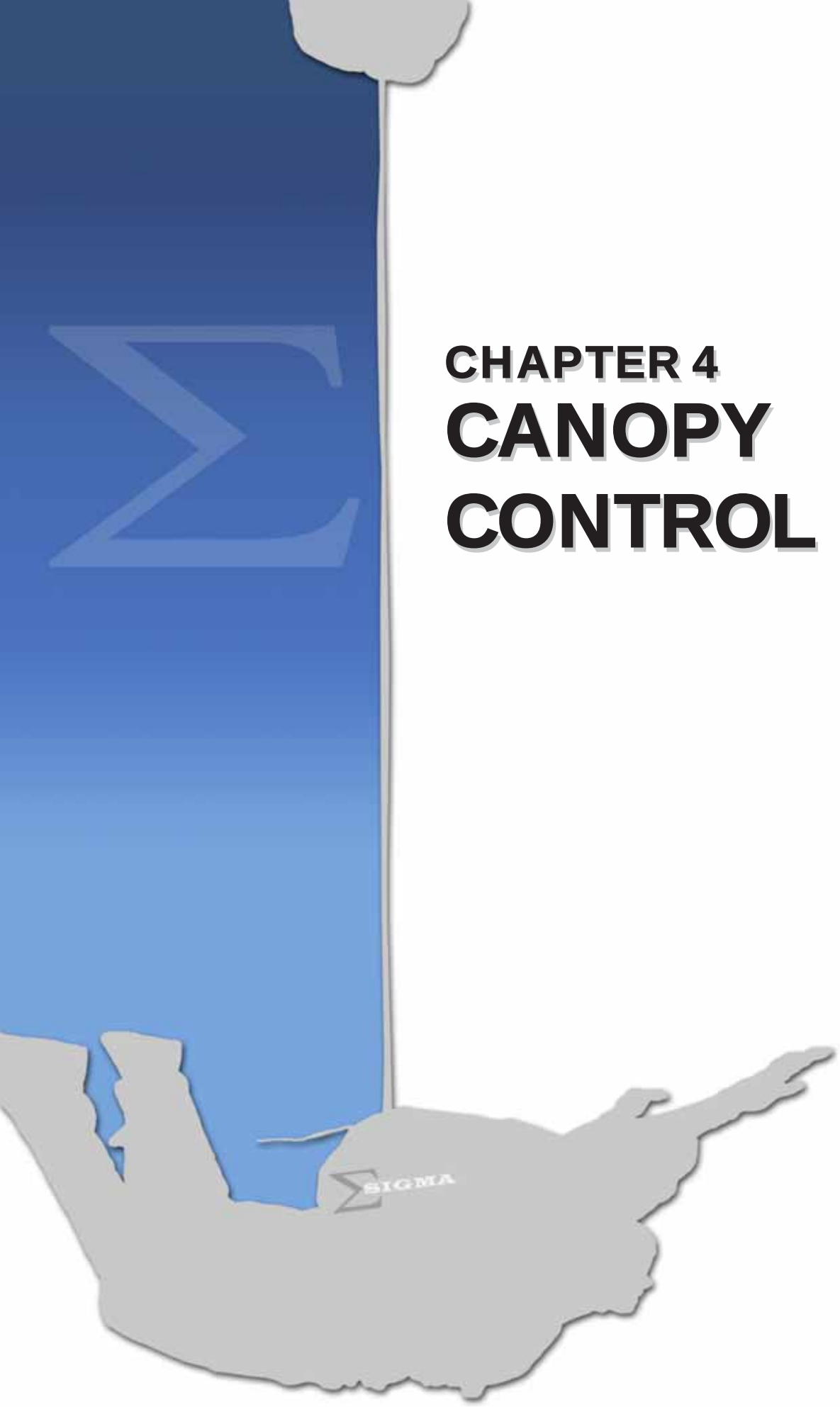
Once the drogue is deployed, tap the student's head or shoulder to indicate it is time for him to put his arms out in normal freefall position. DO NOT reach around and pull the students arms into position, as this would give the student a chance to grab your arms. Another recommended technique is to grab the student's elbows and push them up and away from their body, this will usually cause them to release their grip on the main lift web.

DROGUE RELEASE

The drogue may be released at any time during "drogue fall." To release the drogue (thus deploying the main canopy), simply pull the drogue release handle located at the bottom left-hand corner of the main container and on the right front strap. A pull of approximately 3-4 inches will release the drogue or the secondary drogue release situated on your right upper legstrap.

When you pull the drogue release handle, you will feel an immediate trap door effect. Meaning you will accelerate momentarily until the main canopy starts to inflate. The now partially collapsed drogue acts as a pilot chute and pulls your canopy to line stretch in about half a second. The canopy will streamer for a second or two and then open slowly. (If you pull the release handle completely and do not feel this sensation, your drogue has failed to release.)

This is a critical time for awareness. If anything major goes wrong, a bag lock or streamer, your speed will pickup quickly. Maintain altitude awareness and exercise emergency procedures promptly.



CHAPTER 4
CANOPY CONTROL

Tandem canopy openings are generally quite comfortable and smooth. The opening sequence usually begins as a slight streamer with the slider high. The fall rate of the Tandem pair decreases steadily for several seconds in this configuration. Then the slider quickly descends and the canopy opens to about 90% of its normal size, with end cells open and the slider down almost to the links.

Upon opening
Steering the canopy
Landings

UPON OPENING

A. Canopy check.
B. Release toggles.
C. Check emergency handles and harness.
D. Instruct student to sit back in the harness.

A. Perform Canopy Check:
Watch the opening. Check canopy condition while locating the toggles. Release brakes using the lower student toggles. Perform a controlability check, turn the canopy in both directions, then flare the canopy.

B. Release toggles:
Using the student toggle position, hand the student the steering toggles while saying "grab the toggles the same way I have them." After the student has placed their hands in the toggle loop, remove your hands and pump down the slider and tell student to check the canopy. (Tandem Instructor is checking sky for other canopies at this time.)

C. Stow and check handles and harness.
1) Check the cutaway and reserve handles (grip them to reinforce their location and security).
2) Look at the back of the main riser and check to see that the cables are routed properly and that they continue into the channel as shown in illustration #3/4-115.
3) Check the top student attachment snaps.
4) Check the student harness for comfort.
5) Loosen the student's chest strap if it is too tight.
6) Tell the student you will make the harness more comfortable. Do not tell them that you accomplish this by releasing the lower attachment quick ejectors, pulling to loosen the webbing, and re-attaching.
7) If ground winds are high, release the reserve static line shackle incase you have to cutaway the main canopy to avoid a drag situation after landing.
D. Instruct student to sit back in the harness.
Have student perform the sit back in harness drill as described in student briefing in Section 5 of this manual. Student should lift each leg and ease the leg strap and pad forward several 1-2 inches to alleviate the pressure on the inside of the thigh.

STEERING THE CANOPY

A Tandem system is the ultimate suspended harness. With it you can give the student actual hands on experience controlling a ram-air canopy. How much can be accomplished depends on the student's aptitude and previous training or experience. Not everything can be covered on the first jump. Learning points that would be covered on the first jump are listed in "Student skills for first jump" Chapter 1, Section 5 of this manual.

Once the student has a firm grip on the toggles, provide commands as to the direction that you would like them to steer. Encourage them to pull down part way initiating a slow, flat turn and to pull down all the way performing a full bank turn.

Demonstrate forward flight with hands all the way up (this can be a difficult position for the student). As you set up for final approach explain what you are doing with reference to the target. If you plan to have the student flare for landing then have the student perform 3-5 practice flares while at altitude with feedback of their technique and overall performance.

NOTE: If student reports nausea at any time, keep turns to a minimum and tell student to look at the horizon and breath normally. Have student adjust leg pads or perform sit back in harness drill again. If student's fingers start to tingle, have him release toggles and drop hands to side. An overly tight MLW will restrict upward arm and shoulder movement. Full flight arm position can be very tiring and difficult for the student.

LANDING

In this section you will cover:
A. Prepare for landing
B. Landing
C. After landing

A. Prepare for landing:
1) Landing position:
At about 3,000', remind student about landing body position and leg tension as shown in illustration #3/4-116. Emphasize that the feet and knees should be together, with knees slightly bent, unless instructed otherwise.

2) Enter landing approach pattern:
At about 1,000', enter down wind leg of pattern. Assess the surface winds as you fly past the target area to make final alterations to your final approach set up. Be on the wind line high enough to make corrections to your approach if you've mis-read the winds. Hold the wind line to landing making whatever glide angle adjustments are necessary. Try not to sit in a braked position for any length of time as it will tire your arms out for the flare.

If the winds are high and there is no catcher present, it is permissible to release the reserve static line at a low altitude. With the reserve static line detached, you may cutaway the main after landing if you're being dragged without activating the reserve.

3) Flare canopy:
First-time students can cause a lot of trouble unless they are well prepared and rehearsed. DO NOT allow an untrained student to assist in the flare.
***** If student has received adequate ground training and is well rehearsed in the air, have him assist you as you turn base and final and assist the flare on your command. A good command to use would be "Hands up, feet up and FLARE." Remind the student to "Not over power you" During the flair.

Note: Do not depend on the student to help with, or have the strength to assist with the flare. Always count on doing the flare yourself. If the student has problems with the in -air flare practice DO NOT let them help with the flare.

B. Landings:
There are three kinds of Tandem landings:

1. Stand Up
2. Running
3. Sliding

1. Stand up
When the wind is over 10 mph, a proper flare should yield a no forward speed stand up landing. All a student has to do is keep enough leg tension to support his or her own weight.

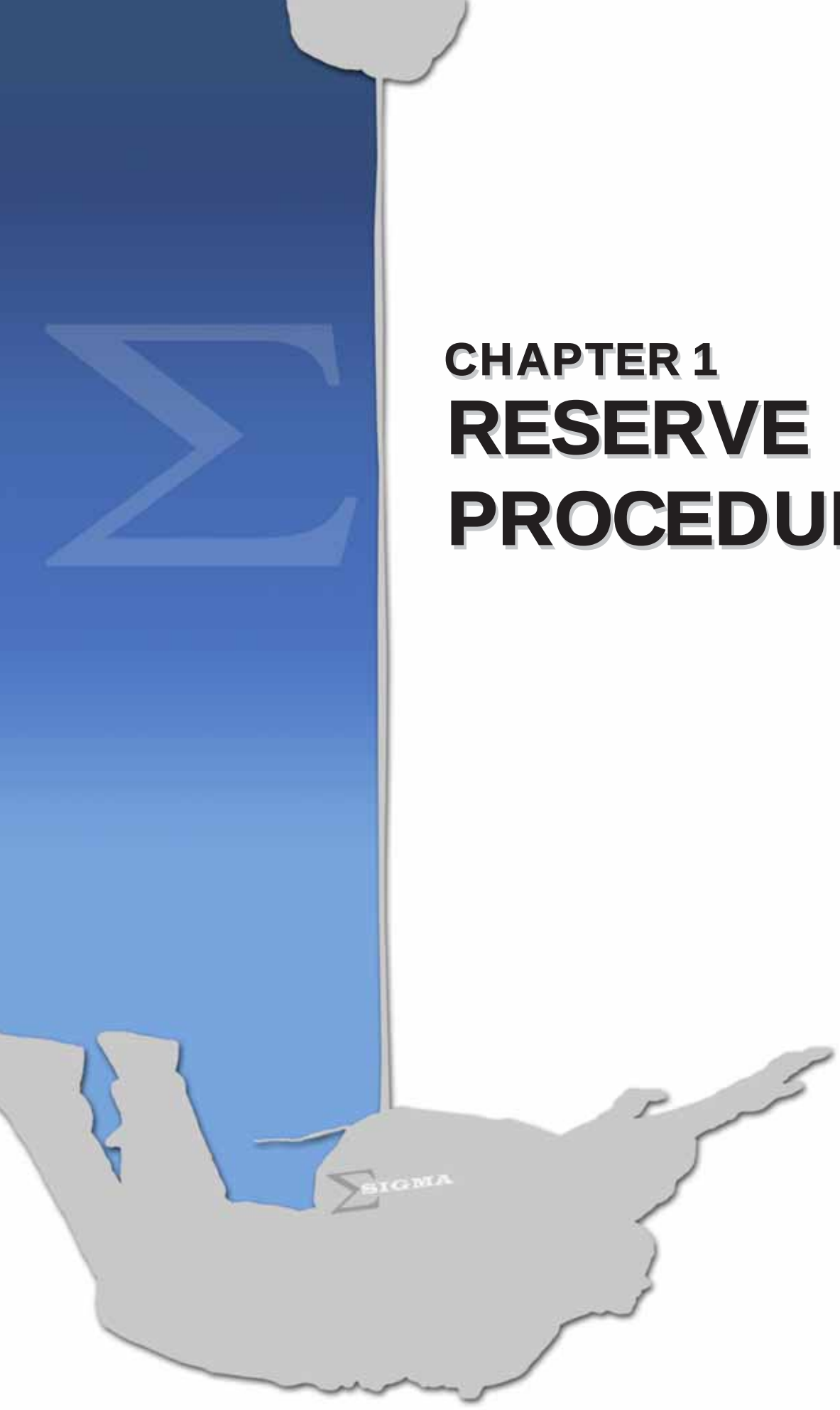
When the wind is high, have a canopy catcher waiting for you at the landing area. Hand ONE toggle to the catcher at touchdown and have him run into the wind with it to collapse the canopy. Remind the student to let go of the toggle immediately after touchdown so that the catcher can do his job. This is one of the things you should rehearse with the student during flare practice under canopy.

2. Running landing
When the wind is more than 5, but less than 10 mph, both Tandem Instructor and student must take a few steps after touchdown. If the student does not have proper leg tension or does not take those few steps, he or she will fall down and pull the Tandem Instructor down with them. This kind of landing is actually the most difficult and takes considerable student preparation. The lighter the wind, the more the student must raise the legs up and forward, with knees bent, prior to touchdown. The Tandem Instructor must be able to see the feet and knees when looking over the students shoulder. The Tandem Instructor can also use his feet to coax the student's feet into the proper position.

3. Sliding landing:
When the wind is less than 5 mph, the day hot, the student heavy, and/or the field altitude high, a sliding landing is probably the best choice. To prepare for a sliding landing, the student must lift his or her legs and put them well out in front prior to touch down. A good slide requires a good flare to almost zero rate of descent. The Tandem Instructor sits back in his harness (thus pulling the student back as well) and is prepared to take the landing on his feet, but continues to sit back after initial ground contact to a slide on his butt with the student literally sitting in his lap. It is important that the Tandem Instructor sit back on landing so the student will not have a tendency to lean forward at touchdown (which can cause the Tandem Instructor to roll over on top of the student.) Never try to take any vertical force on your butt. Serious injury could result.

So, JUST before landing, remind the student about leg tension, make your decision about which landing you are going to use based on ground speed and shout “stand-up” or “run” or “feet-up” into the student’s ear.

CHAPTER 1
RESERVE PROCEDURES



EMERGENCY RESPONSE SEQUENCE

It is very important to take the time to think out and rehearse how you would respond to different situations before you are ever faced with them. Always read the Tandem accident and incident reports to learn from the mistakes of others. Study this information as if your life depends on it, because it does!

Unusual or emergency situations while performing Tandem jumps require quick assessment and decision making with the proper reactions. You must be familiar with all options available for both right and left hand response. It is equally important to have a complete understanding of the proper sequence of actions needed should you experience a situation that you do not fully understand. The addition of the drogue system adds extra procedures which are different than those you would perform when jumping solo. Refer to Malfunction Tree charts on pages 80-81.

A. Reserve procedures:
Out-of sequence deployments
Total malfunctions
Partial malfunctions
Canopy transfers

1) Out-of-sequence deployments:
In the event of an out of sequence deployment or something occurring that you have not seen before, follow your normal sequence of deployment prior to second guessing what the problem may be. That sequence is:

***** deploy the drogue
***** pull either the primary or secondary drogue release handles, or both.
***** assess main canopy condition and cutaway
***** pull one of the reserve deployment systems (either the reserve ripcord or the ball handle on the RSL.)

2) Total malfunctions:
Do not deviate from this sequence unless you can clearly identify a problem that has not been covered by this manual.

***** deploy the drogue
***** pull the primary and the secondary drogue release handles
***** pull one of the reserve deployment systems

3) Partial malfunctions:
***** Ask student to assume freefall position. (Hands on harness, feet together, knees bent at 90 degrees and body arched.)
***** Scissor student's legs between yours.
***** PULL THE GREEN HANDLE (BREAKAWAY) with right hand. Insure a clean breakaway. PULL THE RED RESERVE RIPCORD with the left hand. **REMEMBER - GREEN FOR GO...RED FOR STOP.**

NOTE: The reserve static line should pull the reserve pin, but never rely on it. It is possible to release the reserve static line before breaking away. This will enable you to go back into freefall without activating your reserve. As soon as you regain stability (no more than 5 seconds), **PULL THE RED HANDLE**. This procedure is rarely if ever indicated.

4) Canopy transfers:
A canopy transfer, where the reserve is deployed without first jettisoning the main, is not recommended with a ram-air reserve under normal circumstances, nor is it recommended with Tandem. The reserve pilot chute may not have enough drag to extract the reserve freebag from its container. If it does, the resulting deployment will be unpredictable.

RESERVE CANOPY PROCEDURES

Steering the reserve parachute:
The reserve is set up exactly the same as the main, except the toggles do not have the double loop for student assistance, but are set up for Tandem Instructor solo control.

CHAPTER 2
AIRCRAFT EMERGENCIES & STUDENT REFUSAL

Aircraft emergencies:
A. Below 4,000 Feet, engine out (500m)
B. Below 4,000 Feet, catastrophic airframe failure (500m)
C. 1,500 - 4,000 Feet> > (500m-1200m)
D. 4,000 + Feet> > (1200m & up)

PROBLEM: Aircraft emergency requiring exit at lower altitude than planned.

REACTION: Because of the steps required to deploy the main canopy correctly, it may be better to pull your reserve ripcord in the event of a low-altitude emergency exit. Each Tandem Instructor should develop his own emergency exit procedures designed for the aircraft he jumps from.

ANALYSIS: Due to the high freefall velocities that must be dealt with in Tandem, the United Parachute Technologies Tandem canopies open a little slower than most square reserves. Otherwise, non-drogue Tandem terminal openings (160-180 MPH or 300kph) would be hard and uncomfortable. It is recommended therefore, that no emergency exits from disabled aircraft be made below 4,000' AGL (500m). There are different recommended procedures for different altitudes.

A. Below 4,000' or 500m (aircraft engine out):
If the aircraft is stable and gliding, then stay with the aircraft. (This would be in the case of an engine out.) When the aircraft has descended through 500 feet (150m), unhook your student and instruct them to put on a seat belt. Doing this will facilitate the climb out after a bad landing.

B. Below 4,000' or 500m (catastrophic aircraft failure):
If the aircraft is on fire, or in a spin, or if the wing or some other large control surface has come off, get out and pull the reserve ripcord. If death is assured by staying in the aircraft, then leave. Some chance at survival is better than none.

C. Below 4,000': (500m-1200m)
Exit the aircraft and pull the reserve ripcord.

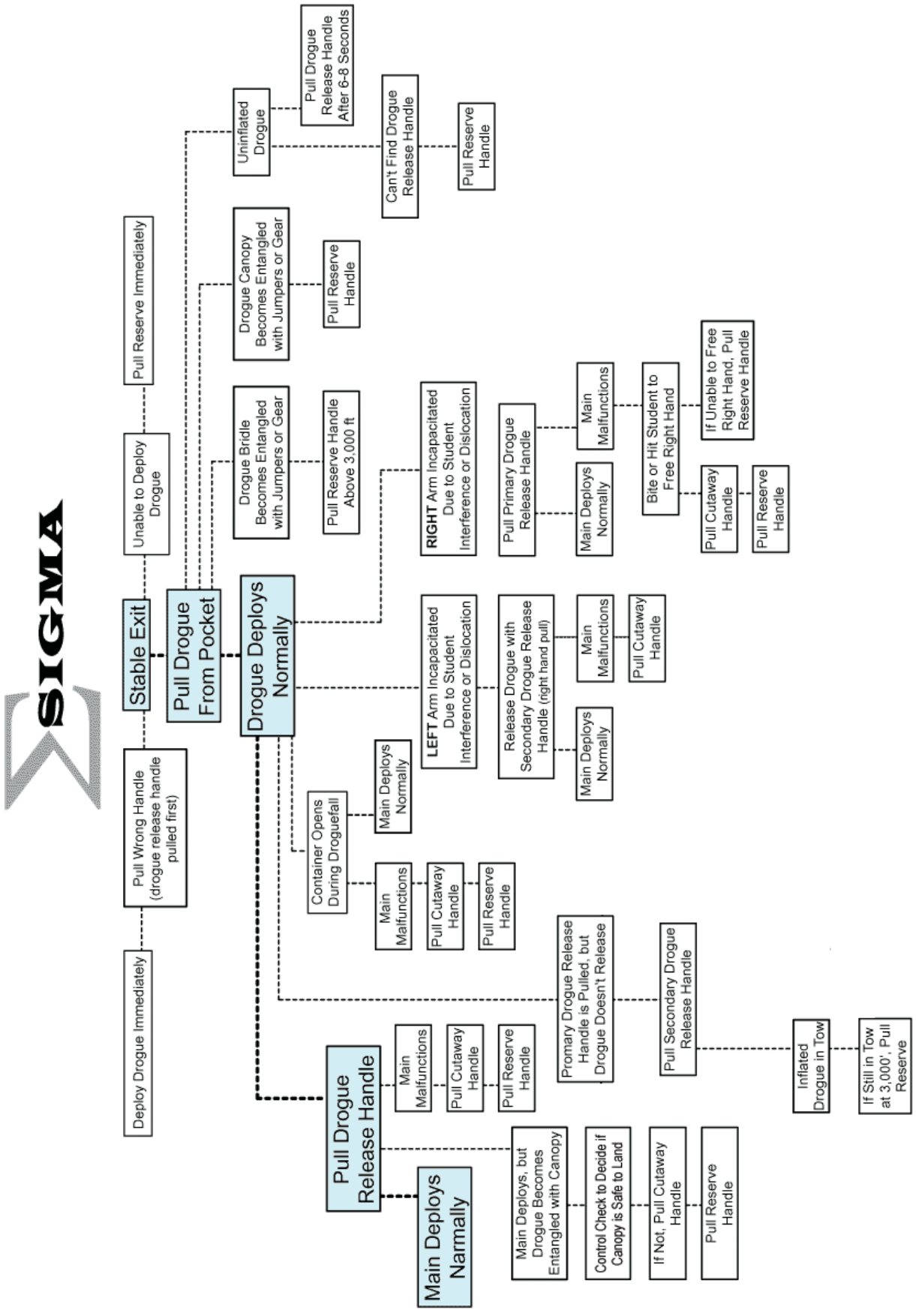
D. Above 4,000': (above 1200m)
Exit the aircraft, deploy the drogue, pull drogue release handle at appropriate altitude. It is important to note here that not all Tandem systems work the same way. On the Tandem Vector, the drogue will not fully inflate if the release handle is pulled first. In fact, if the drogue release handle is pulled first, and then the drogue thrown, a 10 second main canopy deployment can be expected. Not a good idea if you're low. The correct procedure is to throw the drogue, wait for it to inflate (1-2 seconds) and then immediately pull the drogue release handle. On the Sigma you can not release the drogue before deploying it. The obvious advantage here? No mind games to play, no tricky scenarios that require out-of-sequence handle pulling. You must always operate the handles in the same order each and every jump. No matter what the circumstance, pull the operating handles in the same order.

Student refusal:
There are two different situations which may arise: 1) The student refuses while still in the aircraft, or; 2) The student refuses once on the strut or outside of the aircraft. Follow the procedures below:

1. If the student verbally lets you know they do not want to jump then you must bring them back into the aircraft unless the aircraft door is restrictive in a way that it would be dangerous to re-enter the aircraft(accidental deployment of either parachute system).

2. Once back into the aircraft get the student comfortable and ask what the problem is. Do not assume that it is fright, as it could be some physical discomfort.

3. Once you have established the problem decide on whether to make another attempt or not. If it seems to be a psychological problem, re-assure the student of the ease of tasks and reliability of doing Tandem jumps. If they still do not want to jump, descend with the aircraft, accompanying them to the ground.


SIGMA
Stable Exit
Unable to Deploy Drogue
Pull Reserve Immediately
Pull Wrong Handle (drogue release handle pulled first)
Deploy Drogue Immediately
Pull Drogue From Pocket
Uninflated Drogue
Pull Drogue Release Handle After 6-8 Seconds
Can't Find Drogue Release Handle
Pull Reserve Handle
Drogue Canopy Becomes Entangled with Jumpers or Gear
Pull Reserve Handle
Drogue Bridle Becomes Entangled with Jumpers or Gear
Pull Reserve Handle Above 3,000 ft
Drogue Deploys Normally
RIGHT Arm Incapacitated Due to Student Interference or Dislocation
Pull Primary Drogue Release Handle
Main Malfunctions
Main Deploys Normally
Bite or Hit Student to Free Right Hand
If Unable to Free Right Hand, Pull Reserve Handle
Pull Cutaway Handle
Pull Reserve Handle
LEFT Arm Incapacitated Due to Student Interference or Dislocation
Release Drogue with Secondary Drogue Release Handle (right hand pull)
Main Malfunctions
Pull Cutaway Handle
Main Deploys Normally
Container Opens During Droguefall
Main Deploys Normally
Main Malfunctions
Pull Cutaway Handle
Pull Reserve Handle
Promary Drogue Release Handle is Pulled, but Drogue Doesn't Release
Pull Secondary Drogue Release Handle
Inflated Drogue in Tow
If Still in Tow at 3,000', Pull Reserve
Pull Drogue Release Handle
Main Malfunctions
Pull Cutaway Handle
Pull Reserve Handle
Main Deploys Normally
Main Deploys, but Drogue Becomes Entangled with Canopy
Control Check to Decide if Canopy is Safe to Land
If Not, Pull Cutaway Handle
Pull Reserve Handle

CHAPTER 3
FREEFALL

ACCIDENTAL DEPLOYMENTS

Rapid drogue throw:

It is not necessary to deploy the drogue immediately upon exit. As a matter of fact, throwing the drogue too soon after exit can be dangerous. There have been cases of Tandem Instructors throwing the drogue directly into the tail of the aircraft. (Obviously a dangerous situation since the drogue could entangle with the aircraft - it has happened). Therefore: Exit, gain stability, and then throw the drogue.

Untimely pulls:

A. High

B. Low

A. High pull:

Problem: Here is the scenario for the most common complication that arises on Tandem jumps where the student knows where the handle is and knows how to pull it: The Tandem pair exits the aircraft. The student panics and pulls the drogue release handle after the Tandem Instructor deploys the drogue and the main deploys instantly.

This can endanger anyone exiting with the pair, above and in line with the relative wind, such as a cameraman, since he may inadvertently be directly over the pair as the main deploys unexpectedly.

B. Low pull:

Problem: This situation may occur when the student is assigned to pull the secondary drogue release. Following the pull signal the student gropes and has difficulty in finding the secondary drogue release handle. Meanwhile, the Tandem Instructor reaches back for the drogue release handle. So he waits, sure that the student will get it any second. Meanwhile, the delay causes the pair to open below the planned altitude.

In the very worst case scenario, the Tandem Instructor reaches back for the primary drogue release handle but cannot find it. He then deploys the reserve - just as the student finally finds the handle and deploys the main....

REACTION: On every jump, the Tandem Instructor should throw the drogue and perform practice pulls to both drogue release handles, as well as the reserve ripcord. This simple exercise can eliminate the above mentioned scenario.

FREEFALL CONTROL PROBLEMS

PROBLEM: Instability following exit.

REACTION: Upon exit, the Tandem Instructor must assume the hard arch position, with arms and legs fully extended.

ANALYSIS: If the student has the hands on the harness, and the legs are bent at the knees with an arched body position, the Tandem pair will be stable almost instantly. If the Tandem Instructor fails to arch and the student's arms are out with poor lower body control, the pair might stability difficult to achieve. A good body position from the Tandem Instructor will almost always overcome the shortcomings of the student's body position.

PROBLEM: Student grabs the Tandem Instructor's right arm and is holding on tight.

REACTION: If he has the right arm, You must be able to deploy the drogue. Convince student to release your arm or you will have to deploy the reserve.

PROBLEM: Left arm is held.

REACTION: If he has your left arm, hit him on the side of his head as hard as you can; he'll probably let go. If you cannot free your left arm, throw the drogue and release it at the proper altitude.

PROBLEM: Both arms are held.

REACTION: If a student gets both arms, a quick, rearward extraction movement of both hands can generally free you at once. If unsuccessful, you still have your voice, your head, your teeth and your knees to work with.

ANALYSIS: A student that panics is apt to do almost anything. This type of incident has been reported enough times for us to know that it can and will happen again. The best course of action is a preventative one. Keep your arms away from the student in the first place.

NEVER PUT A WRIST MOUNTED ALTIMETER IN FRONT OF A STUDENTS FACE. This is an engraved invitation to grab your arm! (See fatality report #6.)

Always tell the student during the pre-jump briefing not to grab your arms at any time during the jump. Make it clear what the consequences might be. Tell the student that you will both die an ugly death by "sudden impact trauma" if he does interfere with your ability to pull the operating handles.

DROGUE DEPLOYMENT AND RELEASE PROBLEMS

A. Pulling the wrong handle
B. Unable to extract drogue from pouch
C. Un-inflated drogue
D. Entanglement with drogue
E. Entanglement with the drogue bridle
F. Non-collapsed drogue
G. Drogue does not release when first handle pulled.

A. Pulling the wrong handle:

PROBLEM: You have pulled the drogue release handle before deploying the drogue.

REACTION: Deploy the drogue immediately.

ANALYSIS: If you don't deploy the drogue promptly, you will of course continue to accelerate towards 170 mph. If you pull the drogue release and the drogue safety pin is in place nothing will happen.

B. Unable to extract drogue from pouch:

PROBLEM: You are unable to locate the drogue deployment handle or are unable to extract the drogue completely from its pouch.

REACTION: Pull the reserve ripcord.

ANALYSIS: It is not necessary to pull either the drogue release handle or the breakaway handle first. In this situation, the reserve ripcord should be pulled promptly, before your velocity builds up. The longer you wait, the greater the reserve opening shock.

This malfunction can usually be avoided by packing the drogue correctly and by practicing drogue deployment on the ground.

C. Un-inflated drogue

PROBLEM: Drogue has been deployed and is partially or completely uninflated.

REACTION: If the drogue does not inflate within six to eight seconds, pull either one of the drogue release handles to initiate main canopy deployment.

ANALYSIS: An uninflated drogue has enough drag to deploy the main canopy although it will take longer than normal to do so. If you wait longer, your velocity will increase. Higher velocities may produce a higher opening shock.

D. Entanglement with drogue:(#4/3-117)

PROBLEM: The drogue canopy becomes entangled with you, your student or your gear, and does NOT inflate.

REACTION: Spend only a few seconds trying to clear the entangled drogue canopy before pulling the reserve ripcord.

ANALYSIS: In this situation, your velocity will increase to 170 mph in about 18 seconds. The longer you wait to deploy the reserve, the higher the reserve opening shock will be.

E. Entanglement with drogue bridle:
(#4/3-118)

PROBLEM: The drogue bridle becomes entangled with the jumpers or their gear, and the drogue is fully inflated.

REACTION: If you suspect that the drogue bridle is entangled with either person or the gear, do NOT pull the drogue release handle. Instead, deploy the reserve by pulling the reserve ripcord to full extension.

ANALYSIS: Velocity will not exceed approximately 120 mph, giving the Tandem Instructor additional time to analyze and correct the problem. The force of the inflated drogue may or may not clear the entanglement.

F. Non collapsed drogue:

PROBLEM: You pull the drogue handle, but drogue does not collapse. The main canopy will probably open very hard.

REACTION: Ascertain whether the main canopy has been damaged by opening shock. If it has, decide whether is it controllable and safe to land.

ANALYSIS: If the drogue is still attached and trailing behind the canopy (it will still be inflated), there is probably minimal damage to the top of the canopy. A fully inflated drogue is not a problem, it just adds extra drag, slowing your forward speed.

G. Drogue in tow:

PROBLEM: Drogue release handle is pulled, but the main does not deploy, even after a few extra seconds (the time it would take for an uninflated drogue to deploy the main).

REACTION: For the complete release of the drogue to occur, the drogue closing pin must be extracted from the main closing loop.

ANALYSIS: If this fails to occur, you will have an INFLATED DROGUE IN TOW. You will notice no trap door effect after you pull the drogue release handle.

In this case, if the drogue is still in tow at 3,000 ft. AGL, pull the reserve ripcord. It is not necessary to first pull the main cutaway handle.

A drogue in tow malfunction can almost always be avoided by following the packing instructions correctly.

Once the reserve is open and you're heading towards the landing area, reach back and reel in the trailing drogue if altitude permits. If the main canopy should begin to deploy, release the main risers by pulling the breakaway handle.

H) Drogue does not release when first handle is pulled:

PROBLEM: Primary drogue release handle is pulled, but drogue does not release. This malfunction is usually due to improper alignment of the closing pin.

REACTION: Pull the secondary drogue release handle while still attempting to pull the primary drogue release. (two hands are stronger than one). If the main still does not deploy, pull the reserve ripcord.

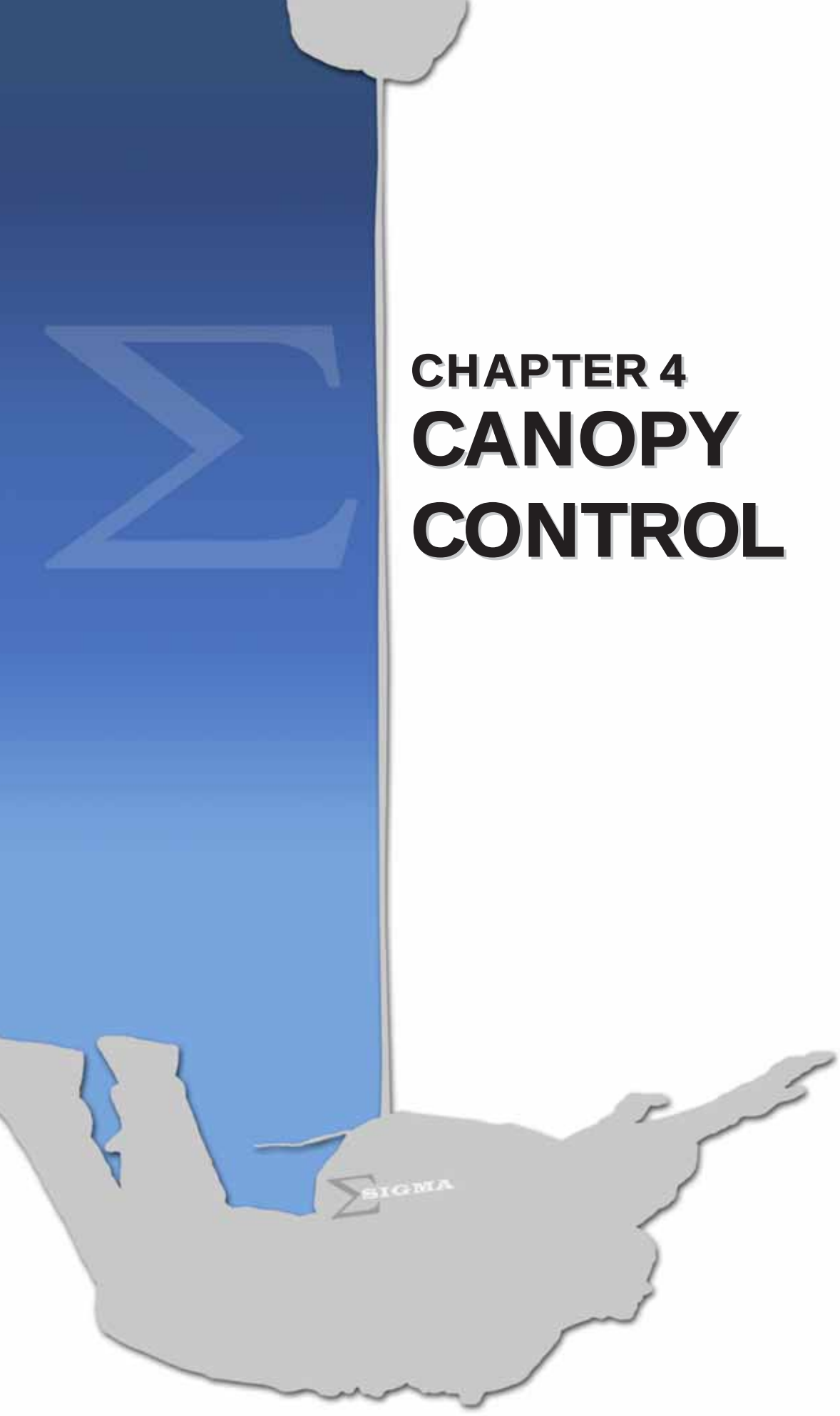
ANALYSIS: This malfunction is usually due to improper alignment of the main pin. This problem can be avoided by checking the pin configuration against the diagram on the main pin cover.

I) Hard or impossible pull on one or both drogue release handles:

PROBLEM: The drogue had been deployed but the drogue release handles cannot be pulled.

REACTION: Pull the reserve ripcord or pull the ball handle on the RSL to activate the reserve.

CHAPTER 4
CANOPY CONTROL



MALFUNCTIONS

A. Drogue entanglement with main
B. Drogue detaches from main
C. Horseshoe malfunction, drogue cannot be pulled
D. Horseshoe malfunction, drogue can be pulled

A. Drogue entanglement with the main:

PROBLEM: The drogue becomes entangled with the inflated main canopy. This may or may not create a problem.

REACTION: Ask yourself two questions: 1) Can I control the canopy? and 2) can we land safely without injury? If you answer "No" to either question, then perform a breakaway by 2500 feet (750 meters).

ANALYSIS: If your main canopy opens in very deep brakes, or opens in a near-stall configuration, there is always the chance the deflated drogue canopy will be thrown forward of the canopy's nose and fall into the suspension lines. This problem rarely calls for a breakaway because the deflated drogue creates very little drag.

B. Drogue detaches when release handle is pulled:

PROBLEM: Drogue canopy detaches when drogue release handle is pulled. The main may or may not deploy.

REACTION: If the main does not deploy, pull the reserve. The main will almost surely then be released and may deploy fully. As soon as the reserve is fully open, cutaway the main.

ANALYSIS: This can happen when the drogue connection to the bag breaks or the connection from the canopy breaks. These two spots have proven to be points of noticeable wear. If the PCA breaks you should still have a normal deployment.

C. Horseshoe malfunction, drogue cannot be pulled.

PROBLEM: The main bag, for whatever reason, has deployed before the drogue has been thrown. Bag and lines are out.

REACTION: Immediately throw the drogue. The main may or may not deploy normally. If not, proceed with emergency procedures. Be aware of your altitude.

ANALYSIS: Study tandem fatality #10. Always operate the handles in the proper order.

D. Horseshoe malfunction, drogue cannot be pulled

PROBLEM: The main bag has somehow been deployed from the container prior to the drogue being thrown. The drogue however, cannot be thrown for whatever reason.

REACTION: Release the RSL shackle and pull the breakaway handle. You may have to give the main risers a tug to assist their release. Then pull the reserve ripcord.

ANALYSIS: Either the main container closing pin was accidentally dislodged, or the main closing loop broke. Care should be taken when moving around inside any aircraft to protect the handles and the closing pins.

Closing loops should be checked every jump. If their condition is suspect, then change them immediately. (Refer to fatality report #10).

NOTE: Do not pull the reserve prior to getting the risers released. The horseshoe malfunction can cause the risers to cross over the reserve container inhibiting the launch of the reserve pilot chute. The RSL must be released prior to breakaway otherwise the right main riser may interfere with the reserve deployment.

Student feels sick under the canopy:

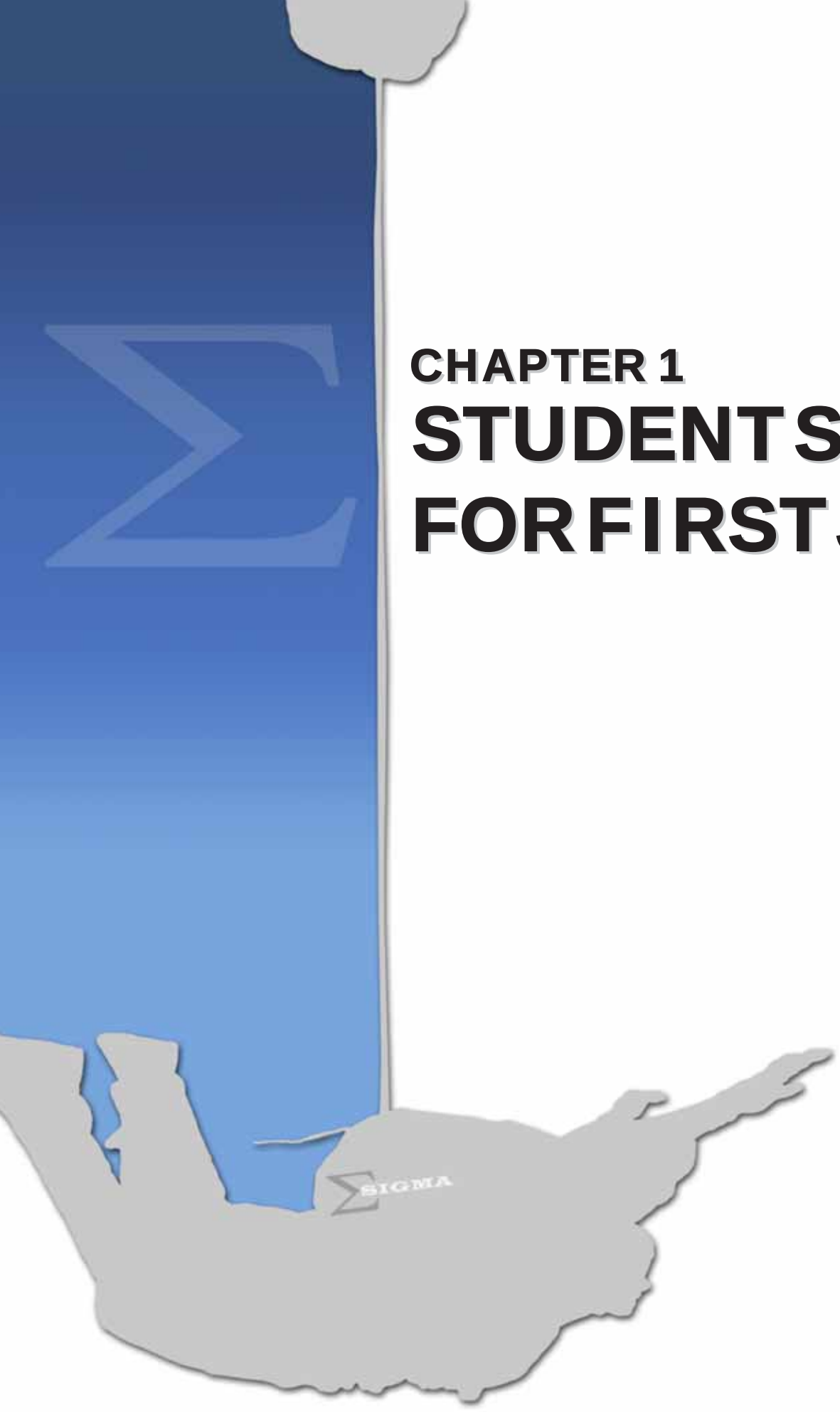
PROBLEM: One theory suggests that the reason some Tandem students get sick or pass out under canopy is that blood circulation is cut off at the inner thighs and the shoulders by the harness.

REACTION: Loosen the chest strap to alleviate the problem, and have the student sit back in the harness and slide both leg pads forward several inches for comfort.

NOTE: Students who are very nervous or frail are usually those who will feel sick. Very slim frail people have very little insulation of any kind on the inside of the thigh to shield the arteries from the pressure of the harness. When you get a student who fits this description, consider being open at 4,000' instead of 5,000'. The canopy ride is what makes students ill, so keep spirals to a minimum and make all turns as gentle as possible.

Top hook positioning is crucial for maximum student comfort. The farther behind the shoulder center line the hooks are placed, the less the front main lift web will be pressing against the student's chest. Refer to the section on student harness adjustment.

A properly adjusted Sigma stuent harness will help eliminate most blood flow issues.



CHAPTER 1
STUDENT SKILLS FOR FIRST JUMP

The following briefing points will be presented in logical order as they would happen on a jump. The briefing points listed here are the minimum points to be briefed. You may chose to include a few extra points from the progression list to fulfill your targeted learning objectives for freefall transition.

Order of presentation:
Equipment
Exit practice
Freefall
Canopy control
Student task list

EQUIPMENT

Provide a briefing and/or practice on the following three items:
A. Student accessories
B. Student harness

A. Student accessories: retrieve and display the following items prior to gearing up: altimeter (optional), jumpsuit, soft helmet, and goggles are a must. Select a tight suit. This will reduce extra drag from your student, aiding stability after exit. A soft helmet is recommended as it is less of a risk if the Tandem Instructor were to strike the student's head during the jump.

B. Student harness: Due to the complexity of properly adjusting the student harness, never allow the student to adjust their harness entirely on their own. They certainly may step into the harness and fasten the chest strap, but the remainder of the adjusting should be done by the Tandem Instructor. Explain the problem of the blood flow being reduced at the legs and the shoulders and the importance of proper harness adjustment. It is practically impossible for the student to do a good job adjusting the harness on his own.

EXIT PRACTICE

To complete the Student Briefing, go to the plane or airport mock-up early, and practice inflight procedures. The inflight briefing should include: climbing into the aircraft and seating position, what to do on the way to altitude, the hook-up procedures and the climb out and launch from the airplane. To practice, get into the plane and run through the whole jump sequence once or twice, including an exit with the student's harness attached and tightened down to yourself. Review the body position the student should assume for the exit launch and freefall.

FREEFALL

A. Freefall positions
B. Arm extension

A. Freefall position: Start by deciding on which exit position the student will use on the jump. Demonstrate and explain the proper body position for exit and freefall to your student. Every stable exit and drogue deployment begins on the ground with thorough training of the student in the proper body position. Have the student lie down and practice the correct freefall position. Several minutes of practice here will make all the difference on exit and freefall. Exit requirements from aircraft to aircraft may cause a variance in the position but the basics remain the same.

Elbows back: head back, torso arched, feet together, and hands holding onto the same side of harness, elbows back. This last position is recommended but remember to emphasize the importance of keeping the arms IN on exit to reduce the likelihood of door contact.

With arms crossed, students sometimes stick their elbows straight down, causing rocking. This also tends to inhibit the arch.

Remember that it is far easier to control a student whose arms are close to the body. If the student hits a hard reverse arch, with arms and legs out, while you are on your back, it may be difficult or impossible to turn back over and get stable.

B. Arm extension:
This is simply a regular RW box body position with the arms out and comfortably bent. It should also be practiced in the prone position including the signal you intend to give for release and attaining this position. The signal will be a tap on the head, and/or a shout in the ear. NEVER reach around in front of the student for any reason. Reaching around in front of the student could give him the chance to grab your arms. (see fatality reports).

At some point during the briefing, tell the student never to grab your arms at any time during the jump. To drive the point home, explain the importance of you having both arms free, and end by saying that you will both die if your arms are hindered.

CANOPY CONTROL

A. Location of steering toggles
B. Steering the canopy
C. Flaring the canopy
D. Landing approach

A. Location of steering toggles:

After opening have the student look up to the risers and visually locate the steering toggles. Demonstrate the release of the brakes with mention of the increasing wind speed as the canopy approaches full flight. The Tandem Instructor should use the student toggle position to release the brakes. Perform a canopy controlability test, turn both directions and flare the canopy. Have the student slip their hands into the toggle and grasp firmly. Advise them to follow your commands and assist in control maneuvers.

B. Steering the canopy:

While the student is assisting in controlling the canopy, have them perform and identify the following flight modes:

1) Full flight: Most students tend to pull on the toggles all the time. They must be taught to consciously leave the hands all the way up for full flight.

2) Turns: Have the student look in direction of the intended turn, checking for other canopies, and then pick out a ground heading to turn to. Practice turns in both directions. The student should try both flat and spiral turns to recognize the difference in speed and descent of the canopy. Inform the student that no countering is necessary to stop a turn, simply return the toggle to the same level as the opposite one and wait for the turn to settle.

3) Braking: Have the student pull down on both toggles from full flight position. Student should listen and feel the change in wind speed and noise. Mention that the canopy will slow down a lot and that is why braking is done on landing. Explain to the student the difference in braking and flaring the canopy for landing. Gradual braking slows the canopy but with an increase in descent, while flaring slows the canopy with an increase in lift.

C. Flaring the canopy: Practice performed at 4000' - 1500'.
Have the student practice flaring the canopy upon your command. The student should follow these steps in flaring;
- Have both arm raised all the way up in the full flight position.
- Start flare immediately upon Tandem Instructor's command.
- Flare symmetrically and fully in one smooth motion.
- Flare by depressing the toggles to full arm extension.
- Hold flare position until landing or commanded otherwise.

This flare drill should be practiced 3-4 times to enable the student to get a good feel for it. You should inform the student to remain relaxed, yet ready to respond to the flare commands you will be giving upon the landing approach. Let the student know that the approach speed may seem quick and reassure them that the canopy will slow down when flared.

D. Landing approach:
Discuss canopy approach to the landing area, point out the pattern or flight path you intend to take and at what altitude you plan to be at each turning point. Point out the direction of the wind and the expected landing point.

STUDENT TASK LIST (FIRST JUMP)

- Get into harness with assistance.
- Perform climbout with Tandem Instructor attached.
- Attain freefall position prior to exit.
- Perform arm extension upon Tandem Instructor's command.
- Grasp steering toggles upon command.
- Perform turns, braking, full flight and perhaps flaring upon Instructors command.
- Prepare for landing on Tandem Instructor's command.

CHAPTER 2
OTHER ACTIVITIES

These guidelines are not optional. They must be followed, or the Tandem Instructor and Tandem rig owner will be in violation of the User Agreement under which Tandem jumping is operated and will consequently no longer be allowed to legally perform Tandem Jumps.

PARTICIPANTS QUALIFICATIONS

For any relative worker to accompany a Tandem pair, the following criteria must be met:

1) Relative worker must have a minimum of 500 relative work skydives; or

2) Relative worker must be either a current Tandem Instructor or a current AFF jumpmaster.

3) Relative worker must have made at least 100 relative work jumps in the last year.

4) Cameramen must meet all the above guidelines, and in addition, must have at least 100 camera jumps.

RW TANDEM BRIEFING

If the Tandem Instructor does decide to take a relative worker on a jump, a briefing must take place before the jump between Tandem Instructor and relative worker which covers these points:

1) No one should ever pass directly over or under the Tandem pair in freefall or droguefall. On exit, the Tandem Instructor needs room to deploy the drogue, and at any time after that, the drogue could suddenly become a deploying main canopy.

2) Once under the drogue, the Tandem pair has very little ability to change drogue fall velocity or to move horizontally (track). This means they can't get out of the way of someone who is closing too fast or someone sliding under them. Therefore, NEVER let anyone who is not a skilled relative worker accompany a Tandem pair on a dive (see fatality report section).

If the grips are taken, take them on the student, not the Tandem Instructor.

3) Because the Tandem pair cannot track very effectively, they must obtain opening separation by opening higher than everyone else. Accompanying relative workers must not attempt to open their main canopies with the Tandem pair. A minimum of 1000' vertical separation is required - to avoid collision situations.

BRIEFING REVIEW

To review: when you dirt dive Tandem drogue relative work, tell the participants four things.

1) Give me room to deploy the drogue in the first five seconds after exit.

2) NEVER pass directly over or under us.

2B) Grip the student, NOT the Tandem Instructor.

3) Approach slowly and dock gently.

4) Wave-off signal given at 6000ft

5) Let me pull first at 4,000' or above, and give us at least 1000' vertical separation.

REMEMBER: If you delay drogue deployment, you eat up altitude at a much faster rate than when the drogue is deployed. See Tandem freefall chart on page 72.

Relative work with Tandem increases the possibility of accident and injury. However, it can be done if approached with care. On every Tandem jump, the Tandem Instructor is in charge. If Relative Work is being contemplated, the Tandem Instructor should have personal knowledge of the relative worker and should feel confident in their abilities.

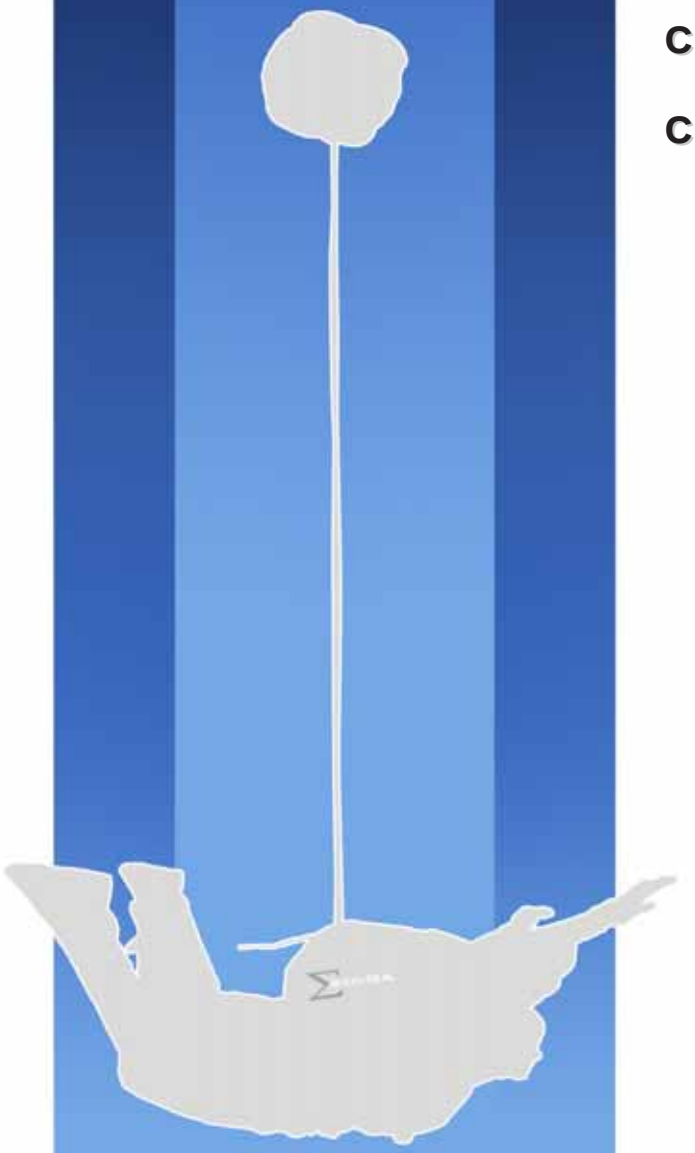
WARNING

With regards to relative work, please consider this. Tandem jumping in essence is a "student training" jump. It almost seems ludicrous to involve a "non-certified jumper" during a tandem jump. You would not allow this to happen in other forms of student training, why allow it to happen here. Especially since it has already proven fatal on several jumps in the past.

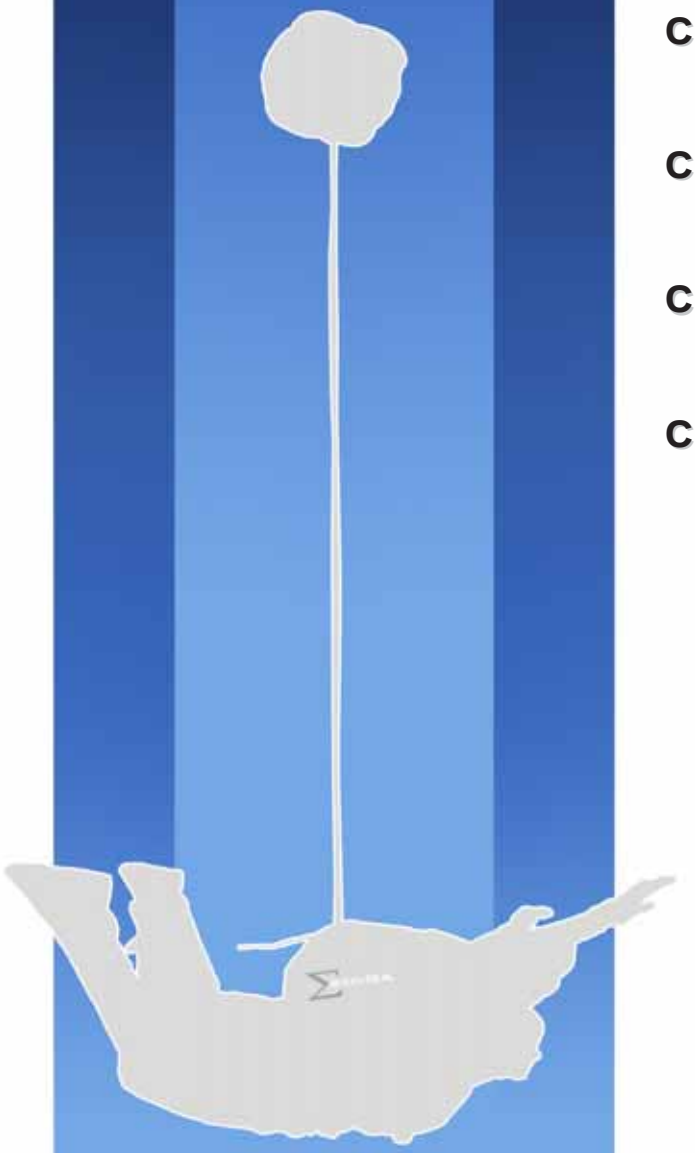
CRW PROCEDURES

CRW IS POSITIVELY BANNED ON ALL TANDEM JUMPS UNDER ANY AND ALL CIRCUMSTANCES (see fatality section). This guideline is not optional. It must be followed or the Tandem Instructor and Tandem rig owner will be in violation of the User Agreement under which Tandem jumping is operated and will consequently no longer be allowed to legally perform tandem jumps.

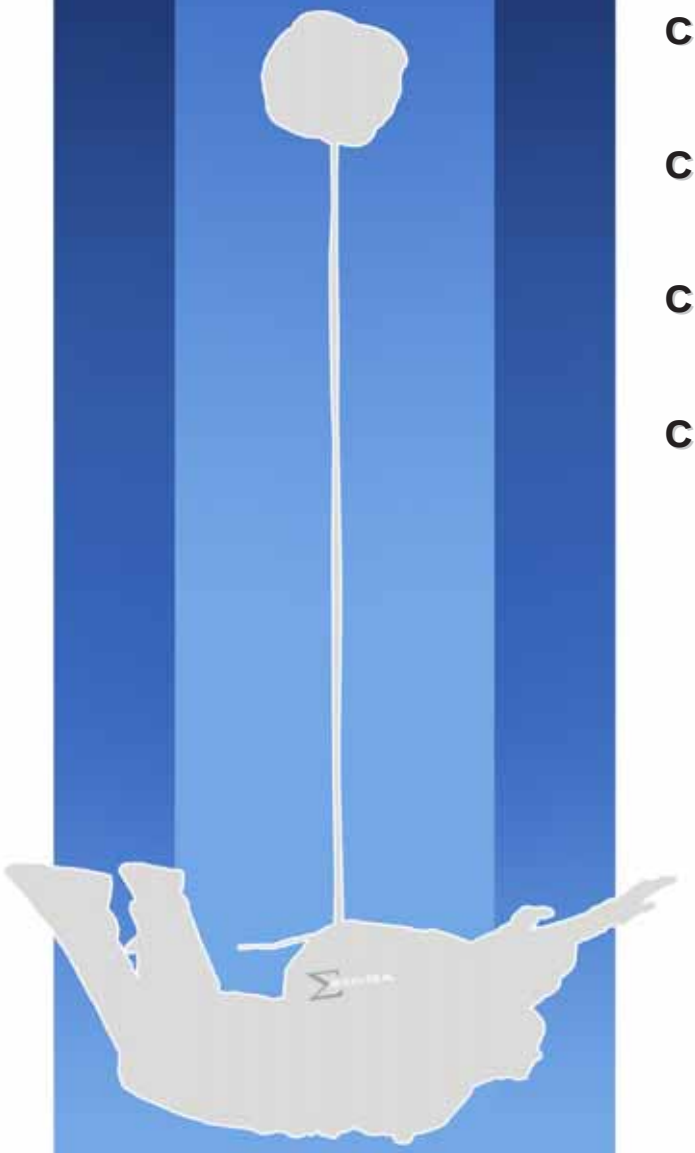
SECTION 1: THE SIGMA TANDEM SYSTEM



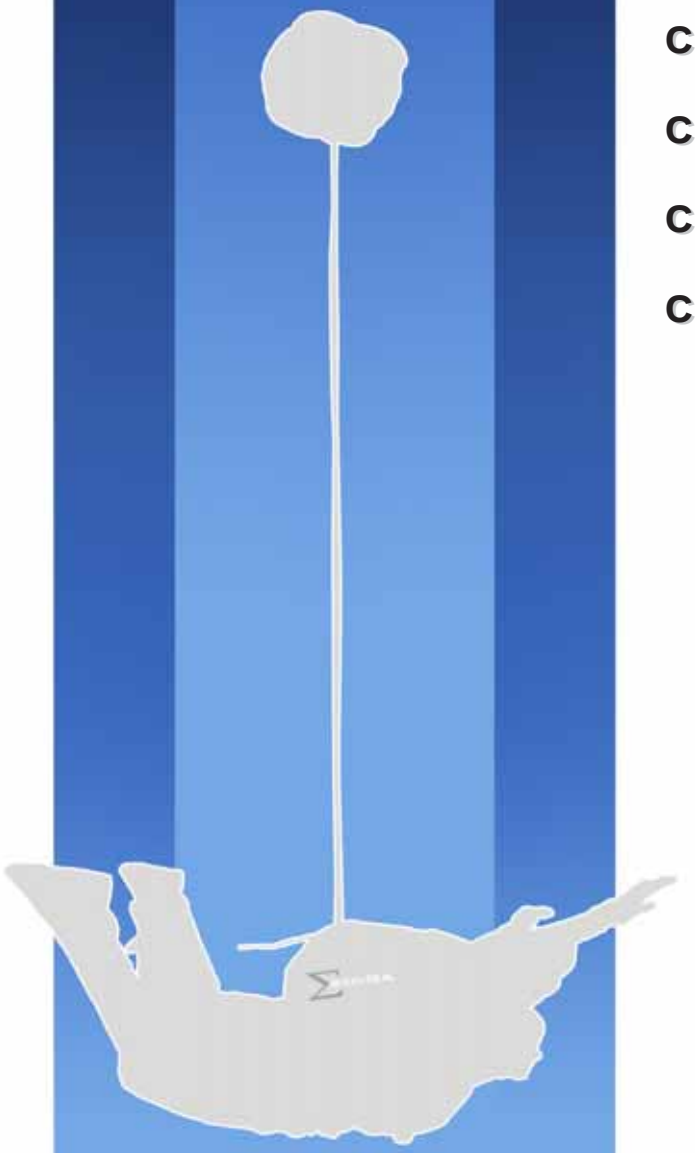
SECTION 2: EQUIPMENT



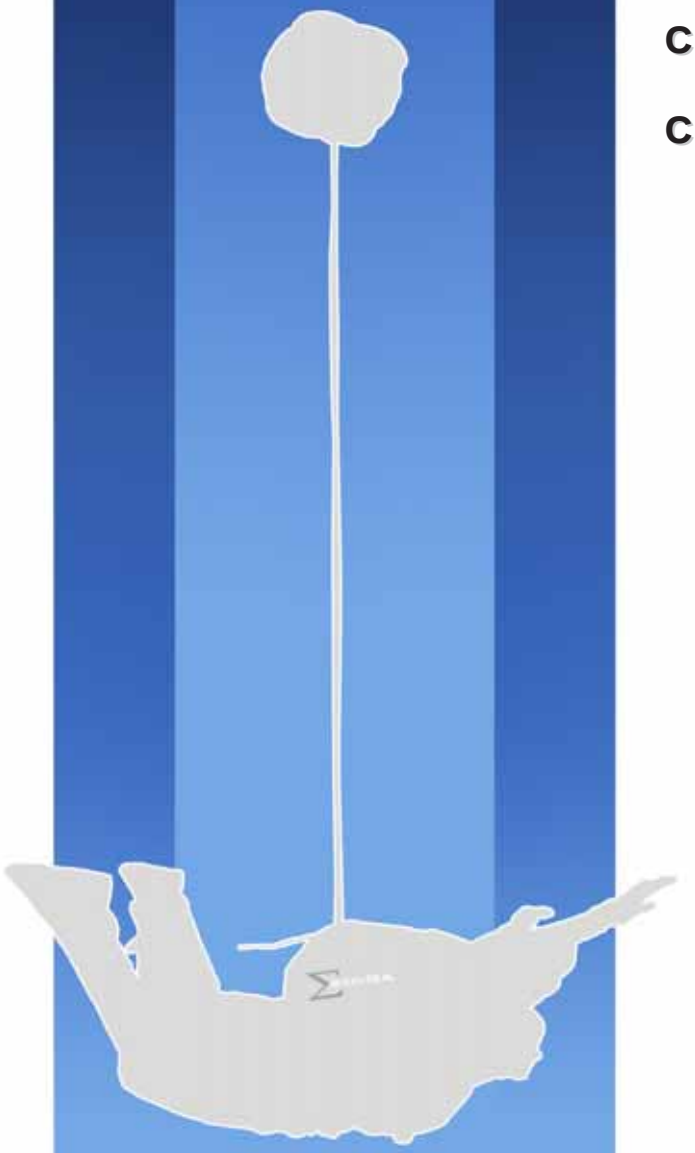
SECTION 3: INSTRUCTOR TECHNIQUES



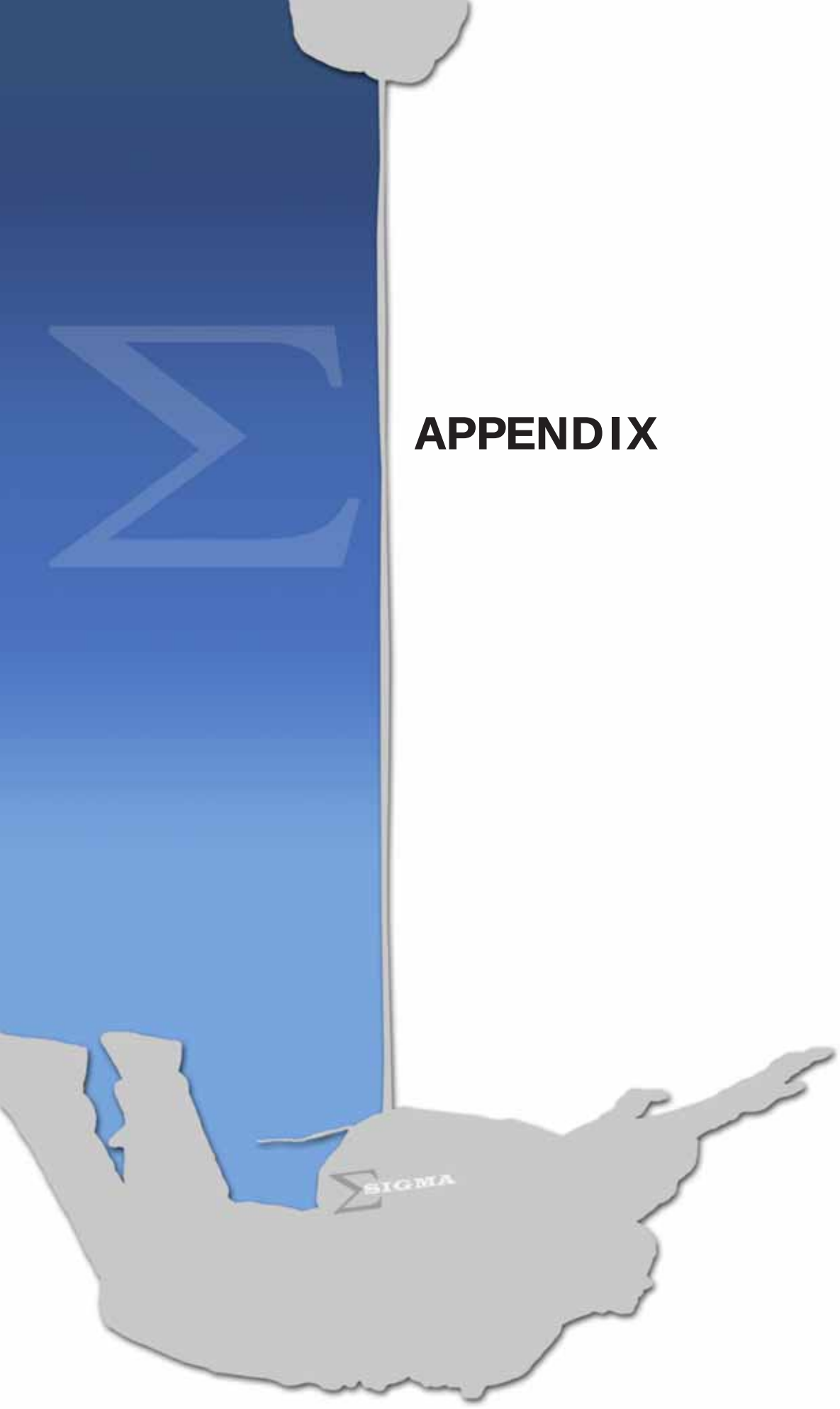
SECTION 4: MALFUNCTIONS & EMERGENCIES



SECTION 5: STUDENT TECHNIQUES



APPENDIX



SIGMA TANDEM "PIN CHECK"

Back of Rig - Top Down

1. Look through window in the yoke and check the Cypres.
2. Open reserve pin cover, check that the yellow breakaway cable is threaded through the Collin's Lanyard loop inside the yoke.
3. Check the reserve pin seating, RSL connection, and loop condition. Close pin cover.
4. Open the main cover flap and check the: A. Routing of the closing loop, B. Routing of the drogue bridle out of the top of the disk, C. Colored kill line in the drogue bridle set window, D. Locking pin and safety pin seating, and E. Spectra Ripcord routing toward the housings. No twists.
5. Check the drogue bridle routing to the pouch.
6. Check that the drogue is well placed in the pouch.
7. Check that both drogue release handles are in place.
8. Check the general condition of container.

Front of Rig – Top Down

1. Check that the riser covers are correctly closed.
2. Check that the 3-Ring releases are assembled correctly.
3. Check that the RSL is hooked up to right riser and routed correctly.
4. Check that the breakaway handle is in place.
5. Check that the reserve ripcord is in its pocket, with slack in the cable.
6. Check the general condition of the harness webbing and hardware.

REPLACING THE DROGUE RIPCORD SYSTEM

(Main container is open and unpacked) (Install Time: 3-5min)

1. Pull one drogue release handle out 8'-10' and clamp the Spectra Ripcord Lanyard at the mouth of the housing using a hemostat. Untie the larks head knot and remove the ball handle.
2. Thread a 36' pull-up cord (or hand-tool cord) through the loop where the ball handle was previously attached. Remove the hemostats.
3. Pull the ripcord lanyard through the housing, leaving the pull-up cord exposed at both ends of the housing.\
4. Tie the two ends of the pull-up cord together so you don't loose them.
5. Pull out the other drogue release handle and repeat steps 1-4.
6. Undo the larks head knot connecting the ripcord lanyard to the container attachment loop. Slide the ripcord pin off the lanyard.
7. Inspect the ripcord pin to ensure there are no sharp edges or nicks that could cause damage to the closing loop. Replace it if necessary.
8. Thread the new ripcord lanyard through the ripcord pin and retie the larks head knot to the container attachment loop.
9. Notice that the ripcord lanyard is triangular in shape. The short section goes to the left-side housing. The longer section will go to the right-hand housing.
10. Use the pull-up cords to route the ripcord lanyards back through their respective housings. Reattach both ball handles using a larks head knot.
11. If you loose either of the of the pull-up cords, you can use a gun cleaning rod or spare ripcord with a metal cable to re-thread the ripcord.
12. When finished, inspect your work to insure it is functional and correct.

INSTALLING A NEW SIGMA DROGUE KILL LINE

The Sigma drogue kill line is little more than a length of line with a finger locked loop at each end. But because each new drogue envelope and bridle may vary slightly, and each can stretch a bit after use, we cannot supply a finished replacement kill line that is the right length for all used drogues. Your replacement kill line has a finished loop at the envelope end, but you must finish the other end to match the particular drogue it is installed in.

Before taking anything apart, and assuming you are replacing your kill line before it breaks, make the following observation so that you will understand what you are trying to accomplish.

1. Attach the #5 rapid link (where the drogue attaches to the main deployment bag) to something that won't move.
2. Go to the other end of the drogue and locate the #0 guide grommet at the base of the envelope.
3. Place two fingers under, and on either side of the guide grommet, and grab the drogue apex handle with the other hand.
4. Apply equal tension (at least 10 pounds) against the drogue bridle and kill line, with each hand.
5. Notice that the lark's head knot, where the kill line attaches to the kill line attachment bridle, is about 1½ " above the guide grommet.

If the kill line were more than 1" shorter, the knot would strike the grommet each time the drogue collapsed, causing excessive wear on both. If the kill line were more than 2" longer, the drogue would not properly collapse during deployment, causing hard openings and canopy damage. Now, find a friend, follow the instructions below, and achieve the same result with your new kill line.

1. Remove drogue kill line from Rapid link at the bag end.
2. Tie a long piece of hand tack cord to old kill line.
3. Re-close the rapid link and secure it to something that won't move.
4. Go to envelope end of drogue and pull the tacking cord through the Kevlar drogue bridle using old kill line.
5. Un-knot old kill line from drogue apex, and discard.
6. Larks-head (knot) the new kill line to the drogue apex.
7. Tie the hand tack cord to the unfinished end of the new kill line, and while you hold the bridle tight, have your friend pull it back down through the drogue bridle.
8. Place two fingers of one hand below and on either side of the guide grommet at the drogue envelope base and pull the bridle tight (at least 10 pounds of pressure), while loosely holding the drogue apex handle with the other hand.
9. Have your friend wrap the kill line around the #5 link and pull the kill line until the larks head knot at the drogue apex attachment is 1½ " above the guide grommet.
10. Pull equal tension on both the Kevlar outer bridle and the kill line, and have your friend mark the new kill line where it passes around the inside of the link.
11. Relax all tension and make a mark 1" above (toward the drogue envelope) the first mark, and again 3" inches above the second mark.
12. Attach a finger trap tool to the loose end of the new kill line. Insert it at the second mark, and push it out at the third mark, so that the mark your friend made is at the bottom of a 1" loop, and you have a finger-trapped area about 3" long. Remove the finger trap tool, but don't cut or sew anything yet.
13. Loosen the rapid link, slip the 1" loop onto it, re-close the link, and again attach it to secure anchor point.
14. Go to the other end of the drogue and repeat step #9, putting equal pressure on both the guide grommet and the apex handle. The larks head attachment knot should be 1" (plus or minus 1/4") above the guide grommet.
15. If this is true, bark-tack, zigzag over twice, or straight stitch over 4 times, the new finger trap , trimming off and retracting the loose end into the kill line. After the first use, the lark's head knot will tighten, yielding the correct 1½ " spacing.

If you do not have a sewing machine, you can tie an overhand knot in the lower 3" finger-locked area, instead of sewing. But, because the knot will shorten the kill line by 2", you will have to make the kill line 2" longer in the first place. Test your new kill line for correct length before you cut off and tuck in the excess line. While this procedure works, sewing in preferred.

TANDEM WATER LANDING PROCEDURES

A water landing is not a likely scenario for a Tandem jump, but it is a possibility. Below is a list of procedures to follow for a Tandem water landing. Since it is best to be prepared for every eventuality, practice the sequence on the ground a few times to get familiar with the order of events.

On any skydive (whether Tandem or sport) made in the vicinity of water, water gear must be worn. If a Tandem jump is made near water, BOTH the Instructor and the student must wear approved water gear.

1) RELEASE RESERVE STATIC LINE (RSL).

2) DISCONNECT STUDENT SIDE ATTACHMENT POINTS.

3) REMOVE PINS OUT OF TOP STUDENT ATTACHMENT POINTS (IF YOU HAVE THEM).

4) HAVE STUDENT INFLATE LPU WATER GEAR.

5) TANDEM INSTRUCTOR UNDOES CHEST STRAP.

6) FLARE AND LAND INTO THE WIND.

7) IF THERE IS A GREAT DEAL OF WIND, RELEASE MAIN.

8) RELEASE STUDENT TOP SNAPS.

9) PUSH STUDENT AWAY.

10) TANDEM INSTRUCTOR SWIMS OUT OF HARNESS.

11) TANDEM INSTRUCTOR INFLATES LPU WATER GEAR.

	Rating	Tandem Jumps	Total Jumps	Overview
1	TI	70	2400	TI attempted to hook up student in free-fall (no drogue).
2	TI	62	1349	CRW wrap and cut-a-way. No reserve pull.
3	TI	72	2000	Mid-air collision.
4	TI	65	1000	Rigging error. Misrouted kill-line. Collapsed drogue in tow. Late reserve pull.
5	NC	10	3750	Used incorrect procedure. Did not receive proper training when transferring from drogue-less to a drogue system.
6	TI	650	1800	student grabbed ti's arms. reserve pulled at treetop.
7	TI	50	1400	out-of-sequence deployment.
8	NR	34	560	heart attack.(rsl disconnected. cut away main, no reserve pull.
9	TI	1100	5000	rigging error. misrouted kill-line. collapsed drogue in tow. no reserve pull.
10	TE	300	2000	broken closing loop. out-of-sequence deployment.
11	TE	1000	7000	no drogue. student drogue release was pulled.
12	TI	60	?	main container opened on step. out-of-sequence deployment. unapproved aircraft - Dornier 27.
13	NR	460	1200	no drogue release. low reserve pull.
14	TE	280	1800	rigging error. improper drogue 3-ring assembly. no reserve pull.
15	TI	265	1650	drogue in-tow. drogue entangled with student's leg. no reserve pull.
16	TI	15	~600	main container opened on step. out-of-sequence deployment.
17	NR	?	?	non-std drogue release jammed. no reserve pull.
18	NR	?	?	no drogue release. out-of-sequence deployment.
19	TI	64	3380	main container opened after exit. out-of-sequence deployment.
20	TI	10	800	side-spin. no action taken. probably unconscious.
21	NR	15	550	break-a-way handle pulled. drogue released just prior to impact.

TI = Tandem Instructor
NC = Not currently rated fir Sigma used
NR= Not rated for Tandem jumping
TE = Tandem Examiner

TANDEM FATALITY REPORTS
TEST FOR SIGMA TANDEM ENDORSEMENT

1. Historically, what is the leading single cause of tandem fatalities?

2. How does the Sigma tandem system address this problem?

3. What differences in emergency procedures are there between the Vector II and Sigma tandem rigs?

4. Why must the main closing loop (and ripcord) on a Sigma tandem system be constructed of Spectra (microline)?

5. What is the only correct length for that closing loop?

6. Why must the pull-up cord used to close a Sigma tandem main also be Spectra?

7. Which side flap does the closing loop go through first when closing the container?

8. What might happen if you trap the drogue bridle, above the disk, under the closing loop?

9. What will happen to the pull force if you pack twists into the ripcord lanyard below the pin?

10. What will sticking the ripcord pin under the disk flange do to pull force?

11. What might happen if you use a disk with a sharp nick in it?

12. How could such a nick be caused, and how should it be removed?

13. What problems might a loose or missing disk pin attachment screw cause?

14. What is the purpose of the "safety pin" on the drogue bridle?

15. What would happen if the kill line were not attached to the #5 link at the top of the main deployment bag, or the kill line were to break during deployment?

16. What are the negative consequences of such an occurrence?

17. What did you forget to do, if the drogue bridle between the disk and the bag is not scrunched up prior to closing the container?

18. What is the purpose of the drogue set limiter tapes?

19. When collapsed, what is the correct distance between the bottom of the kill line attachment bridle, and the kill line guide grommet?

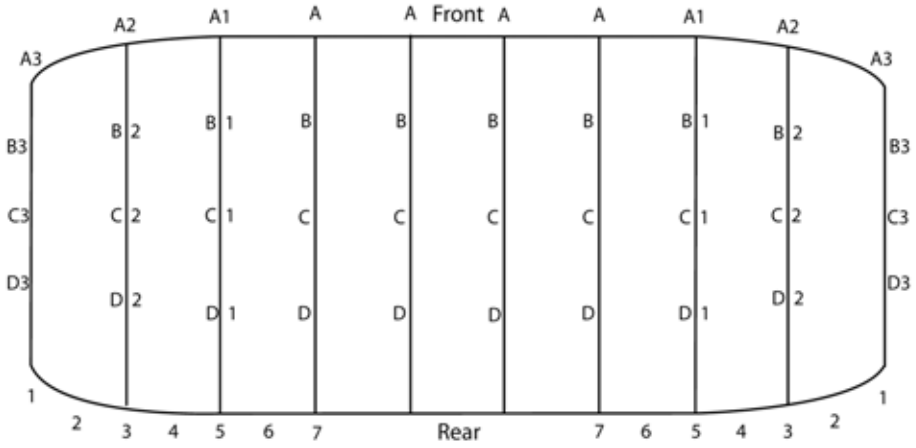
20. What problem does a kill line that is too short cause?

21. What problem does a kill line that is too long cause?

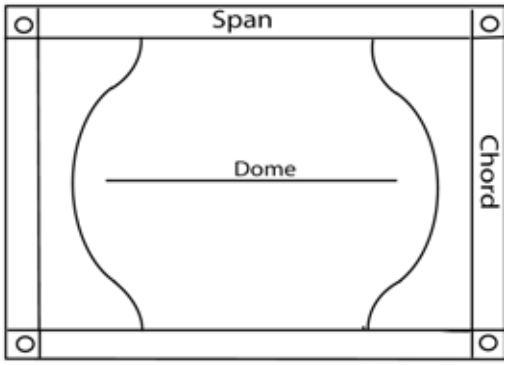
LINE TRIM CHARTS

All line trim charts are reproduced with permission from Performance Designs, Inc. It is advisable to check directly with Performance Designs for any updates or changes to the information contained within the c

V384 Line Trim



Line Trim	in Inches	in cm	+/- Inches	+\- cm
A3	190"	482,6	2"	5,1
A3-B3	3/8"	1	1/2"	1,3
A3-C3	10"	25,4	1"	2,5
A3-D3	20"	50,8	1"	2,5
A2	190 3/8"	483,6	2"	5,1
A2-B2	3"	7,6	1/2"	1,3
A2-C2	11 1/2"	29,2	1"	2,5
A2-D2	23 1/2"	59,7	1"	2,5
A1	190 5/8"	484,2	2"	5,1
A1-B1	3 1/4"	8,3	1/2"	1,3
A1-C1	12 3/4"	32,4	1"	2,5
A1-D1	25 7/8"	65,7	1"	2,5
A	190 3/4"	484,5	2"	5,1
A-B	3 1/2"	8,9	1/2"	1,3
A-C	13 7/8"	35,2	1"	2,5
A-D	27 1/2"	69,9	1"	2,5
Steering Line Trim				
Primary (Brakes set)				
A3-1	20 1/2"	52,1	1 1/2"	3,8
A3-2	17 3/4"	45,1	1 1/2"	3,8
A3-3	15 1/2"	39,4	1 1/2"	3,8
A3-4	11 1/4"	28,6	1 1/2"	3,8
A3-5	11 1/4"	28,6	1 1/2"	3,8
Secondary (brakes set)				
A3-6	15 3/4"	40	1/2"	3,8
A3-7	19"	48,3	1/2"	3,8
Brake to toggle				
Primary	21 1/2"	54,6		
Secondary	18"	45,7		

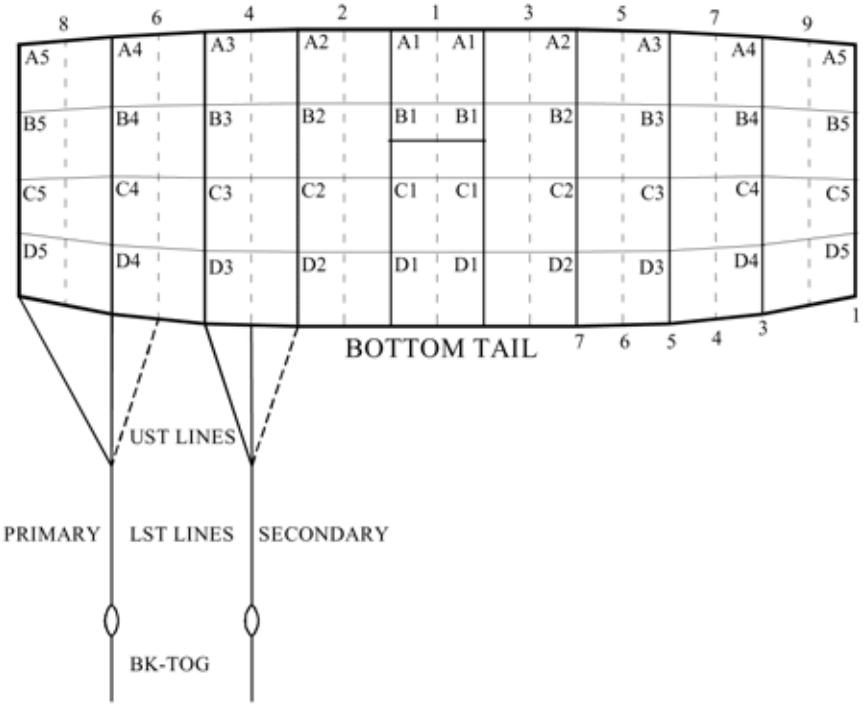


Slider Dimensions		
Old 384 slider	in Inches	in cm
Dome	19 3/4"	49,2
Span	31	78,7
Chord	28	71,1
New 384 Slider		
Dome	25 7/8"	65,7
Span	36 3/4"	93,4
Chord	32	81,3

LINE TRIM CHART

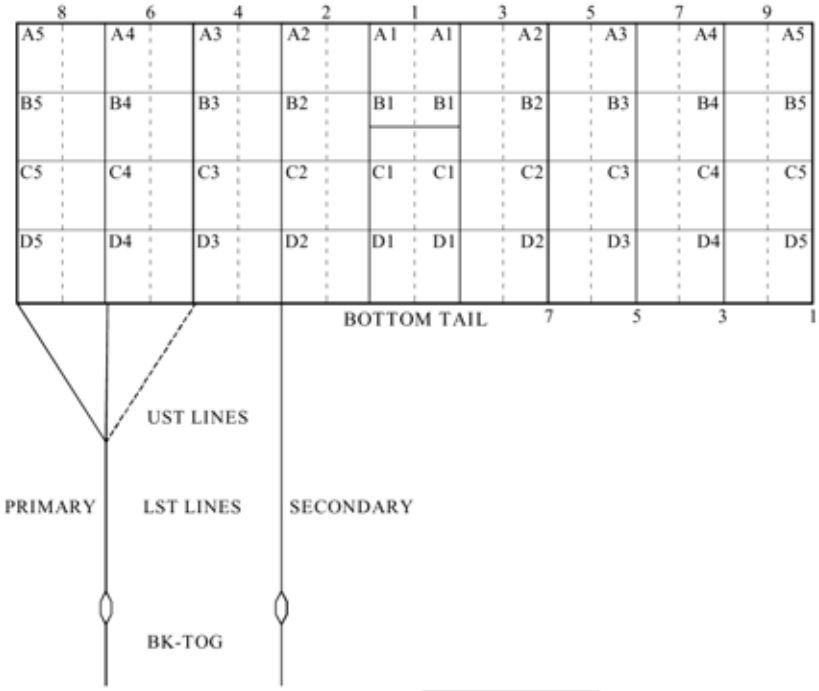
FOR

SIGMA 370 - 395



	SG-370	SG-395
A1	201 3/8	207 3/4
A1-B1	6	5 5/8
A1-C1	16	16 1/4
A1-D1	28 7/8	29 3/8
A2	201 1/2	207 3/4
A2-B2	6	5 3/4
A2-C2	16	16 1/4
A2-D2	28 1/2	29 1/4
A3	202 3/8	209
A3-B3	4 3/4	4 5/8
A3-C3	14 3/4	14 7/8
A3-D3	26 1/2	26 3/8
A4	202 3/4	209 1/2
A4-B4	4 3/8	4 1/8
A4-C4	12 1/2	13
A4-D4	22	22 1/2
A5	203 1/4	209 7/8
A5-B5	4 3/4	4 3/4
A5-C5	13 1/2	13 1/2
A5-UST1	10 1/8	11 1/8
A5-UST3	11 1/8	11 5/8
A5-UST4	15 1/2	12 3/4
A5-UST5	14 1/2	17
A5-UST6	16 7/8	18 1/2
A5-UST7	20 7/8	19 5/8
B STAB SLK	1	1
C STAB SLK	1 1/2	1 1/2
BK-TOG-P	18	18 1/2
BK-TOG-S	19	18 3/4

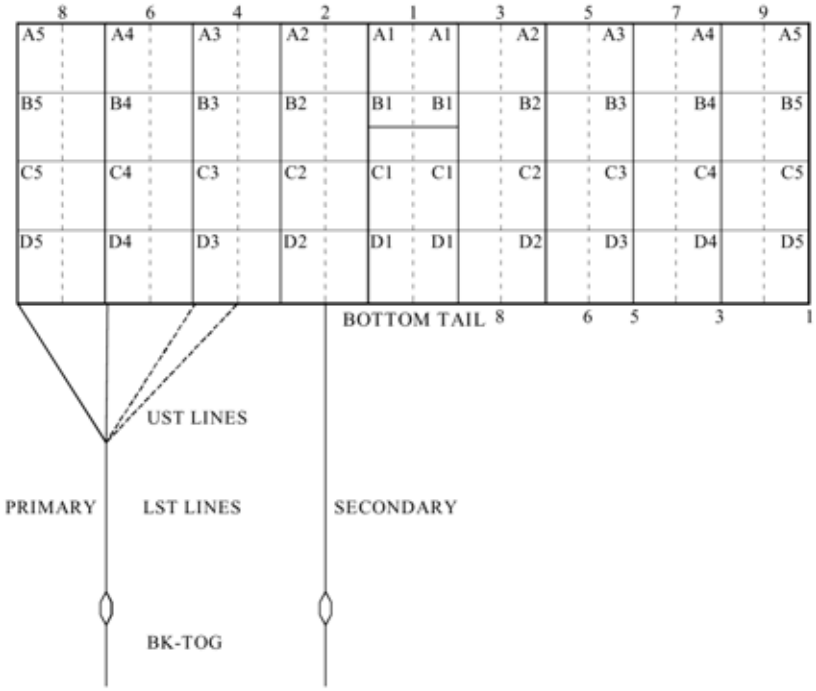
LINE TRIM CHART
FOR
VM 421



	VM-421
A1	207 1/4
A1-B1	1 5/8
A1-C1	10 1/4
A1-D1	27 1/8
A2	207 1/4
A2-B2	1 5/8
A2-C2	10 1/4
A2-D2	27 1/8
A3	207 1/4
A3-B3	1 5/8
A3-C3	10 1/4
A3-D3	27 1/8
A4	207 1/4
A4-B4	1 5/8
A4-C4	10 1/4
A4-D4	27 1/8
A5	207 1/4
A5-B5	1 5/8
A5-C5	10 1/4
A5-D5	27 1/8
A5-UST1	18 1/4
A5-UST3	18 1/4
A5-UST5	18 1/4
A5-UST7	19
B STAB SLK	1
C STAB SLK	1 1/2
D STAB SLK	2
BK-TOG-P	19
BK-TOG-S	19

LINE TRIM CHART
FOR

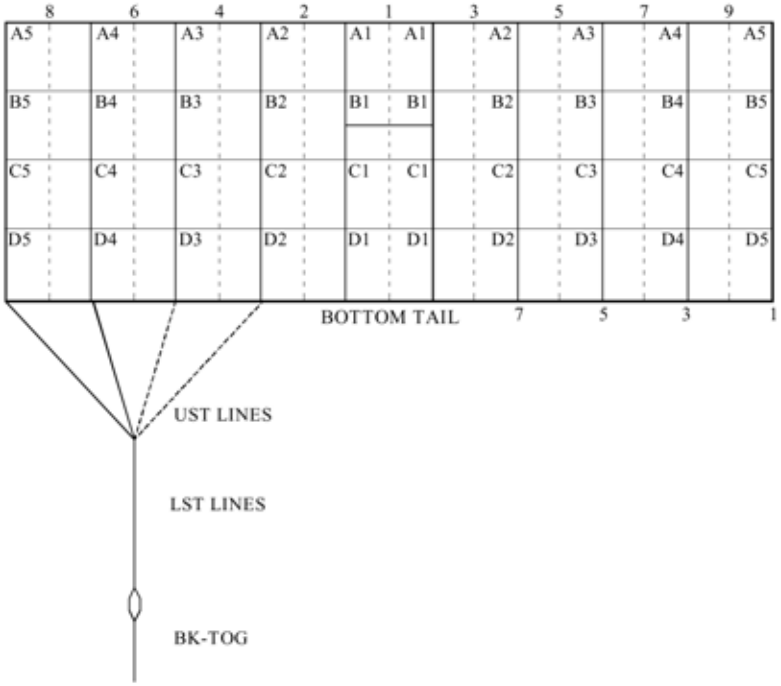
VM 500



	VM-500
A1	221 1/4
A1-B1	- 1/8
A1-C1	10 5/8
A1-D1	29
A2	221 1/4
A2-B2	- 1/8
A2-C2	10 5/8
A2-D2	29
A3	221 1/4
A3-B3	- 1/8
A3-C3	10 5/8
A3-D3	29
A4	223 1/4
A4-B4	- 7/8
A4-C4	9
A4-D4	26 1/2
A5	223 1/4
A5-B5	- 7/8
A5-C5	9
A5-D5	26 1/2
A5-UST1	20 1/8
A5-UST3	20 1/8
A5-UST6	20 1/8
A5-UST5	20 1/8
A5-UST8	18 7/8
B STAB SLK	1
C STAB SLK	1 1/2
D STAB SLK	2
BK-TOG-P	18 1/2
BK-TOG-S	18 1/2

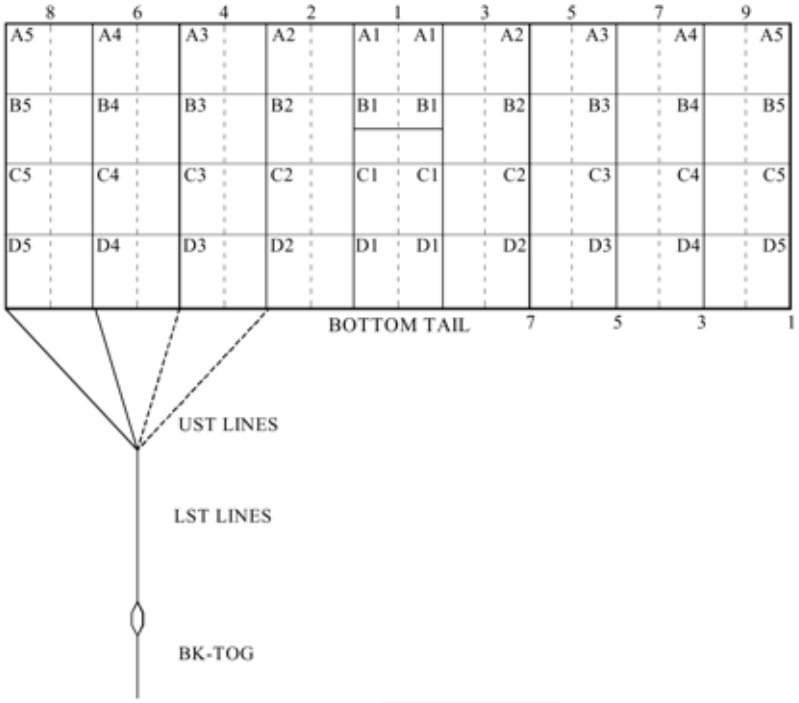
LINE TRIM CHART
FOR

VR 360



	VR-360
A1	182 3/8
A1-B1	3 3/4
A1-C1	11 1/2
A1-D1	21
A2	182 3/8
A2-B2	3 3/4
A2-C2	11 1/2
A2-D2	21
A3	182 3/8
A3-B3	3 3/4
A3-C3	11 1/2
A3-D3	21
A4	182 3/8
A4-B4	3 3/4
A4-C4	11 1/2
A4-D4	21
A5	182 3/8
A5-B5	3 3/4
A5-C5	11 1/2
A5-D5	21
A5-UST1	7 3/4
A5-UST3	7 3/4
A5-UST5	7 3/4
A5-UST7	7 3/4
B STAB SLK	1
C STAB SLK	1 1/2
D STAB SLK	2
BK-TOG	28

LINE TRIM CHART
FOR
VR 421

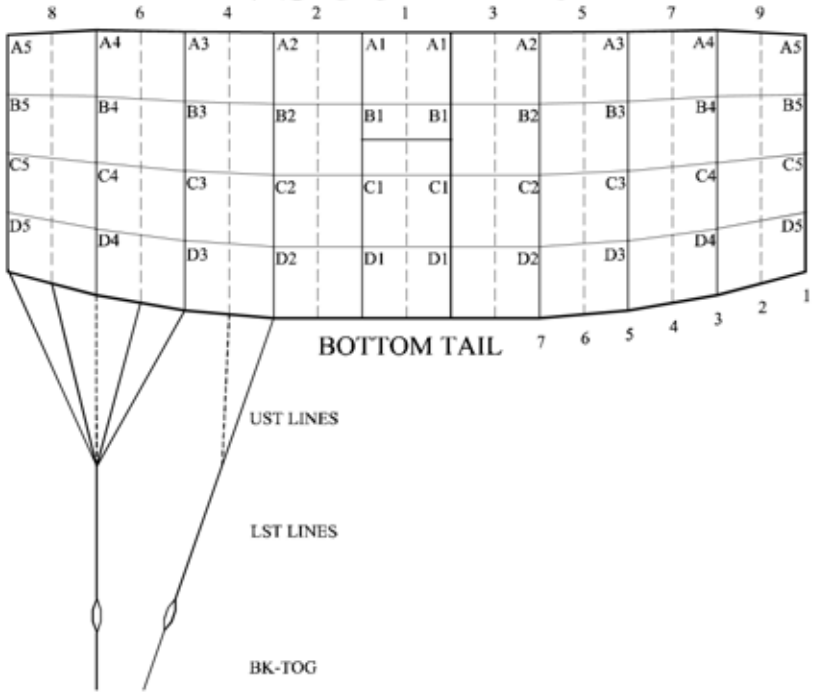


	VR-421
A1	207 1/4
A1-B1	1 5/8
A1-C1	10 1/4
A1-D1	27 1/8
A2	207 1/4
A2-B2	1 5/8
A2-C2	10 1/4
A2-D2	27 1/8
A3	207 1/4
A3-B3	1 5/8
A3-C3	10 1/4
A3-D3	27 1/8
A4	207 1/4
A4-B4	1 5/8
A4-C4	10 1/4
A4-D4	27 1/8
A5	207 1/4
A5-B5	1 5/8
A5-C5	10 1/4
A5-D5	27 1/8
A5-UST1	18 1/4
A5-UST3	18 1/4
A5-UST5	18 1/4
A5-UST7	18 1/4
B STAB SLK	1
C STAB SLK	1 1/2
D STAB SLK	2
BK-TOG	19

LINE TRIM CHART

FOR

VS 384 - 425

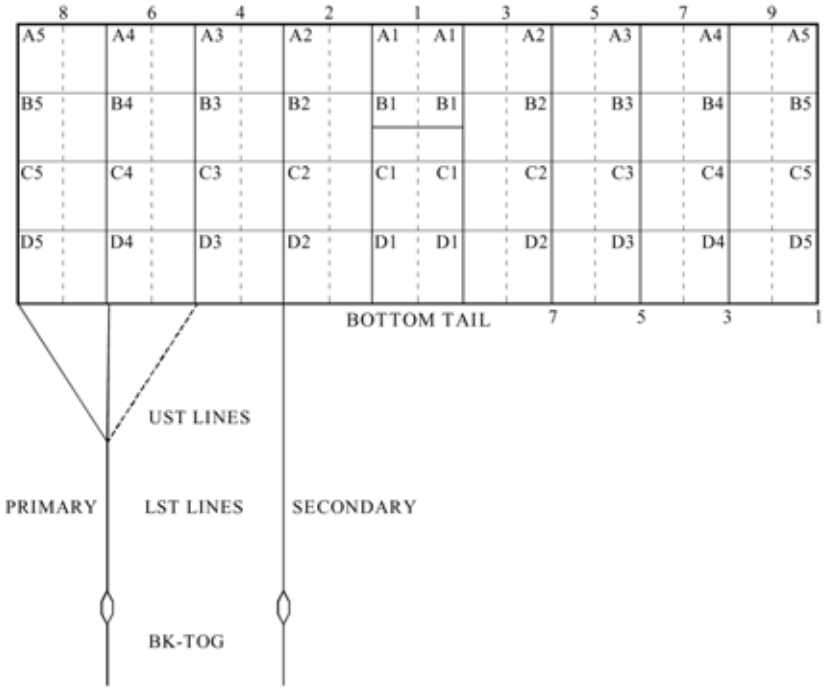


	VS-384	VS-425
A1	188 3/4	200 5/8
A1-B1	3 1/2	4
A1-C1	13 7/8	14 3/4
A1-D1	27 1/2	29 1/8
A2	188 3/4	200 5/8
A2-B2	3 1/2	4
A2-C2	13 7/8	14 3/4
A2-D2	27 1/2	29 1/8
A3	188 5/8	200 1/2
A3-B3	3 1/4	3 7/8
A3-C3	12 3/4	13 7/8
A3-D3	25 7/8	27 5/8
A4	188 3/8	200 3/8
A4-B4	3	3 1/2
A4-C4	11 1/2	12 3/8
A4-D4	23 1/2	24 7/8
A5	188	200 1/8
A5-B5	3/8	3 1/4
A5-C5	10	10 5/8
A5-D5	20	21 1/8
A5-UST1	25 1/2	26 7/8
A5-UST2	22 3/4	23 7/8
A5-UST3	20 1/2	21 1/2
A5-UST4	16 1/4	17 1/8
A5-UST5	16 1/4	17 1/8
A5-UST6	20 3/4	21 7/8
A5-UST7	24	25 1/4
B STAB SLK	1	1
C STAB SLK	1 1/2	1 1/2
D STAB SLK	2	2
BK-TOG-P	21 1/2	22 5/8
BK-TOG-S	18	18 7/8

LINE TRIM CHART

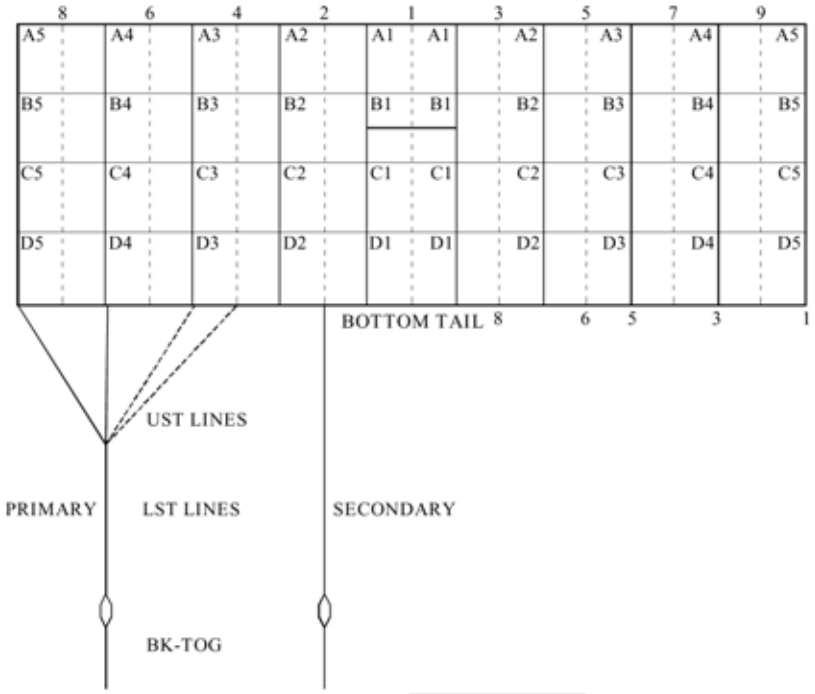
FOR

VT 360 - 421



	VT-360	VT-421
A1	178 3/8	206
A1-B1	2 1/2	1 3/4
A1-C1	12	10 1/4
A1-D1	22	27 1/4
A2	178 3/8	206
A2-B2	2 1/2	1 3/4
A2-C2	12	10 1/4
A2-D2	22	27 1/4
A3	178 3/8	206
A3-B3	2 1/2	1 3/4
A3-C3	12	10 1/4
A3-D3	22	27 1/4
A4	178 3/8	206
A4-B4	2 1/2	1 3/4
A4-C4	12	10 1/4
A4-D4	22	27 1/4
A5	178 3/8	206
A5-B5	2 1/2	1 3/4
A5-C5	12	10 1/4
A5-D5	22	27 1/4
A5-UST1	12 1/4	19
A5-UST3	12 1/4	19
A5-UST5	12 1/4	19
A5-UST7	14	18
B STAB SLK	1	1
C STAB SLK	1 1/2	1 1/2
D STAB SLK	2	2
BK-TOG-P	28	19
BK-TOG-S	28	19

LINE TRIM CHART
FOR
VT 500



	VT-500
A1	223 1/2
A1-B1	- 1/8
A1-C1	9 5/8
A1-D1	27 3/4
A2	223 1/2
A2-B2	- 1/8
A2-C2	9 5/8
A2-D2	27 3/4
A3	223 1/2
A3-B3	- 1/8
A3-C3	9 5/8
A3-D3	27 3/4
A4	225 1/2
A4-B4	- 7/8
A4-C4	8
A4-D4	25 1/4
A5	225 1/2
A5-B5	- 7/8
A5-C5	8
A5-D5	25 1/4
A5-UST1	20 1/2
A5-UST3	20 1/2
A5-UST5	20 1/2
A5-UST6	20 1/2
A5-UST8	18 3/8
B STAB SLK	1
C STAB SLK	1 1/2
D STAB SLK	2
BK-TOG-P	18
BK-TOG-S	18