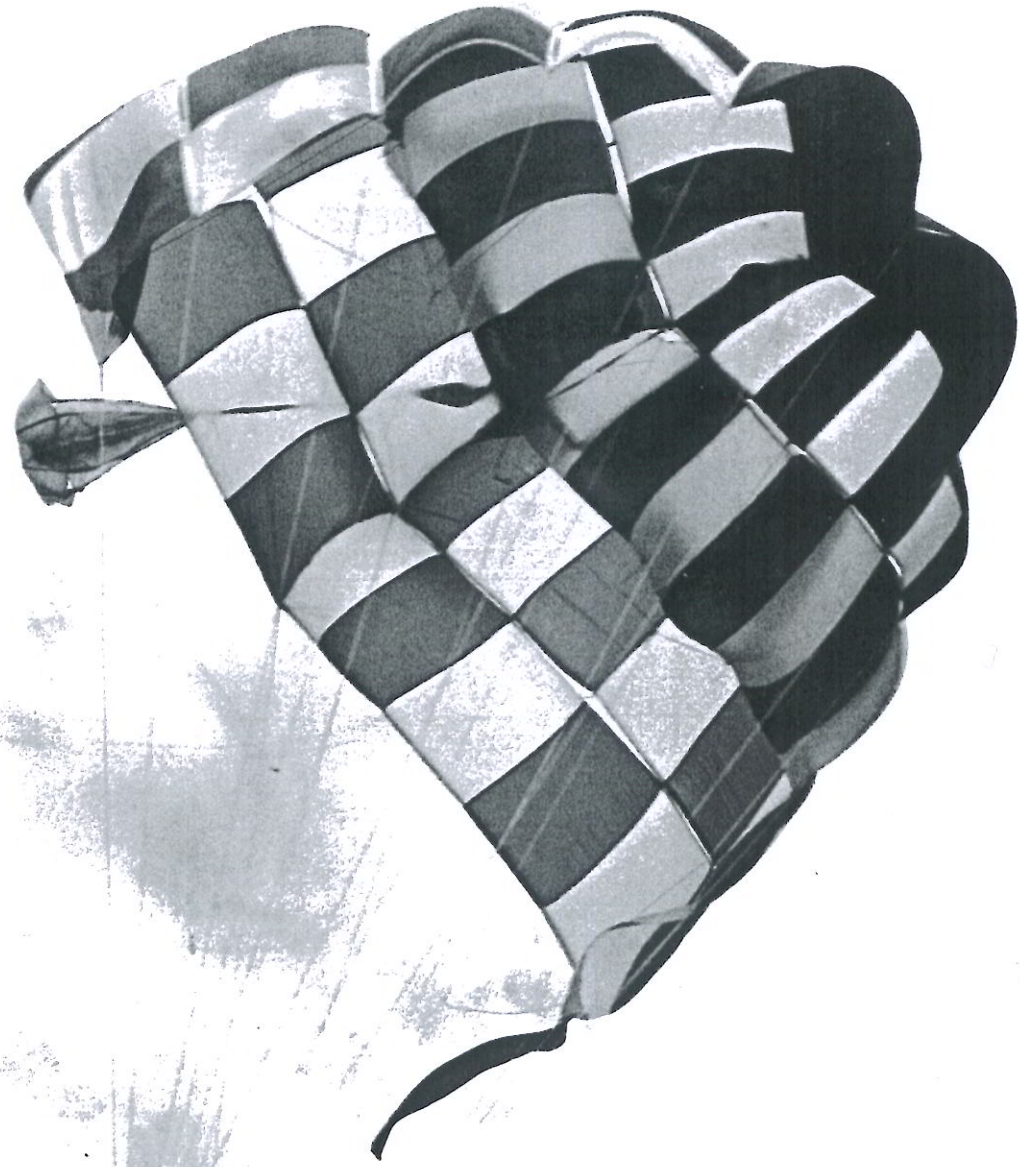

Delta II PARAWING

II

OWNER'S MANUAL

This manual is intended expressly for the use of individuals owning a Delta II Parawing and applies to no other deceleration device except the Parawing. The manual contains the latest information available regarding performance, packing, care and handling and maintenance of the Delta II Parawing, and is not to be considered as any kind of warranty by Irvin Industries, Inc. or its distributors on the performance of any individual Parawing.

The Delta II Parawing is recommended for use by experienced parachutists and careful study of the information presented herein will enable you to get the utmost performance and enjoyment out of your Parawing consistant with safety.

PREFACE

Welcome to the wonderful world of sport parachuting! As the new owner of a Delta II Parawing you are about to enter the realm of true gliding descent which is unequaled by any other commercial parachute used today. The Parawing is not just a means of decelerating the free falling parachutist to a safe landing velocity, but a device in which he will enjoy a soaring descent under the wing, rather than just the quasi-gliding mode he has become accustomed to.

The Delta II has generated a new and exciting atmosphere within the parachuting sport as evidenced by comments from veteran jumpers, some of whom had lost interest in the sport and were considering "retirement". After jumping the Delta II their reaction was as if they had just re-discovered the sport of parachuting.

It makes little difference if you are an avid competition jumper or just a weekend participant who jumps for the fun of it. In either case you will find that with the Delta II Parawing you have a device whose accuracy and gliding ability is unsurpassed.

You and your Parawing are an unbeatable team, and together you will discover a vast new area of parachuting that previously did not exist. Irvin Industries, Inc. is proud to present the Delta II Parawing to you, and wishes you many happy, accurate landings.

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IRVIN INDUSTRIES INCORPORATED

On April 28, 1919, Mr. Leslie L. Irvin made the first free-fall parachute jump from an airplane at McCook Field, Dayton, Ohio. This first jump dispelled the popular belief that a man would black-out immediately upon jumping from a plane.

Mr. Irvin, who was the chief co-inventor of the manually-operated free-fall parachute, had made many jumps from balloons with earlier chutes and knew that these beliefs were without proper foundation. Witnessing safety officials that day instigated immediate adaptation of the free-fall parachute as standard equipment for all military aircraft.

During the same year, Mr. Irvin organized the Irvin Air Chute Company and was awarded a contract by the Army Air Corps. The present company (Irvin Industries, Inc.) is comprised of the six U.S. facilities; one in Canada, Australia, South Africa; seven in Europe; and one in Japan. The company at one time held ninety-five percent of all basic parachute patents. It currently holds 28 active patents and has several pending.

Irvin Industries Inc. has a long continuing history of parachute "firsts", a few of which are mentioned below.

1921	The design of the first Ring Slot Parachute
1929	First Quick-Connect Emergency Reserve Chute for Aircraft gunners
1931	First Quick-Release Parachute Harness
1931	First successful automatic ripcord opener designed and developed by Irvin Air Chute
1938	First parachutes for British Airborne troops
1947	Design of the first Rocket Decelerator for heavy cargo aerial delivery
1960	First United States Satellite recovered from orbit, brought down safely by an Irvin recovery system
1964	XB-70A Landing Deceleration System
1969	The Delta II Parawing

Irvin has saved over 200,000 lives with parachutes, including that of Jimmy Doolittle, whose memorable wire states "Airplane failed – chute worked". Irvin is not engaged in the manufacture of just recovery systems however. The product line includes automobile seat belts, vending machines, metal products, air cargo containers, and motor generators, to name a few.

With the long list of successful accomplishments enjoyed by Irvin Industries, Inc., future innovations in the parachute industry are assured. With an aggressive, experienced engineering staff and modern facilities, we are constantly looking ahead, pushing back the state-of-the-art, to bring you today what others promise you tomorrow.

HISTORY OF THE PARAWING

The Delta II Parawing has been known as the Rogallo Wing, Flexwing, Limp Paraglider and the individual deployment glider. Several of these terms have only recently come into being, thus leading one to believe that the Parawing is a recent development. This is not the case, however, for the Parawing was conceived in 1945 by Mr. Francis M. Rogallo, an aeronautical engineer employed by the Government. Working at home in his spare time, Mr. Rogallo experimented with his new device, testing it in a homemade wind tunnel, free flying it as a hand launched glider and tethered outdoors flying as a kite. His private endeavor spanned 13 years from 1945 to 1958, when America's entry into the exploration of space brought considerable interest from governmental agencies in this and other unconventional ideas.

After extensive testing, the practical application fo Mr. Rogallo's invention was quickly realized. With its gliding ability and pin-point accuracy it could be used for the safe return of astronauts from space, air cargo delivery, individual troop use and other applications where its flying characteristics could be put to advantageous use.

Realizing that the Parawing represented a totally new concept in deceleration devices, Irvin Industries, Inc. began a developmental program on the wing in 1966. After three years of extensive testing, which saw the incorporation of many design innovations, the Parawing is being introduced to the world of sky diving where it will get its most exhausting use.

Extensive testing is continuing today by various agencies who are looking at advance designs of the Parawing for future applications.

TECHNICAL DATA

- The Delta II Parawing has a 254 square foot surface area, consisting of fourteen gores, each having five aerodynamic lifting sail panels. The canopy material is basically 2.25 ounce ripstop nylon cloth, calendered and silicon treated.

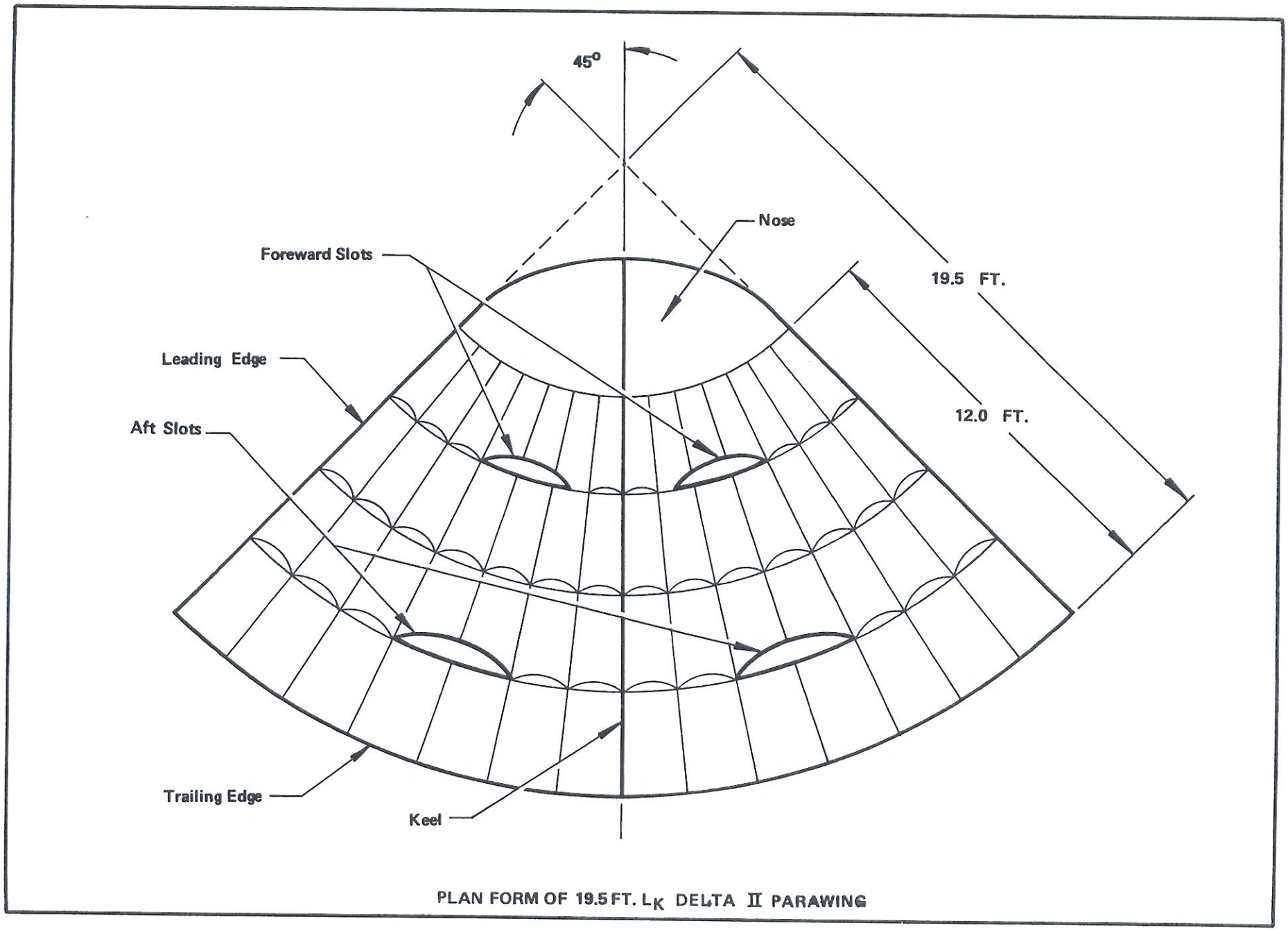
- Both material and geometric porosity (open area) vary as a function of wing location. However, the total canopy porosity is 3.2 percent of the wing's surface area under typical descent conditions.

- The suspension network consists of ten leading edge lines and six keel lines. These are all nylon and have an ultimate tensile strength of 1000 pounds. In addition, there are two slot lines, two panel lines, two steering lines and two control lines. These lines are also nylon and have a 750 pound tensile strength.

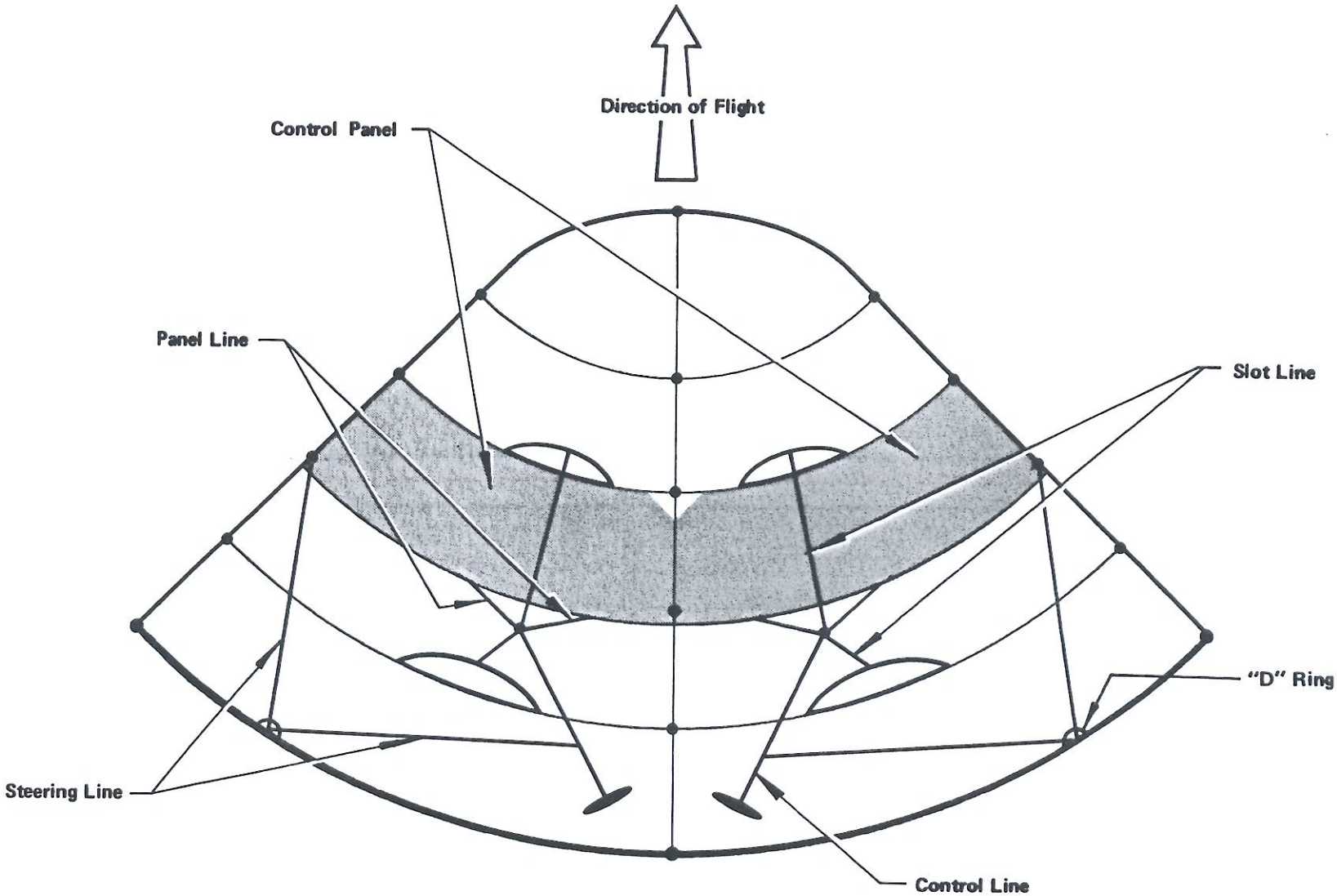
- Risers are contructed from 6500 pound type XIII, nylon webbing with 3600 pound type VIII keepers .

The Parawing's reference size is measured from the trailing edge along the keel and terminates at a focal point of the 90 degree annular sector. Thus the Parawing has a reference keel length of 19.5 feet and is written "19.5 ft. L_K".

High performance of the Irvin Delta II Parawing is due to its basic airfoil design accompanied with introduction of radial louvers in the wing's upper surface to provide directionally controlled air streams. Such controlled air streams promote laminar flow control, wing shaping and a thrusting action. These louvers give a slight saw-tooth profile to the wing created by incorporating extra width to the trailing edge of the gore panels. They also provide a favorable increase in the stability of the wing when compared to the "solid" or nonslotted versions.



PLAN FORM OF 19.5 FT. L_K DELTA II PARAWING



VIEW LOOKING UP AT WING IN FLIGHT

PERFORMANCE DATA

Rate of descent	
(Steady Glide)	14–16 ft./sec.
50% Brakes	15–17 ft./sec. (approx.)
75% Brakes	16–20 ft./sec. (approx.)
Full Brakes	20–30 ft./sec. (approx.)
Turn Rate (360°)	
From straight flight	4 sec.
After 1 revolution	2.8 sec.
Suspended weight	120 to 250 lbs.
Maximum lift/drag ratio	2/1
Maneuvers	Glide, brake, turn, stall

PARAWING OPENING

Delta II Parawing openings are consistent and reliable. The opening process is positive with a logical, repeatable cycle being maintained. The Parawing opening consists of four (4) separate stages as follows:

1. The lines payout from the bag until the bag locking flap is released.

2. The bag is dragged off the folded wing and the wing unfolds as it emerges from the bag.

3. After the wing clears the bag, the nose inflates, creating the initial deceleration shock felt by the jumper and line stretch occours.

4. When the nose inflates, it pulls a locking tab off the Opening Shock Inhibitor allowing the OSI to unwrap, thus freeing the lines and allowing the wing to completely inflate. (The Opening Shock Inhibitor is a device that is attached to the wing and wraps around the lines during packing. Its purpose is to provide a smooth controlled opening. Further information regarding the OSI is presented in the packing instructions.)

It takes only a few seconds for the OSI to unwrap from the rear lines. If by any chance the OSI fails to unwrap completely, jerking of the left front riser will complete the unwrapping process. Once the canopy is fully inflated the OSI will be trailing from the left rear trailing edge of the wing.

After Delta II Parawing inflation, the parachutist will immediately notice two distinct flight characteristics; one being the high maneuverability, and the other is wind noise due to the forward penetration of the glide. A lift over drag ratio of 2 to 1 is typical; in other words, the parachutist will glide approximately 20 feet horizontally for every 10 feet of vertical descent. (4000ft from 2000ft opening in still air)

FLIGHT CHARACTERISTICS

TURNS

Stable, slow turns can be commenced by smoothly and slowly pulling down on either toggle knob (found on the aft side of the front riser on both the left and right side). The turn will commence as soon as the toggle knob is pulled away from the control line keeper. As the knob is pulled further and further down, the turn rate will increase as will the swing angle, 'g' forces on the body and rate of descent.

Upon releasing the toggle knob completely, the wing will stabilize and the body will swing out in a slight reverse arc and return to the normal position under the wing.

During this turn recovery period, the body's forward speed can be heard to diminish to silence as the wing slows, and then the air rush can be heard increasing again as the wing returns to normal flying speed.

If you should fly the wing with the toggle knob unconsciously pulled slightly down, you will find turns in either direction slightly less responsive than normal.

To effect a turn while in the half to full brake positon, let up on the toggle opposite the direction you wish to turn. For example, to execute a right turn, let up on the left toggle.

It is important to mention here that you should not attempt tight turns while you are "low and slow". The Parawing may be likened to an airplane that attempts to turn while near it's stalling speed. If you apply a little aileron and rudder to start the turn, the plane will fall off on one wing and begin to spin because it doesn't have sufficient speed to maintain flight.
The Parawing is more like an airplane than a parachute. The same rules of flight apply to both the airplane and the wing.
So, - if you're below 500 feet, don't attempt any steep turns. Just keep in mind that as you reach low altitudes and begin your run on the target, ONLY MINOR CORRECTIONS SHOULD BE MADE. Don't attempt any radical maneuvers . Non-complience with these instructions can be hazardous.

BRAKING

Braking to slow the wing merely requires slowly and smoothly pulling down both toggle knobs. At about shoulder height the forward speed will be decreased to approximately 5 miles per hour. The L/D can be advantageously decreased or increased by the proper application of brakes. The rate of descent will range from 14 feet per second with no brakes to approximately 30 feet per second with full brakes applied. A wide variation such as this can be used to full advantage to turn a near miss into a scoring jump, but it must be used with proper judgement and technique to be effective.

STALLS

The Parawing, like any other gliding device, is subject to stalling, or loss of flying speed. A stall may be effected by pulling both toggles slowly and smoothly downward slightly past the full brake position. At this point your forward speed gradually diminshes to zero and an accelerated vertical velocity begins. As the stall mode is entered, the canopy remains fully inflated, but loses some directional stability by drifting slightly to the right or left. This is easily corrected for by alternately pulling on the toggles. After a little practice you can keep the canopy directly overhead throughout the stall. If you do not correct the canopy, it will begin a gradual turn to whatever side it has drifted to. Once this happens, the controls must be set free and the canopy will resume a stable gliding attitude within a few seconds. It is to be emphasized that the vertical velocity during a stall can be as much as 30 feet per second. For this reason, it is cautioned that stalling is not a recommended maneuver below 500 feet above ground level.

GLIDES (L/D)

The Delta II Parawing has an inherent gliding ability that is perhaps its most exceptional attribute. While its gliding ability is noteworthy, it is important to remember that certain variables, such as wind velocity and the direction the canopy is facing, can, and do influence the L/D or glide angle with respect to a given point on the ground. The type of terrain you are over also affects your glide path, as certain kinds of surfaces are more effective than others in heating the air directly above.

Ploughed ground, rocks, sand and barren land give off a great deal of heat. These rising warm air currents are commonly known as updrafts and are encountered at low altitudes over these types of surfaces. On hot days the updrafts will be more prevalent than on cool days. When you get to low altitudes and begin your run on the target and encounter updrafts their effects must be taken into account. The extra lift created by the updraft can be nullified by gradual braking which will prevent overshooting the target.

Water and vegetation, on the other hand, have a tendency to retain heat thus allowing a downdraft of air. The effects of a downdraft can be hazardous at low altitudes due to the added vertical velocity created by the falling air currents.

The maximum L/D is obtained during free flight (hands off the controls). In this condition the Parawing will fly in a stable, maximum glide attitude. The nominal L/D may be decreased by the gentle application of brakes. The more brakes you use, the slower you fly, causing a corresponding loss in lift and a subsequent increase in vertical velocity.

TARGET APPROACH

In sport parachuting, and particularly accuracy jumping, target approach is perhaps the most challenging aspect of the jump. A good exit, style and maneuvering can be exceptional but secondary if a dead center is missed due to poor target approach. The Parawing, with its aerodynamic qualities can make target approaches exciting for even the most experienced parachutist.

As long as you exit within one-half mile of target and deploy the Parawing at a minimum altitude of 2,000 feet, you can make it back to target from any direction as long as the winds are less than 8 miles per hour. When the winds are excessive, exit well up-wind of target to avoid possible overshooting of the landing area.

You will find that you can hit the pea gravel every time after a few practice flights. The first problem everybody encounters is overshooting the target area because one is unaccustomed to the high forward speed of the Parawing. With gentle application of brakes after crossing the edge of a pit, the wing can be made to settle in an area where dead center landings are only a matter of foot placement. A suggested approach to target on low wind days is simply to slowly circle the target area about one hundred yards out and when you feel you are low enough and at least cross wind, or better yet, towards upwind, slowly turn in for landing. Another suggested approach is to turn upwind on final over the spot that yeilds the proper trajectory angle to the target based on the wind conditions encountered. Adjust the trajectory through gentle braking adjustments to maintain the desired "approach angle" to the target disc.

Because of the greater forward speed of the Parawing, it requires an earlier application of braking to slow down. Also no forward or rearward swing, as with a conventional parachute canopy, occurs when the brakes are applied and released. Should you desire to avoid conflict with other canopies at your same height, tight 360^{o}degree turns will lose altitude rapidly and allow you to make your run on target from any direction without interference.

Initially , it is suggested that all landings be make facing into the wind from about 100 feet and after assuming a normal landing position. After landing and once the suspended weight is taken off the Parawing, it will collapse.

RESTRICTIVE FLIGHT MANEUVERS

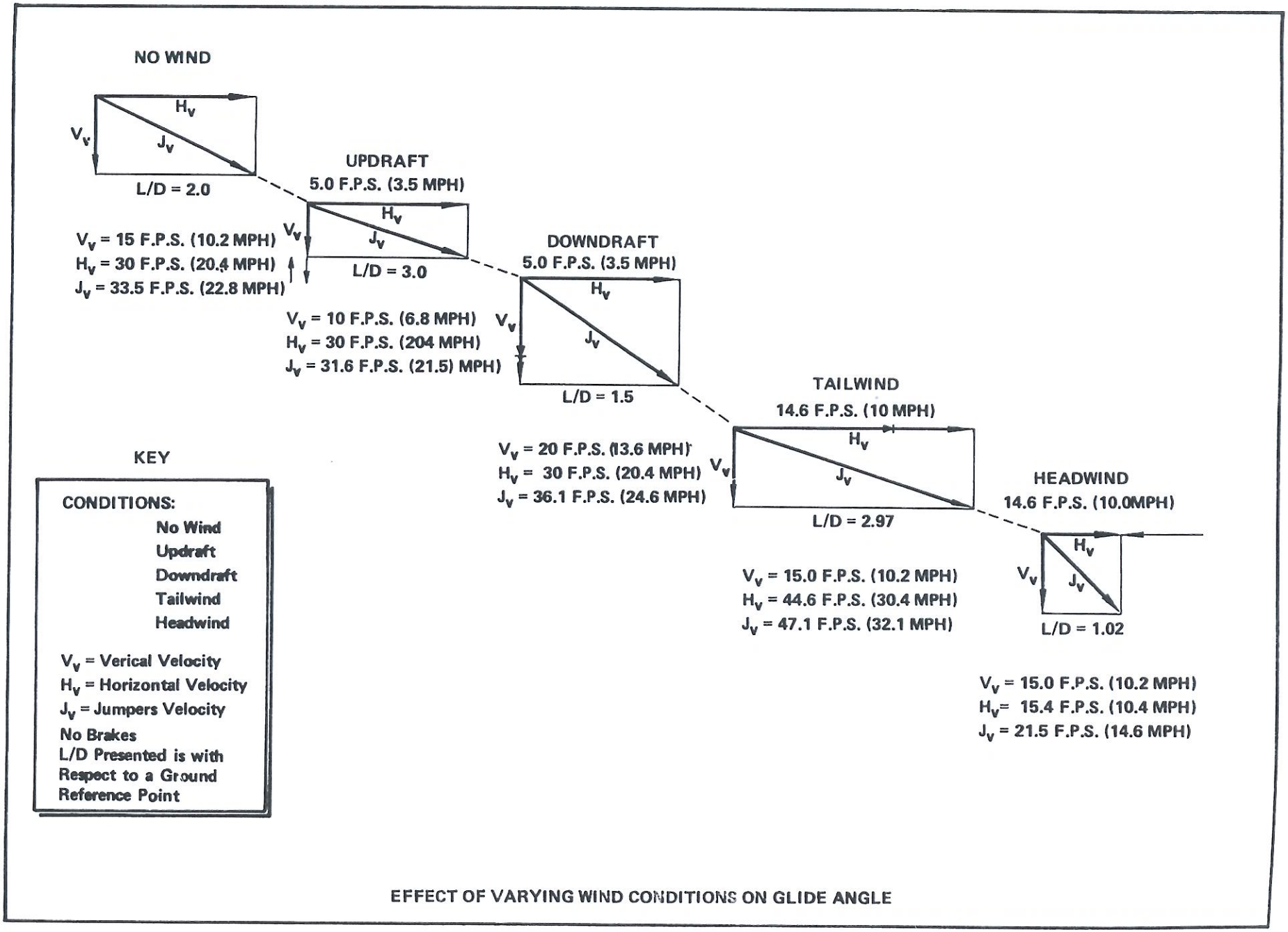
Because the Parawing in its sport parachuting configuration has been designed for high glide ratio and wind penetration, certain limitations to low altitude maneuvers are necessary. It is strongly recommended that the three basic points of advice be understood and followed exactly before jumping the Parawing.

NB

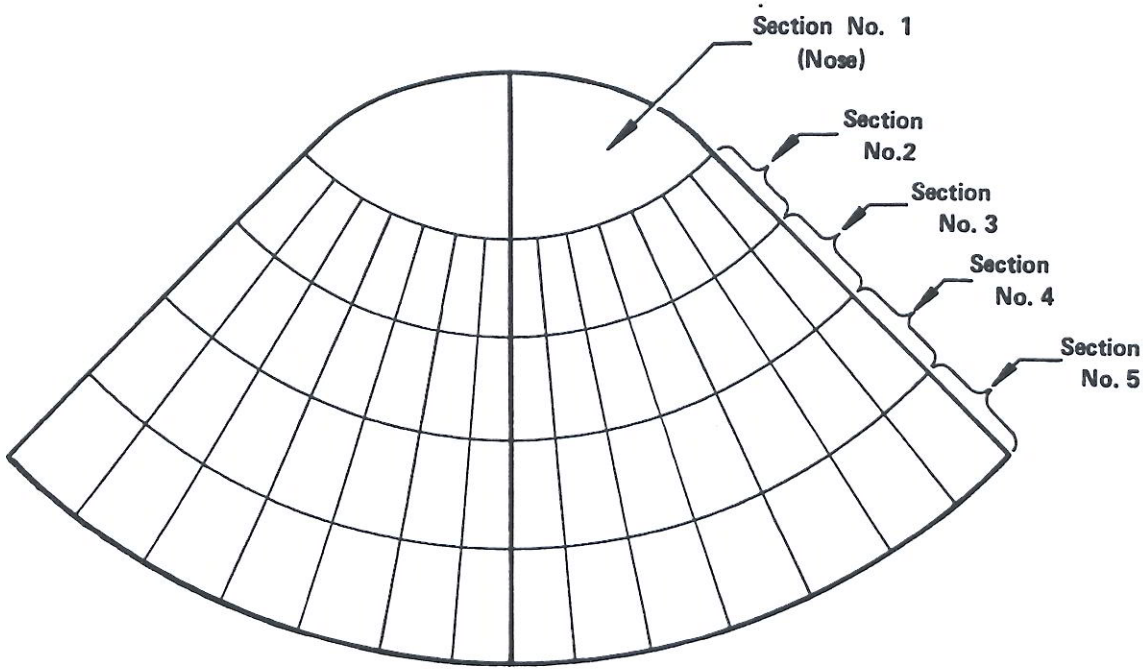
1. Stalling – Do not attempt to stall the wing below 500 feet above ground level.

2. Steep Turns – Do not attempt steep turns at low altitudes. Plan large radius turns with minor corrections in the final approach.

3. Landing – Always land the Parawing upwind.



EFFECT OF VARYING WIND CONDITIONS ON GLIDE ANGLE



When Ordering Specify:

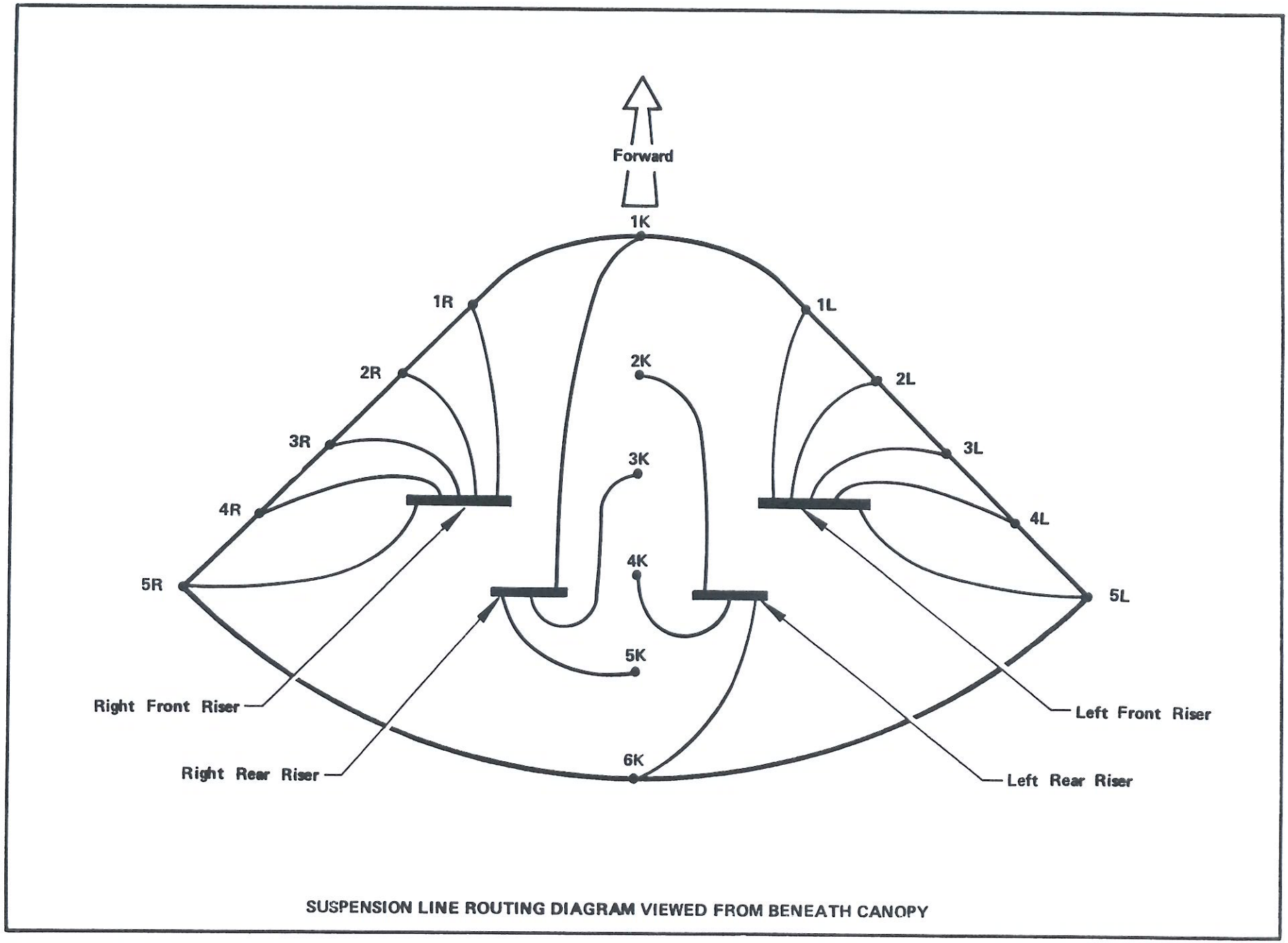
1) Section Number
2) Color of Panel
3) Number of Panels Required

CONTROL PANEL

When Ordering Specify:

1) That needed Panel is for Control Panel
2) Color of Panel
3) Number of Panels Required

DELTA II PARAWING PANEL REPLACEMENT DIAGRAM



SUSPENSION LINE ROUTING DIAGRAM VIEWED FROM BENEATH CANOPY

PACKING PROCEDURES

These packing instructions are intended only for personnel thoroughly experienced in the packing of sport parachutes. Due to the aerodynamic features of the Delta II Parawing, no deviations or additions from these instructions should be made. Inexperienced parachutists are advised to seek the aid of a licensed parachute rigger.

Packing can usually be done near the landing zone as it only requires a few minutes. If you desire to pack elsewhere, without removing the harness, chain link the suspension lines up to the wing. Roll the wing up into a ball and remove it to the packing area.

Line entanglements are extremely rare, as long as the risers are not disconnected from the harness. Suspension and control line orientation as shown on the enclosed figures should be verified before packing is begun.

WARNING

1. Do not change any suspension line lengths.

2. Do not change any rigging of control line lengths Flight performance can be seriously affected.

3. Do not attempt to repair or replace suspension lines except with proper factory supplied pre-assembled and properly measured replacement lines.

PHOTO CREDITS: M. ANDERSON JENKINS

PACKING

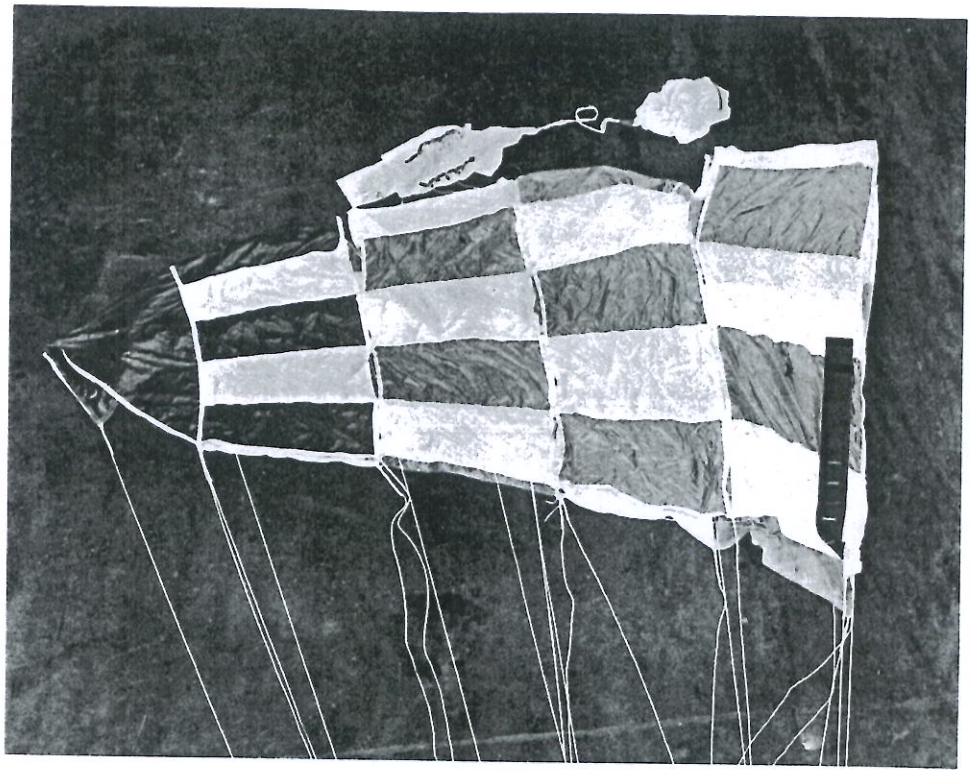


FIGURE 1

Lay the wing on the floor or ground, The open pack tray should be facing down as seen from pack tray toward wing. The wing should lay on its side with the nose pointing to the left, as seen from the pack tray (Figure 1). The OSI should be untangled and extended flat from the trailing edge, Tension (3 to 5 pounds) is necessary as you fold the wing to keep the lines straight, so if the pack tray can be secured, do so.

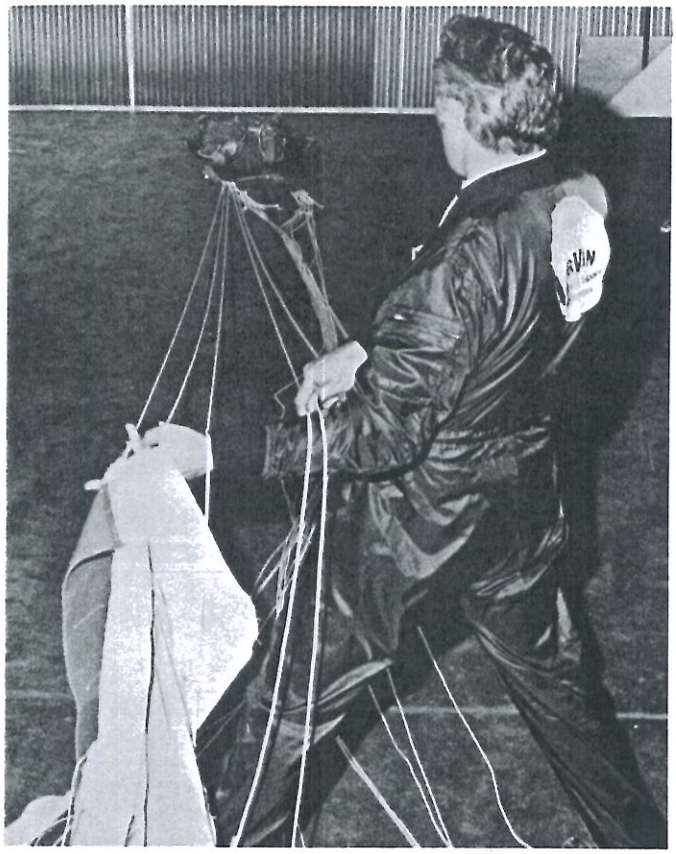


FIGURE 2

Line check is make by lifting the top left side of the wing (Figure 2). All five lines on the left leading edge should run directly to the left front connector link and the five lines on the right leading edge should run directly to the right front connector link. If these lines have no other lines running over the top or through them, all lines are straight provided that the Capewells have not been disconnected since the previous properly rigged jump.

FIGURE 3

Check the locking tab lanyard that is attached to the K2 loop and passes through the D-rings on the keel (Figure 3). Be sure the lanyard is not knotted or entangled around any lines. After the above checks have been made proceed with the packing as outlined in the following steps.

FIGURE 4

(1) Standing at the top of the wing (facing the container) grasp the top of the wing as shown by Figure 4.

FIGURE 5

(2) Pull the first section of canopy toward you to remove the slack from the lines, and fold the first panel in half as depicted by Figure 5. Be sure to pull the top of each lobe so as to maintain tension in the keel lines during the folding process.

FIGURE 6

(3) **Pass the opening shock inhibitor (OSI) under the end three red lines (5L, 6K and 5R) as indicated by Figure 6.**

Note: Since printing of this manual, it has been found beneficial to wrap all steering lines in conjunction with suspension lines 4L, 5K and 4R. (Previously these steering lines were split - two wrapped with the aforementioned and two with the 3L, 4K and 3R suspension lines).

This manual has been corrected to indicate proper packing of the steering lines with exception of Figure 7. Figure 7 should show a group of seven (7) rather than five (5) lines.

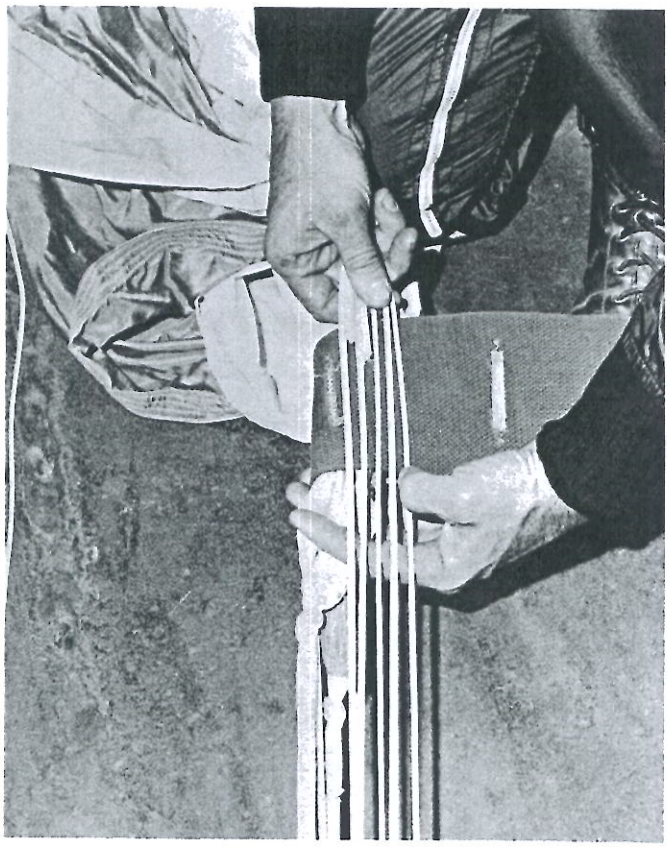


FIGURE 7

(4) Lay the next three lines (4L, 5K and 4R) plus the two control lines (gold in color) plus the two green steering lines on top of the OSI next to the gold colored marker (Figure 7).

(5) **Wrap the OSI completely around itself, enclosing these last-mentioned suspension lines and steering lines.**

FIGURE 8

FIGURE 9

(6) Grasp the wing at the next section and pull it toward you to remove the line slack and fold in half per Figure 8. Lay this fold on top of the preceeding fold.

(7) Place the next three lines (3L, 4K and 3R) [redacted] (all green in color) on top of the rolled OSI and next to the green colored marker. Wrap the OSI around these five lines.

(8) Grasp the wing at the next section, pull it toward you to remove line slack and fold it over on top of the preceeding two sections.

(9) Lay the next three lines (2L, 3K and 2R) orange in color, on top of the OSI next to the orange marker. Wrap the OSI completely around these last three lines (Figure 9).

FIGURE 10

(10) Pick up the next section (Figure 10) and fold it on top of the other sections. Place the nose section atop the folded wing as shown by Figure 11.

FIGURE 11

FIGURE 12

FIGURE 13

(11) Place the last four lines (1L, 1R, 1K and 2K), blue in color, on top of the rolled OSI next to the blue marker. Wrap the OSI around these lines (Figure 12). Continue wrapping the remainder of the OSI around the bundle of lines. When finished, there should be no less than [redacted] four complete additional wraps. If you do not come out with these specified wraps, go back and tighen up all of the preceding wraps until you do. After the OSI is completely wrapped around the lines, the two pieces of velcro pile on the OSI should butt together to insure firm attachment of the locking tab.

(12) At this point, pull lines 1L, 1K and 1R down toward the risers approximately one foot to incorporate a little slack in them.

(13) Reach up 4K and pull the locking tab down 4K and place it over the velcro pile, thus locking the OSI closed (Figure 13). Make sure the D-ring is free and clear of other lines.

FIGURE 14

(14) Fold both sides of the folded wing over (in quarters) on itself (Figure 14).

FIGURE 15

(15) Accordian fold the wing into the deployment bag (Figure 15). Place the rolled OSI on top (Figure 16). (Caution: Make sure the OSI locking tab is still in place.)

FIGURE 16

FIGURE 17

(16) Close the deployment bag locking flap and commence stowing the lines (Figure 17).

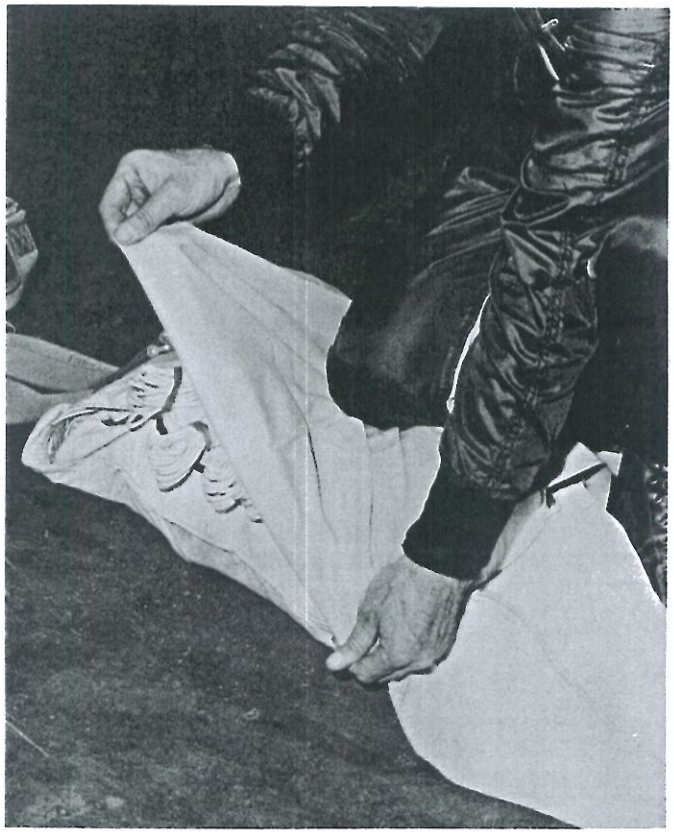


FIGURE 18

(17) When all the lines are stowed, close the line cover flap (Figure 18) and place the stowed wing in your container (Figure. 19).

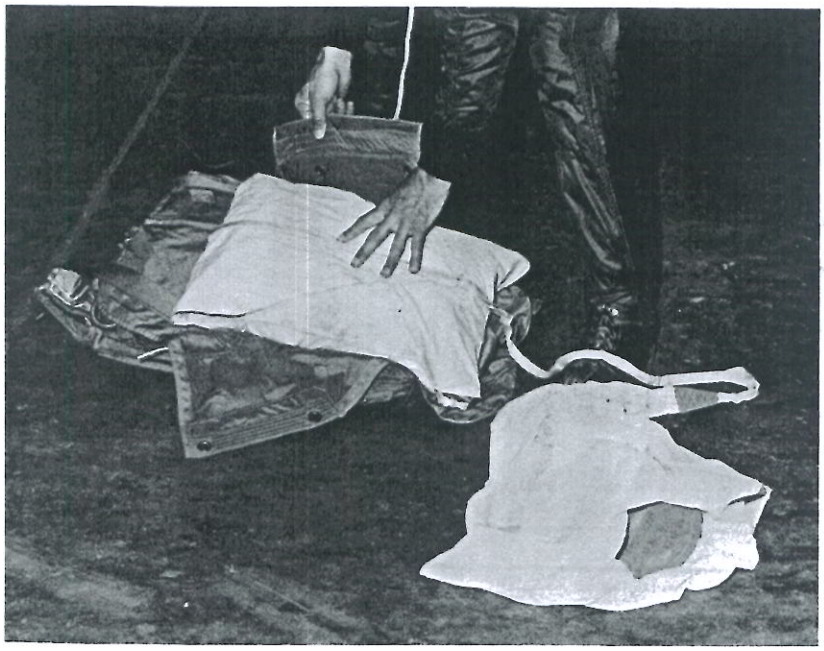
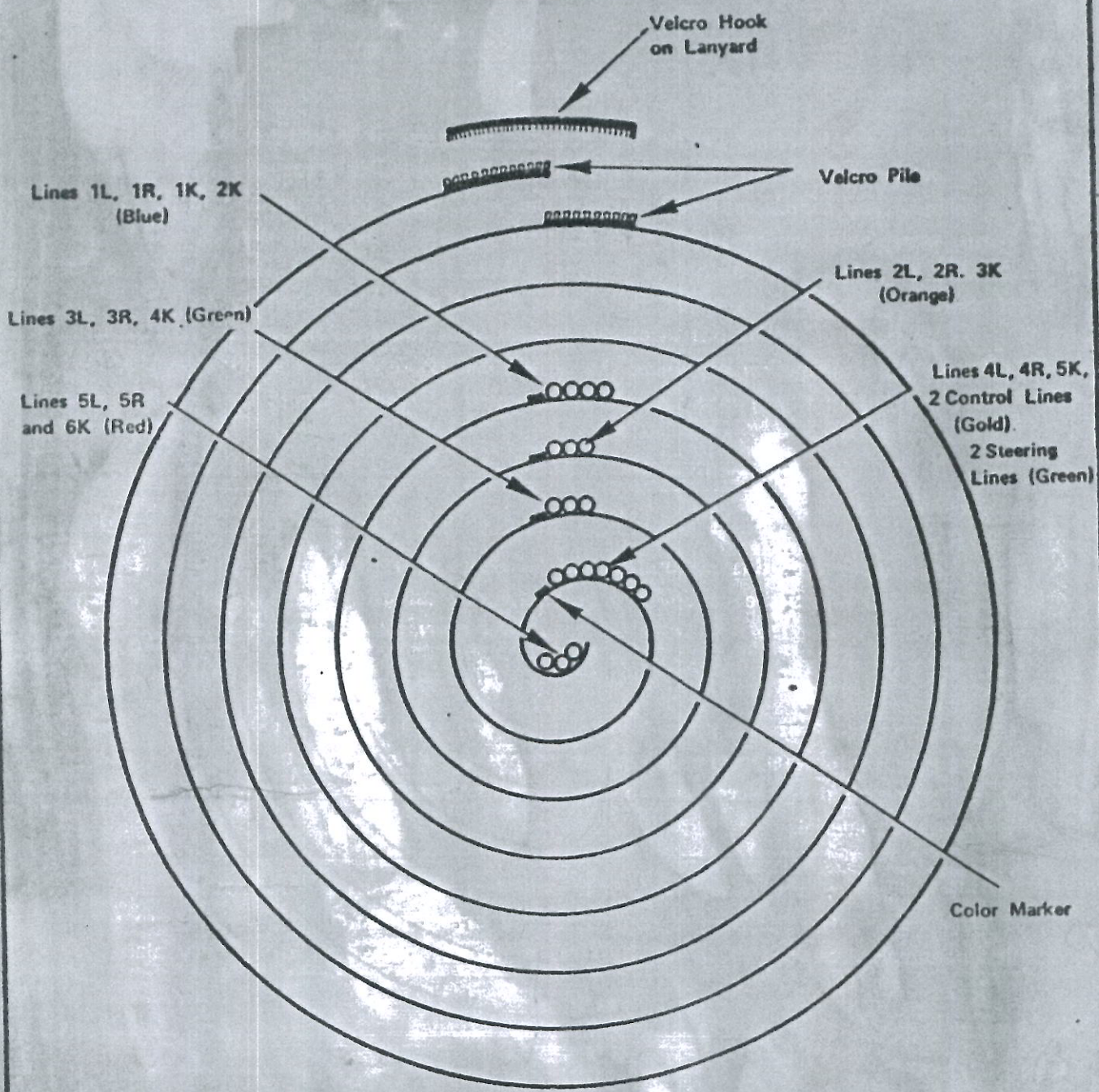


FIGURE 19



CROSS SECTION OF OSI AFTER COMPLETION
OF WRAPPING PROCESS

CARE AND HANDLING

INSPECTION AND REPAIRS

To maintain the Parawing in the best possible condition, it should be inspected after every jump. A brief but thorough inspection will reveal any areas of major damage. Periodically you should minutely examine the wing, panel by panel, and mark any burns, tears, holes or frayed stitching for later repairs. Any slight damage should be attended to as soon as possible to prevent it from becoming more severe in nature. If there are major repairs to be made, they should be accomplished by an FAA licensed rigger. If one is not available, contact your nearest Parawing distributor who can give you information on where the repairs can be made. Your distributor can also supply information concerning the replacement of panels, should the need occur.

CLEANING

Any large deposits of dirt or mud should be removed from the canopy at once. The soiled area, or the entire canopy can be washed by using lukewarm water and a very mild laundry soap. Do not use a detergent and never allow the canopy to come into contact with oil, grease or acid.

If you jump into salt water, the canopy, lines and all hardware must be thoroughly rinsed with fresh water to remove all salt deposits. After doing this, hang the canopy in the shade to dry. Never dry the Parawing in direct sunlight as this will tend to weaken the material.

If you jump into fresh water, you need only hang the wing in the shade to dry. Always be sure the Parawing is completely dry before packing. If you wish to store it for extended periods, it should be hung or loosely packed in a cool, dry place.