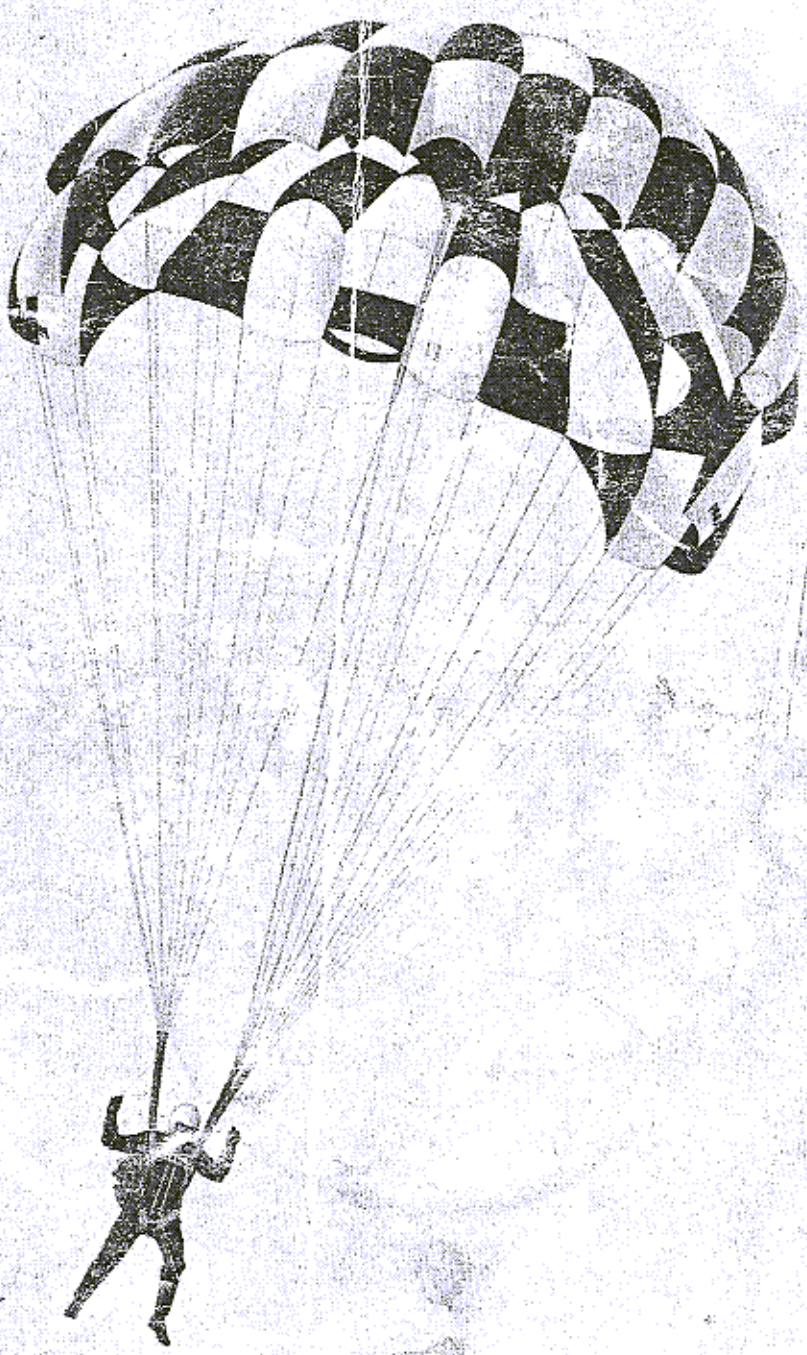

Para-commander owner's manual

Welcome to Para-Commander® land — a land of dead centers and soft landings, of champions and sports enthusiasts. Now that you are the owner of the world's finest and most popular parachute, an entirely new experience in jumping, unequaled in pleasure and excitement, is open to you. Whether you jump for competition or for fun, you will find that the Para-Commander is ideal for both.

This Owner's Manual sets forth information on the performance, operation, and care of the Para-Commander. A careful reading of it will show you how to take advantage of the many unique features of this parachute and how to make it last for hundreds of jumps. Every aspect of jumping the Para-Commander is included, from breaking it in through packing. For the competitive parachutist, there is also a section covering pointers on accuracy.

The Para-Commander is recommended for use by experienced parachutists only. The Owner's Manual is provided solely for the benefit of owners of the Para-Commander and contains the most recent information available. It is in no way to be construed as a representation or warranty on the part of Pioneer Parachute Company, its Distributors or Dealers, as to the performance of any individual Para-Commander.

A nationwide network of Para-Commander Dealers is ready to help you at any time. You can rely on your dealer for efficient service on all your equipment and repair needs.

Happy Jumping!

PARA-COMMANDER
Owner's Manual

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PIONEER PARACHUTE COMPANY

Pioneer Parachute Company, a subsidiary of Pioneer Aerodynamic Systems, Inc., is the largest exclusive designer and manufacturer of parachutes and aerodynamic deceleration and retardation devices in the world, specializing in parachutes and accessory items. Although its entry into the field dates only from 1938, Pioneer has now become a world leader in the design, development, and manufacture of parachutes. And, in 1957, when Pioneer became the first company to manufacture parachutes for sport jumping, it quickly assumed the leadership here too. The first sport parachute can now be seen at a most unusual drop zone – the National Air Museum of the Smithsonian Institution.

To the aeronautically-oriented world, the name Pioneer is synonymous with a wide range of parachutes for civilian, commercial, and military aviation and also with parachute recovery systems for returning astronauts as well as missiles and instruments to earth. To the sport parachutist, however, the name Pioneer signifies the finest in parachuting equipment and, of course, the Para-Commander.

Backed by experience that covers the entire history of practical parachute manufacture and by a highly skilled aeronautical engineering staff, modern production techniques, and complete testing facilities, Pioneer Parachute Company continues in its search for new and safer parachutes and equipment for special purposes and for sport.

PARACHUTES INCORPORATED

Founded in 1957, Parachutes Incorporated was the first sport parachuting firm in the world. It has grown continuously since that time and is now the largest sport parachuting corporation. Although the public often think of Parachutes Incorporated in connection with jump centers, it actually gained fame for establishing many important firsts in the parachuting field.

Parachutes Incorporated was the first to design and originate sport parachuting equipment. It introduced techniques for teaching complete control during free fall, trained the original United States Army free fall instructors, and developed free fall film techniques. In 1961, Parachutes Incorporated executives set the first official parachuting world records for this country.

Aside from its role in the evolution and growth of the sport, Parachutes Incorporated has been continuously developing and testing parachuting equipment. As the world-wide distributor for Pioneer Parachute Company, Parachutes Incorporated offers the highest quality, most reliable equipment and the most dependable service.

HISTORY OF THE PARA-COMMANDER

The Para-Commander is the most radical change in sport parachute design since the first slot for steering and stability was cut into a flat circular canopy – more than thirty-five years ago. In fact, compared to early types of parachutes, or even to the previous favorite, the seven-panel TU, the Para-Commander should not really be called simply a parachute but a precision parachute. This canopy can be controlled and maneuvered with greater precision than any other parachute in the world.

The history of the Para-Commander began in France, where Pierre M. Lemoigne, an aviator and engineer, constructed an ascending parachute based on the development of certain wing and airfoil principles. In 1961, Parachutes Incorporated brought the Lemoigne canopy to the United States, where Pioneer then elaborated the design and manufactured the Para-Sail®. From there, it was just a matter of time before the parachute that went up would also come down and revolutionize sport parachuting.

The public's first view of the Para-Commander was at the Orange Sport Parachuting Center in Massachusetts in November, 1962. The jumpers stared in wonder as this oddly shaped parachute with an inverted apex floated slowly downward. Even more amazing was the landing which was, despite the parachutist's 170 pounds, soft as a feather. His knees barely bent as he lightly touched the target with his toes and remained standing. The following year, at the 1963 National Parachuting Championships in Issaquah, Washington, one Para-Commander was entered. Again the jumpers were astounded by its performance. Not only could they not believe its low rate of descent and long glide angle, but they could not believe that any canopy packed with its apex pulled down inside, almost to the skirt, would ever open. But the Para-Commander showed itself to be the parachute of the future.

Another important debut for the Para-Commander in 1963 occurred in South America. The leaders for the National Geographic Society and the New York Zoological Society expedition selected the Para-Commander as the vehicle for dropping a group of men into the 13,000-foot unexplored Vilcabamba area of the Peruvian Andes. This decision was based on the canopy's low rate of descent, even at high altitudes (it had been tested at 12,000 feet on the slopes of Popocatepetl, a Mexican volcano), as well as on its maneuverability and reliability. Without the Para-Commander, the trip would have been extremely difficult. Parachuting was the most efficient way to reach this unknown territory – provided that the canopy had the special characteristics that only the Para-Commander did have.

Meanwhile, Pioneer continued to test the Para-Commander and make further improvements. By June, 1964, it was ready to receive its first extensive evaluation. The United States Parachute Team used the parachute during the two-month training period prior to the VII World Parachuting Championships held in West Germany. The precision of the Para-Commander as well as the skill of the Team jumping a relatively unfamiliar parachute is shown by the accuracy results. In the 1000-meter individual accuracy event, the United States placed 2 men and 1 women in the top five; in the 1500-meter individual accuracy for men (the women's event was not held), 1 man placed in the top four; in the 1000-meter team accuracy, both the men's and women's team placed third.

The competition record to date proves that the Para-Commander is a precision parachute. Since the 1964 National Parachuting Championships, the percentage of Para-Commadners used in national competition has increased, reaching 100 per cent in 1966. The Para-Commander has also been selected as the parachute for the United States Army Parachute Team and the United States Marine Corps Team.

Para-Commander Competition Record

National Parachuting Championships	Number of Competitors	Percentage with Para-Commanders		
		Total Jumpers	Accuracy Winners *Men*	*Women*
1963: Issaquah, Washington	118	0.8%	0%	0%
1964: Salt Lake City, Utah	92	41%	100%	100%
1965: Orange, Massachusetts	85	86%	100%	100%
1966: Tahlequah, Oklahoma	97	100%	100%	100%

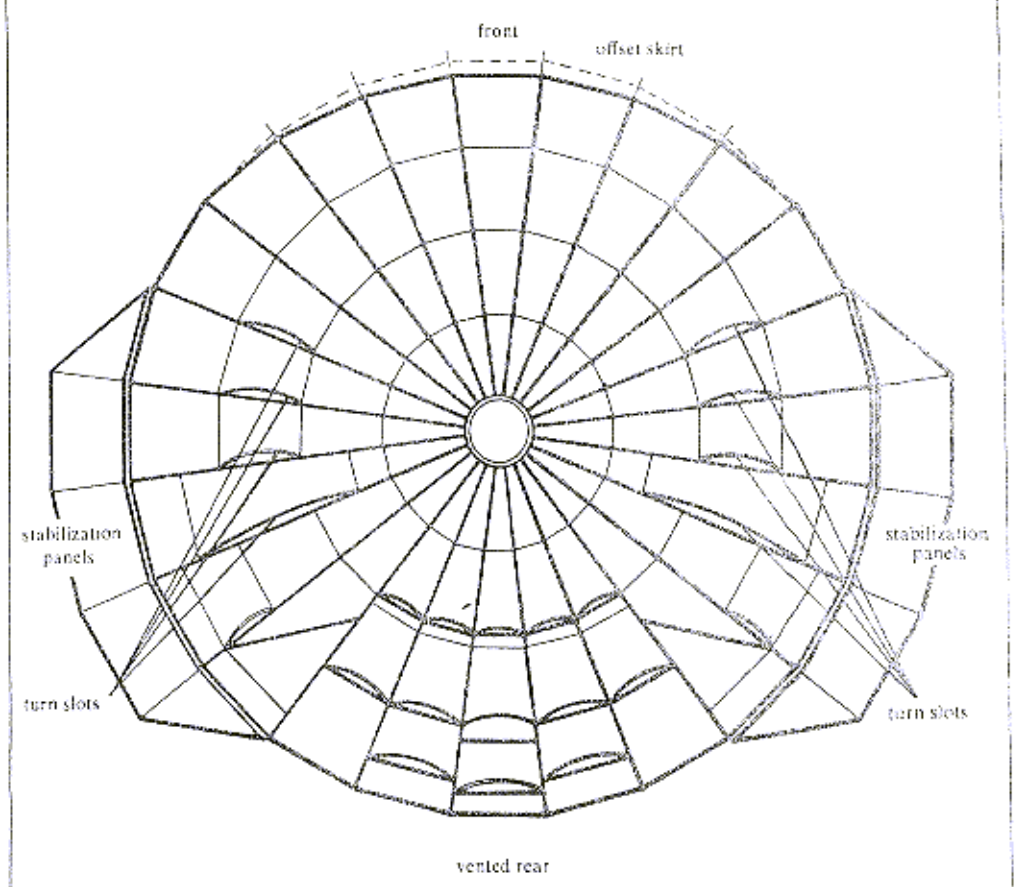
TECHNICAL DATA

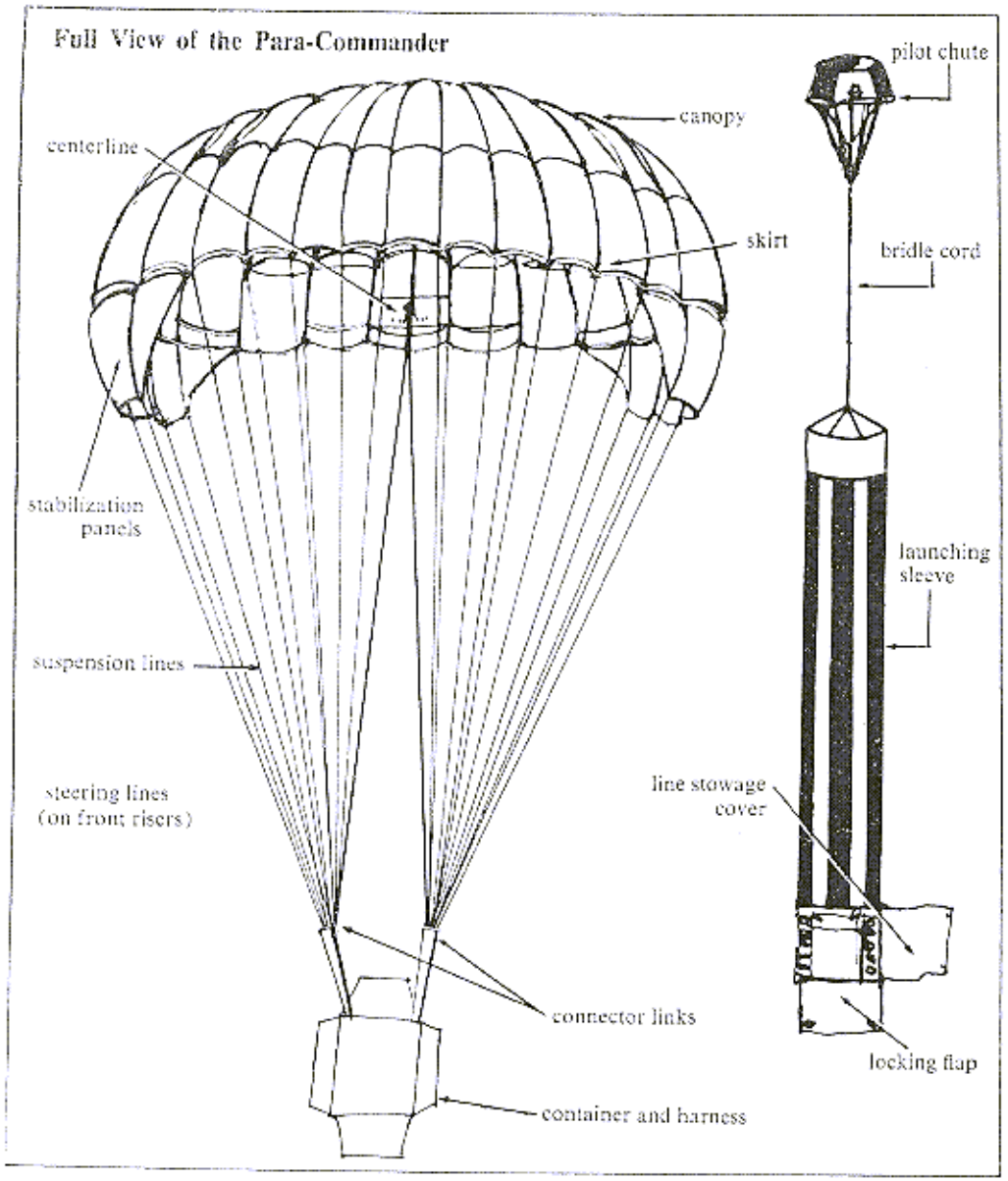
The Para-Commander is a uniquely designed and technically complex piece of equipment. It is made up of 117 parts, which include such items as panels, tapes, lines, webbing, plus 2000 yards of thread. It is important to understand the anatomy of your Para-Commander in order to make full use of it and to provide proper maintenance. The following chart and illustrations offer a technical view of the Para-Commander.

Para-Commander: Technical Data

Design	*24' diameter canopy*
Fabric Weight (nylon taffeta)	*2.0-2.25 oz./sq. yd.*
Fabric Breaking Strength	*warp: 80 lb./in.* *fill: 60 lb./in.*
Fabric Tear Strength	*warp: 5 lb.* *fill: 5 lb.*
Fabric Porosity	*3.0-10.0 cu. ft./sq. ft./min.*
Suspension Lines, Tensile Strength	*550 lb. each*
Steering Lines, Tensile Strength	*550 lb. each*
Sleeve Deployment	*Para-Commander Standard or Para-Commander Short Launching Sleeve*
Pilot Chute	*Para-Commander Pilot Chute: 40" low porosity canopy, 9" crown, 20" spring*

Plan View of the Para-Commander





PERFORMANCE DATA

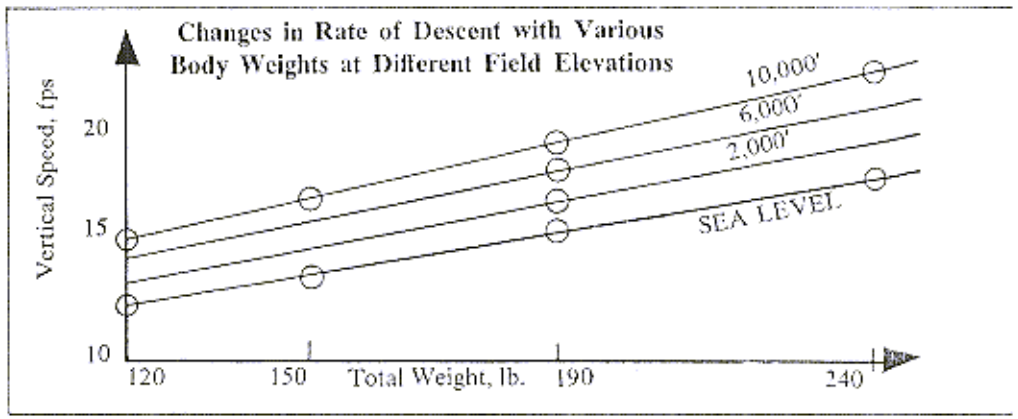
The performance of the Para-Commander is remarkably reliable. However, the way in which the canopy acts will vary from parachutist to parachutist due to different body weights, and it will also show slight changes with different atmospheric conditions. Through an understanding of such facts, the jumper can compensate for them and obtain the same excellent Para-Commander performance as that under average conditions. The information in the table is based on an altitude ranging from sea level to 2500 feet. The suspended weight should be taken as the parachutist's weight with all equipment.

Performance Data for the Para-Commander

Rate of Descent: 190 lb. suspended weight	*15.7 ft./sec.*
250 lb. suspended weight	*17.6 ft./sec.*
L/D (Lift to Drag) Ratio	*1.16*
360° Turn	*3-4 sec.*
Deployment time: Jump and Pull	*2.4 sec.*
Terminal Velocity	*1.7 sec.*
Landing Force	*equal to jump from 3-3½ ft.*
Maneuvers	*turn, brake, stall*

Of particular interest is the lift to drag (L/D) ratio, which shows that the canopy moves 11.6 feet horizontally for every 10 feet vertically. That is, horizontal speed is 16 per cent greater than vertical speed in no wind. Previously, the highest L/D ratio was only 0.7 for a low porosity seven-panel TU.

To find the approximate horizontal speed in winds, add the wind speed to your vertical speed (use the Rate of Descent Chart) if you are heading downwind; or subtract the wind speed if you are going upwind. This rule, of course, is valid only for a canopy with a L/D ratio of 1 (not for a seven-panel TU).



As a further aid in compensating for various atmospheric conditions and body weight, keep these facts in mind.

(1) Both forward speed and rate of descent decrease in dense air. The factors that increase air density are high barometric pressure, low altitude, low humidity, and low temperature.

Where the opposite factors prevail and the air is thinner, both forward speed and rate of descent increase.

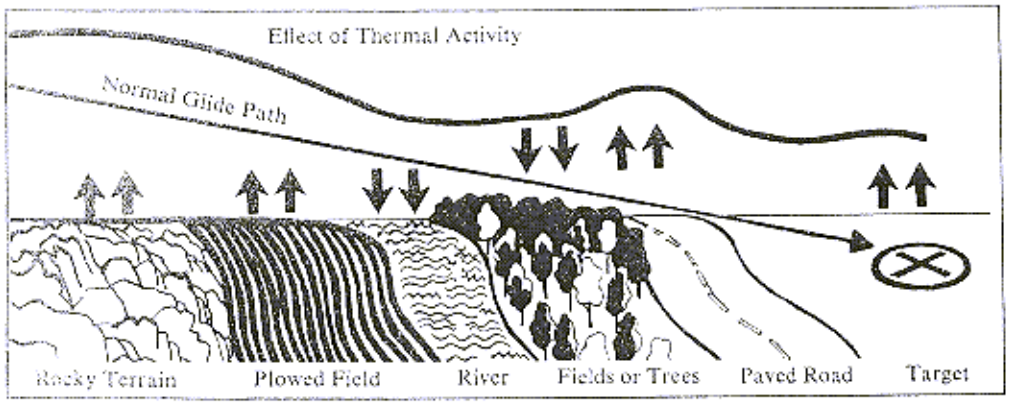
(2) The canopy brakes and stalls more readily and reacts much faster in thin air. This becomes very noticeable at high altitudes, such as in Salt Lake City or Denver, and it will not be necessary to pull downward quite as far or as hard on the toggles.

(3) The tension on the steering lines of a new Para-Commander is set at about six to seven pounds when the canopy is inflated. Thus if you usually jump in thin air conditions, you may have to decrease the original tension. Also, a jumper weighing 200 pounds will need less tension on the steering

lines than a 100-pound jumper. The lines are under the correct ... when a full stall can be obtained by pulling both toggles down to about hip level.

(4) Different surfaces of the earth absorb and release heat at varying rates. The strength of the rising currents of warm air depends on the degree to which the air is heated and the type of surface. The illustration shows what types of surfaces generally release warm air and cause updrafts and those which absorb heat less rapidly, therefore causing downdrafts.

Effects of Thermal Activity on a Canopy



DESCENT AND GLIDE CHARACTERISTICS

The low rate of descent and increased glide angle, or ratio (at a high forward speed), are the outstanding characteristics of the Para-Commander. Both factors play an important part in the dead centers and soft landings for which the parachute is famous.

Low Rate of Descent

The Para-Commander descends more slowly than a conventional parachute. One reason for this is the special material used — a low porosity nylon taffeta. Only 3 to 10 cubic feet of air/square foot of cloth/minute can pass through the material under pressure equal to one half inch of water. The low rate of descent is also a product of the inherent lift properties of the Para-Commander, producing an increased glide angle.

Increased Glide

The unusual lift characteristics of the Para-Commander make it capable of traveling farther and staying in the air longer than conventional canopies. Four specific points in its design favor this improved lift.

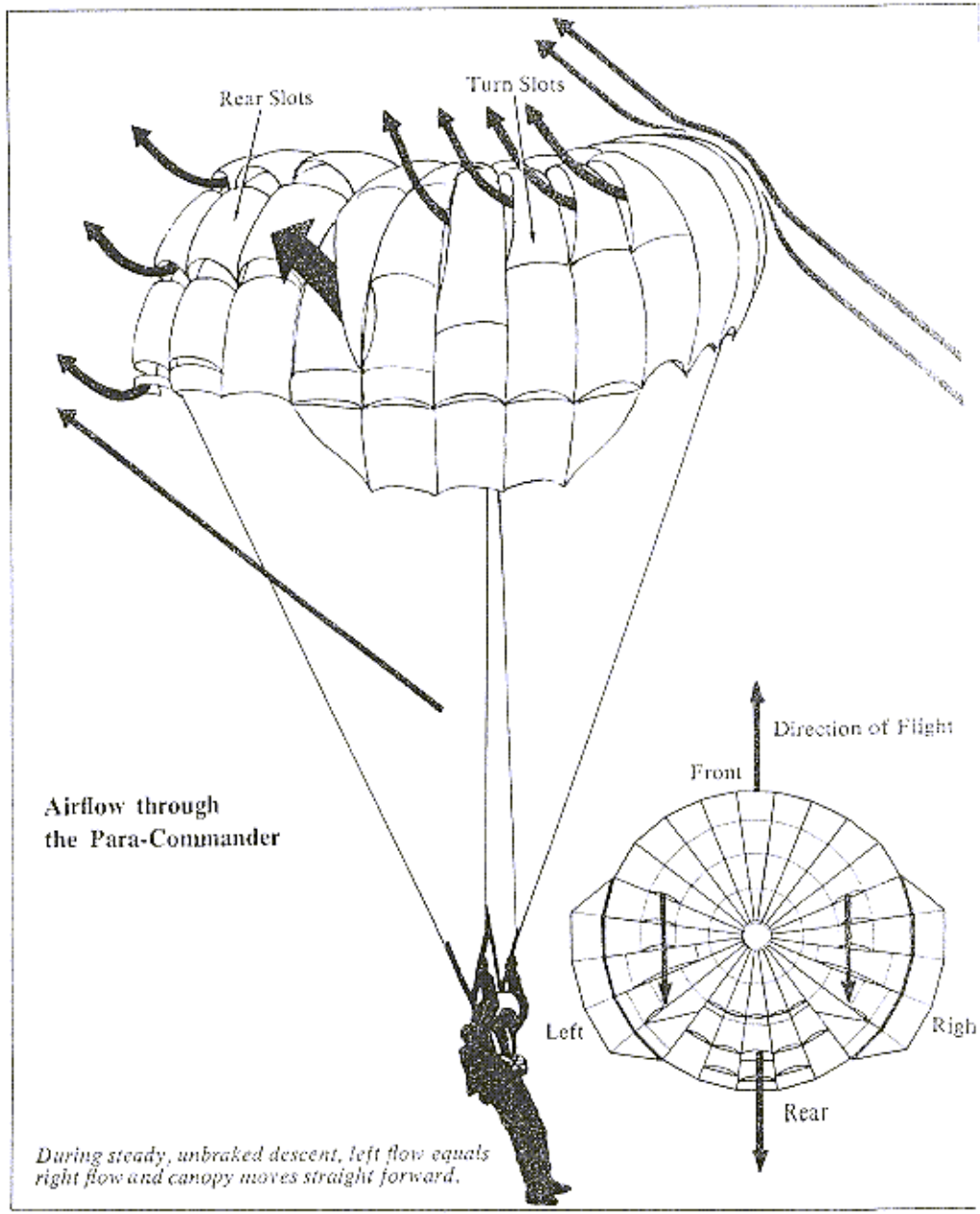
(1) Air captured in the canopy during descent is funneled rearward, rather than upward, through numerous slots. As the air flows through the rear vents, an aerodynamic lift force is created over the front of the canopy.

(2) The permanently inverted apex allows the canopy to spread more and thus retain a more efficient aerodynamic shape.

(3) The stabilizing panels on each side of the canopy also affect its shape by further spreading it into an ellipse, which is more favorable for an increased glide

the direction of glide.

It is essential to be thoroughly familiar with the canopy's glide path when setting up an approach to the target. The approach must be made from a lower altitude than that with conventional canopies in order to avoid overshooting the target. The illustration of the normal airflow through the Para-Commander should be used as a basis for studying glide paths as well as for maneuvering techniques.



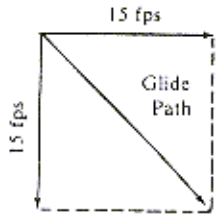
Airflow through the Para-Commander

During steady, unbraked descent, left flow equals right flow and canopy moves straight forward.

Changing the Rate of Descent and Glide Path

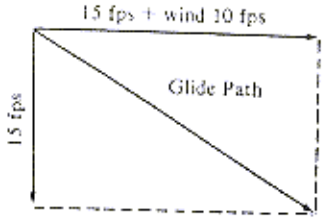
Certain factors, such as wind velocity, use of brakes, and direction in which the canopy faces, can alter the glide path of the Para-Commander. These effects are shown in the following figures. To simplify the graphs, the L/D ratio is taken at 1.0 instead of 1.16. The suspended weight in all cases is 180 pounds.

(1) Conditions: no wind; no brakes; canopy facing any direction.



Total velocity of jumper: about 21 fps (14.5 mph).

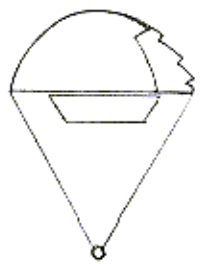
(2) Conditions: wind 10 fps; no brakes; canopy facing downwind.



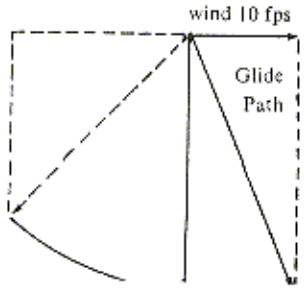
Total velocity of jumper: about 28.5 fps (19.5 mph).

(3) Conditions: wind 10 fps; no brakes; canopy facing upwind.

Total velocity of jumper: about 15.5 fps (10.5 mph).

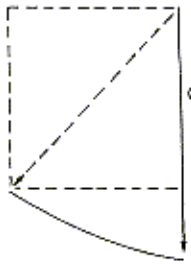


(4) Conditions: wind 10 fps; full brakes; canopy facing upwind.



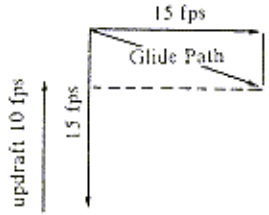
Total velocity of jumper: about 23 fps (15.5 mph).

(5) Conditions: no wind; full brakes; canopy facing any direction.



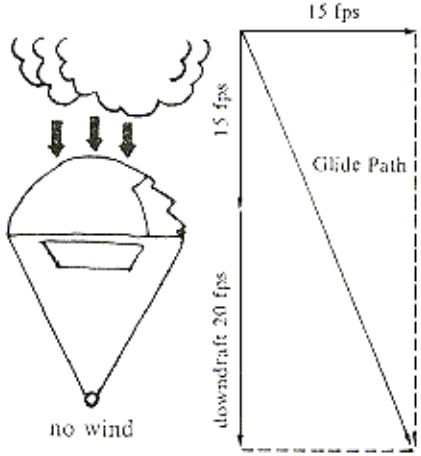
Total velocity of jumper: about 21 fps (14.5 mph).

(6) Conditions: hot day with no wind; no brakes; canopy facing upwind. The decreased rate of descent is due to thermal air current creating an updraft equal to 10 fps.



Total velocity of jumper: about 15.5 fps (10.5 mph).

(7) Conditions: cumulus thundercloud overhead with no wind; no brakes; canopy facing upwind. The increased rate of descent is due to downward air current creating a downdraft equal to 20 fps. (Conditions are obviously unsafe for jumping.)



Total velocity of jumper: about 38 fps (26 mph).

Note: The total velocity of the jumper in graphs #1 and #5 is equal, yet many jumpers will claim that under actual conditions they land harder using full brakes in no wind. What really happens is that the greater glide of graph #1 permits the landing shock to be absorbed by running — something that is impossible during the perpendicular descent shown in graph #5. Thus it is that total velocity alone does not determine the force of landing. The angle

JUMPING A NEW PARA-COMMANDER

Breaking in a new Para-Commander is similar to the standard procedure used for conventional parachutes. After making sure that the canopy is properly assembled and packed, it is suggested that two or three jumps be made within a short period of time in order to give you the opportunity to become accustomed to the new canopy.

Spotting

The opening point for a Para-Commander should be further upwind than for other canopies because of its low rate of descent. How far upwind depends upon body weight and atmospheric conditions as well as canopy handling. Making several jumps on the same day will help you readjust your spotting techniques.

Opening Position

A stable face-to-earth position with head high, arms up rather than out in front, and knees drawn up should be assumed before opening. Do not put undue stress on the Para-Commander by opening in a track or delta. Opening shock is comparable to that of an unmodified 28-foot low porosity canopy deployment.

Deployment

On pulling the ripcord, a slight delay is experienced because of the longer bridle extending from the pilot chute to the crown lines. This is especially noticeable on short delays. The Para-Comander has a TSO* for a 40-inch diameter low porosity pilot chute with a longer bridle. This combination is necessary because the bridle is attached to the crown lines instead of the apex and because it provides the tension on the main seams and centerline that is essential for proper inflation.

As the Para-Commander starts to inflate, air entering the canopy rushes out the slots in the rear. The skirt blossoms momentarily, moves back in slightly, then inflates fully. The air pressure is distributed so that only a minimum amount of the jumper's weight is taken by the front risers. Once in a while, the front of the canopy presses against the centerline on opening. If this happens, do *not* pull down on the front risers. This will further collapse the canopy, although it will reinflate after release of the risers. Instead, pull one or both toggles all the way down in order to increase internal air pressure and force the front to inflate. As the canopy opens, look up and check it and make sure the steering lines are clear.

**A TSO is a Technical Standard Order stating the requirements with which the item (C-23 refers to a parachute) must comply to be considered airworthy according to Federal Aviation Regulations.*

Approach to Target

As discussed in the section on maneuvering, the approach should be made with half brakes. You will find that the approach must be set up lower than with a conventional parachute. In calm to moderate winds, you will be able to move back and forth across the sky without difficulty. In higher winds, you can hold by turning the canopy upwind. *Never at any time pull down on the front risers in an effort to slip.* To lose altitude, only braking, stalling, turning, or holding are recommended. And don't forget to keep an eye out for other parachutists who may have opened above you but, if they do not have a Para-Commander, may pass beneath you during your approach. The lower parachute always has the right of way.

Landing

The high forward speed of the Para-Commander becomes more evident as it approaches the ground. Despite this speed, even downwind landings can be surprisingly gentle because of the low descent rate. Nevertheless, except in competition, it is preferable to land facing upwind, after having completed the turn into the wind well above ground. *Always prepare to execute a parachute landing fall.* And if your Para-Commander leaves you standing, just take it in your stride. You'll get used to it.

Collapsing the Canopy

On landing, the flow of air through the canopy is usually sufficient to make it collapse by itself. In higher winds that do not permit the canopy to collapse, pull down on one steering line (the higher the wind, the more the line must be pulled) until the parachute deflates. *After landing*, if you cannot reach the toggles because you are being dragged, releasing a capewell will completely collapse the canopy.

MANEUVERING THE PARA-COMMANDER

Turning, braking, stalling, and stall recovery are accomplished by manipulation of the two steering, or control, lines. Each line is attached to four elliptical turn slots on its side of the canopy. Pulling down on the toggles inverts these slots; the harder the pull, the greater the inversion. The steering lines are set under tension that should permit the parachutist to stall the canopy when he pulls both toggles down to the stall area about waist level. The tension on the lines must be equal in order to avoid a built-in turn.

Stable maneuvering of the Para-Commander can best be accomplished from a half-brake position, wherein the forward speed of the canopy and the lift are mildly decreased. That this is essential will be seen by examining why maneuvers made from a no-brake position (i.e., starting all toggle movements from the keeper level) are unstable in comparison to those made from half brakes.

The half-brake position is ideal for a target approach because it permits the parachutist to keep a reserve of both speed and brakes – either of which

may be needed for last second adjustments a few feet above the target. The half-brake approach should definitely be used on the final downwind run toward the target. However, the farther out it is set up, the better the final approach will be, with fewer corrections needed. It is important that all maneuvering be done with a smooth, steady pull on the steering lines. Sharp, quick motions, horsing (over-maneuvering) the canopy, or the sudden release or pull of toggles are the main reasons why a good approach is spoiled and a dead center missed. These movements can also be very dangerous when done too close to the ground.

In the half-brake position, both toggles are held down evenly between the shoulder and waist level. (The distance depends partly on weight, partly on atmospheric conditions.) This redirects part of the normal rearward flow of air on both sides upward and out of the top of the canopy. When first applied, the lift efficiency of the canopy is lowered, the body swings slightly forward, then drops back beneath the canopy. With the toggles held in this position, the canopy settles down immediately and glides smoothly ahead. Turns, full brakes, and stalls can now be made with an absolute minimum of oscillation.

Turning

Turn from No Brakes: made with one toggle remaining at the keeper level while the other is lowered. The farther the toggle is pulled down, the faster the turn, and the more unstable. The following results when one toggle is lowered about three feet.

(1) The turning slots on one side invert noticeably.

(2) Part of the normal rearward flow of air on that side is redirected upward and out of the top of the canopy, while the rearward airflow on the opposite side is unchanged.

(3) The shape of the canopy is altered by the change of air pressure. There is a loss of lift on one side as the air flows upward.

(4) The canopy banks on the turning side and begins to rotate rapidly. Forward speed is decreased.

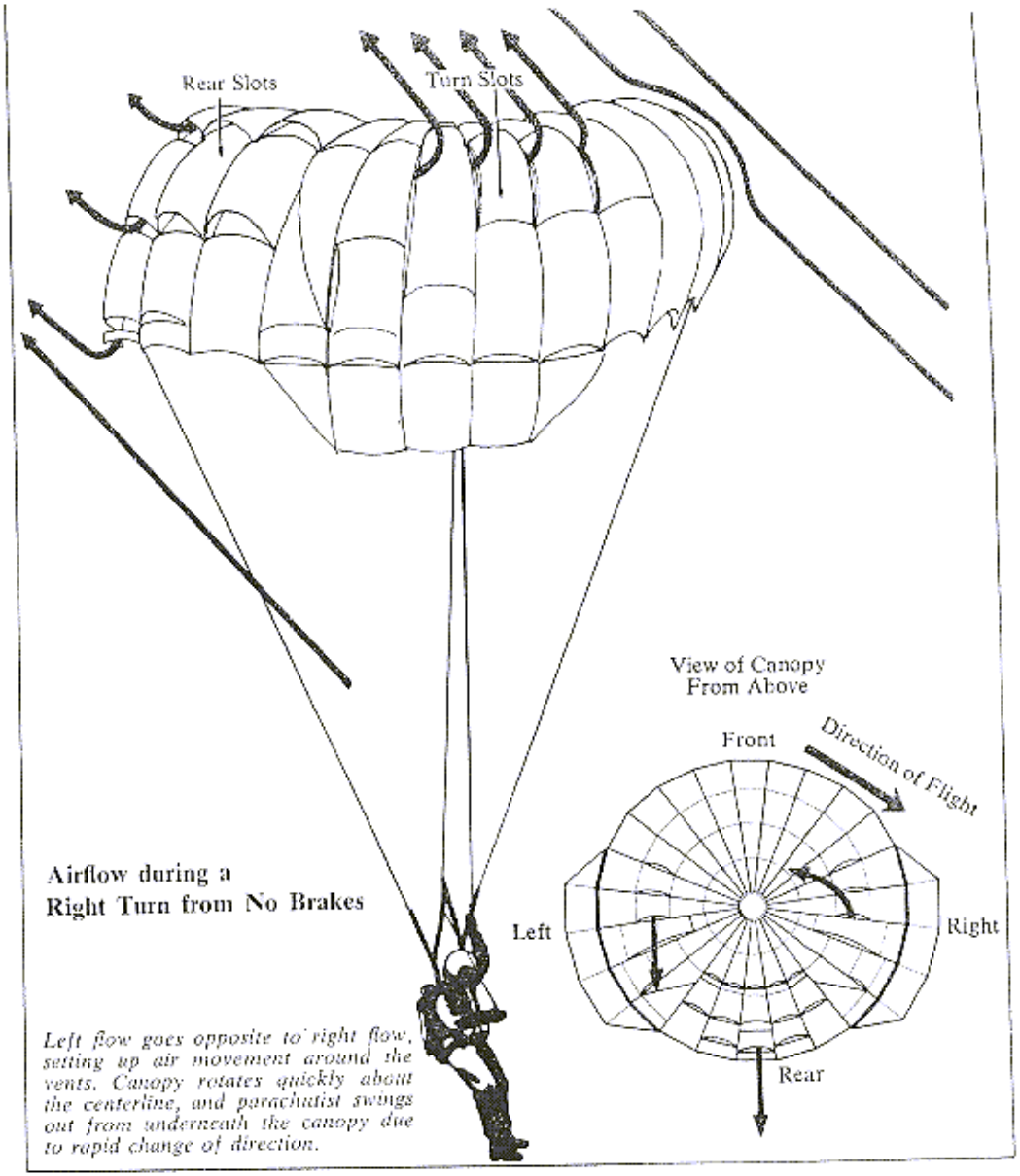
(5) The sudden canopy rotation causes the parachutist to swing to the outside of the turn (i.e., to the opposite side of the canopy).

Turn from Half Brakes: for slight turns up to 45° during final approach downwind to counteract variable winds and gusts. Slow s-turns of 180° are used before setting up on final in order to zigzag across the wind cone and lose altitude until the proper approach angle is perceived by the jumper.

To start a braked turn from half brakes, pull one toggle down toward the waist. The more tension exerted, the faster the turn. Since the lift and speed of the canopy is already dampened, only a moderate loss of lift on the turning side will now occur. The turn will be flat and stable. The canopy cannot suddenly accelerate during the turn because of the over-all lower lift efficiency. To stop the turn, raise the lower hand back to the half-brake position.

Braking

Full Brakes from No Brakes: made by pulling down on both toggles at the same time from the keeper level to a position close to the waist. The lower the toggles are pulled, the faster and more unstable the results. This is what happens.



Airflow during a Right Turn from No Brakes

Left flow goes opposite to right flow, setting up air movement around the vents. Canopy rotates quickly about the centerline, and parachutist swings out from underneath the canopy due to rapid change of direction.

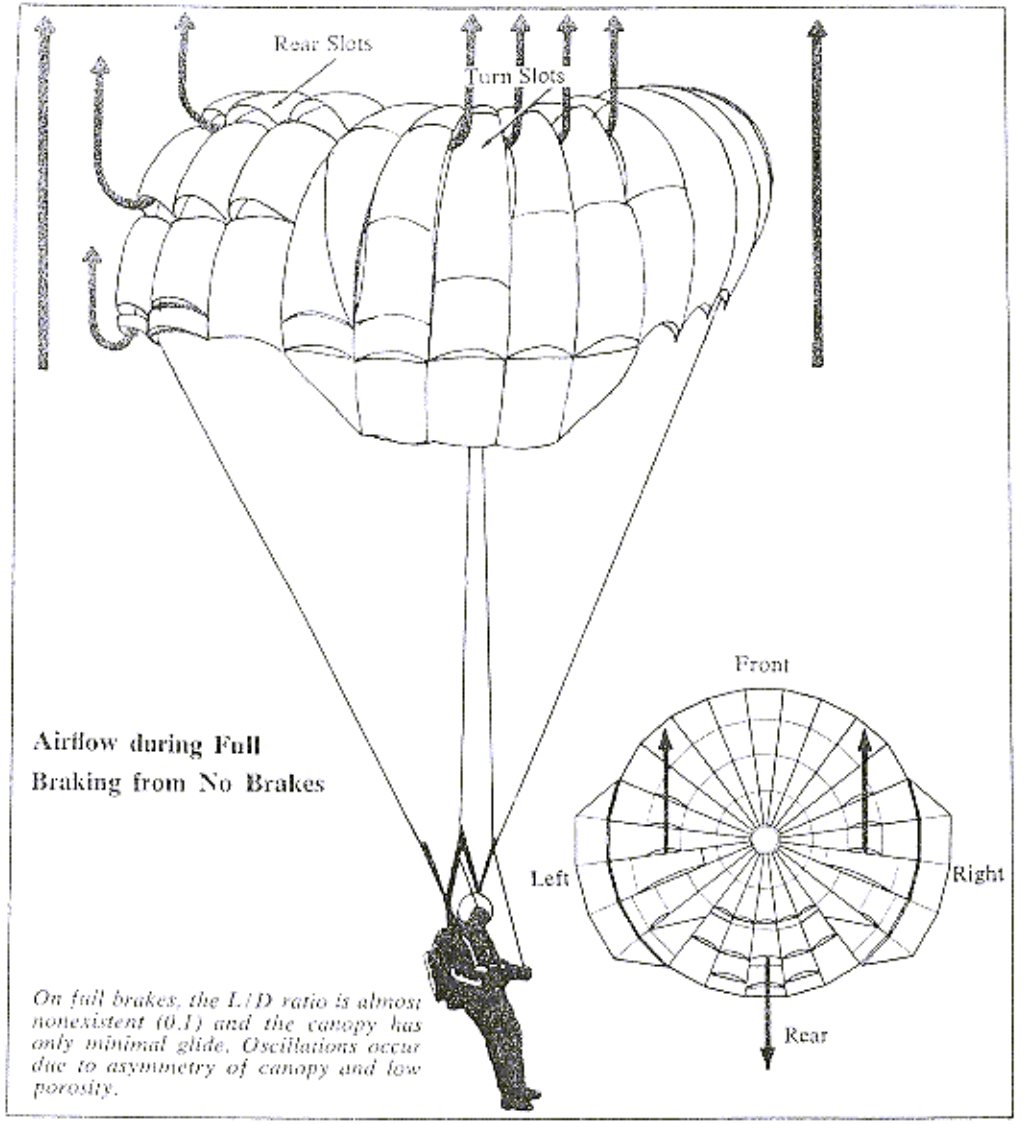
(1) The turning slots on both sides invert noticeably.

(2) Part of the normal rearward flow of air on both sides is redirected upward and out of the top of the canopy.

(3) The shape of the canopy is altered. Lift is lost on both sides since the upward airflow nearly equals the amount of air driven rearward through the remaining slots.

(4) The forward speed decreases rapidly, with only a minimum glide remaining. The rate of descent increases.

(5) The sudden canopy movement causes the parachutist to swing forward.



Airflow during Full Braking from No Brakes

On full brakes, the L/D ratio is almost nonexistent (0.1) and the canopy has only minimal glide. Oscillations occur due to asymmetry of canopy and low porosity.

Full Brakes from Half Brakes: to readjust glide angle when approach is too high and an overshoot probable. Brakes are also used before setting up on final to lose altitude while still facing the target.

To start full brakes from half brakes, pull down on both toggles at the same time toward the waist. Since the lift on both sides of the canopy has already been decreased, only a moderate further loss of lift will now occur. The canopy remains stable as the forward speed decreases and the rate of descent increases. Oscillation is minimal because the change of airflow has been less radical. To release the brakes, raise both hands back to the half-brake position.

Stalling

Stall from No Brakes: made by pulling down on both toggles at the same time from the keeper level to [illegible]. This is extremely unstable. The effects are the same as pulling full brakes from no brakes, but greatly exaggerated.

(1) The turning slots invert fully on both sides.

(2) All of the normal rearward flow of air on both sides is redirected upward and out of the top of the canopy, then spilled at random around the canopy.

(3) The shape of the canopy is altered, with complete loss of lift on both sides.

(4) Forward glide stops. The canopy shudders, then rocks backward, the rear sinking and the front rising. Then it rocks forward and begins to sink straight down rapidly.

(5) The sudden canopy movement causes the parachutist to swing violently forward and backward before settling underneath the sinking canopy.

Stall from Half Brakes: to lose altitude more rapidly than with full brakes or s-turns. It has the advantages of letting the jumper keep his eye on the target and remain directly on the wind line.

To start a stall from half brakes, pull down on both toggles at the same time to about waist level into the stall area. A shudder will be felt after the stall point has been reached, forward glide stops, and the canopy begins to sink. Again, since the lift on both sides of the canopy has already been decreased, only a mild loss of stability occurs. Some oscillation is present in any stall, nevertheless, since the canopy is essentially out of control when it is not flying. To release the stall, the double clutching technique described later should be employed.

Note: This stall may be used to salvage an overshoot at the last moment, *but only under controlled conditions in order to prevent injury*. The stall must be made in the last few feet, when the canopy has time only to lose all forward speed but has not started sinking rapidly. At that point, the canopy will not yet have rocked backward and the body will not have oscillated before the jumper lands. However, increasing your rate of descent just before landing is seldom justified and should be avoided.

Stall Turn from Half Brakes: useful at the edge of the wind cone in variable winds when it is essential to turn over one spot in order not to lose the wind line.

To start a stall turn from half brakes, both toggles must first be brought down to nearly full brakes around the stall area. Then lower the turn toggle even further. As the canopy stops its forward glide, it begins to rotate rapidly with no ground travel and may turn up to 180° over one spot. Just before the desired heading is reached, release the stall turn by double clutching the lowered toggle. Then return both toggles slowly to the half-brake position.

Note: This stall turn may be used to salvage a jump if you are off the wind line at the last moment, *but only under controlled conditions in order to prevent injury*. The stall turn must be made in the last few feet, when the canopy has time only to lose all forward speed but has not started sinking rapidly. At that point, the canopy will be in a fast turn but will not have started rocking and the body will not have oscillated before the jumper lands.

Double Clutching for Stall Recovery

Double clutching is the fastest method of releasing a stall and restoring forward speed with only a minimum of oscillation. It gets the canopy back overhead as soon as possible after it has started to sink but before it has time to surge ahead with loss of stability. This technique of smooth stall recovery requires much practice.

To double clutch, quickly raise both toggles from the stall area to shoulder height, then immediately pull down again to the full-brake position (see illustrations). This is the result.

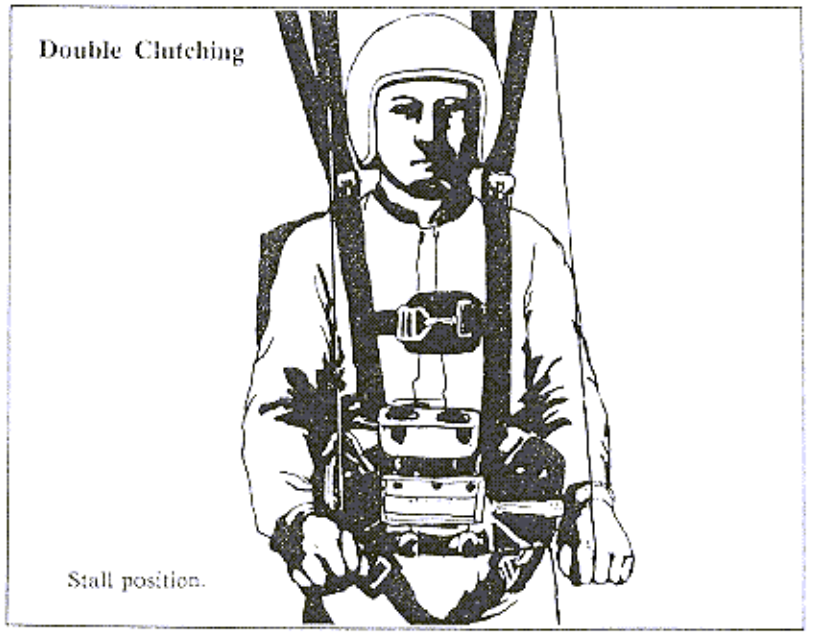
(1) A burst of air escapes through the 8 steering slots as the toggles are raised.

(2) The momentary lift is counteracted instantaneously as the toggles are lowered to full brakes.

(3) The canopy, which had been in a full sink, goes into a partial sink while remaining directly overhead. It cannot surge forward because the application of full brakes keeps forward speed at a minimum.

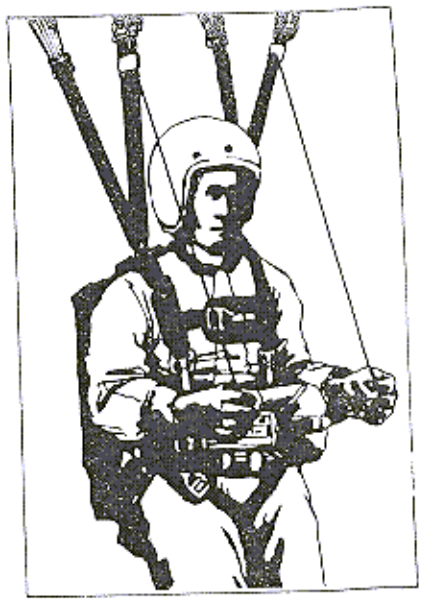
(4) In about one second, minimum glide is restored to the canopy without instability or body oscillation.

This technique should also be used to recover from a stall turn. Here the turn toggle is quickly raised from the stall area to shoulder height, then immediately pulled down to the full-brake position. As it is pulled down, the other toggle, which had been in the stall area, should be eased up gently into a parallel position at full brakes. Then both toggles should be slowly raised to half brakes.



Stall position.

Raise both toggles to shoulder height.



Pull both toggles down to full brakes.

Body Steering

Body steering is a controversial topic in that some experienced jumpers claim that it does not work while others state that they can slightly change their position without moving the toggles, simply by shifting their body weight. It is included here so that you may try it and decide for yourself. Body steering may be of some help in correcting a poor spot by increasing or decreasing forward speed, in counteracting a wind shift a few feet above the ground, and in altering direction in a stall without losing the stall. Its main disadvantage is that it distracts the attention and limits the ability to concentrate on the feel of the canopy and the preparation for a safe reach and landing.

Forward speed may be somewhat increased by lessening the amount of drag. To accomplish this, raise the feet and legs by bringing the knees to the chest or extending the legs forward while leaning back in the saddle. Pulling down on the rear risers also adds lift and increases forward speed slightly, but the jumper loses directional control since he must remove his hands from the toggles.

Forward speed may be decreased by extending the legs straight back. *This should be done with care near the ground; such a position is dangerous for landing.*

To change direction, swing the legs to the side of the turn desired and hold them there. In a stall, the canopy will shift sideways without going forward.

Maneuvers started from a no-brake position are inherently unsafe and are not recommended. Turning, braking, and stalling should not be done near the ground since the parachutist may land during an oscillation and injure himself. Because maneuvers made from no brakes do not favor accuracy in that the jumper is unable to maintain a steady glide path or keep his eyes on the target, there is no justification for using these techniques. Correct maneuvering of your Para-Commander and making safe downwind approaches require much practice. Learn the fundamentals of maneuvering first while high in the air, and before learning how to make downwind landings. Practice such landings in ideal wind conditions and on soft targets until you develop ability in your canopy handling, approach, and landings.

JUMPING FOR COMPETITION

The approach and landing techniques described in this section should be practiced by experienced parachutists only.

Hitting dead center is one of the biggest thrills of parachuting. Making two or more dead centers in a row is even more exciting – and it can be done! But it takes much practice to learn what the Para-Commander can do and how to handle it in all kinds of conditions. The following tips on improving your accuracy will help you reach your goal sooner, with fewer wasted jumps. Learn one step at a time, until it becomes a habit, before going on to the next step. If you train regularly, you will soon be logging centimeters instead of meters, and more dead centers than you can shake a judge at.

The Competition Drop Zone

One of the problems jumpers face at a meet is an unfamiliar drop zone. However, even if you do not have time to jump there before the competition, it is still possible to learn something about the area by studying it ahead of time.

First find out the field elevation, not only for resetting your altimeter but also to determine whether or not this will affect the performance of your Para-Commander. Then study the winds. If the trees in the area are slightly shaped in one direction, this indicates the path of the prevailing winds. Now look at the wind sock and see how it reacts to the present winds: the velocity required to raise it from a limp position to a flutter, half way, and fully; how it moves during gusts. You may compare it to a tetrahedron or other wind sock on the airfield, but you should not rely on the latter indicators. Learn to use the competition wind sock since this is directly in the target area and permits you to keep your eyes on the target at all times.

Another area of study for a meet is the topography of the drop zone. Compare it to your usual drop zone: width of the target, size of the over-all drop zone, landmarks for measuring distances from 100 feet out to help you in spotting and on your approach. Then examine an aerial photograph for surfaces that may affect your canopy by creating thermals or downdrafts. If no photograph is available, survey the area as soon as you take off in order to avoid last minute confusion over the exit point. Further information about the general effects of weather and atmosphere is given in the FAA publication *Realm of Flight*.

Spotting

When only a wind drift indicator or balloon is used, be sure to extend your opening point beyond that shown by the indicator. The same is true for a wind dummy drop, except when a Para-Commander is used. In such a case, if the Para-Commander faces downwind the entire time, the spot indicated will be too long. Likewise, the spot will be too short if it has faced upwind the entire time.

Another help in spotting is watching contestants from the target area for as long as possible before your flight. This is far more reliable than depending upon watching them only when you are in the plane or above them in the air. From either of the latter positions, you cannot see how the jumper is maneuvering and thus cannot correctly judge the wind conditions.

Deployment

Generally it is best to face the target before pulling the ripcord, unless you suddenly realize that you are too short after you exit. On opening, you will then not have to waste time turning to find the target. Check your canopy and steering lines immediately and make sure all lines are clear. Look at your altimeter, the wind sock, and the target before planning your approach. Some jumpers like to lower one side of the reserve at this time and remove their goggles for a better view of the target.

Preparation for Approach

The first point to remember concerns the reaction time of the Para-Commander. It takes about a second for your canopy to react to steering, and it may have already taken you a second to decide what to do. Time can pass too quickly if you are not constantly alert. So think ahead of the canopy. If you want to turn over a certain point on your right, start a right turn a second before you reach that point. And if you want to stop the turn after 90°, let up on the steering line before you reach 90°. The same one-second lapse (approximately) holds for all maneuvers – the time varying with atmospheric conditions and body weight.

As you look at the target after opening, decide immediately whether you are too far away, too near, or in the right spot. If you are too far, start running in without brakes. If you are too near, either make s-turns or turn upwind. You can also stall the canopy, but this will cause some instability, which will make the glide angle difficult to determine. Turning upwind is also disadvantageous in that you can no longer watch the target. However, if done around 2000 feet and held no more than 1000 feet (in average winds that do not blow you back toward the target), you will still have time to turn and watch the target.

Once you are in the right spot, keep your eyes on the dead center disc so that you can maintain a constant check on your glide angle as you approach the target. Look at the wind sock from time to time in order to know ahead of your final approach what the ground winds are doing. The wind sock is the only means you have of determining the direction of the ground winds.

Final Approach

The final approach should be made downwind with half brakes. The only exception to this might be in high winds when some jumpers, especially those who are lightweight, find it easier to control the canopy by using a sideways approach. But even here, the last 100 feet should be run facing the target. In this sideways attitude, half brakes should be applied at least one second before turning downwind to prevent the canopy from surging forward.

The approach may be started as low as 300-500 feet in high winds, or as high as 1000 feet in a calm condition. Once you have started on final, never take your eyes off the disc. Only by keeping the disc in view at all times will you be able to maintain the proper glide angle and have a smooth approach. All toggle movements should be slow and steady to prevent oscillation. In turning, use just one toggle at a time, pulling it down to turn rather than raising the opposite toggle. The only exception to this is when you are falling short of the disc and need the extra flying power that raising the toggle will give you by making the canopy surge forward. Never make a 360° turn on final. You will inevitably miss the target, either by falling off the wind line or by losing lift and falling short. Besides, you should not have allowed yourself to get so close that a 360° turn becomes necessary.

Since you now have your eye on the disc, you may wonder what your hands are doing, especially if you find that the corrections you think you are making do not seem to be taking effect. This can be remedied by holding your hands slightly forward so that they are in the periphery of your vision. You may be surprised by what you see, or don't see, the first time you try this.

Making a Dead Center

Competition judges watch landings very closely. They can see which part of your body touches down first, and you can't fool them. But you can develop a technique of landing that will leave no doubt in anyone's mind as to where you touched. A stretch forward is the preferred method for competition landings. This permits you to watch the disc and see where to place your heels. Get used to making your heels the first point of contact; they leave a definite mark where you land and are far easier to place on the disc than your toes or the side of your boot. Wearing a sturdy, well fitted jump boot in good condition is essential for this.

raised or with both heels is up to you. The safest stretch is always the best stretch. However, whichever method you choose, stick with it and practice it so that you won't have to make a decision about it when your feet are six inches above the disc. Your reach should be an absolutely smooth movement made only when you are just about to land. A premature reach will throw your canopy off, distract you as you try to maintain that position, and block your view of the disc.

If you find that you must make canopy corrections within the last fifty feet of the target, don't forget the delayed reaction time of the Para-Commander here. A slight overcorrection is necessary now if you are somewhat off the wind line because there is not sufficient time for the canopy to react to just the needed degree of correction.

One more point: at the split second before contact, don't blink! Many a centimeter has been lost in the wink of an eye. As soon as you have been marked, get out of the way of the contestants following you. You'll have time to kiss the disc later.

PACKING INSTRUCTIONS

These instructions are intended only for those who are thoroughly experienced in the packing of sport parachutes. Due to the many unusual features of the Para-Commander, no deviations from these instructions should be made. Inexperienced jumpers and riggers are advised to seek aid from an FAA-licensed rigger.

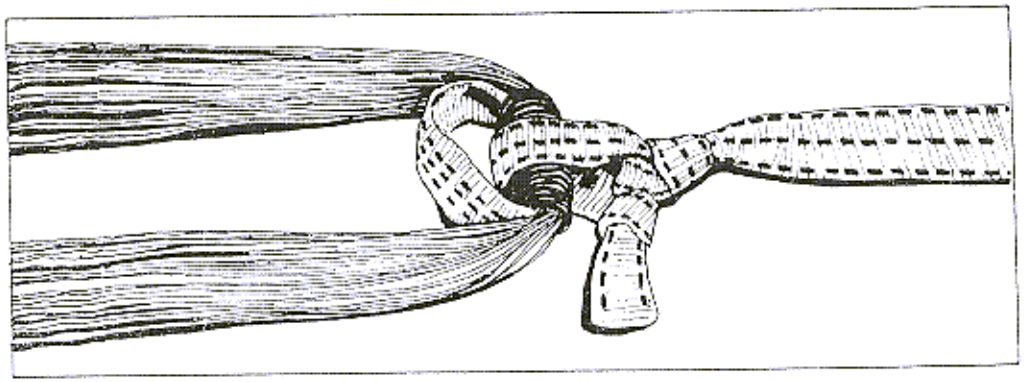
Packing the Para-Commander will be easier if it has been carefully field-packed first. To field pack, lay the entire assembly on the ground, then grasp the top of the crown lines and pull the canopy straight. Check the crown lines to make sure that the sleeve and pilot chute are not entangled in them. To do this, hold one side of the crown lines at the top in each hand and follow the lines down to the top of the canopy. (See step number 2 and figure 3.) The lines should form two separate groupings that divide the canopy in half. When they are straight, pull the sleeve on, chain link the lines, and fold the parachute into the pack.

(1) Laying Out the Canopy

Stretch the parachute assembly out full length on the packing table as if it were being worn by a jumper lying face down (figure 1). All directions to right, left, top, and bottom are from this position. Anchor the canopy at the connector links on the risers and at the bridle loop attached to the crown lines. Apply tension. Slide the sleeve off the canopy and crown lines up to the tension device.

through the loop of tubular nylon and be tied with a bowline knot around the tubular nylon bound with cotton cord (figure 2). *Never tie the bridle to the unbound webbing.*

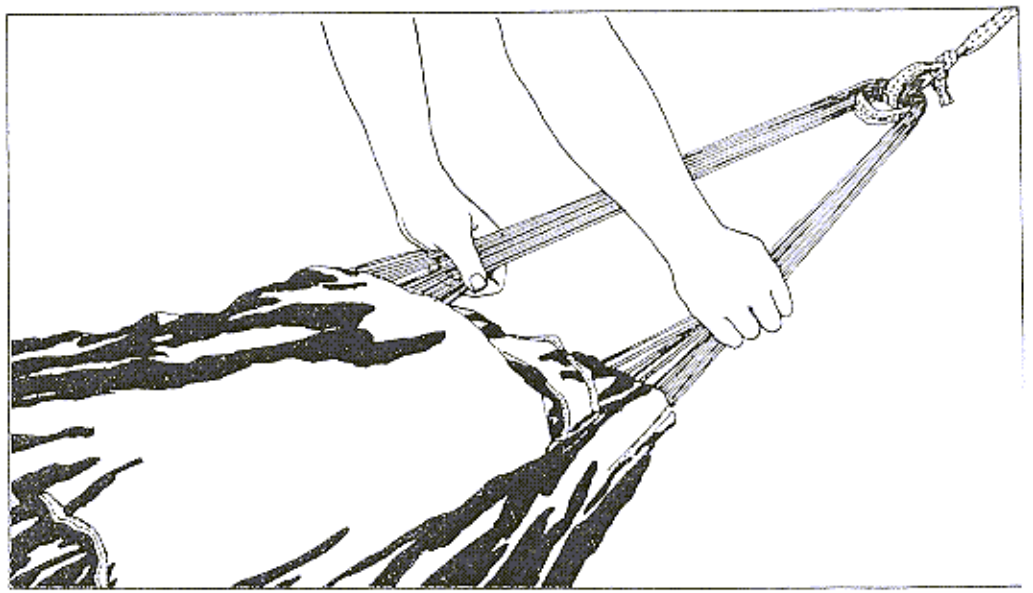
FIG. 2. SLEEVE BRIDLE ATTACHED TO CROWN LINES.



(2) Inspection of the Canopy

Straighten the crown lines (if not already done during field packing) by removing any entanglements with the sleeve and pilot chute. You should be able to separate the two groups of lines dividing the top of the canopy (figure 3).

FIG. 3. CHECKING THE CROWN LINES.



Examine the suspension lines for entanglements by taking the lines from the top center gore (#1 and #24) in one hand and from the bottom center gore (#12 and #13) in the other, then following them down from the skirt to the risers.

Now clear the control lines by following them back up, one set in each hand, from the keepers on the front risers, underneath the centerline, to inside the canopy at the turning slots.

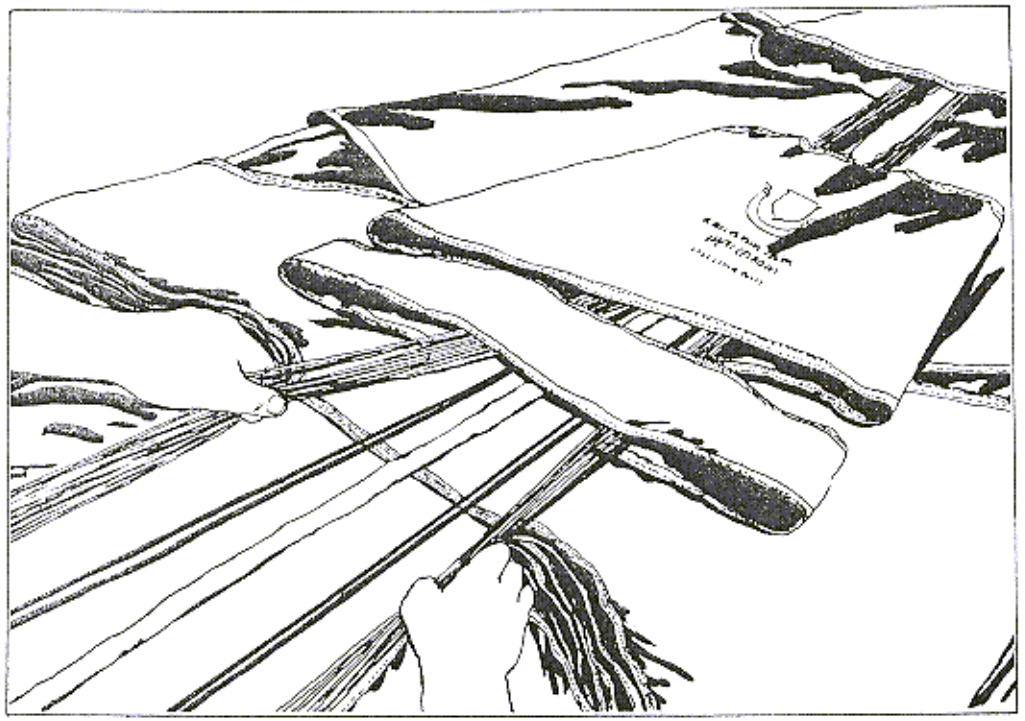
Make sure the centerline is clear by following it down from the apex to its attachment on the inboard side of each rear riser.

Inspect the container, harness, risers, lines, canopy, sleeve, and pilot chute for signs of wear, holes, or other damage. Make sure that the cotton cord wrapping at the top of the crown lines has not frayed or loosened.

(3) Pleating

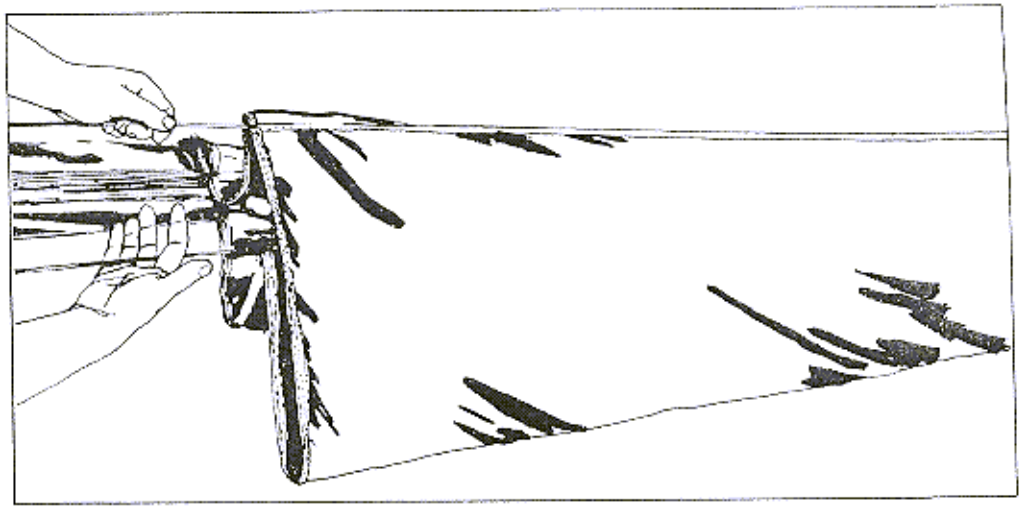
The Para-Commander is pleated like a conventional canopy. Stand on the right side of the table next to the skirt and stabilizer panels. Grasp the two groups of suspension lines and spread them away from the centerline and steering lines (figure 4).

FIG. 4. SEPARATING THE TWO SIDES OF THE CANOPY.



To find the bottom center gore, throw the right group of gores over the left. Pull out line 13 past the right edge of the table. Place it between the right index and middle fingers about 12" back from the skirt since the skirt is shorter in front (figure 5).

FIG. 5. START PLEATING WITH LINE 13.



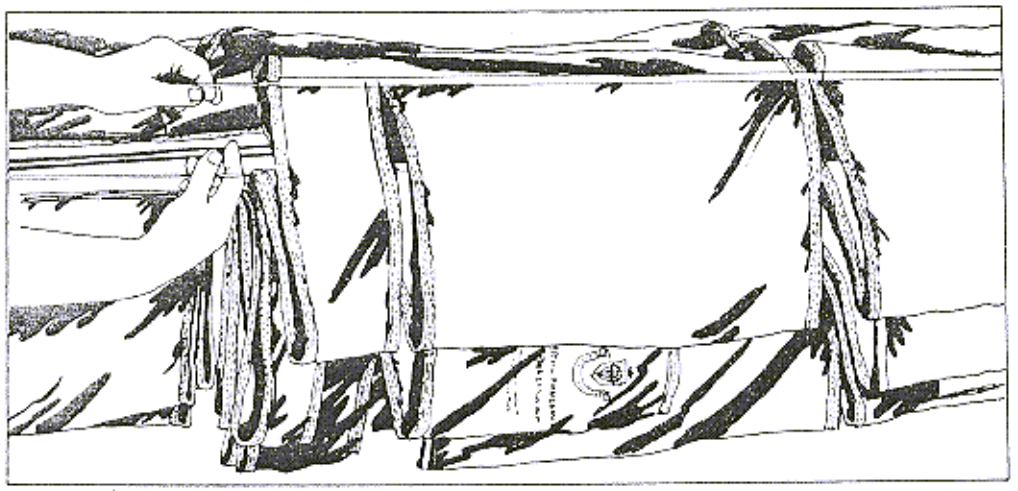
With the left hand, lift line 14 to extend the entire gore. Bring it over to the right side and down to the right hand, using a counterclockwise motion. This traps the air which fills out the gore and pleats it from the crown lines to the skirt (figure 6).

FIG. 6. PLEATING THE RIGHT SIDE OF THE CANOPY.

Continue pleating until 12 lines (#13-#24) are held in the right hand. (The stabilizer panels will pleat to the right in back of your hand during this process.) Now rotate the lines a half turn clockwise and replace them between the index and middle fingers. Pick up the first line on the left (#1)

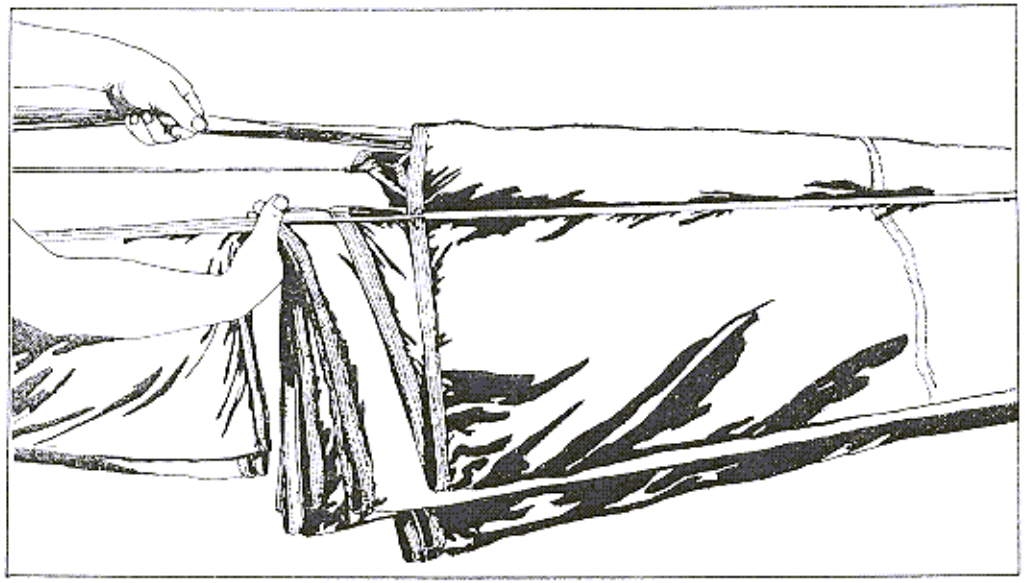
and pleat in the same way (figure 7). However, place these lines between the thumb and index finger of the right hand. Continue through line 11.

FIG. 7. PLEATING THE FIRST GORES ON THE LEFT SIDE.

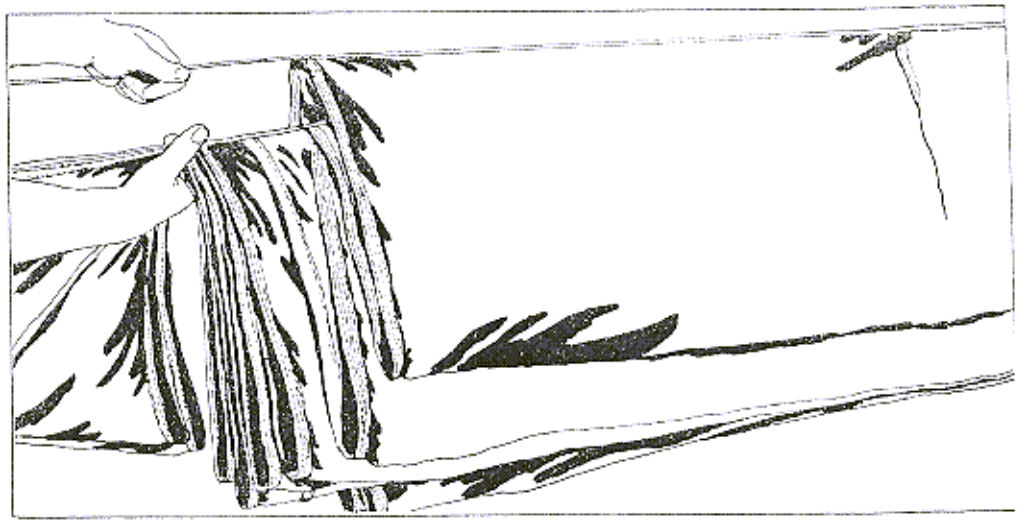


Take the centerline and control lines in the left hand and place them on top of line 11 (figure 8).

FIG. 8. PLACING THE CENTERLINE AND CONTROL LINES ON TOP OF LINE 11.



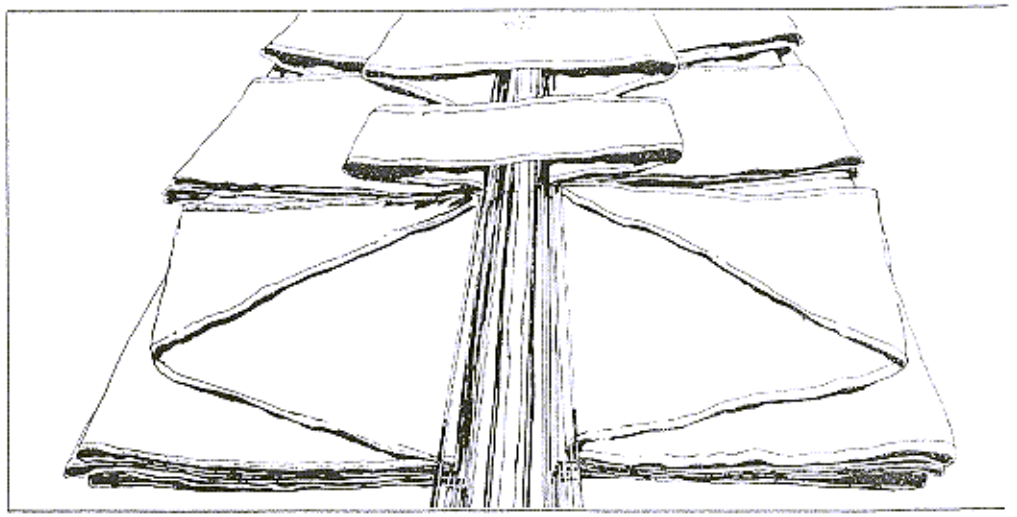
Do not pleat line 12 in the same way. Hold it directly above the right hand and place it on top of the stack of lines so that gore 11 is pleated to the



Note: If a line holder is to be used, insert it now, base up, between the skirt and stabilizers so that it separates the two groups of lines.

Still holding the lines, pull the canopy off the right side of the table and ease it back on while smoothing out the bottom gore as the canopy is laid down. Turn the two groups of lines or line holder upright (figure 10).

FIG. 10. POSITION OF SKIRT AND LINES AFTER PLEATING.



(4) Dressing the Gores: Upper Part of Canopy

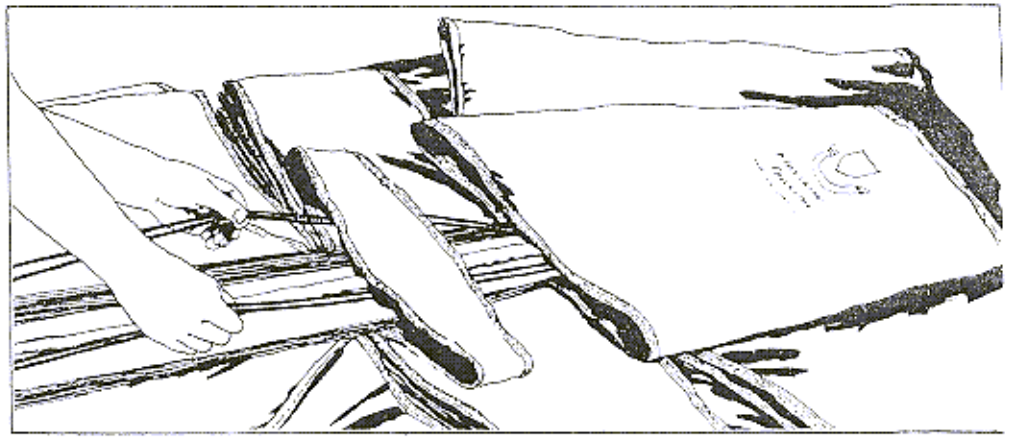
Bring each gore of the left group over to the left side of the table, dressing each one separately. (Do not dress the stabilizers yet.) When the left side is done, fold the right-hand gores onto the left side, then repeat the dressing process (figure 11).

FIG. 11. DRESSING THE GORES.

Note: Make sure that the top of the canopy is pulled out from and clear of the crown lines and that all the material at each slot is pulled out of the center channel. Unusual slackness or tightness of one or more suspension lines indicates an entanglement in the upper part of the canopy.

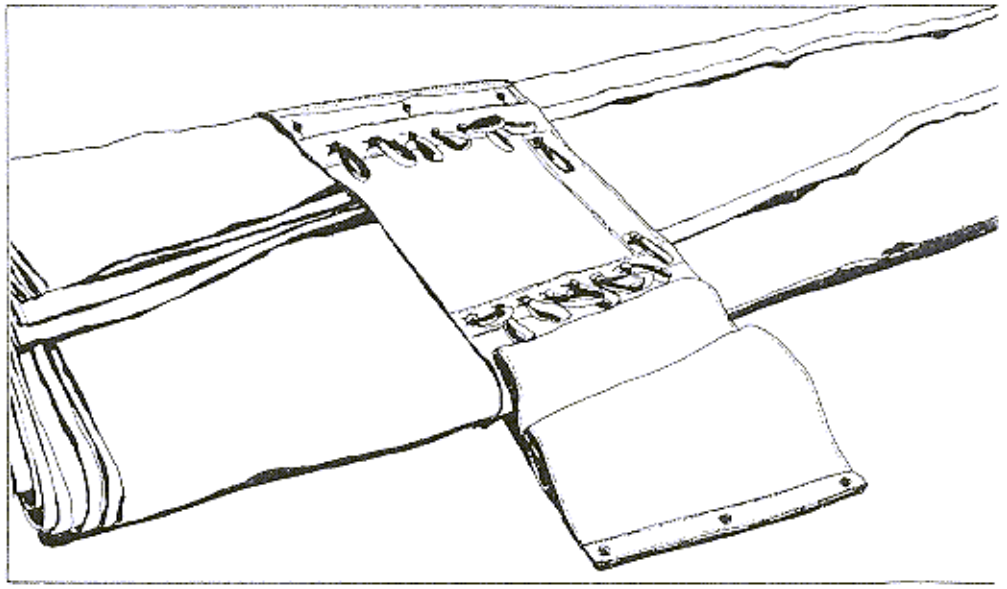
Place the top center panel and the skirt band across the middle of the canopy. Starting at the risers, trace the control lines up inside the canopy to see that each side runs free and clear to its turn slots. Extra tension on either side indicates that the attached panel or lines are entangled (figure 12).

THE UPPER PART OF THE CANOPY.



Fold the outside edges of the pleated gores inward on each side until the width of the canopy is slightly less than that of the sleeve. Pull down the sleeve to the stabilization panels (figure 13).

FIG. 13. PULLING THE SLEEVE OVER THE UPPER PART OF THE CANOPY.

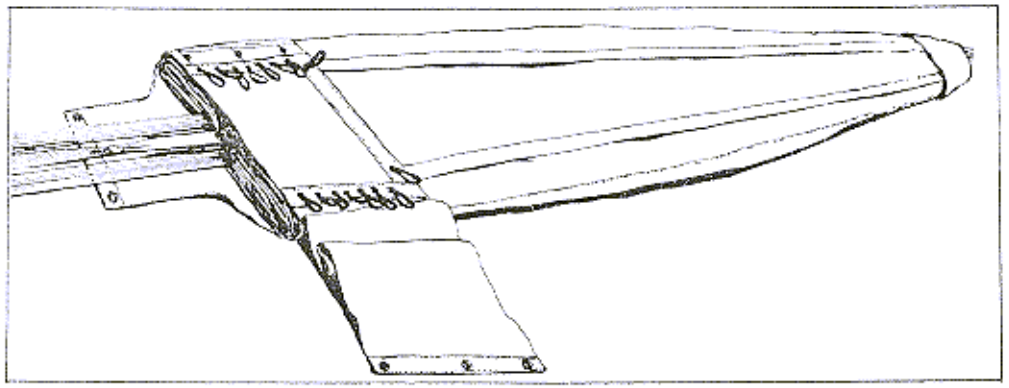


Note: If a line holder was used, remove it now.

(5) Dressing the Stabilization Panels

Dress the stabilization panels on each side very carefully. They *must* be straightened individually and in proper sequence. Fold over toward the center to slightly less than the width of the sleeve. Make sure the panels stay in place as you pull the sleeve down until it is even with the bottom of the stabilizers (figure 14).

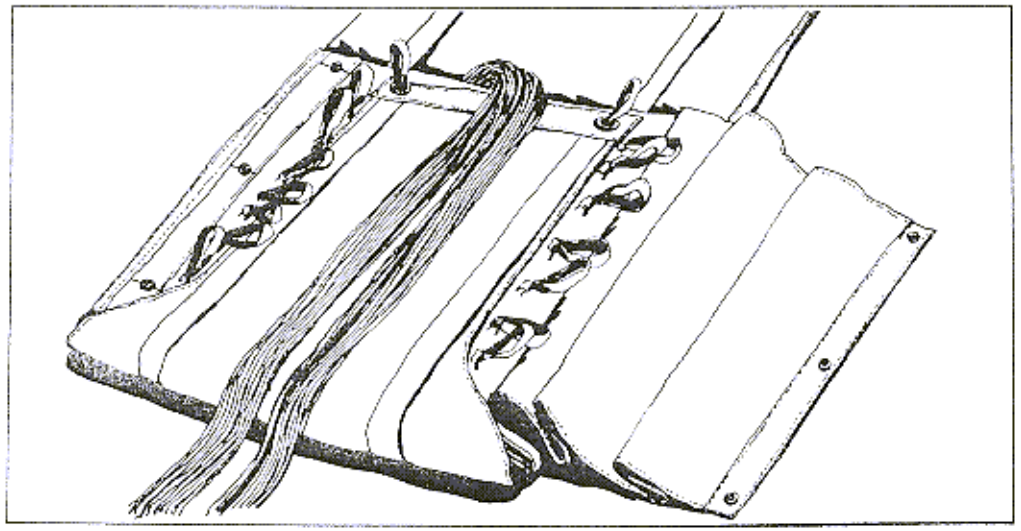
FIG. 14. SLEEVE IN PLACE OVER ENTIRE CANOPY.



(6) Stowing the Lines

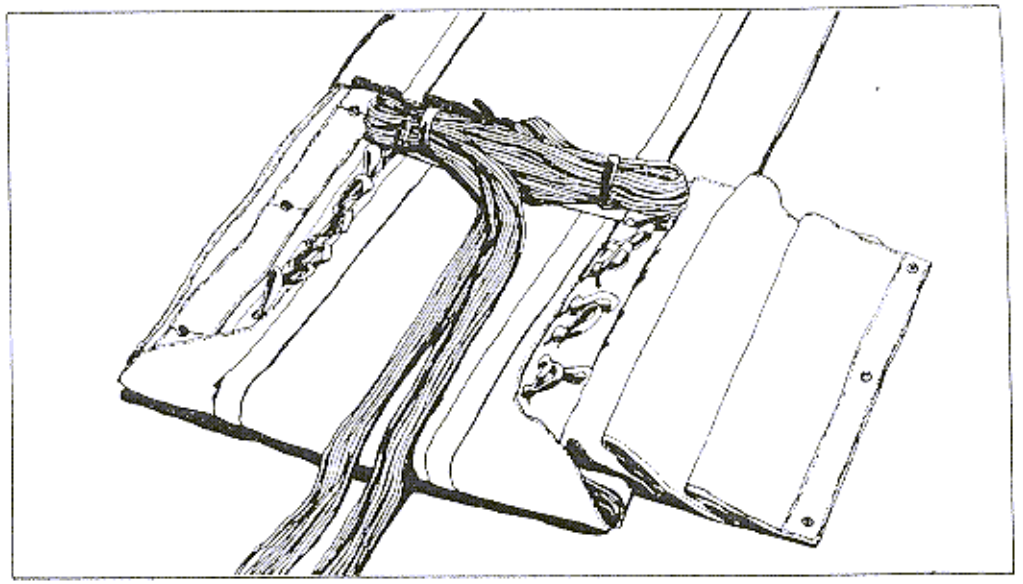
Release the tension on the risers and pull the pack and harness about 2 feet up toward the sleeve. Open the line stowage cover of the sleeve. Lay the suspension lines, centerline, and control lines up the center of the stowing area and past the two locking flap retainers (figure 15).

FIG. 15. PREPARING TO STOW THE LINES.



Fold the locking flap into position and bring the retainer bands through the flap grommets. Stow the first loop in the left-hand retainer, then the second loop in the right-hand one (figure 16).

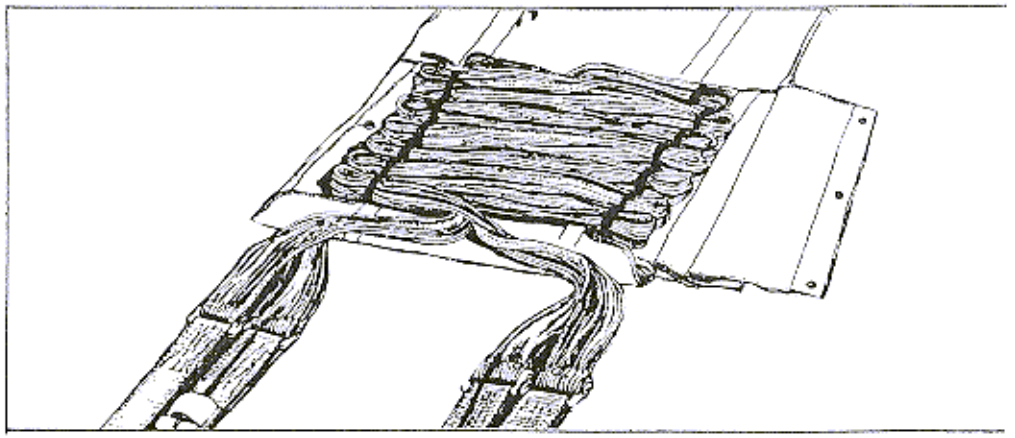
FIG. 16. [illegible]
LOCKING FLAP RETAINERS.



Note: The lines will appear uneven because the tension on the control lines makes them shorter. Compensate for this uneveness during stowing by taking a slightly longer length of suspension lines than control lines for each stow.

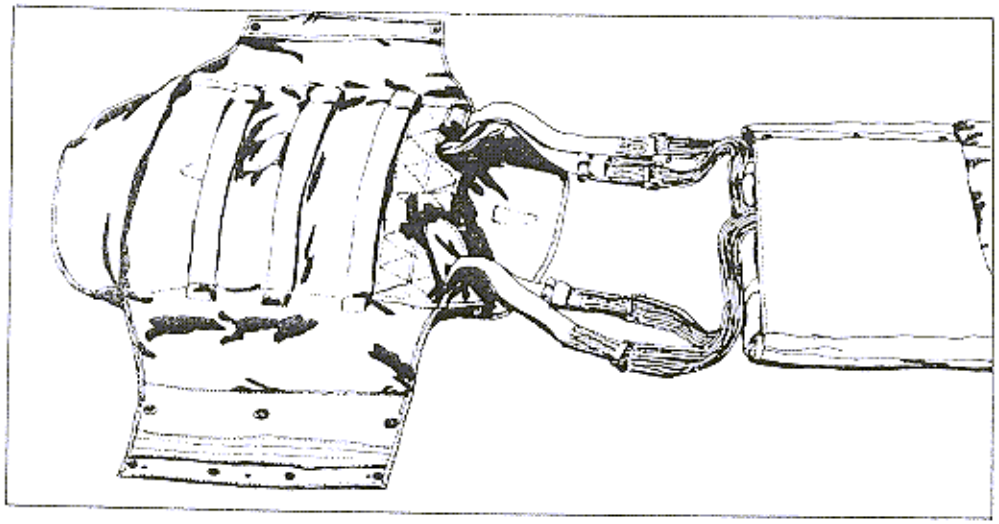
Continue stowing the lines back and forth across the sleeve until about 12 inches of line remain. All stowage loops should be 1-1½ inches long. More or less than this could cause a malfunction of line deployment (figure 17).

FIG. 17. LINES AT COMPLETION OF STOWING.



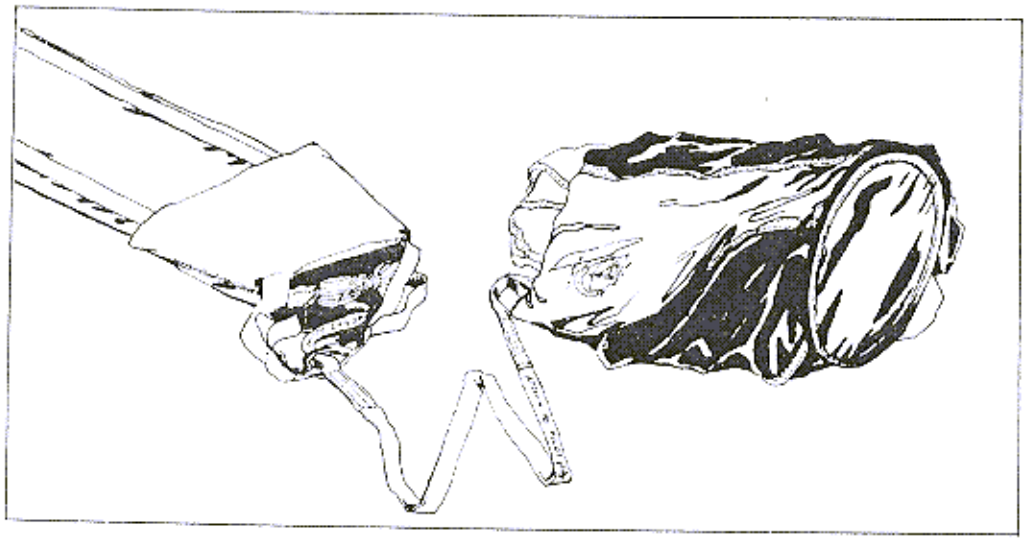
Secure the line stowage cover. Do not twist or entangle the two groups of lines as they lead from the connector links. Place the risers partly on the open pack (figure 18).

FIG. 18. LINE STOWAGE COVER AND RISERS IN PLACE.



Undo the tension at the top of the sleeve. Neatly s-fold the sleeve bridle and stow it in the two retainers just inside the top of the sleeve (figure 19).

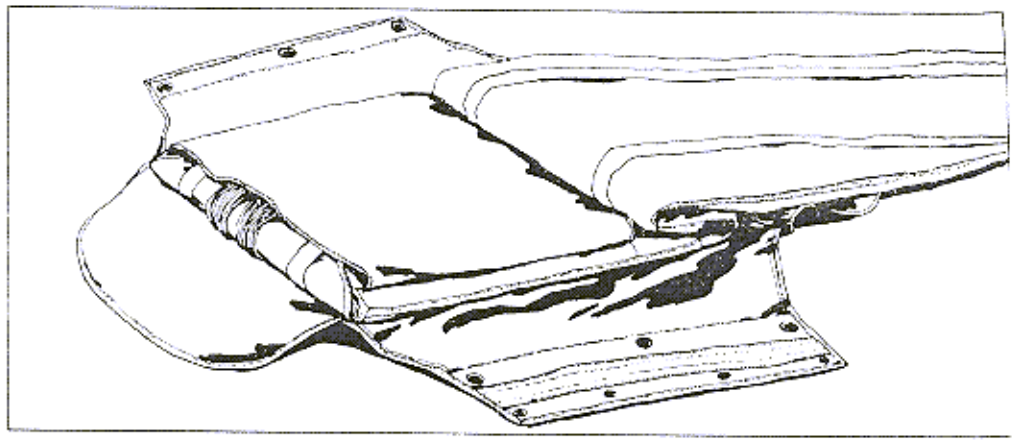
FIG. 19. STOWAGE OF THE SLEEVE BRIDLE.



(7) Placing the Canopy in the Pack

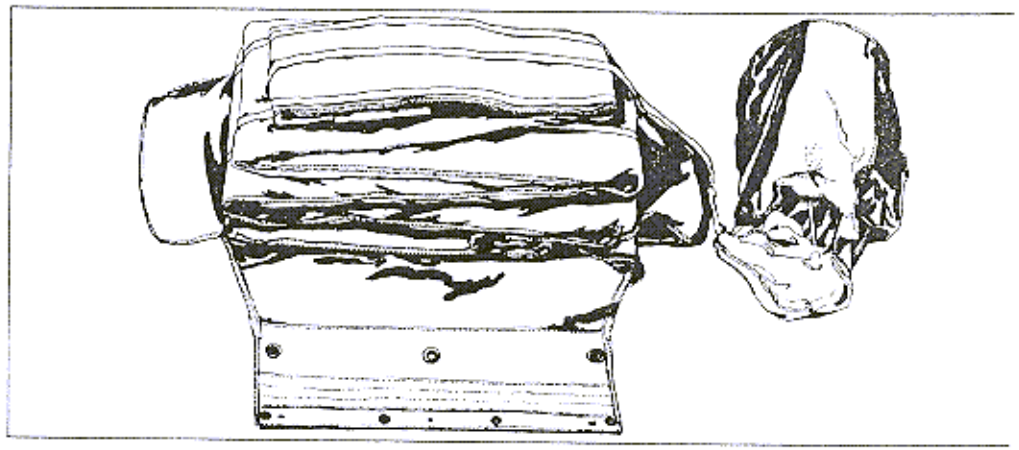
Carefully lift the lower end of the sleeve and bring it down even with the bottom edge of the pack. Straighten the risers and spread them under the sleeve so that the connector links are even with the second bow stiffener from the bottom. The top (front) risers should be inboard. The lines should lead directly from the connector links down to the bottom center of the pack and up to the last stow on the sleeve. Make the first fold short (figure 20) so that the skirt of the canopy meets the top of the stows.

FIG. 20. THE FIRST SLEEVE FOLD.



Continue s-folding the sleeve across the full width of the pack. Fold the sleeve pockets and bridles under the last fold to prevent entanglement with the pilot chute. The pilot bridle should lead out toward the top of the pack (figure 21).

FIG. 21. SLEEVE COMPLETELY FOLDED IN THE PACK.

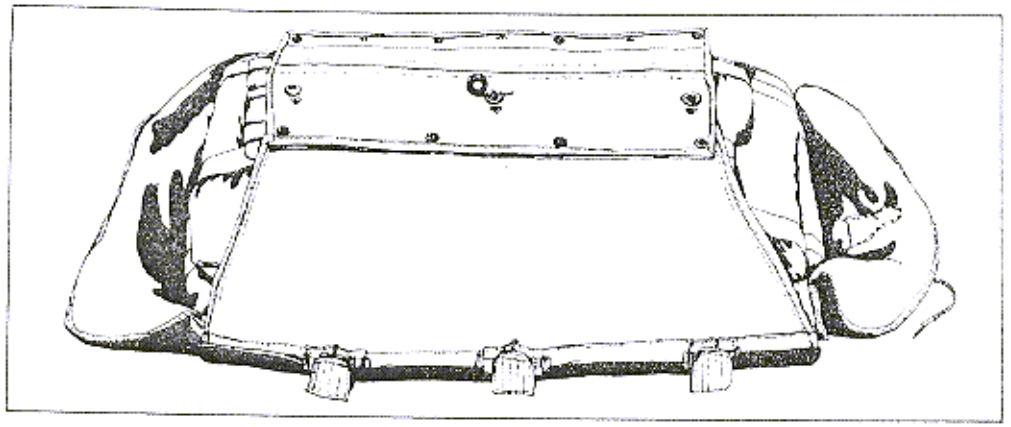


The pilot chute may be inserted either before or after closing the side flaps. If inserted first, center the pilot chute on the sleeve. Tuck its canopy immediately under its top and compress the chute so that there will be no interference with the spiral spring during deployment. The bridle and only the material below the spring should be s-folded beneath the base of the spring.

(8) Closing the Container

Insert the ripcord cable in the housing. To close a 3-pin pack, pull the left side flap up onto the top of the last sleeve fold or pilot chute. Pull the right side flap over the left side until the center cone fits into the grommet. Look in place temporarily (figure 22).

FIG. 22. CLOSING THE SIDE FLAPS OF THE PACK.

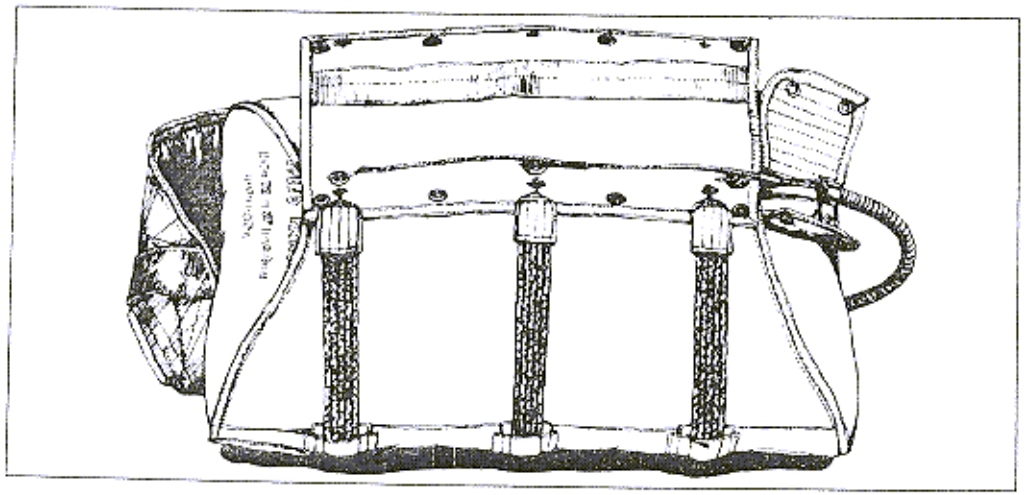


Close the top of the pack using the first ripcord pin. Remove the third or temporary pin from the center cone and insert the middle ripcord pin. Close the bottom flap and insert the last ripcord pin.

Note: Closing a 4-pin pack follows the same procedure except that when closing the side flaps, lock both the second and third cones temporarily. Then close the top and bottom flaps in the same manner as for the 3-pin pack.

Attach the pack opening bands by pulling up on both ends simultaneously in order to equalize the tension on both side flaps and also to prevent one end of the band from slipping out (figure 23). Close the ripcord protector flap.

FIG. 23. ATTACHMENT OF PACK OPENING BANDS.



card are required for emergency [illegible]
main sport parachutes.

CARE AND MAINTENANCE

Inspection and Cleaning

Although the Para-Commander should be inspected for signs of wear and damage every time it is packed, you should also examine it minutely from time to time when you are not in a hurry to board the next flight. Inspect each panel separately and mark all burns, tears, and even pinholes for later repair. Check all the stitching – on the suspension lines and crown lines, steering lines, and tapes. Pay special attention to the wrapping at the top of the crown lines which, if loose, may permit these lines to slip and become uneven. Look for fraying on every line, especially where the steering lines go through the guide rings and keepers. The container, sleeve, and pilot chute should also be thoroughly inspected at the same time, as well as the knots on the bridles.

An unusual amount of dirt, such as dried mud, should be washed from the canopy at once. The soiled areas alone can be cleaned or, if preferred, the entire canopy may be washed. Use lukewarm water and only a very mild laundry soap – never use a detergent. Do not allow the canopy to come in contact with grease, oil, or acid.

If the Para-Commander has been jumped into fresh water, it need only be dried. If it has been jumped into salt water, rinse it thoroughly at once to remove and prevent salt deposits on the canopy and to avoid corrosion of hardware.

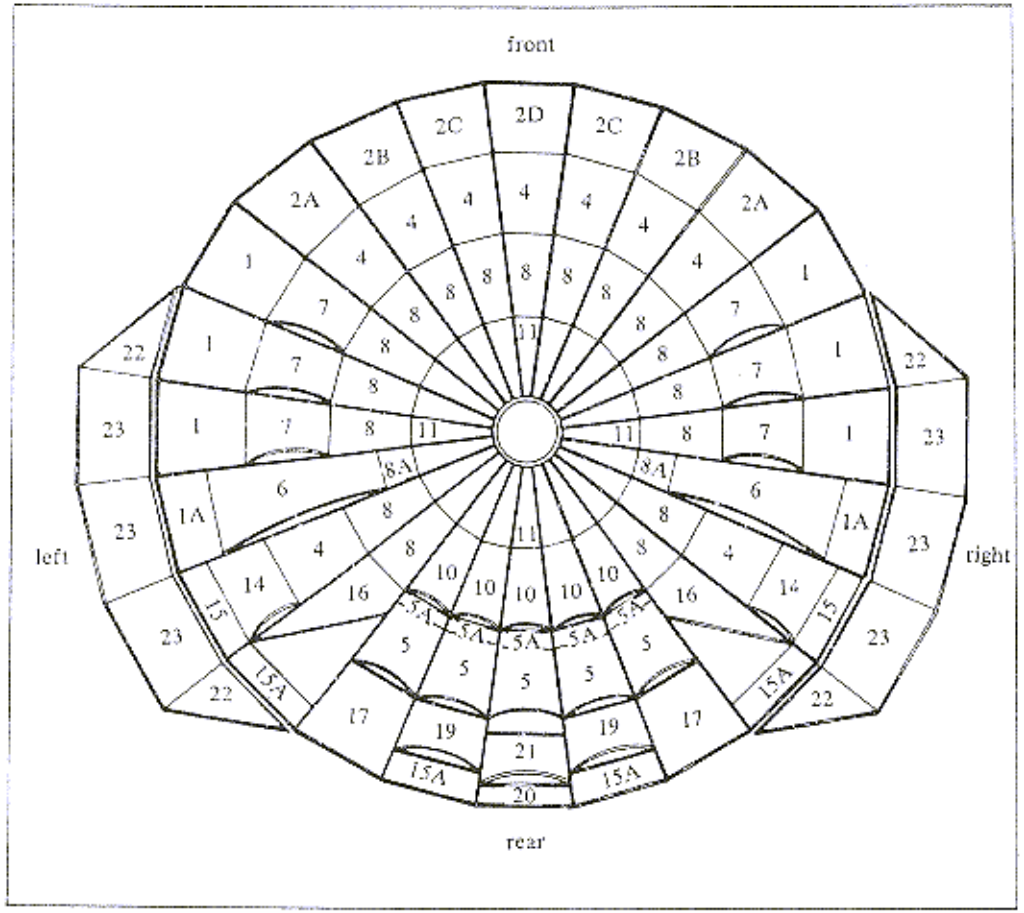
The wet canopy should be dried completely before packing. Do not dry it in direct sunlight since this tends to weaken the material. Hang it in the shade until the canopy and lines are dry. If the Para-Commander is to be stored, keep it in a cool, dry place and, if possible, hang it up or store it loosely packed.

Repair and Replacement of Parts

Your Para-Commander should always be kept in perfect condition. The needed repairs, no matter how small, should be attended to immediately. Minor repairs, such as covering small tears with ripstop tape or sewing keepers in place, may be made by the owner. All larger repairs should be done by an FAA-licensed rigger. If a rigger is not available in your area, contact your Para-Commander Dealer for information about repair and replacement of parts.

On the enclosed lists, you will find equipment and materials for minor repairs, replacement parts for the Para-Commander, and Pioneer accessories for use with the Para-Commander. Be sure to list any replacement panels needed by number and side of canopy, as indicated in the diagram.

Replacement Panel Diagram for the Para-Commander



Aerodynamic force: the force acting on objects moving through the air.

Body steering: use of various body positions which may slightly change canopy direction and speed.

Centerline: the line holding the apex down permanently. It runs from the apex (which, during packing, lies inside the canopy just above the skirt), down between the two groups of suspension lines, and to its attachment on the inboard side of each rear connector link.

Control lines: see steering lines.

Crown lines: set of 24 lines, each of which is attached to a main seam on a panel midway between the skirt and the vent. They are used to apply tension during packing.

Double clutching: technique of stall recovery that minimizes oscillation and instability of the canopy.

Forward speed: the rate at which a parachute moves horizontally in a mass of air. This rate is unchanging with a constant suspended weight, whether the canopy faces upwind or downwind, but it may be decreased by braking and stalling.

Full-brake position: holding both toggles down evenly close to the waist so that forward speed decreases and only a minimum glide remains.

Glide path: the angle at which the parachutist approaches the target. It is formed by drawing one line from the descending parachutist to the target and another line from the parachutist straight down to the ground. This angle can be changed by braking, stalling, variations in wind velocity, updrafts, and downdrafts.

Half-brake position: holding the toggles down evenly between the shoulder and waist so that a reserve of both speed and brakes is maintained.

Lift: the force perpendicular to drag which helps to reduce vertical descent.

L/D ratio: the lift to drag ratio. It is obtained by dividing the number of feet the canopy moves horizontally under zero wind conditions during each 10 feet of vertical movement by the number 10.

Stabilization panels: the set of 5 panels on each side of the Para-Commander. They extend downward from the skirt.

Stalling: pulling down simultaneously on both toggles past full brakes until no lift (flying speed) remains and the canopy sinks straight down rapidly.

Steering lines: a set of lines attached to the 4 turn slots on each side of the canopy and used for maneuvering the Para-Commander.

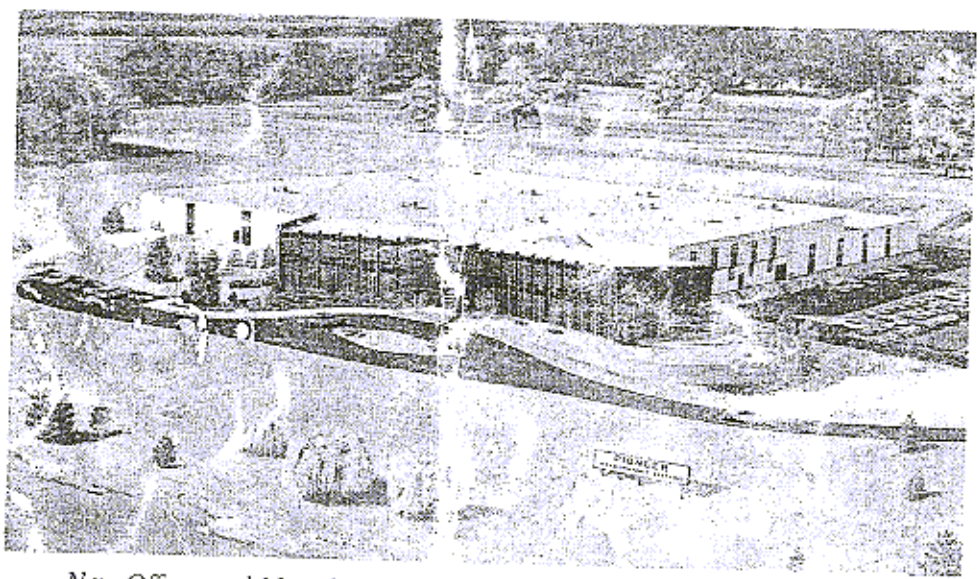
Turning: rotating the canopy to one side by pulling down the steering line attached to that side.

Pioneer Parachute Company and Parachutes Incorporated extend their thanks to the many parachutists whose experience, knowledge, and advice have contributed significantly to the material in this manual. This book is intended specifically for the owners of Para-Commanders and should not be used as a general instruction book for sport parachuting.

We would also like to thank the Para-Commander Dealers across the country who, until now, have had to answer innumerable questions about the Para-Commander. It is our hope that the Owner's Manual will now supply these answers.

Additional copies of the Owner's Manual may be obtained through your Para-Commander Dealer at $1.25 each.

PIONEER PARACHUTE COMPANY



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