A Guide to Flying a Powered Parachute

Anyone searching the internet for information on "how to fly a powered parachute" is beseiged by reams of documents. Hopefully I have been able to produce something that is complete, concise, and easy to understand, especially for the novice. This document is the result of a marriage of various documents. Many of those were supplied by dealers of some of the leading manufacturers of PPCs such as Buckeye, Six-chuter, and Powrachute. Ultralight organizations such as ASC, EAA, and NAPPF were a wealth of information. Together with a compilation of experiences from dealers, flight instructors, flight field owners, and pilots, all compiled into one publication. Print, copy, forward, and plagiarize as much as you want. It may save your life or that of a friend and that is the important issue. "Slow and Low" also means safe and legal.

Training from a Powered Parachute Basic Flight Instructor is the recommended way to learn to fly any Powered Parachute. The following flight manual should be read thoroughly even though you have received flight training. This manual should be reread often, especially after a lull in flying activity.

If you wish to fly a Powered Parachute you must first learn how. Previous flight experience in other types of aircraft can actually work against you, particularly if you feel your experience qualifies you to fly without learning. Although all Powered Parachutes use the same flying and ground principles, the actual controls will vary depending on the particular manufacturer.

You are going to be, basically, self-taught. You will be responsible for your own safety. A good instructor will make it easier to teach yourself by sharing his experiences, giving good complete explanations and providing objective commentary on your progress. Unfortunately, an instructor cannot give you flight experience and that's what you really need, to learn to fly. You're on your own and nobody else can take over the controls and cover your mistakes. Your instructor can suggest what to do next but only you can decide if you'll do it. Self-discipline is very important. Remember, poor self-discipline may lead to broken aircraft parts, personal injury, death, or all three. Take everything one-step at a time. Your safety and our reputation depend on what you decide to do and we can't do a thing about it. So, please follow these instructions and the instructions from your instructor precisely.

Pre-Flight Basics

Apparel

1. A full protection helmet with hearing protection is required. It will help muffle engine noise and improve your concentration. Get one that's comfortable. You'll be spending a great deal of time in it.

2. Eye protection is recommended.

3. A lap belt and shoulder harness are required. These should be standard equipment on your PPC. A lap belt and shoulder harness are effective safety devices, only when worn properly.

4. Gloves and boots are recommended; heavy pants and a heavy long sleeved shirt are usually comfortable do to the cooler temperatures aloft. Floppy clothes and dangling jewelry should not be worn. Otherwise, dress in accordance with weather and fashion. If you have long hair, restrain it under your helmet.

Training site

The ideal site is a big open field covered with short grass. The minimum is any reasonable smooth ground 50 feet wide and 500 feet long, the longer the better. If you can find a couple thousand feet, it will make training much easier; more width helps too. Don't learn on asphalt; it is most unforgiving. The best choice is short grass.

As you look for your site, keep an eye on prevailing winds. Your first lessons call for no wind or a slight breeze coming straight down the runway with a maximum speed of five mph. The wider your field, the easier it is to face the wind. (You will always take off and land into the wind). Power lines, trees or buildings should not surround the site.

The site should be off the beaten track enough to avoid crowds. You'll be under enough pressure without having to perform in front of an audience.

Last but not least, if it's somebody else's land you'll need permission to use it. Don't be afraid to ask. The worst they can say is no. The learning experience is going to take some time. Don't think you won't be noticed. People are generally agreeable when asked and generally disagreeable when they catch you doing something behind their backs.

Instructors

The best instructor is an experienced Powered Parachute instructor who is familiar with you and your aircraft.

You are now ready to start your training. **Try to read through this entire manual before beginning Lesson 1.**

PRE-FLIGHT CHECK LIST

Front wheel assembly

1. Check the wheel for proper play.

2. Check tire inflation.

3. Check that the connection between the front fork and the front axle is secure.

4. Check that the connection between the front fork and the front frame mount is secure.

5. Check for smooth steering.

6 Check that the steering mechanism is not sloppy or loose. Keeping it snug will make steering much easier.

Airframe

1. Check all tubing for dents, cracks, bends, or other damage. Dented tubing can be fatal and must be replaced and cannot be repaired

2. Check all bolts for nylock locknuts and proper tightening. Every connection on the airframe is vital for your safety.

3. Check all pins for safety rings.

4. Check outriggers for proper C.G. (Center of Gravity) Adjustments.

5. Check all cables for kinks, frays, abrasions, or broken strands.

6. Check the end of each flying cable for bolt security and check that the thimbles are not cracked, twisted, or elongated.

Foot control bars

1. Check that the foot steering bars are attached firmly.

2. Check foot bars for freedom of movement.

3. Check control pulleys for wear, cracks, and secure attachments.

Main wheel and axle assembly

1. Check tires for proper inflation.

2. Check each axle and axle hardware.

3. Check that the axle support mechanisms are sound, not cracked or bowed, and properly attached.

4. Check wheels for proper play.

Power plant

1. Check that the engine mount hardware is in place and is secured.

2. Grab the prop near the hub and shake it fore-and-aft. Be sure that the prop, pulleys, hub, engine, engine mount and airframe are securely attached together. Never touch or turn the prop by hand unless the spark plug caps are pulled from the spark plugs. Simply turning the ignition switch "off" is not enough.

3. Inspect the engine mount plate and muffler mount for cracks.

4. Examine the muffler and mounting for cracks, particularly the header pipe, which is subject to wide variations in temperature. Is it securely fastened to the engine?

5. Check the security of the carburetor, air filter, throttle cable, and electrical connections.

6. Check over the electrical connections.
7. Inspect the propeller for cracks and dings. They're most likely to appear around the tips and leading edge.

8. Check the fuel quality as well as quantity. Is the tank full? Simple test kits are available to test fuel for the presents of moisture and alcohols. If you have a sediment bowl, check it for water. Check the grommets and clamps for leaks.

9. Check the propeller guard for proper attachment and proper propeller clearance.

10. Check that the pull starter, if you have one, is firmly attached.

11. Check that plug wires are attached securely to the spark plugs.

12. Check throttle movement for full range and smooth operation.

Parachute and Rigging

1. Check rapid links for proper attachment (finger tight plus 1/4 turn). Check rapid links for cracks.

2. Check suspension and control lines for knots, tangle, and wear.

3. Check control lines for proper routing through all guides and pulleys, and for secure attachment to the steel pulley attachment.

4. Check the parachute for tears, torn stitching, abrasion, and deterioration from sunlight. Whenever the parachute is not in use, keep it stored out of direct sunlight and free from moisture and mildew. Prolonged exposure to these conditions will weaken the material, shortening the life span of the parachute.

Seat and Harness

1. Check the seat for wear or damage.

2. Check seat belts and shoulder harnesses for wear or damage.

3. Put the seat belt and shoulder harness on and adjust the straps securely. The seat belt should be adjusted before the shoulder harness. The straps must be snuggly tight without limiting movement.

Pilot

1. Healthy? Rested? Sober? Relaxed? Dressed comfortably? (It’s going to be cool up there.) Don't wear anything loose enough to interfere with operation of the aircraft.

2. Helmet on and fastened? Earplugs in place? If your hair is long and can get back to the engine, restrain it before putting on your helmet. Goggles in place and clean?

Engine Run-up

1. Brace the front wheel against an unmovable object (building, tree, fence post, automobile tire), clear the prop area directly to the sides and behind. Be aware of your prop blast. *Be courteous; don't create a dust and windstorm for the surrounding people.* Make certain the ground is free of all debris (aluminum cans, branches, gravel, etc.) Are all tools removed from the airframe? Is the area clear? If so**, shout "Clear prop!** " Don't be timid; shout as loud as you can to alert people that a dangerous operation is about to take place. Train your friends and relatives to get in the habit of also checking the area; they can see a lot better than you can when you are strapped into the seat. The correct response to "Clear prop!" is to shout back in response "Clear" if the area is clear.

2. Prime the carburetor. Always place the throttle lever in the idle position when starting engine. Do not attempt to start engine with throttle lever at the full power position. The engine may start and immediately go to full power resulting in engine damage and or personal injury. Pull the rope quickly and evenly until the engine starts. Once started you may need to give short pumps with the fuel primer a couple of times to keep the engine running. Give it just enough throttle until it runs smoothly. Does the engine idle properly? Get it to run properly now. The engine must be up to operating temperature before attempting to fly.
   Optional temperature gauges are available to monitor engine temperature. Never take off with a cold engine; this could result in engine damage and engine failure in flight.

3. Check the mag switches. If engine shuts off during this procedure one of the magnetos is not working. Do not attempt to fly until you have this corrected. You may notice the tach/hour meter giving erratic readings during this procedure; this is normal. Pushing one mag switch at a time will check each mag. Pushing both mag switches will kill the engine. This is useful as an emergency kill switch if the main on/off switch fails to shut off the engine.

4. Check the ignition switch by momentarily shutting off the engine, and then restarting it using the normal starting precautions.

5. Let your engine run until all of your temperatures have stabilized. Use “stable idle” to about ½ throttle. Shut down your engine.

6. Check the wind direction and strength. Is it still within your limitations? Wind over 10 mph will make your flight uncomfortable and unsafe.

7. Shut the engine off now.

Ground Handling and Flying

LESSON 1
Familiarization with aircraft, engine, and controls
(Without parachute, no taxiing)

Set up and pre-flight your aircraft, just as it you were going to fly except without the parachute installed. Dress for flight (helmet, goggles, the works) and get in. Put on your lap belt and shoulder harness. Make yourself comfortable. Adjust your shoulder harness tight enough so you can't be thrown forward, but loose enough to reach the controls. The seat belt must be snug. Work the controls and think about their effect on the plane in flight. The controls differ slightly depending on the manufacturer. Learning them well on the ground is a much safer approach than learning them in the air. This is a difficult lesson if other people are around, because they won't think you're doing anything. The urge to perform is a great one. It's part of our cultural heritage. Just having a neighbor kid who wants to hear the engine run is enough to cause most people to breeze right through this step. Please don't.

The purpose of this step is to make you feel at home in the aircraft. It can save you from having to think where a control is when you need it. Move the controls and think about what they do. Work the throttle, switch the ignition, move the foot steering bars forward and back. Watch what happens and think about how it controls your flight.

Get out, walk away, and take a break. After a short break, get back in the plane. Before you leave this step you must know your aircraft like the inside of your car. How long would you last on the highway if you had to hunt around for the brake pedal?

There's another advantage to spending plenty of time on this step. This is the only part of your flight training where you can't easily get hurt. So relax. Get the feel of things.

One more time; get out and wander around a bit. Walk back to the aircraft, close your eyes and get in. Put on your shoulder harness and work all controls. Does everything come to hand easily?
Check your aircraft and the surrounding area to see that nothing can get sucked into the propeller. Station your instructor in front of the airplane. Get in the aircraft wearing your helmet and other protective gear. Look over the area to be sure there are no stray animals and human beings in harm's way. Shout "Clear prop!" If the instructor sees that you're all alone out there, the traditional reply is to shout "Clear!" You may start the engine as instructed by your owner's manual. Stay away from the propeller. Run the engine at low rpm for a minute and then shut it off.

Let's review the last minute and let me explain all the reasons for going through these steps. The phrase "Clear prop!" is a shortened version of "I'm going to start this engine in a second. I don't think there's anybody in range who might get hurt by it. Please confirm my opinion and stay clear of the prop." The reply "Clear!" means, "I can see you and you're right, everybody is clear of the prop." Many years of aviation history condensed this conversation down to three words, but it's still a conversation.

Propellers are killers and deserve the utmost respect. Hundreds of people have been killed or seriously injured because of bodily contact with propellers. The "Clear prop!" ritual is one safeguard.

A few careless airplane pilots have developed bad habits. They yell "Clear prop" and then hit the starter. Sometimes they barely say it loudly enough to be heard even inside the plane. The seclusion of modern airports and the fences around the runways keep spectators safe. You're going to be out in the real world where there are many people. What's worse, your aircraft looks so cute some of them won't think it’s dangerous.
Don't assume the reply will be "Clear." One time in a thousand it might be "Hold it. Remember, when the engine is running, the propeller disappears. A faint disk is sometimes visible, sometimes the illusion that the propeller is gone is quite convincing. It will be difficult to remember exactly where it is and how big around it is, so stay well-clear of it and keep everybody else well-clear, also. This ritual must be taught to anyone that accompanies you when flying for his or her safety and yours. The fan guard is there to protect the parachute. It is not there to protect you.

Now that the engine is running, the serious stuff has begun. Every step of your education from here on will have an element of risk and danger. The primary purpose of an instructor in this lesson is to drive you to the hospital if needed. Remember this simple truth whenever you run the engine: any portion of your anatomy that touches the propeller will be instantly transformed into hamburger. Let your vivid imagination dwell on that for a moment. The propeller is going as fast as a bullet. What kind of wound would you expect from a three-pound bullet? The two major dangers of aviation are impact with the ground and contact with the propeller. A propeller is virtually harmless unless something gets in it, but if you forget its capabilities for destruction, the doctor will not be able to sew all the pieces together.

I hope I've made my point without rattling your confidence. Look, most people are a few feet from death a hundred times a day. Every time an oncoming car goes by, you have to remember to stay in your own lane. You don't lose sleep worrying about it but you don't ever forget either. That's the sort of respect you must give your prop. The prop is also capable of hurling things with great force, so make sure the area is clear

of loose debris and the craft is clean. Make sure that no tools have been left on the engine and all nuts and bolts are tight. The prop can hurl a loose nut at a lethal speed.

Get in the aircraft, wearing your helmet and other protective gear. Shout "Clear prop!" Your instructor will confirm and say, "Clear!" Only then will you start the engine. Turn off the ignition switch momentarily to see that it kills the engine, then turn it on and restart. After the engine is warmed up, it should idle smoothly with the throttle closed. If something goes wrong with the ignition switch, turning both magneto test switches to “off” can shut off the Rotax engine. It is extremely disconcerting to have an aircraft engine running when you would prefer it was stopped.

Run the engine at varying power settings (including occasional full power). Remember this step takes place with the aircraft secured so that is will not go anywhere. Refer to the Rotax engine manual for the proper break in procedure. Don't overheat the engine and don't forget the "Clear prop!" routine. You are breaking in the engine, and you are breaking in yourself. This is the easiest time to develop these habits. When shutting off the engine, put the throttle in its idle position and shut off the ignition switch.

After the initial engine break-in of your new Rotax engine (refer to Rotax engine manual for proper break-in procedure), loose parts that were not detected before may be ready to fall off by now. Run the engine a few minutes, shut it down, check the entire aircraft again. Repeat this at least three times. A bolt or nut coming into contact with your propeller becomes a bullet, not to mention what it does to your $400.00 propeller.

LESSON 2
Taxiing and ground handling
(Without parachute)

Drive out to the training site with your instructor and your aircraft. How do conditions look today? Walk the full length of the runway and look it over carefully. Are there any puddles or potholes?

It's not unusual for a training site to look pretty good when you first see it, but look questionable when your plane is on site. If close inspection has given you second thoughts about your site, now is the best time to find another one. The minimums given earlier are minimums, doubling those dimensions will make life easier, and quadrupling them is even better.

If the site and the weather are acceptable, unload your aircraft; set it up, and pre-flight it. Do this without the parachute installed; otherwise do the pre-flight as if you were

going to fly. Improper assembly can hurt you on the ground, too. Make sure there is fuel in the tank.

Walk your powered parachute to the runway. Get in with it facing down the runway. Start the engine, following the correct start up procedure.

Put your feet on the foot steering bars; open the throttle until you have gently accelerated to about 10 mph. At a slow 10 mph, close the throttle and shut off the engine and coast to a stop. Some units have front wheel brakes to assist in stopping. ***Notice: The use of feet for stopping is not mentioned.*** Putting your feet on the ground "Flintstone" style to stop will guarantee that your foot will catch on something and your leg will be pulled under the craft thereby breaking your leg in a number of places. **Please note that the craft does not have the drag of the parachute so it will accelerate very fast and stop very slowly.**

Notice that this step does not call for steering. You'll be getting to that shortly, but the first skill you must have is shutting the craft down and stopping it. Get out and wheel it back to your starting point, same as before, except now you can use the steering bar for directional control. The object is to go straight down the runway at a constant 10 mph. If you lose control, stop the engine, stop the aircraft, analyze what happened and try again.

When you reach the end *of* the runway, shut off the engine, turn it around, get back in and taxi back the same way you came. Through this entire lesson, **keep your feet up** and do not use them to stop.

Now try the same thing, except at 15 mph. Try some gentle "S" turns. Over-control is dangerous. In extreme cases you could run off the edge of the runway or possibly flip the aircraft over. To keep this from happening, shut off the engine and stop if you get out of control.

Repeat again, the same as before. Work yourself up gradually until you're going 25 mph. Each attempt must follow the same pattern: the "Clear prop!" exchange, starting the engine, acceleration at partial throttle, reducing throttle to maintain speed, ground steering, killing the engine, and stopping.

Among other things, this step is a test of your self-discipline. Normally the parachute acts as a governor. Without the parachute installed, the PPC will go remarkably fast, much faster than it is designed for. You are likely to have a serious accident if you attempt to drive at high speed. However, you need to learn the effect of the throttle and this is the best time. Be careful not to over-control at higher speeds, as the possibility of loss of control increases with speed. You must now attempt starting from a standing start and accelerating at 3/4 throttle, as you will when the parachute is

attached. 3/4 throttle must only be done for a very brief period (3-4 seconds) and 25 mph must not be exceeded.

If you find you are lacking in self-confidence or are unwilling to resist the urge to drive faster than 25 mph, it is time to reconsider if aviation is really the sport for you.

Repeat as needed to master throttle and front wheel steering control.

LESSON 3
Taxiing and ground handling
(With parachute)

This lesson must be done in no wind. Maximum allowable winds are a headwind of two mph, crosswind of one mph and no tailwind. If you do not have a windsock or airspeed indicator you can check wind speed and direction by throwing grass or dust in the air and following its direction. Casual walking speed is about two mph.

Install the parachute on your PPC in accordance with the proper Parachute Assembly Instructions. Pre-flight the aircraft, top off the fuel tank, warm up the engine (always warm-up the engine with the parachute in the parachute bag), get into your flying gear, and go to the runway. Place the PPC into takeoff position on the runway.

Spread the parachute out behind the PPC. Lay the parachute out with the leading edge away from the PPC and the trailing edge close to the PPC; the top of the parachute should be down, with the points where the suspension lines attach to the parachute visible. Check the suspension and control lines for abrasions, snags or tangles. Hold the front of the parachute at shoulder height. Pull the suspension lines to the PPC snug and the leading edge slightly taut to help you make sure the lines are straight. Push the PPC forward to tighten up the suspension lines before starting engine. A good rule is to push the PPC forward until the leading edge rolls over and is on top of trailing edge of parachute.

Start the engine and open the throttle smoothly until you are at ¾ power. Even though you have given a lot of power, the PPC won't start moving very fast. Although light, the parachute is difficult to get moving. At this moment it is at right angles to your direction of travel and has maximum drag. There is a lot of air between the parachute and you, and you have to push it out of the way to get going. Steer straight with the steering lever.

At roughly 10 mph, you've traveled 20 or 30 feet. The parachute will inflate and rise up overhead. Once it rotates overhead it will lose most of its drag and the PPC will begin to accelerate more rapidly. Smoothly close the throttle and shut off the engine; push

out on both steering bars; grab the steering lines, one in each hand at the pulleys located on the outriggers; pull them toward the front wheel as much as you can reach. This will cause the parachute to deflate quickly and to fall behind the PPC. If you do not pull the steering lines, the parachute may fall in front, or to the side, or on top of you and make preparations for the next take off more time consuming. Hopefully, the PPC will roll to a stop and the parachute will be behind you. Repeat this step until you get a feel for how the parachute comes off of the ground and lifts up overhead. As soon as the parachute comes overhead, you must shut the engine.

At any time in this learning process, if you make a mistake and apply too much power, the PPC will quickly lift off the ground. If this happens, you should shut the engine off immediately because you are not yet ready to fly. The PPC will settle back to the ground with a bounce. You must not fly until you and the PPC have been thoroughly checked out. You must get used to using very small (smooth) throttle movements to control the PPC. If you are making quick, rapid movements to the throttle to accelerate, you are in danger of lifting off and reaching a lot of altitude before you are ready.
Go back to the beginning of the runway and repeat, except this time when the parachute rotates overhead and you feel the PPC speed up on the ground, back off the throttle so that you stop accelerating, but keep enough power to keep the speed at 10-16 mph (about 1/2 throttle). This step requires that you go no faster than 15 mph. Do not go any faster or you will start flying. Look up at the parachute. Does it look nice and square? Sometimes during initial inflation, a front corner will get folded under. This is called end cell closure. If this has happened, push both steering bars firmly and hold to "pump" the fold out. Meanwhile, keep the PPC going straight down the runway.

The reason to “pump” both sides (although the parachute may be only folded closed on one side) is to avoid steering the parachute either left or right. If you pump one side only, you'll steer the parachute that way causing it to go to one side and possibly turn you and the PPC over. If you continue your take-off roll and the corner stays folded the parachute will not have enough lift on that side and when you take off you are going to make a large turn whether you want to or not. Example: If the left side of the parachute is folded under and you lift off the ground you will begin making a left turn and depending on how many cells are closed on the left side will determine how severe the turn will be. In a severe turn you will have no little or no control. Just imagine if you have trees or buildings on your left side what will happen next.

Look up at the parachute and get used to how it looks. The suspension lines must be straight without any twists and the control lines must be straight and must not be wrapped around the suspension lines. The control lines must move freely when the foot steering bars are pushed. Don't get so involved that you forget where you are going. Taxi the length of the runway, shut off the engine, push the steering bars out, grab and pull the steering lines, and roll to a stop.

If there's no wind, you can turn the aircraft around and do the next step going in the opposite direction. If there was a bit of a tailwind you'll have to bring it back to the other end of the runway, Rule number one in aviation is never take off or land with a tailwind. The increased speed necessary to overcome the wind increases the speed and distances required for safe operation.

Repeat at gradually increasing speeds. Move the throttle lever smoothly and gently. Here are some ways of telling that you are about to leave the ground. When you are about to fly there is very little weight on the wheels and very little traction. The ground will feel fluid. You'll skate along on top of it. Another indication that you're almost at take-off speed is that the front wheel will come up off the ground. When the wheels are very light, front wheel steering won't influence your direction much. With the front wheel off the ground, steering will be controlled entirely with the foot steering bars attached to the parachute. This step is to teach control in this transitional stage. The parachute is supporting most of your weight. You don't have to work in three dimensions yet, so concentrate on directional control. The next lesson gives you a taste of altitude control. Before you get to it, ground control should feel natural and precise. Before you leave this lesson you should be able to throttle up, rotate the parachute, pump open-end cells and taxi down the runway short of actually taking off.

When taxiing in transition stage it is important not to steer the PPC one way while using the foot steering bars to steer the parachute the other. In some conditions (particularly crosswinds and rough, soft fields) it would be possible to pull the PPC over if the parachute was too far to one side, or to drag one side of the parachute on the ground. In the air, of course, you won't be able to steer the PPC in the opposite direction of the parachute. The PPC will simply hang under the parachute. When you feel you have mastered lesson 3, either call it a day or take a break. Your decision will depend on the weather, the amount of daylight left and how tired you are. Don't push yourself too hard. I guarantee you'll learn faster by quitting while you're ahead than trying to do too much too soon. If you're tired and you go home you can come back tomorrow. If you're tired and you try to continue your training, one of two things will happen. Number 1; you'll have only a minor accident and will spend all day tomorrow doing repairs instead of flying. Number 2, you're lucky and everything goes smoothly but you will have learned a bad habit. You will have learned that you can fly at a level beyond your ability and get away with it. If you develop this habit, you will soon be doing major repairs, not only to your PPC, but also to yourself. Repeat this section until driving the PPC seems very comfortable to you.

The PPC parachute is easy to inflate when you realize the different phases that occur during the inflation sequence. At the start the parachute is placed behind the vehicle. The lines must be straight and the parachute placed so that the parachute is folded in half with the leading and trailing edges together. Stretch the parachute out so that the

parachute is on the ground neatly. When you start to accelerate, use about 3/4 throttle. When the parachute is on the ground there is no drag and you will start to accelerate rapidly. As soon as the parachute comes off of the ground you will feel a jerk and instantly acquire maximum drag. The parachute is now directly behind you and is not flying. The parachute is at maximum drag and no lift, as well as being in the unstable air behind the PPC that is being caused by the propeller. A lot of power is necessary to overcome this maximum drag region. If the parachute remains in this area for any length of time the parachute may become twisted or may flip upside down. A wide-angle rear view mirror mounted on the front fork may help you to see the parachute behind you and help you to determine if this happens. It is not to be used to see if your parachute is fully inflated. You need to have direct eye contact with the parachute when it is rotated overhead.

As the parachute rotates upward, the drag quickly goes away. The transition from maximum drag and no lift, to some drag and a lot of lift, comes relatively quickly and the power needed to clear the high drag region will now cause rapid acceleration. As the parachute transitions overhead, the drag will reduce and lift will increase. Reduce power to 50-60% to maintain a taxi speed of 15 mph. Push the foot bars all the way out and hold until all of the cells have fully inflated. Once full inflation has occurred, release the foot bars and inspect the parachute and lines. If everything checks out, accelerate to take off speed.

Now that the parachute is overhead, you now have two vehicles to drive! One is the craft that you are sitting in that is being driven like a car on the ground while the other is the parachute that is overhead already flying. The ground steering is through the front wheel; the parachute is now being steered through the foot bars. The parachute will remain flying at a very slow speed. As long as you are above 8 mph the parachute will remain overhead. If you get busy and slow down too much the parachute will fall behind you. If this happens, shut the engine off and start all over again. If you taxi at too high a speed the parachute will start to lift the vehicle and the ground steering will not work. 10-15 mph is the right taxi speed. You will be safely above the speed necessary to keep the parachute overhead and safely below flight speed with full ground steering.
It is critical that you look at the parachute each and every time. Verify that the parachute is fully inflated; all of the suspension lines are straight with no twists or tangles. Push on both foot bars to verify that you have the full range of travel with no bind. If you do this while you are taxiing you have the advantage of stopping and repairing any problems. You cannot do that while in flight.

PROPER TAKE OFF PROCEDURE

Step #1. Accelerate smoothly to 3/4 power until parachute rotates completely overhead.

Step #2. You will now lose the drag of the parachute and begin to speed up. Reduce power to about 50% or 10-15 mph. (Remember you must reduce power here or you will go airborne, reducing to much power here and parachute will begin to fall back behind you)

Step #3. Look up at the end cells of the parachute. Are both sides fully inflated? If not, push both foot bars all the way out and hold. In effect you are pushing a flare or putting on the brakes to help pressurize the parachute and open the end cells. While pushing a full flare or putting on the brakes as some people call it, the parachute may want to fall back behind you. If this happens you need to add a little more throttle. Once the parachute is fully inflated release the foot bars to their neutral position against the foot bar stops.

Step # 4. Look up at the right and left flying cables and suspension lines making sure there are no twists, kinks, or tangled lines

Step # 5. Look down the runway. Do you have plenty of runway to the left, to the right, and straight-ahead? If there are trees at the end of the runway do you have enough room to clear them?

Step # 6. This is the final step in you adventure to fly. Only you can now make that decision.

Are you confident in the previous 5 steps? Did everything go smoothly? Did things happen too fast? Did you get confused and skip a step or two? If so, start over. If during this step you say to yourself, "I think I can make it," your brain is already fore warning you that it doesn't think you can. These 6 little words have been the source of many accidents and fatalities in aviation. If you ignore the "I think I can make it" warning, sooner or later you will have an accident.

A REVIEW OF THINGS TO AVOID

Full throttle at the start

If you accelerate at full throttle you will gain too much speed and when the parachute lifts off the ground you will be yanked to a sudden stop. This places severe stress on the entire system and should be avoided. It may also cause a sudden change in direction.

Too little throttle at the start

As the parachute lifts off the ground you will have maximum drag. Too little throttle will cause the PPC to stop rolling forward and the parachute is then trapped in the maximum turbulence area and may twist or flip upside down. If you add a little more power, the parachute may start to lift overhead, run out of power and then drop back. Maximum power is required to start moving forward again. At this point you have very little (or no) speed.

The thrust developed by the propeller to push you forward now has to push against the parachute! Instead of gaining speed you now have a tug of war going. If you have wondered why full power sometimes doesn't do much, now you know why. Unfortunately, all of this takes place behind you, out of view. Try taking off in the morning with the sun behind you and watch the shadow. Some pilots find that a wide-angle mirror mounted on the front fork helps to see the parachute. However, do not rely solely on a mirror to see if the parachute is fully inflated. Look up at the parachute to make sure.

Taxi too fast or too slow

Now that you can get the parachute overhead smoothly, a common problem is that the end cells have not yet inflated properly. The outer edges of the parachute have the least amount of pressure; therefore they are the last to inflate. The center of the parachute has the most amount of air pressure, therefore it will inflate faster. Once the parachute is overhead in flight position, maintain a taxi speed of 15 mph.

With a ground speed too slow the parachute will be slower in rotating overhead and act mushy and may wander side to side. With a ground speed that is too fast, the parachute will be harder to inflate because air is pushing harder on the closed cells of the parachute. With a ground speed of approximately 15 mph, the parachute is overhead; but if the end cells have not fully inflated, then push both foot bars as far as they will go. This pulls down on the trailing edge of the parachute and helps pressurize it. Hold fully out on both foot bars until both sides are inflated and then release the foot bars to their neutral position against the foot bar stops. Do not push one foot bar to inflate a closed end cell. This will cause a turn of the parachute and possibly a tip over of your airframe. Always push on both foot bars even if only one side of parachute has end cell closure,

Taking off with the end cell closed. This is a dangerous practice. Part of the safety factor in flying the PPC is to make sure that all of the systems are working before you leave the ground. You must establish a safe take off distance at your flying site. If you have used up that distance and the parachute is not ready to fly, then **STOP.**

Using flare on take off is a dangerous practice!
Pushing on both foot bars (this is also called a flare) will gain more lift on take off. If you need to do that, then your flying site is too short. If you take off with both foot bars pushed out and the engine quits, then you will be at maximum angle of attack on the parachute. With the foot bars pushed out you will have nothing to help compensate for the rapid descent, and you will hit the ground the hardest way that is possible in the PPC.

LESSON 4
Takeoff and Landing

Are you rested and fresh from Lesson 3? Is the weather cooperating? Even a slight breeze can make this lesson unnecessarily difficult, as you'll have trouble telling what you're controlling versus what the wind is controlling. If the wind is less than 5 mph then continue, but it's higher, do this lesson some other time. **Be patient and wait for better conditions. You'll enjoy your first flights so much more.**

Go to your training site with your instructor, set up your aircraft and pre-flight it. Fill up the fuel tank, put on your helmet and other apparel. You are now ready for Lesson 4.

Do a review *of* Lesson 3. Not only re-read it, do it. Make sure you still remember how it's done. If you have any difficulty controlling on the ground, stay with the review until high speed taxiing is controlled, smooth and natural.

This run will be just like a high-speed taxi except for one thing: you're not going to decrease throttle just before reaching takeoff speed, you're going to continue to slowly accelerate until you are airborne.

On your first flight you should climb to a minimum of 500-700 hundred feet and fly for 20-30 minutes getting used to the throttle. By adding power you climb and by decreasing power you descend; pushing the right foot bar you turn right, pushing the left foot bar you turn left. Stay in a pattern around your airfield. Try flying level, looking at what rpm it takes to maintain level flight and make a mental note of that level flight rpm. Don't be in a hurry to come down. When you have a full tank of fuel and a cruise rpm, you will have plenty of time to relax. Remember to stay within safe landing distance of your runway.

During this step you'll find that the throttle (which controlled speed on the ground) doesn't control speed any more. It controls altitude. The PPC takes off, climbs, cruises, descends and lands at one set speed. If you add power, it will go up, if you reduce power, it will come down. To keep a precise altitude requires precise and gentle throttle control. The exceptions to the single speed flight envelope are in turns,

where centripetal force adds load, and in a flared landing, where pushing both foot steering bars reduces speed.

The throttle is your complete control over climbing and descending. Closing the throttle all the way to an idle, you will descend at a high sink rate. The rate of your decent is completely controlled by your throttle setting. Use an amount that gives you a reasonable sink rate. Normally, a good rule is 300-500 rpm less than that of level flight.

Try flying straight down the runway while maintaining a constant 50 feet altitude. Next fly down the runway at a constant 40 feet altitude, then 30 feet then 20 feet. Do not fly over the runway lower than 20 feet. You do not have enough throttle control at this time to try flying lower than 20 feet, but with practice you will be able to fly 12 feet off the ground straight down the runway.

Setup your landing approach several hundred feet before you actually get to the runway. You need to clear obstacles that are at the end of the runway such as trees, power lines, fences, etc. by a minimum of 50 feet. Hold the throttle at 300-500 rpm less than that of level flight rpm. Keep the PPC over the center of the runway using the left and right foot bars. The most common mistake at this point is to over-steer. Only slight corrections with the foot pedals should be necessary. Over-steering causes the cart to oscillate left and right under the parachute. When the cart swing to the left side you will turn right and visa-versa. If this should happen, simple add some power and go around for another attempt. Now that you're coming in at a slow sink rate in the center of the airfield, as you lose altitude and approach the runway (about 5-6 feet above the ground) push a smooth full (1-2-3) flare with the foot bars and hold out until you feel the rear wheels touch the ground. Release the foot bars, close the throttle to an idle, shut the engine off, apply full flare, grab the steering lines and pull them across your chest to drop the parachute behind you.

Congratulations, you have just made your first solo flight! You may have felt that the earth seemed to becoming at you very fast at the last 5-6 feet, and then, when you pushed the full flare it felt as though you stopped in mid air. The flare has tremendous ability of slowing down both your sink rate and air speed, and it is a very important part of flying the PPC safely.
To review the process that you are going through, the throttle may be viewed as the coarse control for descending, and the flare is your brake. In normal flight the throttle is used entirely to control altitude. In a normal landing the throttle is used to control your descent until you are ready to land. At this point, the throttle is used to set a reasonable (slow) sink rate and the flare is used (as brakes) to modify the sink rate and air speed. Landing with just the throttle is harder because there is always a 2 to 3 second lag until the power takes effect. The flare is instantaneous and will increase lift as soon as you push on the foot bars. If you decrease throttle too much and are descending too fast you may not have enough time to put more throttle in before

landing. The total range of travel with the foot bars will give you more than enough braking action to do a normal landing. The worst case is if the engine quits. In this case the only way to modify your rate of descent is to use the flare to do a normal landing. Example: in a power off situation you are coming down faster, therefore, you will need to flare higher above the ground (about 10 feet). Normally, at 1/2 throttle you are descending slower therefore you would flare closer to the ground (about 5-6 feet).

If you are going to fly safely, you must remember the next two paragraphs.

The landing process ends up at a zero descent rate at the ground no matter what the starting descent rate is. If you are descending at a high rate speed you will contact the ground and very suddenly decelerate to zero. When you are coming down for a landing you will want to put power back on to reduce the descent rate to zero several feet above the ground and then fly along parallel to the ground. Now you only have to descend a couple of feet at a slow rate and glide down. Use the foot bars to fine tune descent rate. The instant the wheels touch dawn you must power back to an idle. If you leave the power on you will bounce. Don't be in a hurry to get on the ground if there is a lot of runway left. If you are running out of room, power up and fly around and try again.

Do not be in a hurry to land. No prizes are awarded for touching down in the first 100 feet of the runway. Leave plenty of clearance over obstacles. You should never hit the ground hard. No matter how fast you are coming down initially, put more power back in and fly parallel to the ground and very slowly descend the last foot until you touch down so easy you don't realize that you are on the ground. Hold pressure on the foot bars and use flare to modify if necessary. It you balloon up a little, back off the foot bars a little to compensate. If you are descending too fast, add a little foot bar to compensate.

REVIEW OF PROPER LANDING PROCEDURE

Step #1 Setup a long final approach to your runway. As you pass over your runway be sure to have plenty of altitude to clear obstacles such as trees, power lines, fences, etc. (At least a 50 feet clearance is needed).

Step #2 Once you pass over the beginning of the runway hold the throttle to a setting of 300-500 rpm, less than that of level flight rpm.

Step #3 Use the foot bars to keep you and the PPC going down the center of the runway. Don’t over steer.

Step #4 At 5-6 feet before touching the ground, push a smooth full (1-2-3) flare and hold until you feel the rear wheels touch the ground.

Step #5 Release the foot bars to their neutral position as soon as you touch the ground. Close the throttle to an idle, shut the engine off, and pull the steering lines to deflate the parachute.

A REVIEW OF THINGS TO AVOID

Full throttle at the start
Too little throttle at the start
Taxi too fast or too slow
Taking off with the end cell closed
Using flare on take off

And:

Pulling the steering line with your hand while flying. This is a dangerous practice
The steering lines are attached to the foot bars and the foot bars limit the amount of travel. Pulling the steering lines with your hand will allow you to pull past the normal limits. Pulling past the normal limits of the foot bars range will stall the parachute or completely collapse the parachute, resulting in a rapid loss of altitude.

LESSON 5
Flight Test Area and Local Flight Restrictions

If you're a private pilot or a student who’s passed the written test for a private license, you can do this lesson yourself. If you're not, you'll need outside help. A basic flight instructor (BFI) or AOPA Ultralight examiner can show you. Anyone with a pilot's license should have the necessary knowledge, although the professionals should be better at passing it on. You can find a BFI under "aircraft schools" in the yellow pages or through organizations like the ASC and EAA. The purpose is to discover what parts of the sky are open and what parts are closed.

If you go with a BFI, find a good one and be prepared to pay for his time. Call and tell them what you're doing. An arrogant instructor will tell you you're crazy and offer lessons in a real airplane. You don't need those people around, try somebody else.

The purpose of this lesson is to give you a limited area where the flight rules are simple, so you can concentrate more on developing flying skills. You have no business leaving your pattern until you have completed this step.

Take a current FAA local sectional map (that's a map of the area in flying terms. Have the BFI explain it to you) and part 91-b of the FARS (the Federal Air Regulations govern the rules *of* the sky and you must be familiar with them.) Part 103 governs Ultralight aircraft operation and you must understand it to fly safely. Find your training site on the sectional. With the information from the FARS, draw an area around the site where you can fly without breaking any of the regulations, which would apply to a pilot. You want enough room to explore a bit, but not enough to get lost. It will not take too much. There's more than a hundred square miles of land within six miles of your airstrip.

Define your limits with landmarks, so you can tell where you are in flight. Set an altitude limit. A few thousand feet is plenty. Set weather minimums. Right now, unlimited visibility, no clouds and no wind. There may be places inside these limits you will not want to fly over (lakes, cities, large gathering of people etc.), Crosshatch over them to remind you. Go through part 91-b and put a check by each regulation pertaining to flight in your limited area. Commit these to memory and ignore the rest that do not apply to your flying situation.

Emergency Procedures, Ground Handling

Although the PPC is designed for ease of flying and pilot safety, certain situations can occur that require quick thinking and instant "on the job training" in order to avoid a major mishap and injury. There is no way to put every situation you may encounter in this manual. Everyday, new situations and experiences are created in the Ultralight world. Some situations are once in a lifetime "freak accidents," while others occur more often. You may have experiences that "only you can have". When something does happen and you do come out of it in basically good shape, share it with others and turn it into a learning experience. They may not be as fortunate as you were, put in the same predicament.

The following pages explain a few of the more common problems and predicaments that you could encounter while flying; from taxi all the way up to advanced, high-time flying.

The key phrase in an emergency situation is "Don't panic". Always go for the surest, safest, solution. For instance, your engine quits at 500 feet over some trees (where you shouldn't have been anyway), you spot a wide open field just on the other side of the power lines that are running next to the trees. From 500 feet it appears you might

make it over the power lines, but you just aren't sure. You know for sure you can land in the trees. Go for the trees. That would be the surest, safest solution to this situation. There is no set solution and procedure for any emergency situation, only guidelines. **You are the pilot in command.** Use your own good judgment to decide what would be your safest option and then stick to it.

Effect of Wind

Note: although wind and weather are discussed in the following paragraphs, it is not a substitute for a course in weather training. Anytime you fly you are subject to predictable and unpredictable weather. If you fly without thoroughly understanding wind and weather you risk injury or death. You must learn weather independently. You must learn how to take advantage of the national weather service forecasts, the FAA aviation weather forecasts, and local and regional weather forecasts. You can call 1-800-WX BRIEF and tell them that you are a powered parachute pilot and you would like the wind conditions for that day.

During your first flights in your PPC, you must learn in completely calm air. This gives you your best advantage to learn what the aircraft does by your inputs and not the wind's. However, dead still air has its share of problems. For instance, say you're just ready to begin Lesson 3. You roll the power smoothly to full power, you start to move forward, and it appears the parachute is inflating properly. Low and behold the parachute starts gyrating and twisting violently and isn't even beginning to inflate. Cut your engine off! Occasionally, your prop blast hits the parachute unevenly and since it is a swirling air mass, it tends to twist a partially inflated parachute to the point it tangles. It will not inflate until you straighten it out and start again.

Okay, this time you start, the parachute inflates properly, but it is not moving overhead as it should. Instead, it is hanging back at about a 60-degree angle. Simply close the throttle slightly from full power until the parachute is overhead where it should be. (The leading edge of the parachute should be just about even with your line of sight looking straight up from the seat.) Then proceed with your proper lesson and step number. This problem may also occur in situations other than calm air, handle it the same way.

Crosswinds

Takeoffs or landings in a crosswind are to be avoided! The parachute is going to go in the direction of the wind, and so will you. If you are taxiing and caught by surprise and the craft starts to tip over, shut the engine off immediately and lean in the opposite direction while steering the parachute in the opposite direction. If you tip over make sure the engine is off! When the engine is off, grab the nearest steering line and collapse the parachute before attempting to exit the vehicle.

Now you've figured out how to taxi and inflate the parachute properly, you reach the end of the runway, you turn your engine off, coast to a stop, but there is no wind, remember? Here comes the parachute and lines, directly down on top of you and the red-hot engine and exhaust pipe. Get in the habit from the beginning to always monitor the position of the parachute. When you see that it is coming directly down on the exhaust, reach back and stop the parachute from coming in contact with any hot parts, and worry about the nylon lines second. It doesn't take long to melt the parachute fabric (about two seconds). It also doesn't take long to burn your hand, so be careful. The parachute descends slowly and not at all until you stop forward motion so you have enough time to stop, unbuckle your seat belt while seeing where the parachute is heading, and step out in time to grab the lines or parachute before damage occurs.

The parachute may come down off to the side of the vehicle if you are turning or the wind is slightly to the side when you stop. The parachute will come down to the side of the vehicle and the lines will go over the top. The fan guard will prevent them from contacting the hot exhaust, but you must quickly remove them from close proximity in case someone moves the parachute or the wind blows it around.

During your taxiing, short hops, and short flights, you should develop the habit of constantly checking the position and shape of the parachute and lines. Any time you see tangled lines or a steering line not taking the most direct route to the parachute, stop and straighten it.

WIND AND THE POWERED PARACHUTE
(See figure 1-5)

Flying in higher winds can be very tricky at times. Never over extend your wind limitations. Wind can be one of your worst enemies in a PPC, as it can be in most ultralights. The PPC has a maximum air speed of 26-28 mph so a wind of 20 mph will put you in the position of only having six-eight mph forward speed and a 30 mph wind will make you land backwards. Since this is difficult, if not impossible, you have to carefully observe local weather conditions before you fly. Observing the weather forecast and checking with other pilots can save you much time and effort. The air may be beautiful for flying now, but if the forecast is for high winds, you can believe that the wind will blow. A safe margin is to fly in no higher than 10 mph winds. That will give you a 15 mph margin of safety.

The windsock tells you the direction and velocity of the wind only at ground level. The winds aloft can be from a different direction and velocity. Find the local aviation weather forecast before flying. Calling the local airport should get you this information. Remember that the winds change constantly and you may be flying along having a perfectly nice time, only to discover that your actual speed and direction is backwards to the direction you wish to go.

The air that you fly in is invisible. Unlike water where you can see the direction of flow and estimate the speed or gauge the amount of roughness, the air around us doesn't allow us to do that. The windsock lets us see the direction of the wind and allows us to gauge its speed only at ground level. While in the air there is no way to guess where the wind is coming from or the speed. While flying in a straight line you can look at the ground and to some extent gauge the direction of the wind by how much you have to adjust your flight direction to keep heading in the right direction. Your true ground speed can be guessed by gauging how fast you are going in relation to the ground. If you are flying in a 15 mph wind (the maximum recommended speed) and flying into the wind, the 25 mph forward speed combined with the 15 mph head wind will give you 10 mph true ground speed. If you turn 180 degrees and fly with the wind then the 25 mph forward speed combined with the 15 mph tailwind will give you 40 mph ground speed! If you start out flying down wind with a full tank of gas and then turn around to head back you may not make it. The use of a GPS unit may take a lot of the guesswork out of flying but you must learn to be a competent pilot without it.

Turbulence

Up to this point we have assumed that the wind is a steady stream. The air is frequently a boiling mass that goes up and down, as well as along the ground. Turbulence can be injurious or fatal.

As the wind blows over ground obstacles, it creates the most annoying air disturbance called rotors. These rotors are exactly as they sound; a rolling mass of air on the downwind side of most obstacles. The rotor will try to push you into the ground and/or collapse your parachute. Avoid rotor activity. Plan your take off so you are well above any obstacles by the time you pass over them (at least 50). A rotor is a member of the family of mechanical turbulence which is any disruption of wind/air flow caused by ground objects like trees, buildings, hills, bridges, etc. Strong down drafts can be created that may slam you into the ground. Severe rotors could cause you to lose control. The best way to avoid mechanical turbulence is to either get an unobstructed field a couple of thousand feet on each side or fly in a no wind condition. Respect the wind. It can hurt you.

While flying at an altitude high enough to clear ground turbulence, you may run in to all kinds of totally invisible turbulence that we call “gusts" or "thermals" or all kinds of other names. Calm air in the morning is heated by the sun and starts to rise. How quickly this happens, affects the amount of turbulence. Other planes flying through the air tear great big holes in the air. Even your own flight path will have a turbulent influence on the air if you turn around and cross through your own wake. Be careful of 360° turns.

As soon as you complete the turn you will run into the hole in the air you just made with violent results.

How does turbulence affect your PPC? The parachute will react to the change in speed and direction the same as any parachute. Although your direction has not changed the parachute thinks it has and reacts accordingly. If the gust hits one side of the parachute then the parachute may turn strongly in one direction. Random turbulence will bounce you around. If the turbulence is mild then it may be no more than uncomfortable to fly in. Strong turbulence must be avoided. Gauge the amount of turbulence by studying the weather before you fly. Do not fly if storms are forecast or thunderclouds are in the area. At some point the air will be turbulent enough to collapse the parachute. Because there is no way to gauge turbulence we cannot tell you how much is too much. If you are being bounced around then it is time to land. If dust devils or waterspouts are seen in the area then you are in danger. Certainly, when thunderstorms or any type of violent winds are near, then you must not fly. This manual cannot teach you weather. If you wish to fly safely you must learn and understand the weather.

During turns or in straight flight, giving a small amount of steering input can dampen a small amount of bouncing around. The extra load on the parachute will tend to dampen oscillations. During a turn apply mild pressure in the opposite direction to steady the parachute. During straight flight apply mild pressure to both levers.

Operations in Dangerous winds

Up to 10 mph the parachute will lay on the ground without being affected by the wind. Above 10 mph the wind will pick the parachute off the ground and inflate the parachute without any one near the PPC. Remember that 10 mph is more than enough speed to taxi! Do not leave the parachute unattended. Put the parachute away if you are going to stop flying for any length of time. To fly in winds above 10 mph you may need instructors to hold the parachute down on the ground until you are ready to begin your take off roll. As soon as they release the parachute the parachute will come up and out and climb overhead. The instructors will have to release the parachute and back away quickly. They must release the parachute as soon as you begin to roll forward and must not run along with it. Your take off roll will be very short. Taxi at a very slow speed to inspect the parachute. Remember that you are already taxiing at 10 mph even if you are stopped.

If you attempt to fly in a 15 mph ground wind you risk serious injury. When you taxi at 15 mph in no wind and look at the amount of pressure on the parachute you will realize that the parachute will snap off the ground very quickly and you will start to roll backwards unless you apply enough power. The parachute is dangerous when strongly inflated.

Any time you land in wind you risk being pulled along the ground. You have a +500 square foot parachute in the wind and you are sifting on wheels. This can be very embarrassing and dangerous. The best way to avoid being pulled along the ground is to fly in no wind. If you are flying by yourself and the wind is blowing strongly: as soon as the wheels touch down, simultaneously turn the engine off, push both foot bars as far as they will go and grab the steering lines and pull quickly to collapse the parachute. When you pull the lines you pull the rear of the parachute. You must pull far enough so the parachute no longer has a wing shape. When the canopy collapses, wrap the line around the outrigger pulley. Quickly do the same for the other side. As soon as you turn the engine off you will no longer have any forward thrust, and if you do not quickly collapse the parachute you will be pulled backwards at whatever speed the wind is blowing and risk being pulled over. Even if you only roll a short distance backwards before you collapse the parachute, you might run over the parachute.

Once the parachute is safely tied off you must daisy chain the suspension lines, or use the optional line sleeves to prevent accidental re-inflating.

End Cell Closure

Occasionally, you will notice a common characteristic of ram-air parachutes in turbulence called "end-cell closure". This is when the forward outer-most cells roll under slightly. No cause for alarm, push firmly on both steering bars until it billows back out. If this happens on your take off roll, you must open the end cells prior to take off. If both end cells are closed and you take off and only one opens, you will have a sudden turn. Correct the problem before taking off. If you are running out of runway, stop, go back and start over.

Occasionally, you will be flying around at altitude and notice one or both end cells closed by the wind. Don't panic, simply push both toot steering bars quickly and firmly until inflation occurs. You may not see the end cell closure. What you will notice is a loss of altitude and a turn, even though you were flying straight and level at the time. After flying through rough air, thermals, or other turbulence, end cells may close. Any time you experience rough air, check the parachute for this occurrence. The only time end cell closure can be dangerous is if, for instance, you have the right cell closed and you start turning and spiraling to the right, the cells could (but probably won't) continue to collapse further in toward the center. Level out and push both foot steering bars as before. Use the same procedure for the left side. End cell closure at low attitude can be hazardous.

Any time the parachute appears to be "flimsy” or slightly depressurized, simply push both foot steering bars until the parachute is normal again. If you are experiencing constant rough air and turbulence, continue holding pressure on the foot steering bars.

This will prevent end cell closure and maintain a more rigid parachute. The obvious answer to the above problems is to avoid conditions that lead to flying in turbulence.

ENGINE FAILURE

Your PPC is probably equipped with a Rotax 2-cycle Ultralight engine. This engine is a derivative of the Rotax-bombardier snowmobile type engine. Snowmobiles have been known to foul plugs creating a rough running, low power producing effect. They sometimes quit unexpectedly. It you were riding a snowmobile and the engine quit you would simply pull it over and walk to help or have your buddy take you to help. Well, having the same engine on an aircraft still has the same problems as it does on a snowmobile, only now you have one more step before walking to get help. You have to land safely. The following procedures should be used in the event of an engine or drive train failure.

Having an engine failure on takeoff in a PPC is generally incident free. If you lose power as you takeoff, simply continue on straight ahead (assuming you are using ample runway length) and push steadily on both foot steering bars at approximately five feet, and land. Never attempt to make abrupt turns below 100 feet! Make smooth graceful turns if necessary. Turns increase sink rate, which in turn increase broken bone rate. Never use flare to shorten take-off distance. If the engine quits on take off, you will not have enough flare capability to land safely.

If your engine quits, immediately start looking for a place to land. **Land into the wind if at all possible.** If you know you can make the landing area you chose and plenty of altitude remains (above 300 feet), you may want to give the rope a yank or two to see if you can restart. Chances are, whatever made your engine stop cannot be fixed by pulling the rope. Part of successful flying is constantly surveying the territory below you to determine a safe landing place in case of engine failure. But don't waste valuable time with restarting the engine unless you are 100% sure you can land in a safe place and have an altitude of more than 300 feet. Fly the aircraft first. Worry about a restart later. Now you have your field in sight. You are turned into the wind. There are no fences, ravines, boulders, power poles or wires in your glide path. You are ready to land. Start pushing your foot steering bars at approximately 15 feet. Time it so you have them all the way out just prior to touchdown. Keep your back straight and your feet on the pedals. If done properly you are now smiling and climbing out of your undamaged PPC. By flaring too much too soon, you can cause severe damage to the airframe and yourself.

By flaring too little, too late you will probably damage the airframe slightly, but you should be okay. Never flare too high.

We highly recommend you practice these emergency flares before you need them. If you practice emergency landings on a frequent basis a real one will be a non-event. Your ability to land safely when the engine quits requires some advance planning. **Always survey the land below you for a landing site. Every minute that you are flying you must have an alternate landing spot picked out.** Altitude is your friend. The higher you are, the longer you have to make a decision and the further you can glide to a landing spot. Practice emergency landings. Fly to some point and imagine how far you would be able to glide with the engine out. Now bring the engine to an idle and try to glide to that spot. An actual landing is not required. Just get an idea how far you can actually go with the engine at an idle. The difference between engine out and idle is very small. The above procedures are for landing in an ideal emergency field. What if you neglected to leave yourself adequate safety margin and all you have are trees and power lines below? First of all, power lines are not even considered to be an option, so eliminate them immediately. Otherwise they will eliminate you. As scary as the trees may look, they are an alternative. The only problems are they tear up your PPC and you could get stranded in the top of a big pine for a while. If you can see any low points in the tree line that are within your glide range go for it. Otherwise visualize the treetops as being the ground. Face into the wind and do a normal emergency flare. As the airframe falls through the tops, cross your arms across your legs and bury your face in your lap. Do not attempt to grab branches as you fall through the tree limbs. The parachute and lines will probably snag in the branches. When everything quits moving and bouncing, slowly look where you are and avoid sudden movements if the airframe is still in a tree. Survey the situation and decide if you can safely climb out and down. Otherwise, stay put until help arrives. When help arrives, disconnect the parachute from the airframe and remove them from the tree separately, rope will be required to do this. Power equipment may be required.

All right, now you've landed in an ideal emergency field, missed the power lines, and made a tree landing. What's next? How about a water landing? Lakes and rivers are very tempting to fly over because they look so open from the air and there are usually lots of people around to show off. However, if you lose an engine over the water, out of glide range of shore, you are not going to sink like a rock, you are going to sink quicker than a rock. Would you consider being dropped into the water strapped to a 379-pound rock? That is what it will be like. Avoid flying over large bodies of water and rivers. I personally have never spoken or read of someone doing a water landing, so everything I have to offer is purely speculation. This subject has been debated without any conclusive evidence. Here is the theory. First of all remember, that as soon as your wheels touch the water you will be engulfed with water and come to an immediate stop. None of that “coasting to a stop” stuff here. Unless you’re flaring, your front wheel will dig in first. Your chute on the other hand will act the same as if you were on land. If you don’t flare it and pull in the lines, it will just keep on going forward, unless you have a significant head wind. Applying a flare and pulling in the lines is difficult when you’re sinking to the bottom of the lake. On land, you can experiment. Land into

a 10 mph head wind, cut your engine and apply your hand brake as hard as possible. No flaring allowed. Where did the chute land? It landed directly in your face. In the unfortunate event that you do have to set down in a lake deeper than four feet, this is what you should do. **Fly your machine until it is time to bail out.** My goal would be to abandon ship without getting tossed around by splashing water or getting tangled in parachute lines. You must avoid them at all cost. I think that I would try to position my so that the wind is from my side. As I approach the water, I would unbuckle my seat and shoulder belt, and remove my helmet and goggles. I would fly the PPC down to 15 feet and do a full flare to slow my forward movement as much as possible. Next, I would jump feet first, “cannon ball style”, over the front toward the upwind side of the front wheel and swim away from the parachute and the lines. I would try to make sure that I jumped clear BEFORE I touched the water. Because as soon as the wheels hit the water, the PPC will stop instantly, the chute will keep traveling forward and with the wind, and the craft will sink immediately. Some people theorize that it would be better to flare right down to the water, then abandon ship and swim clear. If anyone has a definite answer please let me know.

The rule of thumb is not to fly over anything that you don't want to land on. If you must fly over an obstacle, you must have enough altitude to abort short of the obstacle or glide with the engine out completely over with enough altitude to safely land on the other side. Fly over a lake? Only if you have enough altitude to glide to the other side. Fly over trees? Only if you have a safe landing site close enough.

TAKE OFF DISTANCE

The take off distance will vary depending on several factors. The first factor is how long it takes to get the parachute off of the ground, up overhead and inspected. This distance will vary with practice and wind conditions. The longest distance will be if the wind is not blowing. Any time the wind blows it will assist the parachute in inflating. Once the parachute is inspected you have to accelerate to 26 mph and lift off. The total length of runway needed will depend on the obstacles to be cleared and the air. Any obstacle that you have to fly over you will want the maximum amount of clearance that can be obtained. 20 feet should be the absolute minimum clearance and 50 feet is better to clear an obstacle. The air condition will affect the performance of the parachute. Most PPC have a climb rate of 500 feet/minute. This figure is at sea level, 72° Fahrenheit, standard barometric conditions and a 175 lb. pilot. The climb rate with a passenger on board will decrease depending on the passenger weight. As the altitude gets higher, the temperature gets hotter and the humidity rises, the air thins out. The effect of this is to reduce the lifting ability of the parachute. With 26 mph forward speed you will have an approx. 3:1 climb ratio. That means that you will travel forward 3 feet for every foot you climb. To clear a 50-foot obstacle you will need an absolute minimum of 300 feet to clear the obstacle. This is only if you can lift off in 150 feet, which is about the minimum, take-off distance. As much as 300 feet may be necessary to inspect the parachute for some pilots and at certain times. Compare with

a 400-600 feet feet/minute rate of climb. An additional 134 feet is now needed to clear the same obstacle. Head winds will decrease the take off distance, tail winds will increase it.

Warning: this information is provided as an example only. Actual performance on any given day will vary. When calculating (estimating) rate of climb and performance to clear an obstacle always figure on the conservative side to be safe.

How will you know what is a safe distance to give you a sufficient margin? Use the above factors and gauge your own vehicle, weight, wind, temperature, humidity, and take off distance. It you are not sure if the safety factor is sufficient, don't fly from that field. Move your operations to a larger runway until you have practiced enough to know if you can safely take off from the smaller runway. Measure the distance to the obstacle and lay out the same distance at the larger runway. When you have reached that distance, what is your altitude? If you are too close to the ground when you reach that point then don't consider flying at the shorter runway.

HANDLING A POWERED PARACHUTE

Moving and handling your PPC on the ground by hand is very simple compared to other ultralights. You have no parachute or wing tips to look out for. It's basically a go-cart when the parachute is not installed. After you've finished flying or when you leave your PPC unattended for any length of time, you must get in the habit of disconnecting the plug wires from the spark plugs. This is a safety precaution, because even the slightest movement of the prop can cause the engine to fire, spinning the prop unexpectedly. Whenever you are transporting, storing, or parking your PPC, the prop should be secured with a prop sock to prevent accidental turning. If you have a two-blade prop, secure it horizontally to minimize the chances of it hitting the ground while moving the craft using the front wheel. Never turn the prop by hand unless the plug wires are disconnected. Simply turning off the ignition switch is not enough. Most PPC’s can be moved by pushing from behind or by pulling on the front wheel assembly. Watch out for HOT parts when pushing from behind.

PACKING THE PARACHUTE

After a day of flying, putting the parachute back in the storage bag systematically will greatly speed your set up time up the next time you go out flying. You will come up with your own procedures and technique that works best for you. We recommend that when you are finished flying that you lay out the parachute with the ends stretched out and the parachute folded in half, lengthwise with the nose folded over to meet the tail.

Neatness adds to the life of the parachute. Fold the parachute from the end towards the middle. Do the same on the other side. Smooth out the fabric as much as possible to avoid unnecessary folds in the material. Fold again from the end towards the middle. The parachute will be puffed up and difficult to fold because of the trapped air inside at some point in the process. Smooth the parachute by pushing the air from the rear towards the front. Continue folding towards the center and pushing the air out until the two halves are about a foot wide. Fold the two halves together and roll up the parachute towards the front. When you are finished the parachute should be smaller than a rolled up sleeping bag. Put the parachute in the carrying bag. Practice will make this job easier so that the finished bundle will be smaller and easier to handle.

Is the wind blowing? Forget everything you have just read and stuff the parachute in the bag any way you can manage. The wind will make it impossible to do anything else. Daisy chain the lines as usual or use your line sleeves.

It is important that the parachute be removed and refolded as soon as the wind allows. The extreme folds that result from stuffing the parachute in the bag will reduce the life of the parachute.

Make sure you check all your lines the next time out. Twists can occur very easily when placing the canopy and lines in your storage bag. When you take the bag out of the seat the next time you may take it out the other way and put a complete twist in the lines. The parachute will look completely normal on the ground, however the steering lines will be wrapped completely around the suspension lines, so always check that first. The next time you want to go flying its as simple as unloading the craft, taking the parachute out of the seat, doing your pre-flight and within 15 minutes you're flying. That's the idea, isn't it?

THE FINAL WORD

You have reached the end of the manual. Quite a bit to read? You have probably read through this the same way you would read any book. However, this book directly concerns your safety. Reread the entire manual and make sure that every item is committed to memory. You cannot take this with you to refer to in flight or in an emergency.

This manual should have given you the impression that flying is dangerous. Of course it is, but so is scuba diving, motorcycle riding and a lot of other sports. The Powered Parachute is one of the safest aircraft in the world but only if you fly in a safe, conservative manner. Do not assume that everything is safe because you just finished flying and nothing happened. The next time you fly you must check the vehicle as if it has never flown before.

Again, a word of thanks to all of the dealers and other sources who contributed to this publication.

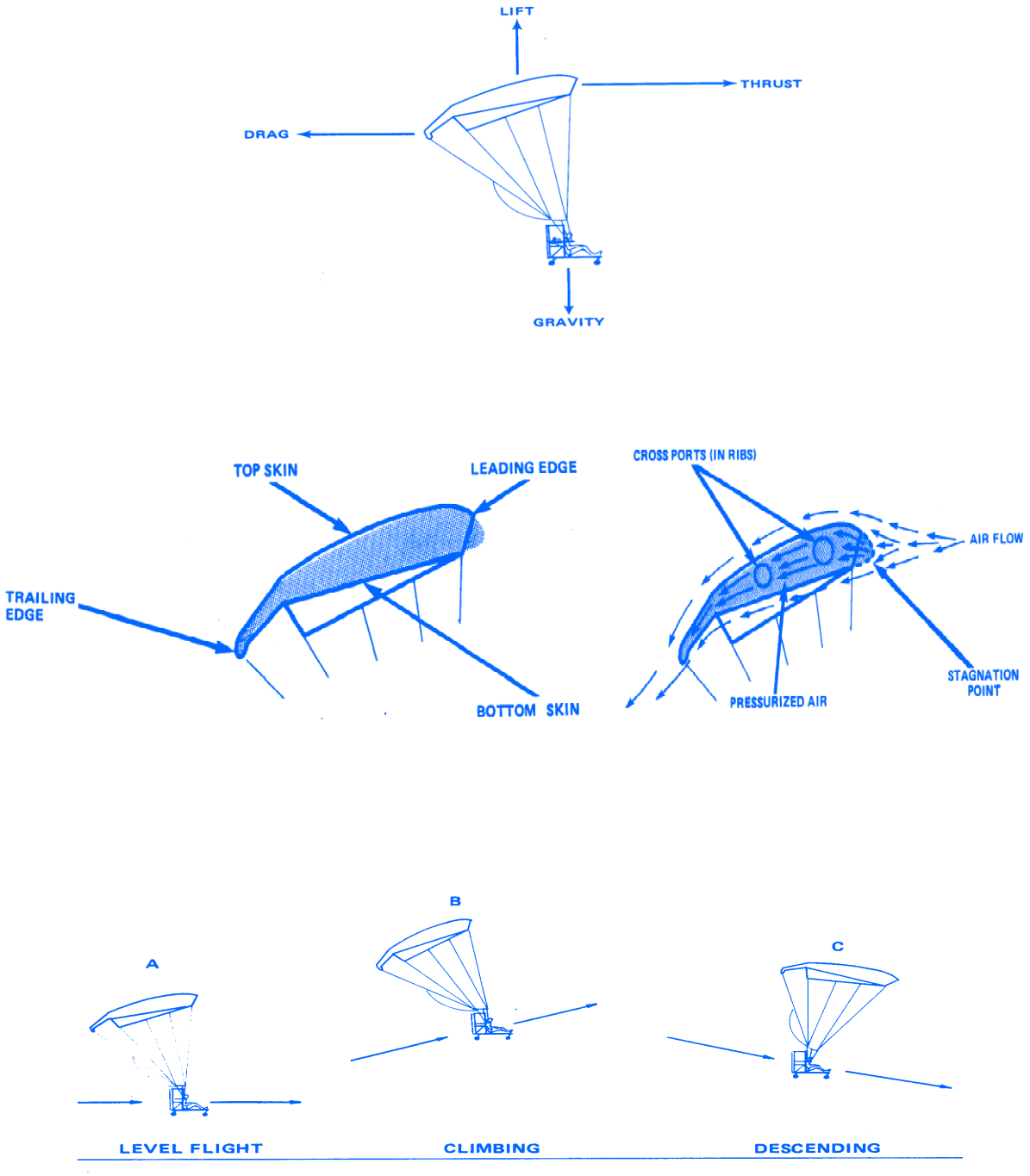
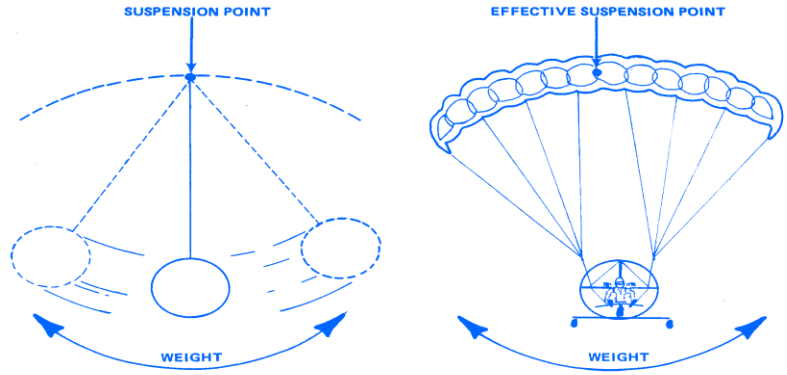
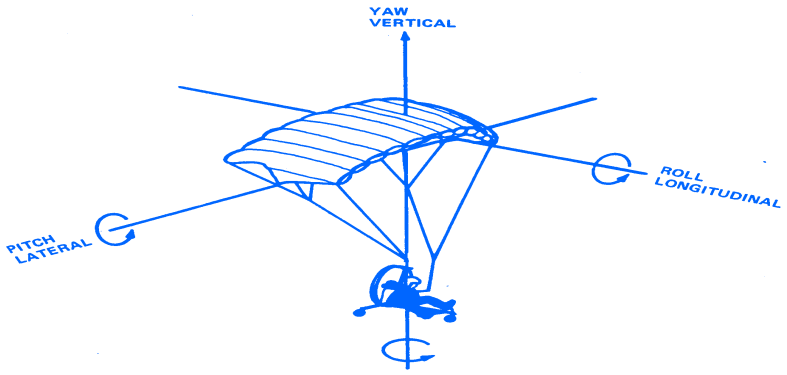
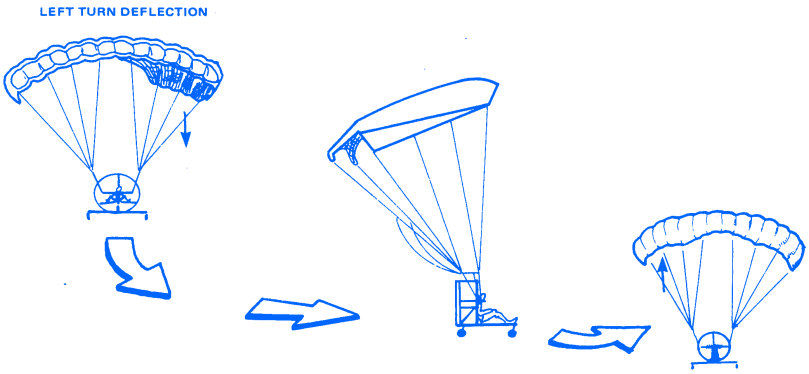
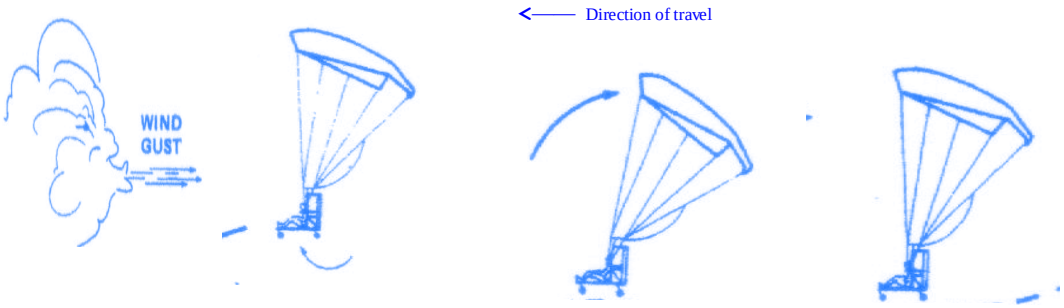


Figure 1

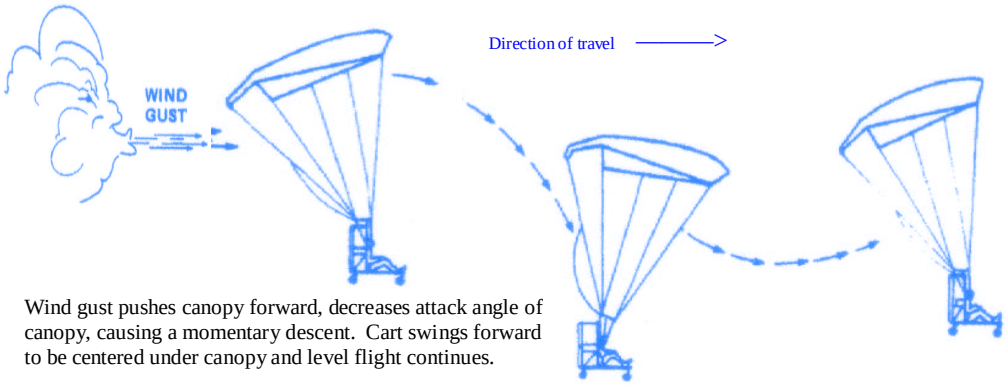

SUSPENSION POINT
WEIGHT
EFFECTIVE SUSPENSION POINT
WEIGHT


YAW
VERTICAL
ROLL
LONGITUDINAL
PITCH
LATERAL

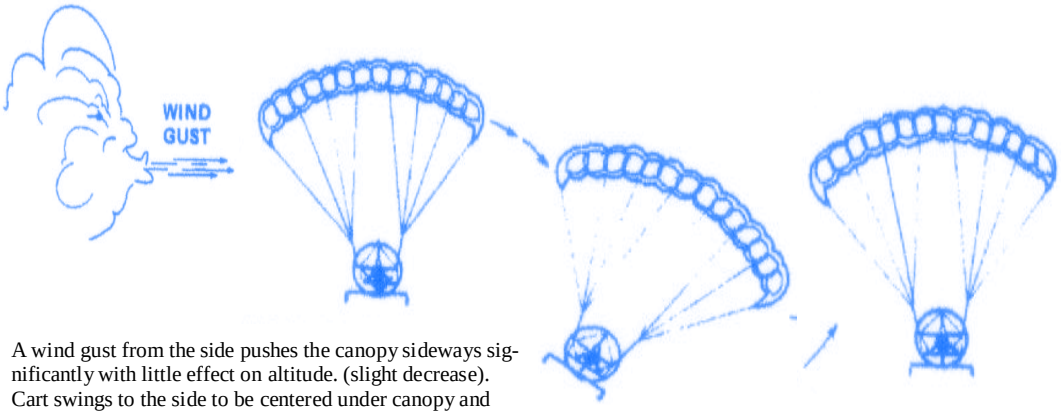

LEFT TURN DEFLECTION
NOTE: INCREASED RATE OF TURN RESULTS IN INCREASED LOSS OF ALTITUDE
LEFT TURN DEFLECTION RELEASED



Wind gust pushes canopy back, increasing attack angle of canopy, causing a momentary ascent. Cart swings to the rear to be centered under canopy and level flight continues.

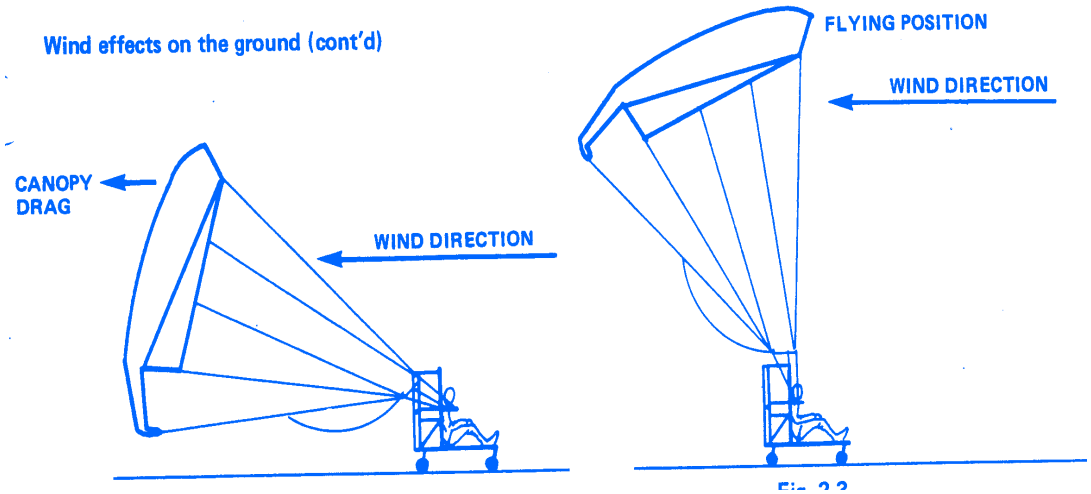


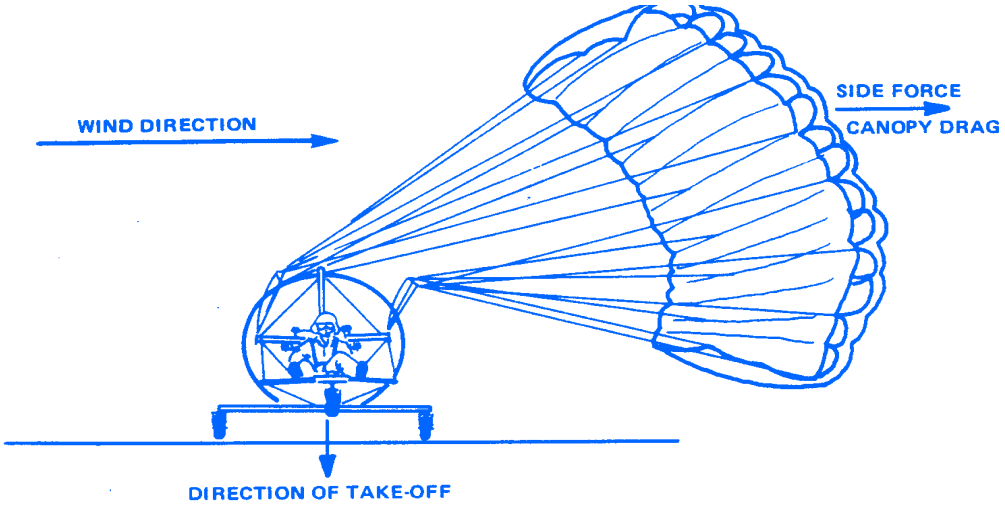
Wind gust pushes canopy forward, decreases attack angle of canopy, causing a momentary descent. Cart swings forward to be centered under canopy and level flight continues.

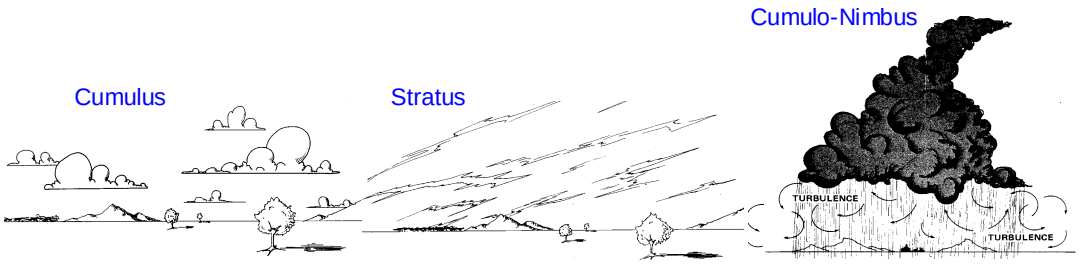


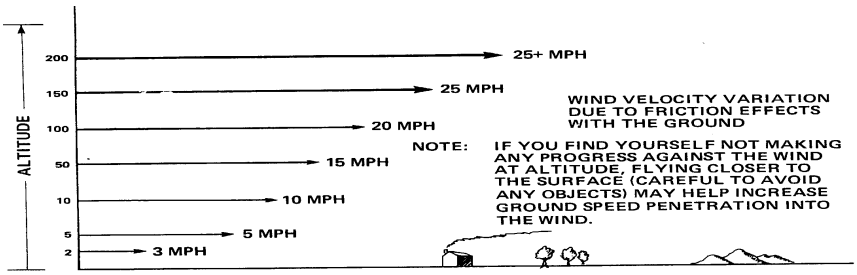
A wind gust from the side pushes the canopy sideways significantly with little effect on altitude. (slight decrease). Cart swings to the side to be centered under canopy and level flight continues.

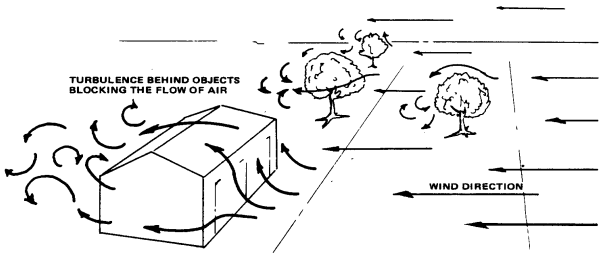
Wind effects on the ground (cont'd)

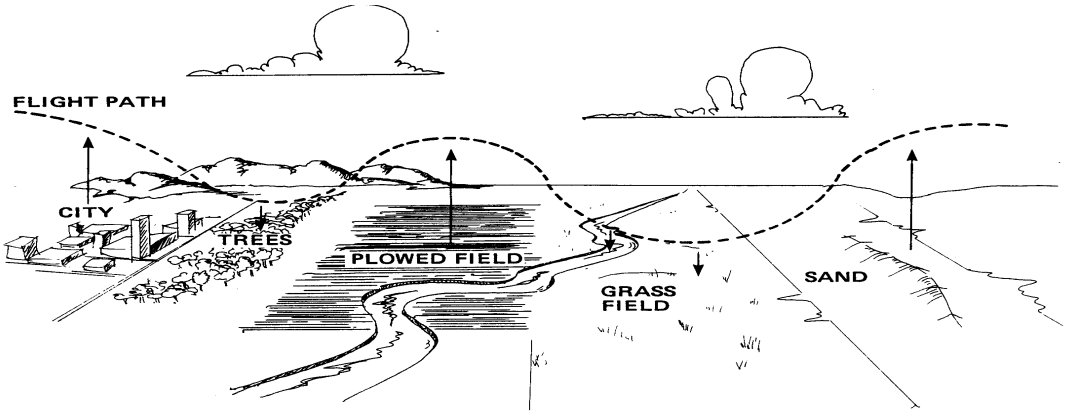





Cumulo-Nimbus
Cumulus
Stratus
TURBULENCE
TURBULENCE


ALTITUDE
200
150
100
50
10
5
2
25+ MPH
25 MPH
20 MPH
15 MPH
10 MPH
5 MPH
3 MPH
WIND VELOCITY VARIATION DUE TO FRICTION EFFECTS WITH THE GROUND
NOTE:
IF YOU FIND YOURSELF NOT MAKING ANY PROGRESS AGAINST THE WIND AT ALTITUDE, FLYING CLOSER TO THE SURFACE (CAREFUL TO AVOID ANY OBJECTS) MAY HELP INCREASE GROUND SPEED PENETRATION INTO THE WIND.


TURBULENCE BEHIND OBJECTS BLOCKING THE FLOW OF AIR
WIND DIRECTION


FLIGHT PATH
CITY
TREES
PLOWED FIELD
GRASS FIELD
SAND

Figures 1-5