KASPERWING T.M.

PILOT FLIGHT OPERATIONS MANUAL

MODELS:

180-A

180-B

180-BX

CONTENTS

INTRODUCTION Congratulations! Now that you have assembled your KASPERWING, you are ready to learn to fly it. First of all, if you have not already flown an ultralight, airplane, sailplane, hang glider or helicopter, contact our factory for a list of our qualified dealers who will provide you with flight training and the background information necessary to safely fly your KASPERWING.

If you already have a minimum of 5 to 10 hours solo flight time (including a minimum of 20 solo take-offs and landings) in aircraft such as a Cessna 150, Schweizer sailplane or other ultralight aircraft, you can safely transition to the KASPERWING after thoroughly studying this flight operation manual and following its step-by-step procedures.

The purpose of this manual is not to teach you to fly a KASPERWING; that is the job of dealers and flight training programs. We assume you already have a reasonable understanding of aircraft flight characteristics and aerodynamics of flight in general (i.e., stalls, spins, level flight, pattern maneuvers, etc.) and have been properly versed in the appropriate FAR's pertaining to ultralights, in particular FAR part 103.

BASIC FLIGHT ENVELOPE AND HANDLING CHARACTERISTICS The KASPERWING was designed as a soaring motorglider intended for operation at airspeeds between 0 and 60 m.p.h. and capable of performing all types of aircraft maneuvers with the exception of aerobatics.

The control system is a 2-axis type using weight shift for pitch control and the Kasper wingtip control system for yaw and roll control. This system is very docile and forgiving while providing more than adequate control for high performance flight as you will discover. As an added bonus the control system functions independent of forward airspeed and duplicates what birds do to control their flight.

PITCH CONTROL When a bird changes pitch in flight, it moves its wings forward or backward, changing the relationship between its center of pressure and its center of gravity. That is, it shifts its weight relative to its center of lift. In the KASPERWING we move the pilot's weight back and forth to change the aircraft's load distribution causing the wing to nose up or down instead of shifting the wing back and forth as birds do.

This is a very simple and effective means of pitch control and gives the pilot a greater range of control than having a conventional 3-axis type stick and elevator arrangement. The biggest difference between conventional aircraft controls and weight shift pitch control is the obvious reversal of control movements. This is very easy to adapt to if the pilot thinks of his body as being the stick:

Body forward (stick forward) = nose down
Body back (stick back) = nose up

Another way of thinking of pitch control is the concept of pushing on the steering yoke to "push the nose up" or "pull the nose down." In any event once you have made a few hops or short flights, you will find that pitch in the KASPERWING is very docile and you should be able to master its use in a short period of time.

YAW AND ROLL CONTROL Turning in the KASPERWING is accomplished by twisting the steering yoke to the right or left, individually deploying the rudders to effect turns. When a rudder is opened, it pushes the wing down, destroys lift on top of the wing acting as a spoiler and creates a certain amount of drag. The combination of these forces causes the wing to behave in a coordinated fashion. Suffice it to say that to turn left, open the left rudder; to turn right, open the right rudder.

For straight and level flight both rudders should be in the closed position with the lower rear portion of the rudder touching the short V-strut which acts as a stop. If the rudders are allowed to float open together, no turn will result as long as both rudders are equally deployed, but the pilot will notice a slight tendency for the nose to pitch up. This is caused by the spoiler action and down load which the rudders individually place on the wing. There is an advantage to having a

rudder system which also affects the pitch of the wing. This and finer points of turns will be discussed later.

HARNESS ADJUSTMENT AND NEUTRAL TRIM POSITION Supplied in your kit you will find the North Star harness, hang strap and carabiner. Remove the hang strap and carabiner from the harness and loop them around the keel tube and upper frame tubes of the KASPERWING in the position shown in *Figure 1.* The hang strap should be left in this position for taxiing and first flights but can be moved and adjusted in flight for soaring, cruising or climbing under full power. *This will be covered in greater detail later.*

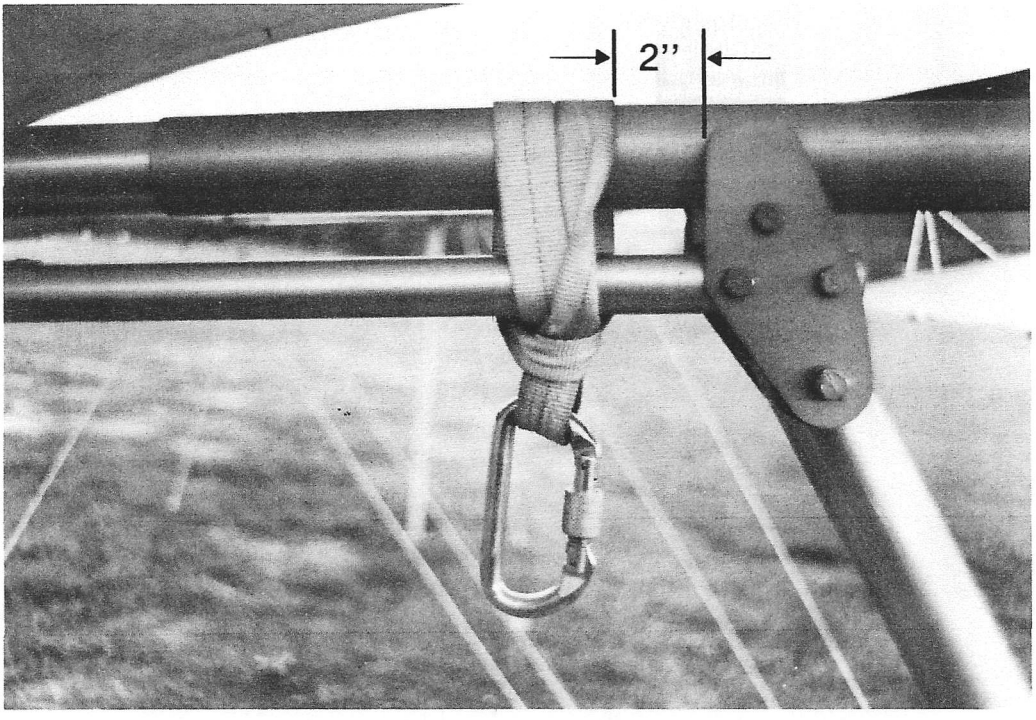

Figure 1

Lift the harness over your head, raise your arms and slide into it as if you were putting on a shirt or jacket. Fasten the seat belts and climb into the undercarriage. Connect the harness hang loop to the carabiner and sit down in the undercarriage placing your feet on the nose wheel steering bar. You will notice that almost all of the straps of the harness are adjustable. Sit in the machine for a while, adjusting and readjusting the harness and headrest straps for maximum comfort. After you have adjusted the harness, tape or trim the excess straps so they do not flap in flight. If you find the headrest undesirable, it can be removed with a hot knife or other heat cutting tool.

For any pilot whose weight is between 130 and 220 lbs. there is a minimum throttle setting which will allow the aircraft to maintain straight and level flight at a minimum airspeed. The pilot's body position relative to the aircraft at this minimum level flight airspeed is called the neutral trim position. This is because most pilots' bodies (or the stick, if you prefer to think of it that way) are at a neutral or mid-point in the range of pitch control movement. For a given minimum throttle setting with the pilot in the neutral trim position, the aircraft will maintain level flight without climbing or descending unless the throttle setting is changed or the pilot moves his body forward

or backward causing the aircraft to nose up or down with an accompanying change of airspeed.

As a coincidence this neutral trim position happens to be almost in the same point for all pilots and as can be seen in *Figure 2,* the pilot's hands are on the steering yoke and his knees are positioned directly beneath.

Figure 2

PRE-FLIGHT TECHNIQUES In the back portion of your KASPERWING assembly manual you will find a final assembly checklist. This list can double as a pre-flight checklist until you become familiar enough with the craft to develop pre-flight habits enabling you to mentally check over your craft prior to each flight.

Procedure — Begin at the front center of the wing. Use a written checklist until you can memorize all the checkpoints on the wing. Then proceed to walk around and physically put a finger on or grab hold of each part of the aircraft you wish to check for security. Look for things such as broken strands of cable, dented tubes and soiled portions of the sail indicating possible hidden damage. When you have walked all around the wing once, checking for unsecured fittings, damage, etc., then check over the undercarriage and its supporting structures for security and proper operation. Run your hands over all the cables and thimbles of the rigging, looking for broken cable strands or controls not properly connected. It is better to snag your fingers on a loose strand of cable than to risk an in-flight structural failure due to a weakened or broken cable. If possible, have someone lift up on the middle of each outboard compression strut to take up any cable slack, simulating a flight load, while you sight down the struts checking for wash-in, wash-out and wing symmetry. Finally, grab hold of the compression struts and physically shake the wing until you are satisfied it is properly secure. Remember, if you can shake your wing apart, you don't want to fly it.

Developing proper pre-flight habits is one of the most important things you can do in operating an

aircraft. Once you develop a good pre-flight routine, stick to it. It could save your life one day.

ENGINE OPERATION AND BREAK-IN The KASPERWING models 1-80, 1-80B and 1-80BX all come standard with the Zenoah G-25B-1 engine and engine manual. Carefully read the manual from front to back covers to completely familiarize yourself with this engine and its operation.

PRE-STARTING AND RUN-UP PROCEDURE You will want to tie down the airframe securely and run up the engine in order to tune it prior to taxiing or first flight. Make sure you do not run the engine until you have thoroughly pre-flighted the machine and tied it down very securely. Try to secure the rear axles to some very solid stakes driven into the ground or push the nose wheel up against something solid like the side of a building or wall in order to keep it from running off without you during run-up.

Remove the spark plug and rinse it off in gasoline, as the tip will be fouled due to pre-lubrication at the factory. Reinstall the spark plug and coil wire. Check to be sure the plug in the secondary spark plug hole on the cylinder head is tight. Remove the recoil starter assembly and check ignition breaker points for proper gap and tighten the breaker point hold down screw securely (refer to engine manual). CAUTION: Do not run the engine without the prop and belts installed as this can cause major engine damage.

ENGINE STARTING

1. Aircraft securely tied down
2. Gas on
3. Switch on
4. Choke open (lever in rear position)
5. Throttle open approximately 1/3
6. Prop clear (spectators at a safe distance)
7. Yell, "Clear prop!"
8. Pull starter rope until engine fires
9. If engine fails to fire after 2 or 3 pulls, apply full choke until the engine fires (engine should run for several seconds, then stop)
10. Open choke lever and start engine. When engine fires, back throttle off to an idle and let the engine warm up.

TUNING As the Zenoah engine comes pre-set from the factory, yours may run without any necessary adjustments. Still it is a good idea to adjust the engine to your density altitude which will vary according to your geographic location. As is illustrated in the engine owners manual, the carburetor has two mixture adjustments. The low speed jet is the one found on the propeller side of the carburetor and is marked with an "L". The high speed jet is the one on the pilot side of the carburetor and is the only one which can be reached and adjusted with the engine running. It is marked with an "H".

PROCEDURE — LOW SPEED JET ADJUSTMENT

1. Warm engine up at low idle for about 2-3 minutes
2. Advance throttle lever to about ¼ open (Note: Make sure throttle friction is set.)
3. Engine R.P.M. should stabilize and engine should run smoothly.
4. If engine loads up and runs rough (four-stroking), low speed jet is to rich. Stop engine and adjust low speed jet to leaner setting by screwing jet in clockwise 1/8 turn at a time. Re-start engine and continue to adjust low speed jet until engine runs smoothly between 1/4 and 1/3 throttle.
5. Engine should run a little rough near an idle (four-stroking) but as throttle is advanced from 1/4 to 1/3, engine should smooth out. If low speed jet is to lean, engine will not idle at all and when throttle is opened all the way, engine will not accelerate into the upper R.P.M. range. Richen low speed jet by screwing out — counter clockwise — 1/8 turn at a time until engine

runs smoothly between 1/4 and 1/3 throttle. When throttle is opened, engine should accelerate into its upper R.P.M. range.

CAUTION: Do not attempt to adjust low speed jet with engine running as there is little clearance between prop and carburetor jet. It could be very easy to accidentally catch your hand in the spinning propeller.

PROCEDURE — HIGH SPEED JET ADJUSTMENT The high speed jet located on the front of the carburetor should be adjusted with the engine running first on the ground and then later in flight under a constant load.

1. With the aircraft securely anchored in place, climb into the frame and assume a comfortable position.
2. Warm engine up and advance throttle to about ½.
3. Reach back and richen high speed jet by slowly unscrewing jet in a counter-clockwise direction 1/8 turn at a time until engine bogs down and begins to four-stroke.
4. Slowly screw the high speed jet clockwise, leaning the mixture until R.P.M. peaks. Leaning mixture beyond a peak engine R.P.M. for any given throttle setting can result in high engine temperatures and subsequent overheating or seizure. Care should be taken not to run engine any leaner than necessary to achieve a peak engine R.P.M. Always adjust high speed jet by first richening the mixture and then slowly leaning it to achieve an R.P.M. peak. If you have an exhaust gas temperature gauge or cylinder head temperature gauge, then adjust mixture so as not to exceed temperature limitations as called out in Zenoah engine owners manual. Some pilots don't trust gauges and prefer to use their ears to tell them when the R.P.M. has peaked and stop leaning the mixture at that point.
5. Once you have set the high speed mixture at ½ throttle, run the engine at a lower throttle setting for about 5 minutes and allow it to cool down a little. Then increase R.P.M. to about ¾ throttle and readjust mixture again.
6. Run the engine for about ½ hour on the ground, varying the throttle from about ¼ to ¾, holding no one R.P.M. for more than 2 or 3 minutes at a time. Finally run the engine at full throttle and adjust high speed jet to achieve a peak full throttle R.P.M. Remember, always richen mixture until engine bogs down and R.P.M.'s drop, then slowly lean mixture until R.P.M.'s peak and go no further. To be on the safe side once you achieve peak full throttle R.P.M., run the mixture about 1/8 turn on the rich side for the first 10 — 12 hours of engine operation.
7. Avoid full throttle engine operation totally for the first ½ hour of break-in and then only as necessary to achieve quick take-off on climb out or for purposes of carburetor adjustment. You should find that the plane climbs nicely on ½ throttle which is about what you'll be using on your first flights.
8. After about an hour of static engine break-in time, remove the spark plug and examine the tip. It should be just starting to turn golden or charcoal brown. If it is black and oily, your engine is running a little rich. If it is white or specked with white areas, it may be running a little lean or hot; richen the high speed mixture a little. Take a wrench and check the exposed cylinder base, head, intake and exhaust flange nuts and bolts to be sure they are still tight. They may loosen up during break-in because of heating and contraction of the engine. In particular check the auxiliary spark plug hole plug to be sure it is tight. If it loosens up in flight and falls out, it can break your prop and the engine will immediately stop.

TAXIING Low speed taxi control is provided by a steerable nose wheel which is operated by the pilot's feet. At speeds below 12 m.p.h. push on the right foot bar to turn left, push on the left foot bar to turn right. If you are going above 12 m.p.h., the rudder control starts to become more effective and should be used for primary control instead of the nose wheel.

To master taxi control start by taxiing slowly (about 5 m.p.h.) with the engine about ¼ throttle. Allow yourself plenty of room wherever you have chosen taxi practice so as not to run into any obstacles. Practice for several hours doing figure-eights, S-turns and 360° turns at 5-10 m.p.h. or until you become comfortable with the nose wheel control. Concentrate on keeping the rudders

closed by allowing the weight of both arms to hang on the steering yoke during taxiing. Try to become aware of the wingtips in relation to where you are as the wingspan is quite wide and can be easily misjudged.

Be careful not to apply too much throttle during taxiing as the machine's inertia can build up quickly and can coast farther than you intended it to go.

RUDDER TURNS After you have mastered the art of taxiing, the next step is to become proficient at high speed taxiing using just the rudders for control. This practice must be done in near calm conditions to avoid ground looping or accidentally lifting off during the learning process. Try to find a nice long runway or grass strip approximately 150 ft. wide and 2,000 - 3,000 ft. long. You can learn in a smaller area but it will take longer and the chance of mishap is greater.

After you have thoroughly pre-flighted your machine, climb in and start the engine. Don't forget to hook in and adjust the hang strap so you are hanging about 2 inches to the rear of the upper main strut bracket as shown in *Figure 1.* Taxi out to one end of the practice strip and line up the machine on the center line of the runway. With your body in the neutral trim position (hands and knees even) advance the throttle to about 1/3 and accelerate to about 12 m.p.h. Fully open one rudder or the other and practice making S-turns across the center line of the runway. Remember, the faster you go, the less rudder deflection is required to effect a turn and the quicker the control response will be. After a few passes up and down the runway, try taking your feet completely off the nose wheel steering bar and position your feet back on the lower frame tubes if leg room allows. You will find that the nose wheel will castor automatically and you will gain confidence by knowing that the machine can be turned on the ground by using rudders exclusively.

Practice 10 or 20 S-turns at about 12 m.p.h. and then speed up about 3 m.p.h. By this speed you should be getting excellent rudder response but you will not have quite enough speed to lift off. If you should catch a gust of wind and accidentally lift off, throttle back and move your weight forward a little.

Practice S-turns with your body in neutral trim position and at speeds to about 18 m.p.h. for at least 30 or 40 turn cycles. Try to change direction about 30° maximum off the runway centerline if runway width allows. Discontinue practice if the wind picks up more than 3 or 4 miles per hour or if enough crosswind is apparent to cause control problems such as ground looping. If at any time you don't feel totally in control of the machine, cut power immediately by pulling back the throttle or hitting the kill switch.

WHEEL LIFTS Now that you have some high speed taxi practice under your belt, this next step will take a little more skill. Line up on the runway center line as before. With your feet on the nose wheel foot bar, bend your knees and pull your body forward as far as you can and still operate the rudders. It may help to slide the harness hang strap all the way forward against the main strut bracket. Practice a few full rudder deflections with your body forward to assure yourself that you can still operate the rudders with your body in the forward position. With your weight well forward of the neutral point, advance the throttle to about 1/3. Concentrate on keeping the machine going straight down the runway until you reach about 20 m.p.h. Remember to keep your weight forward. You may actually reach flying speed without knowing it but you won't be able to lift off as long as your weight is forward in the frame. Use full rudder deflections to literally lift one or the other of your rear wheels off the ground a few inches. At this speed the rudders should be nearly as responsive as they will be during slow flight. The swept back angle of the wings makes it difficult to see the wing banking in your peripheral vision, so it may help to relate to the angle created by the mainstrut of the frame and the horizon. Practice the same weaving, S-turn technique as you did doing the slower S-turns but concentrate on keeping your weight forward to avoid lifting off inadvertently. If you can't obviously see or feel the rear wheels leaving the ground even with full rudder deflections, you are not going fast enough and you should probably increase your speed about 5 m.p.h. Practice at least 10 or 20 wheel lifts until you feel comfortable handling the

machine at these slow speeds and wing bank angles. Be careful not to overbank the wing and cause the wingtip to drag the ground. This can cause a sudden ground loop. If you find yourself dragging a wingtip and entering a ground loop, cut power immediately and steer the nose wheel of the machine in the direction of the turn. It is easier to spin around in a full circle than it is to try and fight the ground loop once the machine has begun to enter a turn.

FIRST FLIGHT HOPS You should now have a feel for the roll control of the machine and the next thing to learn is pitch control. This can be done flying in ground effect (within one wingspan of the ground) and enough practice should be done at this stage to insure a high degree of confidence prior to higher flights.

Before you make your first hop, let's review a few of the elements of pitch control. Moving the pilot's body forward of the neutral trim point will cause the machine to nose down and pick up speed. Moving the pilot's body rearward of the neutral point will cause the machine to nose up and lose speed or stall if enough airspeed is lost. With different sizes or weights of pilots, the exact location of the neutral trim point will vary a little but for purposes of learning we will assume it is in the same place for all pilots, hands directly above and even with pilots knees as described earlier in *Figure 2.* In this position it is possible (but not suggested) to fly the KASPERWING around on throttle alone without ever changing pitch, but for proper control it is important to learn and understand the full range of pitch control and to locate the exact neutral trim point for each individual pilot. You will do this by making short hops, taking off and landing until you have mastered pitch control enough to proceed to higher flight.

Line up on the center line at the end of the runway. Do a tight 360° turn while you are on the ground and check the pattern for other air traffic operating in your vicinity. Check the harness hang strap and make sure it is positioned about 2 inches behind the mainstrut bracket. Check to be sure the fuel tank has fuel in it and the fuel petcock is turned on. Running out of gas ten feet after take-off can be quite embarrassing.

With your body at the neutral trim point, flip the rudders open and closed a few times to check them for proper operation and give the machine about 1/3 throttle as you did during wheel lifts. Concentrate on keeping the machine going straight down the center of the runway while you accelerate to flying speed. Hold a little downward pressure on the steering yoke to prevent the rudders from opening accidentally (they are slightly neutral balanced and will float open a little at certain attitudes or airspeeds).

Keep slowly advancing the throttle a little at a time until you feel yourself lift off. As soon as your wheels leave the ground, shift your weight forward a little and level off a few feet above the runway. When you have established level flight, back the throttle off until the machine begins to settle, then move your weight back again to achieve a smooth landing.

After you land, return to the end of the runway and repeat the process, making progressively longer flights until you feel comfortable making take-offs and landings and flying a few feet above the ground. Remember, once you achieve a lift off, leave the throttle setting alone and practice shifting your weight to maintain level flight until you plan on landing. If you try to hold or control your altitude using throttle alone without adjusting your pitch, you will have difficult time learning to fly smoothly.

Be sure to make your first flights in absolutely calm conditions, as any amount of wind will create an unpredictable variable that could make your first hops an uncomfortable experience.

HIGHER FLIGHTS Once you feel confident flying the KASPERWING in ground effect and making your basic take-off and landing, it is time to go a little higher. If room and conditions permit, take-off using a little more power than you had during the hop stage and climb to about 50 feet of altitude. Keep in mind that the KASPERWING glides about 10 feet forward for every foot of altitude used, so if you only climb to 50 feet you will need about 500 feet in which to safely land. This is why a fairly long runway is necessary.

Remember to keep your body at the neutral trim point or a little further forward to avoid porpoising or stalling. When you reach altitude, throttle the engine back to an idle and move forward to establish a glide. As you approach ground effect, start moving your weight back in order to "round out" at the bottom of the glide. As the aircraft levels off several feet above the ground, slowly move your weight back until the plane settles gently to a landing as you did when making hops.

The important thing to remember when gliding in to land is keep your airspeed up when you are near the ground. If you have an ultralight airspeed indicator like a Hall windmeter, etc., try to maintain about 30 m.p.h. in a glide. If not, try to become aware of the breeze blowing over your hands and face. If you can feel plenty of wind, then you have airspeed. When the wind stops or you feel very little wind, you are dangerously close to a stall, so speed up a little.

All in all it is better to learn to fly the KASPERWING by the "seat of your pants" and learn to relate airspeed to the craft's attitude, as ultralight airspeed indicators are notorious for having high lag times or incorrect readings altogether.

After you have made a number of gliding approaches from about 50 feet and feel comfortable landing with the engine near an idle, you are ready to "take it around the patch". Before making higher flights away from the landing field, you should have an altimeter of some kind. Recommended would be an aircraft type with 20 ft. increments, but a non-sensitive type with larger increments will do.

SETTING THE TRIM The carabiner hang strap which suspends the harness is adjustable in flight. By sliding the hang strap forward or backward along the keel tube you can adjust the feel of the glider for different attitudes or power settings. Because of the low engine thrust line, the glider will want to nose up under a high throttle setting as when climbing out hard and the pilot will feel as if he has to pull himself forward constantly to keep from stalling. This can be almost totally corrected by sliding the hang strap as far forward as it can go against the rear of the mainstrut bracket.

Figure 3

For climbing flight under high power settings the pilot should adjust the hang strap all the way forward if he weighs 160 lbs. or less. If the pilot weighs over 160 lbs., he should start with the hang strap back about 2 inches. Even with the hang strap all the way forward, lighter pilots will still feel a small tendency for the nose to "pitch up" and will have to pull forward a little in order to hold themselves in the neutral trim position.

When a desired altitude is reached and the engine is throttled back for cruise or for gliding flight, the hang strap can be slid back to give a neutral feel to the controls. The strap can be easily moved in flight by partially removing your weight from the harness with one hand while you slide the strap forward or backward with the other hand *Figure 3.* Naturally this requires letting go of the control yoke completely for a few moments and should not be attempted at low altitudes or until some experience is gained flying the machine away from the landing strip.

PRE-TAKEOFF CHECKLIST The following list should be committed to memory and used prior to **every** take-off. If your aircraft does not meet all the requirements on this list, do not fly until the problem is corrected.

1. Fuel tank secured by both bungees.
2. Fuel on, cap in position and tank topped off.
3. Fuel quick-disconnect securely fastened.
4. Run up engine — engine holds full power for 10 seconds.
5. Kill switch functioning — flip off and on with engine at low throttle setting to check.
6. Both rudders open and close smoothly.
7. Trim set — hang strap forward in take-off position.
8. Parachute bridle connected (if applicable) and carabiner locked.
9. Set altimeter and check windsock for wind direction and velocity.
10. Do 360° turn and clear pattern for take-off (look for traffic on approach or final).

This list is in no way intended to eliminate the step of pre-flighting your aircraft. You should also do a proper walk-around pre-flight prior to each day's flying activities or during the day if you stop flying or leave the machine unattended in the presence of an unfamiliar crowd. Stop flying and do a complete pre-flight anytime you suspect something strange about the machine's behavior, have a hard landing or suspect that someone has tampered with or adjusted your aircraft while it was unattended.

PATTERN WORK Traditionally pilots on their first solo flight take off, climb to altitude (500 — 1,000 ft.) and then do crosswind, downwind, base and final approach legs to landing. If you are already very familiar with setting up a pattern in the conventional manner you may be better off climbing to altitude and staying up for a while practicing stalls, turns and gliding flight in order to familiarize yourself better with the machine. If you have had limited experience flying the pattern and setting up a landing approach, then practice several flights climbing between 200 and 500 feet in altitude and set up a rectangular right or left-hand pattern for practice. Remember, always stay high enough and near enough to the airport to safely glide back if the engine quits unexpectedly. Always watch out for other aircraft which may be sharing your pattern or flying in an opposite pattern near the airport. If you are planning on practicing stalls, turns, etc., fly far enough from the airport to avoid other air traffic but always keep a landing spot somewhere beneath you.

CLIMBING OUT One of the most important things to practice on your first high flights as you leave the security of the airfield is to climb steeply and quickly enough to guarantee yourself a safe altitude margin at the end of the strip. In case of an engine failure or if some other problem should arise, you will have enough altitude to do a 180° turn back to the airfield or enough time to safely choose an alternate landing. For this reason we suggest you climb out at or near full power for at least 30 — 60 seconds. One full minute of full power engine operation will not hurt the engine during its break-in period as long as you throttle back and give it a rest afterward. Remember to keep your body at or near the neutral trim point to establish the best angle and

rate of climb for a given throttle setting. If you move back too far, the machine will stop climbing and will alternately stall and porpoise gently until you move forward again. If you hold your weight a little too far forward, you will level off and pick up a great deal of speed. Try to find the position which allows you to climb quickly while maintaining a constant minimum airspeed and angle of climb. For most pilots this is about 25 — 30 m.p.h. at sea level and your rate of climb should be between 500 and 800 feet per minute!

After you reach several hundred feet of altitude, it is usually safe to throttle back and level off or climb at a more relaxed rate in order to spare the engine during the break-in period. After 10 hours of operation you can run the engine wide open almost constantly but its usable life expectancy will be diminished considerably and you will burn up a great deal of gas very quickly. At cruise near sea level a properly tuned engine should use about one gallon per hour but wide open it will gobble gas at twice or three times that rate. A common practice which gets you into the air quickly and conserves the engine and fuel at the same time is to climb about 1,000 feet at around ¾ throttle, then throttle back and level off for a few minutes until you feel like climbing again. This allows the engine temperature to drop and stabilize. It is always best not to hold any one r.p.m. setting for too long regardless of what type of flying you are doing, so change throttle settings once in a while to get the maximum life from your engine.

STALLS Any flying machine ever devised (including birds) which uses a fixed or moving surface reacting against the air to produce lift can be said to stall. By definition a stall is a loss of lift due to a loss of relative airspeed, accompanied by loss of control and a sudden lowering of the nose. The KASPERWING, which was designed around the control system used by birds, only partially fits the definition.

When the KASPERWING loses airspeed, it also loses lift (to a point), but does not lose control. The rudders keep functioning and can be used to level the wing even at speeds well below a stall. This will be covered further in the section on "mushing" and glide slope control.

A stall is not something the pilot should be afraid of, but on the contrary should learn to practice and understand. When airspeed is lost due to the pilot intentionally pushing the nose up or from a sudden gust or downdraft, the wing will assume a nose-down attitude until it picks up enough airspeed to return to level flight. As long as the wing is level and properly rigged, the plane will fly straight through a stall without turning or lowering a wing. If the plane is stalled with one wing low, it will begin to turn in the direction of the low wing.

The stall characteristics of the KASPERWING are very gentle docile and forgiving compared to other types of aircraft. If the pilot is climbing out with power on and moves his weight back a little too far, the machine will simply stop climbing and the nose will gently porpoise up and down until the pilot moves forward again restoring equilibrium. If he is in a climbing turn, the plane will stop climbing and porpoise through a turn. If the pilot intentionally picks up an excess of speed and forces the nose up to 30° or more, holding his weight back in the process, the wing will lose speed and stall. The nose will pitch over at about the same angle as the stall entry angle and the plane will continue to stall, porpoise, stall, porpoise continuously until the pilot elects to move forward, returning the craft to level flight.

Stalls should be practiced within the first 10 hours of flight in the KASPERWING so that the pilot can become familiar with the entry and recovery procedure. Climb to at least 1,000 feet A.G.L. and level off with the engine at a cruise setting. Make sure the wing is level, then slowly move your weight back until the nose pitches over. Immediately move forward and re-establish level flight.

Practice doing gradual stalls at different power settings and in gliding flight with the engine off or at an idle until you become familiar with the attitudes and changes in airspeed associated with a stall. It is also a good idea to practice stalls in a shallow turn. Remember to level off and recover after one or two porpoises and consider how the wing reacted in different attitudes before moving on to another maneuver.

Building up a great deal of speed and then forcing the nose up as radically as possible is called a whip-stall and should be avoided at all costs. It is possible to force the wing to go literally straight up and straight back down again. This falls under the heading of aerobatics and is something the machine was not designed to do. Great care should be taken not to pull up too abruptly from such a maneuver whether entered intentionally or not as the machine can be forced past its maximum design limits. Try to confine your stall practice to a limit of 30° to 45° nose up and down.

TURNS No other maneuver which can be done in the KASPERWING will require as much attention to detail as a properly coordinated turn. If the pilot is only changing direction slightly or making turns at bank angles less than 15° or 20°, then there is not much need to coordinate the controls. However, if you wish to do smooth turns with bank angles exceeding 30°, then a certain amount of pitch changing is required.

When a rudder is opened, it tends to place a down load on the wingtip. Because of the rearward sweep of the wing, this tends to make the nose pitch up a little. The proper thing to do in order to enter or exit a turn smoothly is to pull in a little when entering or leaving the turn. To initiate a right banking 360° turn, the pilot moves forward about 3 or 4 inches at the same time he opens the right rudder. The machine will bank smoothly until it reaches the desired bank angle, whereby the pilot closes the rudder and moves his weight rearward of neutral trim until the wing is creating enough lift to maintain a constant altitude and angle of bank. When the pilot desires to roll out of the turn, he opens the opposite rudder and moves forward again. The machine rolls out and the pilot closes the rudder and returns to the neutral trim point for level flight. All this must be practiced at altitude for some time in order to become proficient at making smooth, coordinated turns with a minimum of skidding or loss of altitude.

Find a suitable practice area near your airstrip where you have fields below for emergency landing and few or no other aircraft to watch out for. Practice doing figure-eight's, 360°'s and S-turns, maintaining a constant altitude throughout. Remember, the steeper you bank, the farther back you will have to move your weight and the more throttle you will have to apply in order to maintain altitude. Conversely, to leave the turn, the farther forward you will have to move to coordinate the maneuver when rolling level again.

As was mentioned earlier, the KASPERWING has been taken off, flown and landed again on throttle alone. All the pilot had to do was steer and avoid obstacles, his body in the neutral trim position. To become a smooth, proficient pilot will require hours of practice which can only be gotten from actual flight experience.

SPINS While some aircraft or ultralights are billed as being stall and spin proof, we prefer to think of the KASPERWING as being highly stall and spin resistant. Although a stall in the KASPERWING is a very docile, easy to cope with maneuver, the spin is another story. Normally we would consider a spin in any aircraft to be an aerobatic maneuver and we would not even discuss it in a flight manual except that we wish to familiarize the pilot with the nature of spins and the proper recovery procedure in order to protect the pilot from accidental mishap.

To begin with, a properly rigged wing will not enter a spin accidentally unless a certain combination of bank angle and lack of airspeed is attained. The wing will never enter a spin as long as both wings are moving forward through the air as in normal flight maneuvers, stalls, turns, etc.

To force the KASPERWING to spin, the following things must occur:

1. The wing is stalled by backing off power and holding weight back.
2. One rudder is held open, causing a tip to stall and the wing to rotate rapidly in that direction.
3. Weight is held to the rear of neutral point to build up rotation.

The wing cannot be spun by simply backing off power and stalling in a turn. The result of this is

a series of porpoising turns or a steep mushy spiral where the upper rudder constantly blows open and tries to roll the machine out of the turn. In order to spin, the wing must reach a certain rotational speed and the pilot must physically hold his weight a considerable distance aft of neutral trim.

As soon as the pilot relaxes his rearward pressure and his weight is moved forward to neutral trim, the plane will exit the spin and zoom up into a normal stall which can be avoided entirely if the pilot moves forward at the right moment.

To summarize, we do not encourage the practice of spins. We feel it is an aerobatic type maneuver which should be avoided. Still we think that a pilot should have knowledge of the spin and its recovery procedure. In the KASPERWING spin recovery is virtually the same as for any aircraft; neutralize controls and apply opposite rudder.

In spin maneuvers the greatest danger is not to the machine but to the pilot becoming disoriented since the rate of spin rotation is quite high, the altitude loss rapid, and a pilot could easily lose his reference to the ground.

GLIDE SLOPE CONTROL AND THE MUSH As was mentioned earlier, there are several advantages to a rudder system that also affects the pitch. The first advantage is when both rudders are opened, they cause the nose to pitch up and can be used like an elevator to give the pilot additional flare ability. The second is that they help the wing to achieve a higher angle of attack, allowing the machine to enter the vertical mush mode.

In descending flight as in a landing approach, you may want to vary your approach angle in one of three ways. The first is to simply open the rudders and create a lot of drag, causing your glide slope to deteriorate from 10/1 to about 6/1. Remember to move forward just a little to keep from porpoising. You can actually come down a little steeper by keeping your weight back and allowing the wing to porpoise but it will be a little more difficult to keep the wings level.

The second method of approach control is to slow down, open the rudders all the way and then pull the machine into a dive with the rudders fully open, creating a vast amount of parasitic drag due to additional speed. This is the preferred method when conditions are turbulent and it guarantees the pilot the maximum descent angle and maximum amount of control without building up too much airspeed. The rudders act as spoilers and dive brakes at the same time. In this method you can descend at about a 45° angle at a 1/1 glide slope. Remember not to let the rudders close until you have leveled off near the ground because releasing them a little too early will cause the nose to drop and the machine may crash if you don't have enough altitude for recovery.

The great advantage of the first two methods is that the pilot is afforded a maximum amount of control for the steepest possible angle of descent. If the pilot does not mind trading off a little control for a steeper than 1/1 glide slope, he can choose the third method which we call the "mush".

An entire book could be devoted to the subject of mushing flight which is a new realm of aerodynamics in itself. For practical purposes we shall restrict our discussion here to a little theory and how to properly utilize the mush for practical applications. Many modern aerodynamicists and engineers have never heard of the term "vortex lift" as it applies to the KASPERWING. Still others would never agree that you can make an airplane maneuver below the stalling speed. This is because all other modern aircraft, tailless or otherwise, cannot maneuver safely below the stall because their control systems depend on forward speed for stability. The KASPERWING, which was designed more like a bird, is stable and can maneuver below the stall, independent of forward airspeed. When an aircraft with a conventional tail stalls, it loses airspeed, the lift above the wing is destroyed and the tail causes the nose to pitch down. Because the KASPERWING has no tail to cause the nose to drop, we can force the wing to slow down by opening the rudders,

move our weight aft and cause the machine to lose flying speed. When this happens the air flowing over the top of the wing begins to separate as in a normal stall, but because we use a reflex wing and no tail, the air on the upper surface of the wing shears off and begins to flow in a large circular swirl called a vortex. This vortex extends for the full length of the wing creating a low pressure lift zone above the wing as in forward flight, hence the term "vortex lift".

When descending in the "mush" or "vortex lift mode", the machine will be quite stable and can be turned left or right by the pilot usually at will. The rate of descent, however, will be quite high (around 1,000 f.p.m.) so the pilot must take care to return to normal forward flight prior to landing.

This descent rate is roughly equivalent to that of a parachute and could be used in an emergency situation to pancake the craft into a very small area. The KASPERWING has been accidentally crash landed in this manner with the pilot uninjured, but the machine sustained significant damage to its undercarriage and landing gear.

The mush should never be attempted the first time with less than 2,000 ft. of altitude or by a pilot with less than 20 hours of flight time in the KASPERWING. Experienced pilots will find the concept of coming to a full stop in mid-air, then hovering nearly straight down at 1,000 f.p.m. hard to grasp. Actually the transition from forward flight to mushing flight is a little more gradual than that, but it is still a strange sensation to cut the engine, enter the mush, then hear all sound become "dead silent" as you descend vertically.

To practice the mush the pilot must spiral wrap the lower frame tubes of the KASPERWING with anti-skid tape similar to that used on boat decks or walkways and is available at most hardware stores. This will give the pilot's feet enough traction to move his body to the absolute rear of the frame. The best size tape strips to use are about one inch wide and 12 feet is enough to do both lower frame tubes. Simply peel off the paper backing, begin at the front and spiral wrap the tubes from front to back. Wrap a little electrical tape over the ends of the skid strips to keep them from unravelling.

The KASPERWING undercarriage was designed for all types of flying and is rigged to give the pilot the maximum amount of control for all situations. As such it does everything well, not just one thing better than any other. Because of this, when you mush, you will always have a little forward speed (about 3 m.p.h.). This means that instead of mushing absolutely straight down, you will descend at about a 10 degree angle from the vertical. If the primary consideration were to come absolutely straight down or even back up, the wing could be rigged for this type of flight, but due to structural limitations, some part of the standard flight envelope would have to be sacrificed.

When you practice the mush, try to stay over or near the airfield in the event the engine accidentally dies and you may not have time to restart. Fill the fuel tank as full as you can and climb to at least 2,000 ft.; the higher the better. Idle the engine back and adjust your weight to set up in a smooth glide. Open both rudders all the way and continue to steer, keeping the wings level. If the air is very rough, you will have a great difficulty mushing at all so try to practice only when the air is absolutely calm. If you haven't already done so, take your feet from the nose wheel foot bar and place them on the lower frame tubes beneath you. With the rudders still in the full open position, gradually move your weight back a little at a time until the machine begins to porpoise. Time the porpoising so that just as the nose begins to break, move all of your weight very quickly as far into the back of the frame as you can *(Figure 4).* Continue to hold the rudders fully open and use them to keep the wings level during the mush entry. Remember to keep your weight all the way back until the machine "locks into" the mush. If the air is rough or if your entry was not smooth enough, the machine may porpoise a few more times before it locks in. If it doesn't lock in within several porpoises or if one wing begins to drop more than 20°, move forward and re-establish a glide. Try again until you can successfully time your entry properly and lock into the mush.

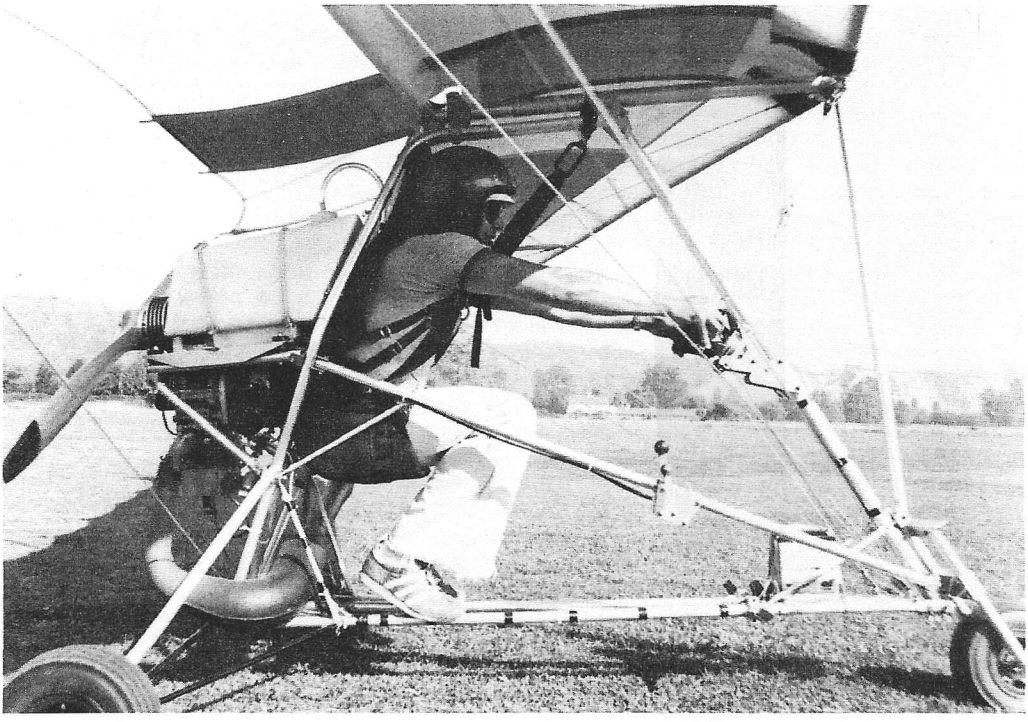

Figure 4

Once in the mush you should continue to hold the rudders open as the wing is the most stable in this configuration. Use the rudders to turn by completely closing one rudder or the other. If your wing is properly in rig, (that is, zero washout on both wings as described in the assembly manual), you should be able to turn equally well in both directions. If one wing is out of rig or there is a difference in airfoil shapes between one wing and the other, it may be all you can do to keep the machine mushing straight, even with full rudder deflections. If this is the case, land immediately and correct the problem.

In mushing flight the machine is very stable but control is at a minimum. While there is enough yaw and roll control to do complete 360° turns, it is quite a bit slower to respond than in normal flight and occasionally may take a little additional impetus to get the controls to respond properly. Do this by rocking or inching your upper body forward with one rudder fully open and the other fully closed until the machine begins to turn in the desired direction. As soon as the machine begins to respond, stop adding pitch input or even add a little opposite rudder to keep the machine from accelerating too quickly into a turn. If one wing accelerates too rapidly or the wing drops below a 20° angle of bank, the vortex will be blown from the high wing and it will return to normal flight. This can cause a problem as the other wing will still be totally stalled, the nose will drop and the machine will begin an immediate spin entry. If you feel this begin to happen, do the standard spin recovery procedure: body forward and full opposite rudder.

Be sure not to practice the mush with loose harness straps or loose fitting clothing as they may get tangled or hooked on some part of the rear frame, preventing you from moving forward and returning to normal flight. This is why we cannot overemphasize the safety factor of having plenty of altitude. Even beginning the mush from 2,000 ft., the pilot will find himself on the ground in two minutes or less and care should be taken not to mush for more than 1,000 ft. at a time in the beginning.

To leave the mush at a save altitude, simply move your body forward again to the neutral trim position. If you move slowly and gradually, the nose of the machine will hardly dip and you will simply begin to fly forward again. If you move forward quickly and close the rudders in the process, the nose will drop similarly to leaving a stall.

To summarize, practice the mush with plenty of altitude. Be sure the engine is at or near an idle or you will have too much forward speed to mush at all. Decelerate smoothly into the mush entry and time the entry for a minimum amount of porpoising. There is a grey area between mushing and normal flight where control is at an absolute minimum and the machine must decelerate quickly through this in order to lock into the mush completely. Do not practice mushing turns until you have done at least half a dozen straight descents with smooth entries and exits. Be sure to leave the mush high enough to allow yourself a safe gliding approach into a field if the engine should quit. It is better not to use the mush on landing approach in rough air unless absolutely necessary, as a sudden gust could drop you into a spin with little altitude for recovery. Once you become proficient at descending in the mush, it can be a highly entertaining maneuver as well as being very useful for getting into tight landing fields where a very steep approach is necessary.

AEROBATICS AND FLIGHT LIMITATIONS Any maneuver which places the plane's wing beyond a 60° angle of bank or causes the nose to be 45° above or below the horizon could be considered an aerobatic maneuver. DO NOT DO AEROBATIC MANEUVERS.

The KASPERWING ultralight was never designed for performing aerobatics and any pilot who does such maneuvers is subjecting himself to needless and unnecessary risks. The KASPERWING was designed to fly safely between 0 and 60 m.p.h. and performing aerobatics such as loops, wingovers or spiral dives can easily force the machine past its structural limitations. The KASPERWING should never be flown faster than 60 m.p.h. in smooth air and 45 m.p.h. in rough air. If you have an airspeed indicator, use it to tell you how fast you are going. If not, look at the

Figure 5

wing — you will begin to feel it shake and shudder, particularly at the wingtips, around 50 m.p.h., telling you to slow down. A good general rule is never fly faster than you feel comfortable with and always slow down to a minimum safe maneuvering speed in turbulence.

When soaring with the engine off, it is sometimes necessary to speed up or slow down dramatically to negotiate different lift situations. *Figure 5* shows the pilot at the maximum nose down control limit. It is acceptable to pull forward this far for brief moments with the engine off in order to pick up speed quickly or lose altitude with rudders fully open to change your glide slope. Never pull the KASPERWING into a maximum dive with engine on at full throttle, as the machine could easily exceed its safe operating red line.

Another way to dangerously exceed the red line is to place the KASPERWING in a spiraling dive (not a spin). In a spin the pilot has the engine off or at a very low power setting. His weight is rear of neutral trim and the machine is really in a turn with one wing stalled, the other flying. This could be considered an aerobatic maneuver but is much less dangerous than a spiral dive. In a spiral dive the pilot has his weight forward of neutral trim, the machine is in a diving turn at a high rate of speed and the rotational G-forces are quite high. The machine can quickly exceed the red line and if the pilot attempts to recover too quickly, he can literally snap a wing off. Recovery from any type of aircraft maneuver which builds up a great deal of speed should always be slow and gradual regardless of how fast the machine is going. Never purposely build up a lot of speed and then jam the controls one way or the other for any reason. Even the strongest of aircraft have been known to be broken by a clumsy or ham-fisted pilot. Refrain from doing aerobatics in the KASPERWING and limit yourself to normal maneuvers or soaring flight and you will have a long and fruitful flying career.

CROSSWIND OPERATIONS Because of the KASPERWING'S short take-off and landing roll, it is very seldom necessary to operate in a crosswind. However, if you do find yourself in that situation, there is a technique which you can use to safely take-off and land in those conditions.

First of all, if you haven't had at least 20 hours in the KASPERWING, don't even consider taking off crosswind. Fold up your aircraft and go home. If you have the minimum 20 hours and the wind is blowing no more than 8 or 10 m.p.h., you may attempt a crosswind take-off.

Line up on the center of the runway in typical fashion. If the wind is blowing 90° from the right, fully open the right rudder. Move your weight as far forward as you can, while keeping your feet on the steering bar. Give the engine full throttle and begin the take-off roll. Keep your weight all the way forward and use as much rudder as is necessary to keep the wings level. Continue to steer the machine straight down the runway with the nose wheel, while you use the rudder to hold the wings level. When you feel the rear wheels lift off or slide around, allowing the machine to crab a little, move your weight back and lift off. The idea is to build up enough speed to raise the rear wheels from the ground until the machine reaches flying speed.

Always try to land into the wind if at all possible. When it is not possible, a similar technique to taking off crosswind can be employed. Make your approach down the center of the runway. Allow yourself to drift a little to the downwind side if room permits. You will be in a crab as you touch down, so as soon as your wheels touch the ground, turn into the wind and get your weight forward. Use the rudders to try and hold the wings level. If a ground loop occurs, don't fight it. Simply spin around in a circle and come to a stop, facing into the wind.

MAINTENANCE AND SAFETY TIPS, Airframe — The most important thing to keep in good working condition is your aircraft's airframe. Outside of the usual pre-flight inspection, a routine periodic inspection should be performed every 100 hours or once a year, whichever comes first. A complete and thorough check of the airframe should be made after any crash or hard landing. The following is a list of critical points, but in general every part of the aircraft should be checked for damage, function and security.

Remove, inspect and replace if bent, corroded or worn:

1. Bolts at top and bottom of mainstrut
2. Flying wire attach plate and shackle attach bolts
3. Kingpost and kingpost tensioner pivot bolts
4. Kingpost top, landing wire attach bolts
5. Keel tube/upper rear frame half, anchor bolt
6. Front spar/nose plate, anchor eyebolts
7. Front spar, dragwire attach eyebolt and clevis pin
8. Front spar/compression strut plug, coarse thread attach bolts
9. Rear spar/keel tube pivot bolts
10. Rear spar flying and landing wire attach bolts
11. Compression strut pivot bolts
12. V-strut anchor eyebolts
13. Rudder hinge eyebolts
14. Rudder hinge clevis pins and cotter pins
15. Landing gear diagonal attach eyebolts (if applicable)

Inspect and replace if cracked, worn or bent:

1. Front spar attach plates
2. Rear spar attach plates
3. Keel tube/kingpost/upper rear frame half attach plates
4. Main strut/keel attach plates
5. Kingpost landing wire tangs
6. All stainless steel flying and landing wire tangs
7. Flying wire attach plate
8. All universal channel brackets
9. Engine mount plate and angles
10. Control mount attach plates
11. Rudder cable guide clamps on outer compression strut
12. Kingpost tensioner safety ring
13. V-strut fork ends for cracks

Additional airframe components to inspect and replace if necessary:

1. All airframe tubes for straightness, dents or corrosion. Never try to fly with a tube that has been bent and straightened.
2. All tube ends with flattened or formed ends for cracks around holes
3. All holes for elongation in tubes where flying or landing wires attach.
4. All control pulleys and swivels for security of mount bolts, lock pins and proper operation
5. Remove steering wheel and check steering hub shaft cotter pin for wear and security
6. Remove steering hub lock tab and inspect control cables for signs of fraying or breakage
7. Rudder control cables for proper adjustment, tension and chafed or broken strands
8. Rudder control line attachment eyebolts for proper alignment and security of fibre locknuts
9. Rudder cable guides and wingtip tensioner for lubrication
10. Look for corrosion around rudder line, thimble attach points
11. All cable ends for broken strands, mis-aligned thimbles or corrosion around ends of copper nico-press sleeves
12. All flying and landing wire cables for chafing, kinking or broken strands
13. All circular safety rings for security — ring ends should not be bent outward
14. Upper rear frame half tube/wing attachment hole and gusset for severe elongation, cracking or loose rivets
15. Front axle for excessive wear
16. Rear axles for excessive wear, cracks around mount holes or excessive bends

17. Landing gear attach clevis pins and bolts for wear and security
18. Landing gear axle cotter pins for wear and security
19. Rudder bracket/tip strut attach hole for cracking and elongation
20. Tip strut/rear spar anchor bolt hole for elongation

MAINTENANCE AND SAFETY TIPS, Engine and fuel system

Inspect and replace or repair following items if necessary:

1. Fuel tank vent and vent tube for proper routing attachments and security
2. Fuel tank and cap for leaks
3. Fuel tank petcock O-ring for leaks
4. Fuel tank bungee cords for wear and security
5. Fuel line, clamps and quick-disconnect fittings for leaks and security
6. Fuel filter for dirt or contamination
7. Fuel tank mount brackets for cracks or loose rivets
8. Carburetor for leaking diaphragms or loose mount bolts
9. Engine/carb vacuum tube for leaks and security
10. Choke and throttle cables for chafing and proper adjustment
11. Velocity stack and choke mount plate for security
12. Throttle shaft inside carburetor for cracks around butterfly
13. All cylinder base and head gaskets for security and leaks
14. Intake and exhaust flanges and gaskets for security and leaks
15. Exhaust pipe and expansion chamber for cracks, leaks or broken mount flanges and attachment springs
16. Engine and exhaust rubber mount doughnuts for wear, function and security
17. Drive pulley mount bolt for proper torque and security
18. Drive belts for cracking or wear
19. Propeller reduction unit for excessive bearing wear or noise
20. Reduction unit shaft and sleeve for cracks, bends or corrosion
21. Reduction mount pylons for proper security
22. Engine mount plate and angles for hole elongation, and mount bolt security
23. Propeller for splits or cracks in ends or around hub
24. Propeller mount bolts and nuts for security
25. Throttle quadrant levers for cracks and proper operation
26. Kill switch for proper security and operation
27. All electrical wires and connections for loose ends, frays, proper routing and security
28. Pull starter, rope and pulleys for proper security and operation
29. Spark plug for corrosion, wear and proper gap
30. Ignition points for excessive wear, proper gap and timing
31. Engine compression check, replace rings and/or piston if compression falls below 20% of normal or if engine has suffered severe piston seizure
32. Ignition coil, coil wire and plug cap for chafing, corrosion and proper security
33. Engine mount bolts for corrosion and security
34. Plug in secondary spark plug hole for security
35. All engine, carburetor and exhaust mount bolts, nuts and screws for looseness and security

ADDITIONAL SAFETY AND MAINTENANCE TIPS

1. Attach a couple of parachute cords, fishing lines or even heavy string to the shackle of each control cable opening the rudders. Run the cord back through the wing and down the forward inside edge of each rear spar pocket. Make a large loop in the end of the cord and tape it to the bottom of the wing near where the rear spars join the keel. In case the pilot forgets to connect his rudders or has a control cable malfunction, this would provide a backup rudder control

system which can be used to safely land the glider in case of emergency.

2. It is not mandatory but we suggest you re-rig all the cables on your airframe once a year or every 200 Hrs. Due to vibration, cables tend to fatigue directly behind the nico-press swage and you can economically re-rig your KASPERWING by cutting off all the cables and re-using the longer lengths for shorter pieces. Never attempt to splice two cables together to make a longer piece and always use a proper swaging tool!
3. Repair all holes, tears or loose stitching in wing as they occur.
4. Check and repair loose or worn straps or stitching in harness or hang strap.
5. Run tire pressure as low as possible without allowing tires to go flat or spin on rims.
6. Keep aircraft parked in a hanger or at least in a shady area — direct sunlight causes dacron sail material to break down rapidly.
7. Fold wing neatly into bag when transporting and always use a padded roof rack.
8. Use foam padding inside bag wherever tangs or thimbles may rub and chafe against sail or tubes.
9. Always carry tie downs and rope when flying cross-country.
10. Never fly under the influence of drugs or alcohol.
11. Always make sure spectators are clear of prop and propeller shrapnel zone when starting engine or taxiing.

If you assemble your KASPERWING carefully, take your time learning to fly it and treat it with the same care and respect you would any aircraft, it will reward you with hundreds of hours of flying enjoyment and exciting adventures.
FLY SAFELY!

REFERENCE MATERIAL FOR FURTHER READING

Powered Ultralight Training Course by Dennis Pagen, P.O. Box 601, State College, PA 16801

Powered Ultralight Aircraft by Dennis Pagen

Flying Conditions by Dennis Pagen

The Joy of Soaring by Karl Conway (try your local public library)

F.A.R., Part 103 — contact your local FAA, Govt. Aviation District Office (GADO) or Gary Perkins, AFO-820, General Aviation Operations Branch, Federal Aviation Administration, Washington, DC 20591, phone (202) 426-8194