NORTH WING

FREEDOM 220
OWNER'S MANUAL

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Congratulations on your purchase of a North Wing glider. We believe it to be the finest available recreational flex-wing glider on the market today. It achieves an exceptional performance and very good handling for many reasons. The FREEDOM has a sailcut that is carefully matched to the leading edge bend, floating cross-tube, mylar reinforced leading edge pocket. These features combine to ensure a good usable glide angle, an excellent sink rate and a broad speed range making the FREEDOM both an excellent beginner glide/soaring wing and a reliable cross country glider.

Like any hang glider it has been manufactured and tuned to close tolerances and its performance and safety depend on you maintaining those tolerances. We require that you read this owner's manual thoroughly and follow its instructions to the letter when you set up the glider, fly it, break it down for storage or shipping, or perform repairs or maintenance on it. Failure to do so will not only invalidate your warranty but may also compromise the safety of your glider.

The safety of this or any hang glider ultimately rests with you, because hang gliding is an inherently dangerous sport and can induce injury or death even to good pilots flying safe equipment. Because the responsibility of flying and maintaining the glider rests entirely with you, the risks of damage or injury you may cause to others and to yourself also rests entirely with you. We believe that in order to safely practice the sport of hang gliding, you must accept this responsibility, fly conservatively, and avail yourself of all safety equipment appropriate to the conditions in which you fly.

No glider is totally safe. It is entirely possible to push the FREEDOM beyond its tolerances. This could result in a structural failure, very strong flying conditions may also cause structural failure if flown outside the gliders limits. Aerobatic maneuvers, pitch angles beyond 30º up or down, bank angles exceeding 60º, aggressive stalls, and spins are maneuvers that should never be attempted under any circumstances. We hope to provide you with many hours of enjoyable flying. If you ever need any spare parts or advice do not hesitate to contact your nearest North Wing dealer, If they are not available, contact us directly.

All of us at North Wing would like to welcome you to the growing family of FREEDOM pilots.

SECTION 1: SPECIFICATIONS

FREEDOM 220

SPAN	35.5’
NOSE ANGLE	124 Deg.
ASPECT RATIO	5.8
SAIL AREA	220 Sq/ft
NUMBER OF RIBS (per side) TOP	19

(Other dimensional specifications may be found in section 7)

Placards bearing test flight information and operating limits are located on the glider's left cross-tubes.

Special care should be taken to note the operating limitations, which are clearly stated on the flight operation placard as follows:
FLIGHT OPERATIONS should be limited to non-aerobatic maneuvers--those in which the pitch angle will not exceed either 30 degrees nose up or nose down of the horizon and in which the bank angle will not exceed 60 degrees.

WARNING -- The owner and operator must understand that, due to the inherent risk involved in flying such a unique vehicle, no warranty is made or implied of any kind against accidents, bodily injury, or death. Operations such as aerobatic maneuvers or erratic pilot technique may ultimately produce equipment failure and are specifically excluded from the warranty. (Reference workmanship warranty described in Section 10 of this manual.)

OPERATING LIMITS

FREEDOM 220

Wing loading (hook in weight)

Usable weight range	225-500 lbs.
Optimal weight range	275-475 lbs.
Maximum stall speed	24 mph
Minimum top speed	41 mph
VNE (Never exceed)	45 mph

The Steady state speed with pilot full forward in normal prone position will not exceed the recommended VNE

Load limits Positive:	45 mph @ 35 deg	Ult. Load 55mph
Load limits Negative:	32 mph @ -30 deg	Ult. Load 39mph
Load Limits Negative :	25 mph @-150 deg	Ult. Load 30mph
Recommended USHGA rating	II-V	

This glider must not:

a) be flown by more than one person at a time.
b) exceed 30 degrees nose up or down to the horizon.
c) exceed 60 degrees bank angle left or right to the horizon.
d) be flown inverted or backwards.
e) be flown with auxiliary power unless designed, installed and tested by the factory.

SECTION 3: TESTING

The FREEDOM glider has undergone extensive testing and has satisfied the standards of the designers and North Wing Inc. as an ultra light glider. The FREEDOM has not been tested to any state or federal airworthiness specification.

A combination of stainless steel trailing edge reflex lines along with airframe geometry provide the most effective positive pitching system known to date. Careful test vehicle pitch experimentation was necessary to determine trailing edge line lengths. Altering those overall dimensions, even to the slightest degree, will decrease your glider's performance, or more importantly, its pitch stability.

You can verify the tested configuration of your **FREEDOM** by using the compliance verification sheet (Section 7 of this manual).

SECTION 4: ASSEMBLY FROM BROKEN DOWN FORM

FULL LENGTH SHIPPING FORM:

Your **Freedom** will probably be shipped to you in 13 ft. length configuration.

13-FOOT SHIPPING FORM:

If your **Freedom** was shipped to you in the 13 Ft shipping form, you can reassemble your glider to its full length by following these procedures. You will not need any tools.

1. Un-pad all tubing ends. Note the 3/4" deep slot machined at the front end of each rear leading edge sections. (The rear leading edge sections should be marked to indicate right and left sides).
2. Assemble your glider's control bar as described in section 5 of this manual, and flip the glider on its folded back control bar, laying flat on the ground. Unfold both wings and spread both leading edge front sections a foot on each side of the keel tube.
3. Align both tubes and slide rear section into its front sleeve until it stops. Rotate the rear tube into position making sure the top of the rear section is up. Now push the leading edge rear section the rest of the way in (3/4"). It should now be impossible to rotate the leading edge rear tube in its front section. Please insure that this is the case.
4. You are now ready to mount the sail on its leading edge clevis pin. The pin should go in from the bottom of the tube (through the webbing up through the tube) and the safety ring installed in pin on top of tube. You can access this area through the under surface tip zipper.
5. With all other shipping pads removed, your **Freedom** is now ready to be fully assembled as described in section 5 of this manual.

BREAK DOWN FOR SHIPPING

Carefully reverse the above procedure, padding all possible wear points.

SECTION 5: SET-UP AND FOLD DOWN PROCEDURES

Your Freedoms unique components were designed to set-up in the simplest, most efficient manner.

The instructions given below provide you with the step-by-step procedure for setting up your glider. By closely following these instructions, you can assure yourself a smooth, quick set-up.

The Freedom should always be stored ribs and zipper facing up especially during transportation.

* - The Freedom may be set up in either of two ways. The first technique is with the control bar set into position at the beginning of the procedure, and it allows the glider to be set up off the ground. This is acceptable in lower wind conditions, and it is effective in keeping the sail clean. In higher winds, however, the second procedure is preferable, in which the glider is left on the ground until ready to launch. In this procedure, the control bar is set into position last, and it reduces possible damage to the glider in the event of a sudden gust of wind.

1- Place the glider on the ground with the nose into the wind and with the zipper facing upward. Remove the ribs from their bag, unzip the cover bag, undo the glider ties and assemble the control frame. NOTE: Check that all the rigging is on the outside of the control frame and check that the bolt, wing nut and safety rings are fully assembled.

2- Roll the glider over so that it is the right way up and either standing on the 'A' frame or flat on the ground. If the latter then ensure that the control frame is central and that the rigging is not snagged.

3- Remove the cover and all the ties. Carefully walk each wing out to its approximate flying position. AT THIS STAGE IT IS ESSENTIAL TO ENSURE THAT THE KEEL AND LEADING EDGES ARE ALWAYS IN THE SAME PLANE.

4- Rotate Kingpost up into position and hook up reflex bridles (luff lines).

DO NOT FORCE! To secure with bungee cords, lift the loop over the rib end fitting. The last 2 ribs on each side are secured in position with a "double purchase " method. To secure, place the bottom loop onto the rib end fitting and pull the top loop over and into the fitting notch.

NOTE: The nose rib is inner-sleeved and can remain in the sail at all times, and need not to be removed, except for periodical inspection.

5- Separate white and black ribs, white on right black on left. Insert the battens **from root to tip** with gentle pressure, if the batten meets resistance, lift the sail at trailing edge and gently shake the sail up and down in order to billow it. At the same time push the rib forwards. This enables the rib to go over the cross bar and L.E. tubes. Install all ribs but the last two at the tip.

NOTE: Do not install the last two tip curved ribs at this time.

NOTE: Every 50 hours or after a hard landing you should check the battens against the template and for symmetry.

DO NOT FORCE! To secure with elastic cords or strings, lift the loop over the rib end fitting.

All ribs on each side are secured in position with a "**double purchase** " method. To secure, place the bottom loop onto the rib end fitting and pull the top loop over and into the fitting notch.

NOTE: The nose rib is inner-sleeved and can remain in the sail at all times, and need not to be removed, except for periodical inspection.

6- **FIG. 5** Find the cross tube tension cable retrieve line and pull it through the keel pocket till you can get the black webbing handle. Pull the shackle back and latch into the spring catch. Now hook the lower rear top wire triangle ring into the same spring catch.

ENSURE THAT THE SPRING IS PROPERLY INSTALLED so it is pushing up on the top of the latch.

8- Install the tip wand. Open up the Velcro at tip slip fiberglass wand into the tip receptor at end of LE tube. Make sure tip wand bottoms out on pin (apx. 4” in). Now hook tip lever socket over end of tip wand and over center lever. After you have installed the tip wands you will install the last two ribs at the tip.

9- Install if necessary the nose batten (tail end first) from the nose of the glider, now seat the front end of the rib on the standoff just in front of the nose plate.

10- If the glider has been assembled flat on the ground, lift it onto its 'A' frame (be careful of the tip battens), ensure that all the lower rigging is untangled.

11- Now attach the front flying wires at the nose plate area by slipping the ring around the nose spring catch.

Install the glider's nose cone, starting with the two top velcro tabs and gently pulling the shroud down and around the nose plate to connect the two bottom velcros of the nose cone to its corresponding velcro on the under-surface.

Your **Freedom** is now ready for a **pre-flight inspection,** described next.

PREFLIGHT INSPECTION

The nature of the **Freedom** is such that most of the pre-flight checkpoints common to other flex wings are hidden to eliminate parasitic drag. A thorough pre-flight procedure is mandatory with all aircraft, however, and the best technique is a circular walk around the glider.

Start at one location, the nose plate for example and check each assembly point available for inspection. Keep in mind the THREE MOST CRITICAL set-up factors. These are the nose catch; the control frame base tube bolt and the cross tube tension cables attaching to the spring catch on the keel. As stated in the set-up procedure, ENSURE THAT ALL SECURING PINS ARE PROPERLY POSITIONED AND CANNOT PULL THROUGH.

Starting at the nose, a suitable pre-flight checklist would be:

1) Sight along both leading edges checking for similar curves.
2) Walk towards the tip feeling for dents in the tube.
3) Pause at the wing bolts and look into the sail through the opening (under surface).
4) Continue to the tip and check the tip wand.
5) Walk to the keel checking each rib to ensure that they are connected and properly secured.
6) Check the luff line attachment points, both at kingpost and trailing edge grommets. Ensure that the luff lines are not wrapped around the batten ends
7) Check the cross tube cable to spring catch connection.
8) Check the rear top rigging and luff line attachments.
9) Repeat items 2 to 7 in reverse order as you walk to the other side.
10) Check the nose cable catch.
11) Check all the lower rigging.
12) Check that the control frame uprights are straight and that the bolt is correctly assembled with wing nut and ring.
13) HOOK IN AND HANG CHECK.
14) Instruments on, set altimeter.

FOLD DOWN PROCEDURE

To fold down your **Freedom,** just reverse the set-up procedure steps as described above. Included here are a few guidelines to follow which will save you time and prevent wear areas on your sail:

1. **IMPORTANT:** While setting up or releasing the **Freedom** cross tubes pull back cable, the rear of the keel must remain on the ground at all times!

2. Always try to fold the wings together symmetrically, bringing both leading edges back together at the same time.

Generally, if anything offers you resistance during any phase of the **Freedom** set-up or fold-down procedure, be sure to **stop and investigate.**

Make sure that both the cross-tube tension cables are free to run forward. Roll the sail from the outer luffline into the Mylar reinforced leading edge pocket. Pull one sail tie just ahead of where the top laterals emerge from the sail, a second one half way between the A-frame apex and the nose plate holding the leading edge pockets overlapped and the third sail tie provided with your glider about 2 feet inboard from the leading edge tip. It is not necessary to over-tighten your sail ties: keep the Mylar pockets and the rest of your sail free of wrinkles and creases.

3. Neatness and organization are particularly important when repacking your **Freedom** disassembled control bar. Cover bag pockets and pads are provided to help eliminate wear points that some fittings might create during transportation.

TRANSPORTATION AND STORAGE

Avoid hard spots pressing on the glider during transportation or storage and have as many supports as possible. Use rope or webbing rather than elastic to secure the glider and tie both ends of the glider to a support or down to the ends of the vehicle in order to stop the glider flexing. It is preferable to keep the glider dry and ensure that it is dry before storing.

SECTION 6: FLYING TECHNIQUES

Take Off

The **FREEDOM** has a neutral static balance and is very easy to launch in both calm and windy conditions. When you hold the glider prior to your take off run, you should have the nose slightly elevated and the wings level. **MAKE SURE THAT YOU ARE HOOKED IN!** Run hard and ease the bar out for lift-off.

Turns

The **FREEDOM** has a straight-forward flight characteristic, typical for a defined airfoil flex-wing. The glider can be easily directed into a turn, even at very low flying speed. However, to obtain the best handling characteristics and fast roll rate, it is advisable to pull in for a little extra flying speed, then enter the turn, move to one side and push out slightly. The **FREEDOM** will maintain in a turn of a certain bank angle and radius until the turn is removed. Give yourself an extra margin of safety and DON'T fly your glider at the slowest possible airspeed when scratching for lift close to the terrain.

Thermalling

This is also very straight-forward, the trim speed of the **FREEDOM** is slightly faster than the speed that will give you the best climb rate in a thermal. Once you have centered a thermal, push out as much as possible without stalling. Maintain anywhere from 10 to 50 degree bank angle, depending on the nature and diameter of the thermal. The **FREEDOM** will maintain a certain bank angle and radius without further input. The **FREEDOM** feels very good in turbulence and it doesn't get displaced very easily even by strong turbulence. The **FREEDOMS** handling characteristics have been designed to give you the optimum performance, to achieve your personal longest cross-country flight. The **FREEDOM** is probably the least tiring glider on the market to fly, because of its ideal combination of light control inputs and inertia. There is not a lot of work involved in flying the **FREEDOM**.

STALLS

When practicing stalls always make sure that you have sufficient altitude. The stall characteristics of the **FREEDOM** are very straight -forward. If you push out slowly it is hard to stall, but possible. The **FREEDOM** will mush without a tendency to drop a wing. The sink rate of your glide will increase if you 'fly' the glider in this mode. If you push out more, the nose of the glider will come up a little bit higher until it presents a gentle stall, then the nose will pitch down and the glider will regain flying speed. There is not a lot of altitude lost in this type of maneuver. Never stall your glider completely with the nose pitched-up very high. This is one of the most uncontrollable and dangerous maneuvers for any tailless aircraft and can result in a tail slide and severe tumble. Stalls in a coordinated turn are difficult to do by mistake. If you push out too much in a turn the glider will turn tighter, unless you are flying very slowly, in which case you may enter a spin (see Spins).

SPINS

The **FREEDOM** will strongly resist spinning. However should you stall one wing in a turn, move your weight forward and the glider will recover quickly from a spin (half a turn) without entering extreme attitudes and without extreme loss of height. This is due to the **FREEDOM'S** positive roll-yaw coupling and a neutrally balanced roll characteristic.

LANDING

This is a simple matter. Your final approach should be a straight glide into the wind at faster than best L/D airspeed. Bleed your speed off slowly, wings level, and ground skim onto your chosen landing spot. In light or no wind conditions a full flare is required. When it is time to flare, flare aggressively and abruptly and hold 'A' frame out. It is possible to make steep approaches to a landing area or target utilizing the mush mode, but this should only be done in steady, smooth winds. It is not recommended to mush the **FREEDOM** all the way to the ground.

SECTION 7: COMPLIANCE VERIFICATION SHEET

FREEDOM'S STABILITY SYSTEM

There are multiple features built into the Freedom to achieve a safe degree of pitch stability. These are:

1- Reflex (re-bend) in root area ribs.
2- Tip wand angle setting.
3- The airfoil shape in all ribs.
4- Wing twist.
5- Trailing edge luff-line cables.

The first four we have fine-tuned into the Freedom for the best flight characteristics and performance. The glider will not be airworthy with only the first four features. The Freedom must have luff-lines to be pitch positive at the critical low angles of attack. Proper reflex luff-lines on the Freedom are highly important and is directly related to stability and airworthiness.

NOTE: THESE SPECIFICATIONS ARE INTENDED ONLY AS A GUIDE LINE FOR DETERMINING WHETHER OR NOT A GIVEN GLIDER IS A CERTIFIED MODEL, AND WHETHER IT IS IN ITS CERTIFIED CONFIGURATION.

BE AWARE, HOWEVER, THAT NO SET OF SPECIFICATIONS, HOWEVER DETAILED, CAN GUARANTEE THE ABILITY TO DETERMINE WHETHER A GLIDER IS THE SAME MODEL AS WAS DESIGNED, OR HAVE THOSE PERFORMANCE, STABILITY AND STRUCTURAL CHARACTERISTICS REQUIRED BY THE CERTIFICATION STANDARDS.

Glider Model: **FREEDOM 220**

-- **Glider Weight** (without cover bag) 79 Lbs
-- **Leading Edge Tube**
A. **Distance from** the nose plate anchor hole to:
1. crossbar attachment hole: 143.75"
2. rearmost sail attachment pt: 219.50"
B. **Outside Diameter** at:
1. nose 2.25”
2. crossbar 2.5”
3. rear sail attachment point 2”
-- **Cross bar tube**
A. "Pin to Pin" 129.375"
B. Outside diameter 2.5”

-- **Keel tube** - least and greatest distance from leading edge bolts to:
A. Crossbar Hinge pin 53.25" +/- .75
B. Hang loop 64.5" & 67.5"

-- **Sail Chord** length at:
A. 3' from root 96.5”
B. 3' from tip 44"

-- **Total span** 35.7 Ft
-- Placards and test flight stickers located behind pull-back cable catch on the keel
-- Recommended pilot “flying” weight range 225 - 500 Lbs
-- Recommended pilot proficiency level min. Hang 2
-- Bridle measurements - inner _____ 66.5"
center _____ 97.625"
outer1 _____1125"
outer1 _____151.25"
Measured from the hook at the kingpost to the end of the loop of the cable.

SECTION 8: TUNING AND TROUBLESHOOTING

The **FREEDOM** has undergone a rigorous test-flying program in a wide range of conditions. As a result, it is precisely tuned to achieve maximum flying performance. Therefore, it should not be necessary to make any changes in your glider's tuning or configuration. If, however, you have any questions, please contact your authorized North Wing dealer.

If any adjustments are made on your glider, we recommend that they be noted in your Maintenance Log (Section 12 of this Manual). It is then easy to go back and trace occasional problems.

Please bear in mind that certain adjustments, like the cross tube sweep setting, are very critical and often create trade-offs in handling, performance, or --more seriously-- safety.

The troubleshooting chart below offers you a first solution (first action to be taken) and then a second (or more) solution for any possible problems you may encounter.

Please investigate each problem as indicated by the chart. Never make more than one change at a time. This is a basic rule in test flying, which allows you to better keep track of the progress made.

We sincerely hope you never have to use this chart.

TROUBLESHOOTING CHART

SYMPTOM	1st solution	2nd solution
Tail heaviness (flies too slow)	B, D	H
Nose heaviness (flies too fast)	B, C	G
Right turn	B, A	F, J
Left turn	B, A	E, K
Yaw unstable (roll response lag)	L	N
Roll unstable	B	A, R
Roll stable	M	O
Breaks left in stall	B	J, P
Breaks right in stall	B	K, Q
Trailing edge flutter	A, S	O
Sail wrinkles	S	M
Loose rigging	A	
Tight rigging	A	

TROUBLESHOOTING CHART KEY

KEY ACTION

A. Check for proper assembly, twisted thimbles. Crossbar setup cable not fouled on kingpost bolts. All ribs secured, check for proper position of trailing edge lines.

B. Match all ribs to the airfoil maintenance blueprint provided with your FREEDOM

C. Move hang strap back (1/2 " at a time).

D. Move hang strap forward (1/2 " at a time).

E. Increase camber on last 2 cambered left tip ribs by 1/4", or decrease the same on right tip by 1/4".

F. Increase camber on last 2 cambered right tip ribs by 1/4", or decrease the same on left by 1/4".

G. Decrease camber on last 2-cambered tip ribs on both sides, 1/4" at a time.

H. Increase camber on last 2-cambered tip ribs on both sides, 1/4" at a time.

I. Check leading edges for straightness, and replace if bent.

J. Increase the tension of the right leading edge pocket, or loosen the tension of the left leading edge pocket*

K. Increase the tension of the left leading edge pocket, or loosen the tension of the right leading edge pocket.*

L. Loosen leading edge pocket on both sides.*

M. Tighten leading edge pocket on both sides.* (note: If you are using this step to remove sail wrinkles, be aware that excessive leading edge pocket tension will cause excessive leading edge deflection, releasing enough trailing edge tension to cause wrinkles).

N. Loosen rib tension on both sides symmetrically, starting at the tips.

O. Tighten rib tension on both sides symmetrically, starting at the tips.

P. Check for over-tension in the left side ribs #1-4.

Q. Check for over tension in the right side ribs #1-4.

R. Loosen tension on ribs #2-4, both sides, to remove excess reflex from these ribs.

S. Adjust rib tension in the locality of each problem area.

*To modify leading edge tension, you will add spacers into the tip wand receptacle tube to increase tension or cut off the tip wand to decrease tension. Do this in ¼" increments. For Spacer we use 4 nylon 1/16" washer tapes to gether.

If your FREEDOM has a turn, you have to check for bent battens first and then for bent spars. If you cannot find a bent leading edge, it is still possible, that one of the leading edges has been stressed in a hard landing and this results in slightly different bending characteristics of both leading edges. This is not always necessarily critical and the turn can be tuned out by differential batten bending. The only three battens that should be changed are the three curved tip battens. For example, if your glider has a right turn in it, the battens on the right hand side would require an addition of approximately 1/2" to the slow wing (in this case the right wing).

The camber of the corresponding battens on the fast wing should be decreased by approximately 1/2". This seems to be the best possible method of tuning a turn out of the FREEDOM. Tightening the batten tension also has the same effect as increasing the camber. Having the batten tension slacker improves the handling, possibly at the expense of glide angle. Trim is accomplished by simply moving the kingpost hole location (hang point) of the keel.

To make the glider fly faster, simply move the Kingpost forward. The trim speed covers a range of approximately 7 m.p.h. (King Post all the way forward to kingpost all the way back.)

NOTE: **Backup hang loop** on the **FREEDOM** are **directly in front** of the 'A' frame top fittings and kingpost. The main and back-up hang loops are of different colors or at least color-coded.

The **main hang loop of the KP** is always the shorter of the two.

Changing the main cross spar tension actually changes the nose angle and the anhedral of the glider. Increasing the nose angle **WILL NOT** necessarily increase the performance. In fact, over-tightening the main cross spar tension can deteriorate the sink rate with no advantage at high speeds. However, slackening the cross spar tension does make the handling lighter. This feature is mainly use to tighten the glider for heavier wing loading.

SECTION 9: MAINTENANCE SCHEDULE

Your new **FREEDOM** will require very little in the way of maintenance if you care for it properly in your everyday use. Here are some general points to follow in maintaining your new **FREEDOM** which will help ensure the safety of your flying and the performance retention of your glider. We suggest you follow this maintenance schedule faithfully: your care will always pay off in the future.

EVERY 10 HOURS:

-- Check all ribs against the airfoil maintenance blueprint.

EVERY 50 HOURS:

--Inspect all cross tube support cable components (tangs, pins, nuts, bolts, cross tube plates, and cable itself).

--Inspect all rib tensioning cords.

--Check all tubing for possible wear damage, which could occur during set-up, fold-down, or transportation.

--Inspect sail mounting grommets and webbing at tips.

EVERY 100 HOURS:

--A complete inspection of your glider is recommended, including all rigging and components, replacement of any worn or bent bolts or locknuts connecting 2 moving parts together (i.e., cross tube plate junction bolt, crossbar clamp bolt, etc.)

--If badly scratched, dinged, or damaged, the control bar should also be replaced.

--A professional sail maker should mend critical sail tears. (See also Sail Maintenance below)

--Please contact your dealer for a complete and professional inspection of your glider.

1) If you must wash the sail, wash it with a light detergent only. Better still, wipe the sail down frequently with a soft, damp cloth and that will keep detergent washing to a minimum.

2) Acetone or alcohol can be used to remove stubborn stains without harming the sail. (Do not use any solvents on a mylar sail).

3) Rinse very thoroughly after cleaning with any detergent or solvent.

4) To renew the luster of Dacron, you can use a product called 'Sail Bright' available from marine hardware stores.

5) Apply sail repair tape to any rips or tears in your sail. This will prevent fraying on the edges where the tear is located. However, do not worry about small tears continuing unless they are located at stress points.

6) Keep an eye on all the grommets and all areas of the sail that take extra abuse.

7) The best thing you can do for your sail is to always use the bag. Do not carry your glider on top of a car, even for short distances, without one. Sun and weather cause more deterioration than hours of flying. Keep your **FREEDOM** covered when not in use.

8) Be careful and precise when you re-pack your glider after each flight. Keep all the foam padding that arrived with the glider when it was new, tie everything off the same way. A few extra moments when you de-rig the glider will give you many extra hours of noiseless flight.

CABLES

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1) Naturally any frays or kinks in your cables should be examined with great care and any frayed cables should be replaced immediately.

2) Many **expert pilots replace their flying wires every 75 hours,** regardless of wear. This is certainly worth considering. Each cable has a breaking strength in excess of 800 lbs. Actual non-aerobatic in-flight loads seldom exceed 400 lbs. Inspect the thimbles - if elongation is evident, 300-400 lbs load has been applied to the cable, ferrules and thimbles. If you must constantly set your glider up and break it down in rough, rocky areas, you will need to replace you cables more frequently than someone who flies the grasslands. Use your best judgment; those cables hold the frame together.

SPARS

Examine your spars for dents, wear spots, corrosion and bends during every pre-flight check. To maintain the structural integrity of the spars of your glider, always

use a well-padded glider rack on your vehicle. Ideally the rack should support the glider in three places over the entire length. If a glider has been badly looked after, the spars should be replaced.

HARDWARE AND BOLTS

1) For all practical purposes, North Wing hardware is indestructible in hang gliding (flight) applications. "**AN**' bolts, however, are not indestructible and bending them even in light crashes is common. Check them periodically to be safe. Discard and replace any bent bolts.

2)All bolts, of course, should show exposed threads above the locknut during pre-flight.

BATTENS

When inserting battens, place them in their pockets smoothly and gently to avoid wear on the sail and on the batten ends. Pushing them rapidly into the pockets at an angle will wear out the stitching on the edge of the pockets, not to mention possible damage to the sail itself.

ANNUAL INSPECTION

Even if yours is the best kept **FREEDOM** you should have the glider stripped down for a **full inspection at least once a year.** This can be done by you or preferably by one of our professional North Wing DEALERS.

With **proper care and maintenance**, your **FREEDOM** will remain for some years at a high level of airworthiness. There is much that we still don't know such as what is the effective lifetime of a hang glider before material fatigue and degradation compromise the airworthiness of the gliders. We do know that there are forces in nature, which can severely compromise your safety, regardless of the quality of design or condition of the aircraft you are operating. Your safety is ultimately your responsibility. We strongly recommend that you **fly conservatively,** both in your choice of the conditions in which you fly and the safety margins you allow in the maneuvers you attempt. We recommend that you only fly with a harness that has been tested for strength and that you **always fly with an emergency parachute system.**

SECTION 10: GUARANTEED MAINTENANCE

The **FREEDOM** is a very sophisticated machine and its airworthiness requires scheduled and professional attention.

Every six months, from the date of purchase, your authorized North Wing dealer will inspect and maintain all the different components of your new **FREEDOM**. He will also suggest the replacement or repair of all bent or damaged parts of your glider. This unique service, provided by all **North Wing Service Centers,** should be followed very seriously at the risk of voiding your warranty. Just make an appointment with your dealer and set up your glider in a "ready to fly" configuration. Your dealer will perform the inspection and will fill out the Maintenance Inspection Sheet below.

GLIDER MAINTENANCE INSPECTION SHEET

Customer's Name:_____Purchase Date:_____
Glider model/size:_____Serial number:_____

Inspection Points (Description)	6 months	1 year
Check all ribs against pattern (including nose rib).		
Check all sail attachment points (grommets, screws, rib cords, fittings)		
Check all tubing for straightness, normal corrosion, wear, and fatigue areas (inner and over sleeve edges).		
Check all nuts and bolts (proper tightness).		
Check all rib cords for wear and proper tensions.		
Check hangs straps for normal wear and U.V. exposure.		

Six-Month Inspection Comments:_____
_____

Signature:_____Date:_____

One-Year Inspection Comments:_____
_____

Signature:_____Date:_____

SECTION 11: GLIDER DISASSEMBLY

PREPARATION: In order to best perform this operation, you must first place your glider "right side up" on two saw horses located 3 feet from both ends, with all ties removed and with the leading edge spread approx. 1 ft apart. (You can actually perform the same operation on a clean floor or lawn.)

Next, you need to flip the sail on the outside and the top of the airframe in a manner to expose the under-surface facing upwards. If your glider is equipped with X-tube to Leading Edge junction inspection zippers, open the zippers and move the sail around to allow you to work on the X-tube to L.E. junction. (If your glider is not equipped with that option, you will find a corresponding access point to the desired junction in the form of a velcro opening running along the under-surface seam. By separating the velcro and positioning the opening over the junction, you can perform the necessary steps. You may want to dismount the sail at the L.E. Tips and slip the sail slightly forward to provide better working access to the X-Tubes junction.

STEP # 1: - Remove the safety wire, the lock nut and slip both side cables tangs from wing bolt.

STEP # 2: - Disconnect all four trailing edge reflex lines ball terminals from the cable loops and slip the lines off the grommets.

STEP# 3: - Remove the screws securing the sail at the nose plate junction, slip the sail back a bit and remove the top front cable tang off the top nose plate. Slip the cable off its sail slot running along side the nose rib pocket. At this point, we would recommend that you "coil" all the free top rigging into 6 " rolls in order to keep the procedure organized.

STEP # 4: - Now you must detach the lower rear rigging tang from the keel tube. The tang is fastened to the keel with the same bolt retaining the X-Tubes "pull-back " cables catch. You will need a 3/16" allen key wrench to perform this step.

STEP # 5: - Lastly, you will need to completely dis-assemble the shackle assembly connecting the 2 "pull-back" cables and the top rear cable together and feed both X-Tubes "pull-back" cables off the two little webbing loops located on each side of the sail kingpost hole.

STEP # 6: - You can now proceed to slip the sail off the rear of the airframe, taking great care not to catch the sail on any parts of it. Be especially careful when nearing the washout tubes, the X-Tubes center junction, the control bar apex and the wing bolt area.

You may wish to pull out the foam or mylar leading edge reinforcement at this time, depending on the nature of the disassembly.

GLIDER RE-ASSEMBLY: The re-assembly procedure of your **FREEDOM** is best achieved by simply reversing the steps described above. Please remember that optimally **locknuts should not be used twice**, and that the de-assembly and re-assembly of your glider provides the best opportunity for an extensive and thorough inspection to each and every component. **Take advantage of it !**

INSPECTION

Check the sail for tears and abrasion. Have any damage repaired by a professional sail maker. Inspect all other parts for damage and replace anything that is suspect. Pay special attention to the lufflines, hang loops and rigging. If they show **ANY** signs of wear then replace them.

A FEW LAST WORDS

Your North Wing **FREEDOM** is a sophisticated high performance hang glider, that will give you years of safe and enjoyable soaring, provided that you treat it properly and always maintain a healthy respect for the demands and potential dangers of flying. Please remember that aviation is always potentially dangerous and that your safety depends on you.

You are reminded that you fly a hang glider at your own risk.

SEE YOU IN THE SKY!

North Wing Inc.

SECTION 12: MAINTENANCE LOG

Glider Type:_____ Serial Number:_____

DATE	WORK ACCOMPLISHED	INITIALS