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1. About This Manual

Most everything the pilot needs to know about the **MUSTANG 3-15** Wing from North Wing is contained within this manual.

It is recommended that you thoroughly familiarize yourself with the entire manual before you use your new wing for the first time.

It is very important that you become familiar with the set-up procedure for the **MUSTANG 3-15**, or it is possible to damage it. Please take the time to look through the appropriate set-up sections before attempting assembly.

Most importantly, you are reminded that this manual is not intended as an instructional device on how to fly weight shift trikes. Rather, as the purchaser of this product, in the spirit of our self-regulated sport, you are responsible for bringing with you the expertise required to safely operate this vehicle. If your trike is a Light Sport aircraft you need the proper Light Sport documentation to fly your Trike legally. By purchasing or operating this product, you assume complete liability for its safe operation. North Wing offers this owner's manual simply to assist you with the features particular to this model of trike wing regarding its unique: assembly, flying characteristics, care and maintenance, and technical specifications.

For those looking to advance or refine their particular flying skills, consult the fine line of instructional books dedicated to ultralight skill-building written by Dennis Pagen, or the factory can recommend any number of professional flight training centers.

Please practice safe aviation!

2. About the **MUSTANG 3-15** Trike Wing

The **MUSTANG 3-15** is a intermediate to advanced trike wing. You should have a minimum of 30 hrs of flight experience in weight shift trikes with an instructor's approval before flying a **MUSTANG 3-15**.

Congratulations on the purchase of your new North Wing **MUSTANG 3-15**. We believe it to be the finest available high performance recreational trike (flex) wing in the market today.

The **MUSTANG 3-15** achieves exceptional low speed performance and superb handling for many reasons. Its sail body and cut are composed of a carefully selected and applied field-proven synthesis of the latest materials that is matched to the leading edge curve. The sail body features a leading edge pocket internally reinforced with a mylar sheet insert. Drag is reduced with a faired side struts. These features combine to ensure a good usable flight performance.

3. Re-Assembly From Shipping Crate

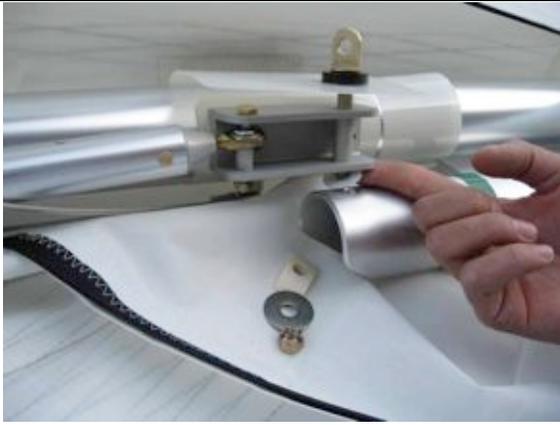
Carefully undo the crate packing so as not to damage the wing inside. ie: Do not cut into the box. With the wing out of the box find the Base tube, ribs and rear LE's. Separate the left and right rear LEs. (Leading Edge). Green is right and red is left. With the wing on it's back slide the rear sections into the sail from the tip.



Turn the sprogs so they point towards the tip. Slide the rear section into the front section until the hole lines up. Install bolt from the bottom up, wrap the mylar protector around the LE and put over the bolt, now thread the nut on over the mylar. Tighten snug. Do not over tighten or you may elongate the tube.



Now install the eye bolt through the X-bar channel bracket. X-bar onto the 3/8" eyebolt. To do this follow the picture. 1/4" thick plastic spacer, mylar, channel bracket, white nylon washer (between the bracket and X-bar), X-bar. On the inside of the X-bar you will have the Half moon spacer, SS finder washers, and std. washer, then the castle nut and safety.



Installing the tip sail strap (yellow) over the end of the trim tip cap. Make sure that the webbing is in the 1" inch wide slot. See picture. Note: You can take the sail nose screws out of the grommet to make it easier to put the webbing over tip. After the webbing is over tip run a string from grommet to grommet and around the nose plate and tighten line to pull tension in the leading edge. Now you are ready to set up your new wing.

After the wing is completely set up and you have put in the nose ribs you can reinstall the nose screws.



4. Setup Procedure

The best value that this chapter can provide the owner is to share some techniques and procedures that other people using the MUSTANG 3-15 have discovered; things that will minimize wear or even prevent needless damage from occurring. Use this information to extend the life of your wing.

1. ASSEMBLE THE CONTROL FRAME Place the wing on the ground with it's nose pointing 120 degrees to the wind (if the wind is over 5 MPH) and with the zipper facing upward. Unzip the cover bag; remove the ribs from the nose area and the side struts. Undo the wing ties and assemble the control frame. Check the rigging to ensure that it is not tangled. FIG.1&2



2. ROLL THE WING OVER Stand wing on the control frame (do not attach the lower front wires at this time). FIG.3



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3. REMOVE BAG. SPREAD WINGS Ensure that the keel stand “stinger” is in place. Carefully walk each wing out to 3/4 of it’s own approximate flying position. Leave enough slack in the sail so that during the next step the ribs may slide in with minimal resistance. FIG.4



4. INSERT INBOARD RIBS Install all but the last three curved ribs; white ribs go to the right, black to the left. Insert the ribs from root to tip with gentle pressure, moving the sail’s trailing edge up or down as necessary to help the front of the ribs up over the cross tube and leading edge. Keep the rear tip close to the ground so the curved front glides smoothly in the pocket. **DO NOT FORCE** the ribs into place, especially the first two ribs (in particular when the sails crispy new). To put the first ribs in, lift the keel off the ground about 20”. FIG.5



5. PRE-TENSION THE CROSS TUBE Spread the leading edge tubes out the rest of the way before pulling back the cross tube retrieve line. Find the cross tube tensioning Nylon line appearing immediately at the center of the sail. (sometimes the loop of the line needs to be put back through the center hole in the sail) Pull on the nylon line to pull back the cross bar. Pull back until the nylon rope loop can be hooked into the spring catch on top of the rear keel tube. This opens the wing spars enough to hook up the side struts. **DO NOT FLY THE WING LIKE THIS!** You must use the main restraint cable to fly. FIG.6



6. INSTALL STRUTS Place struts under wing on each side. There is a left and right strut and are marked. The strut also should be marked top. This is the side that has a 5/16" clevis pin. First hook up the lower end of the strut (1/4" pin) then the top. Make sure you install the safety rings and make sure that the safety rings are not sprung. FIG.7&8



7. HOOK UP CROSSBAR MAIN CABLE Remove pull back nylon line from spring catch. Pull the line all the way back, till you can latch the cable shackle into the spring catch. Make sure the wing tip yellow webbing is in the 1" slot on the trim tip cap before tightening the wing with cable.



8. INSERT REMAINING RIBS Remove the tip bags and insert remaining 3 tip ribs, than lastly the straight tip struts onto LE hooks.



9. LOCATE SPROGS INTO POSITION (If it is light winds you can put the wing on its nose for this) Open the zipper at each sprog location, rotate the four sprogs out to center of the transversal batten. Now put the Velcro loop around the end of the sprogs. Leave Velcro loops slightly loose (apx. 1/2" gap). FIG.10&11
10. UNDER SURFACE RIBS Install the under surface ribs from longest to shortest. Make sure the back ends are inserted back into the slot at the rear.
11. ATTACH FRONT FLYING WIRES Ensure that all the lower rigging is untangled first. Position the ring on the latch; install bolt, nut & safety pin. FIG.12



12. POSITION THE NOSE RIBS AND NOSE CONE Pull the nose down to eye level so you can put the nose rib on the 1/4" stud located front top of keel tube. With nose cone in hand start with the two top Velcro tabs and gently pull the nose cone down and around the nose plate to connect the two bottom Velcro tabs on the nose cone to its corresponding Velcro sewn on the under surface below the keel. FIG.13&14



Now make sure all zippers are closed after you per-flight your wing and before you fly.

Cover bag, pads, and ties can fold into one of the bag ends for storage.

Before you attach the wing to the trike be sure to perform a thorough preflight as described on the following pages.

5. Preflight Procedure

A thorough preflight procedure is mandatory with all aircraft. The best technique is a circular walk around. Start at one location, the nose, and check each assembly point available for inspection.

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Starting at the nose:

- Sight along both leading edges, checking for similar curves.
- Walk towards the tip, feeling for dents in the leading edge tube.
- Pause at the wing bolts and look into the sail through the zipper inspection access. Check side struts fittings and safety rings.
- Continue to the tip and check the sail tip area for proper seating on the leading edge tube, and sail integrity.
- Verify that the sprog tubes are positioned correctly and velcros are in place.
- Insure that the tip struts are properly seated on the leading edge hooks, and that the tension strings are correctly installed.
- Walk to the keel, checking each of the ribs to ensure that they are properly secured, with the double-purchase strings.
- Check the cross tube-to-keel cable catch connection.
- Repeat first half inspection as you work your way back around the nose.
- Check the nose catch.
- Check the nose cone for secure attachment.
- Check all the lower cable rigging for proper routing about the control frame.
- Check that the control frame uprights are straight and that the set up bolt is correctly assembled with speed nut and safety ring through the base bar and forked end fitting
- Check the cross tube center bolt/plates to insure that they are properly attached.
- Make sure you zip up the center zipper after inspection. Flying the wing with the center zipper open (or any zipper) will result in loss of lift and cause dangerous flight handling!!
- Generally site the entire wing for symmetry. If you see something that does not look “right”, stop and investigate.

NEVER RUSH A PREFLIGHT!

6. Fold Down Procedure

To fold down your MUSTANG 3-15, just follow the reverse set up procedure steps (common sense) as described in the previous section. Included below are a few guidelines to follow which will save you time and prevent wear areas on your sail.

- TIP BAGS Remember to remove last 4 ribs, install the wing tip bags and un-zip access zippers for upper wing strut before releasing the cross tubes cable.



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- FOLDING WINGS IN Always fold the wings together symmetrically, bringing both leading edges back together at the same time. An alternative to having someone help bringing in both leading edges at once, is to bring in one a bit, then the other a bit more, in three to four incremental steps. If you meet resistance folding in the wings, check that the cross tube tensioning line or cable are free to run forward through the cable hole center of the sail.
- FOLDING SAIL The important thing here is to simply get your sail body neatly stowed inside the Mylar reinforced leading edge pocket. Also, some owners prefer to alternate folding, then rolling, their sail to minimize potential permanent creases developing over time.



- ATTACHING SAIL TIES Fasten the first tie just aft of the rear cable (or X-bar latch). By keeping the keel tube outside of the tie, it will make it easier to organize the control bar in this area after the wing is flipped over. The forward tie is located splitting the distance between the control frame apex and nose plate. Pull the leading edge pocket up over the top of the wing so the top of the LE mylar pocket is touching and/or overlapped. The third sail tie goes about 2 feet inboard from the leading edge tips.

7. About Flying the **MUSTANG 3-15 Wing**

The **MUSTANG 3-15** wing likes to fly between 45 to 55 MPH at hands off trim, this where we set the trim during our test flight. Adjust the trike on the keel to fly the speed of your liking. At gross load the **MUSTANG 3-15** may stall as high as 44 mph depending on your trim setting and tuning.

The safe operation of this or any trike wing ultimately rests with you. Because Ultralight and Light Sport flying is an inherently dangerous sport it can induce injury or death, even to very good pilots flying the latest equipment in perfect conditions. Because the responsibility of flying and maintaining the wing rests entirely with you, the risk of damage or injury you may cause to others and to yourself also rests entirely with you. We believe that in order to safely participate and practice the sport of flying, you must maturely accept responsibility for yourself and others. We recommend to fly conservatively, and avail yourself of all safety equipment (i.e.; parachute, strobes.....etc.) appropriate to the conditions you fly in.

No wing on the market is totally safe. It is entirely possible to push any aircraft beyond its tolerances and damage or even break a wing. Very strong weather conditions may also cause structural failure. Aerobatics maneuvers, pitch angles beyond 30 degrees up or down, bank angles exceeding 60 degrees, aggressive stalls, and spins are maneuvers that should never be attempted under any circumstance.

CAUTION

The speed never to exceed for the MUSTANG 3-15 is 70 mph. The MUSTANG 3-15, even when flown in its lightest wing loading, can exceed airspeed of 70 mph.

Your new MUSTANG 3-15 combines the best blend of low speed performance, rugged construction and easy handling that the art and science of trike wing design allows. Properly maintained and flown within its design limits, it will provide you many years of flying pleasure. But, like any wing, its safety is directly proportional to your diligence in maintaining and repairing it properly, and to your ability to fly it intelligently and conservatively.

We hope your MUSTANG 3-15 will provide you with many hours of enjoyable flying. All of us at North Wing would like to welcome you to our growing family of pilots!

8. Flight Limitations

Operations and limitation for the MUSTANG 3-15 wing on the Light Sport Scout X-C or the Sport X2 is available in the POH manual. The wing performance placard bearing test flight information and operating limits is located on the wing's left cross tubes. Special care should be taken to note the operating limitations, which are clearly stated on the flight operation placard. As with any wing, special care should be taken to note the operating limitations, which have been ascertained by careful testing.

Flight operations should not exceed those laid down in the operating limits specified within this manual. No wing is totally safe; there are inherent risks involved in flying a trike wing. It is quite possible to fly the MUSTANG 3-15 beyond its operating limits using deliberate flying skills. Do not do this!

The responsibility for safety rests ultimately with the pilot alone who must decide whether the wing they are about to fly has been properly maintained, and is in air worthy condition.

- **FLIGHT OPERATIONS:** Should be limited to non-aerobatics 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 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 aerobatics maneuvers or

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erratic pilot technique may ultimately produce equipment failure and are strongly discouraged.

- NEVER FLY FASTER THAN 70 MPH: To verify the speeds you are achieving, you should fly with an accurate airspeed indicator. During certification testing, test pilots found that it would be possible to exceed V_{ne} during smooth acceleration. The most typical cause of exceeding V_{ne} is rapid acceleration performing aerobatics maneuvers and steep dives.

9. Transportation and Storage

The MUSTANG 3-15 should always be stored with the zipper facing down, especially during transportation. There are fewer potential “wear points” with the wing riding this way. Additionally, with the zipper down less water will collect inside of the cover bag in case of rain. Avoid hard spots pressing on the wing during transportation or storage and have as many supports as possible; we recommend using a well padded three-point support system, with less than four feet of unsupported wing extending off either end.

Use flat tie down straps, at least 1” width (available through North Wing) rather than elastic or rope to secure the wing, and tie both ends of the wing to a support or down to the ends of the vehicle in order to prevent the wing from flexing. Take care to not over tighten the wing tie-downs, as this can crimp your Mylar leading edges. A good technique is to squeeze and compress the wing’s Mylar, sail, and leading edges into a snug bundle as it gets tied down, rather than using the wing tie-downs to compress the wing within the bag.

It is preferable to keep the wing dry. Definitely ensure that it is dry before storing for longer than just overnight. Any contact with salt water, of course, requires immediate rinsing with fresh water to prevent corrosion to hardware, rigging and tubes.

10. Regular Maintenance Schedule

The MUSTANG 3-15 will require very little in the way of maintenance if you care for it properly in your day-to-day use. Following are some general points to follow in maintaining your new wing which will help ensure the safety of your flying and the performance retention of your wing; we suggest you follow this maintenance schedule faithfully -- your ongoing care will pay off in the future.

A note on use of silicone spray: This lubricant is useful in that it can minimize friction on zipper pulls. Care must be exhibited, however, in that if you do not wipe off excessive silicon application, the fluid will act essentially as a dust and dirt magnet. Due in particular to the problems associated with silicon attracting foreign material, we recommend against the practice of using silicon on your wing’s ribs. Clean, dry ribs all by themselves are the best ways to prolong the life of the high wear area of the sail rib pockets. Probably the best way to prolong those rib pockets under adverse conditions is to wipe off the ribs with a clean dry cloth prior to each insertion.

11. Sail Maintenance

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 keeping detergent washing to a minimum.

Remove dirt with clear water immediately to avoid stains. Acetone or alcohol can be used to remove stubborn stains without harming the sail. Rinse very thoroughly with clean water after cleaning.

Because of the acids in their system bug grime should be cleaned immediately to prevent long-term deterioration of the sail.

To renew the luster of Dacron, you can use the product called "Sail Bright" available from marine hardware stores. Use as directed.

Apply sail repair tape to small rips or tears. This will prevent fraying on the edges where the tear is located. Any small tears located at stress points (i.e. the railing edge or critical seams) should be professionally repaired to insure that the structural integrity of the unit is not compromised. Any tear in the trailing edge seam area is cause for grounding the wing until repaired.

The best thing you can do for your sail is to always use a wing cover (when on the trike), wing bag and pads (when you pack it up). Do not carry your wing on top of a car, even for short distances, without the bag.

Sun and weather cause more deterioration than hours of flying. Keep your MUSTANG 3-15 covered when not in use. North Wing has wing covers available.

The very best thing one can do, by way of preventive sail maintenance, is to severely limit the amount of high-G maneuvers.

12. Monthly Inspection

- Check Nose ribs against the airfoil maintenance blueprint.
- Inspect all rib tensioning cords or flip tips.
- Lubricate the zippers on the sail and cover bag.

13. Twice Yearly Inspection

- Remove the cross tube center junction scuff pad to inspect all cross tube support cable components: tangs, pins, nuts, bolts, cross tube and cable itself. Tighten nuts if loose.
- Check all tubing, especially the control bar frame, for possible damage, which could occur during, set up, fold down, or transportation.
- Closely inspect the sail mounting grommets and webbing at the tips.
- Inspect the sprog cable for wear and/or undue stretch.

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- Inspect all rigging and components. Replace any worn or bent bolts or locknuts connecting two moving parts together: cross tube plate junction bolt, cross tube clamp bolt, etc.
- A professional sail maker should mend critical sail tears.

14. Annual Inspection

The only way to thoroughly and completely inspect all of the components of your wing is to completely remove the sail from the frame, to allow visual and physical access to everything. Even if yours is the best-kept MUSTANG 3-15, you should have the sail removed for a complete inspection at least once a year. This should be done by an authorized service center.

With the sail off the airframe, you can more thoroughly perform all of the inspection points listed for the six-month inspection.

Additionally, you should inspect inside the tubes for corrosion. If discoloration indicating that corrosion is present, you will need to arrest this process immediately. We have tested and approved boiled linseed oil (commonly found in most hardware stores) as an effective coating/film to apply on the inside wall surface of the tubes. Clean the tube first, allow it to dry, then apply the linseed oil.

Inspect the entire inner sail body, and in particular examine the rib pockets for wear points, especially at their stops at the front of each pocket.

It is recommended that you annually replace the lower cables.

WHEN REPLACING PARTS OR INSPECTING NEVER REUSE A NYLOCK NUT.

Wing Maintenance: and Mustang 3 wing

Wing Cleaning

Skill Level: Owner and higher

Tools: Damp cloth, pail, soft brush

Materials: Water and possibly mild detergent, aluminum polish/cleaner, WD40

Task Description:

The sail fabric should be cleaned regularly with a soft damp cloth. If the wing is exceptionally dirty, it can be washed with a mild detergent only. Keep detergent washing to a minimum. Acetone or alcohol can be used to remove stubborn stains without harming the sail. However, rinse thoroughly with water after cleaning with these chemicals. Because of the acid in their system, bug grime should be removed immediately to prevent long term deterioration of the sail.

All cables can be cleaned with a soft damp cloth. The plastic coating on the wing cables can be cleaned with WD40 or household cleaner if necessary.

Wing struts are anodized and can be cleaned with a soft damp cloth, or with a mild detergent. If placards, such as the "EXPERIMENTAL" placard is attached to the strut, be careful not to scrub the strut to avoid removing or damaging the placards.

Other exposed aluminum tubes, keel tube, cross bars, down tubes, base tube, leading edges, and ribs can be cleaned with a soft damp cloth or a mild detergent. In some cases it may be desirable to polish these tubes with a mild aluminum polishing cloth and compound.

Wing Tuning

Skill level: Owner and higher

Tools: Philips screw driver

Parts: Leading Edge Shims if necessary

Task Description:

This task can be complicated. If you do not feel comfortable in your understanding of the following instructions, do not attempt to adjust the wing. The performance of the wing can be significantly affected if excessive adjustments, or improper adjustments are made.

Prior to starting any wing adjustments, check the following items which may cause any number of problems.

1. Check for proper wing assembly. i.e. no cable routing problems, nose cable is not twisted at swan hook, nose cone is secure in place, sprogs are in place
2. Assure the crossbar setup cable is not caught or riding on the pivot block
3. Assure that all ribs are secured and have reasonable tension in the trailing edge rib strings or flip tip ends. If a rib is loose for no apparent reason, check to see if the rib has punctured and pushed through the rib pocket at the leading edge. This will cause a loose rib and a turning problem.

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4. Match all ribs to the rib blueprint provided with your wing. Correct any deviations unless they were changed as a result of prior successful tuning.
5. Check the leading edges to assure they are not bent. If so, they must be replaced.

Once these checks are completed, and wing handling or performance problems persist, then proceed with the following diagnostics.

A few basic rules of wing tuning are listed here:

1. Make only small adjustments until the effect of those changes is determined by test flying.
2. Never change more than one adjustment at a time without testing the result of that adjustment.
3. Upon completion of making any adjustments, test fly the trike about a foot off the ground for the length of the runway at least three times before climbing to altitude to assure no adverse characteristics have been introduced.
4. Record all changes in your wing maintenance log

There are six basic types of adjustments that an owner is authorized to make to tune his wing handling:

1. Sail tension from front to rear at selective locations (rib positions)
2. Sail tension along the leading edge
3. Selective rib re-shaping
4. Twist (or washout) along the span of the wing
5. Cross bar pull back adjustment
6. Hang block location (CG adjustment)

Each of these adjustments has a different affect on the performance and handling of the wing. Table 4.2-1: Wing Tuning Diagnostics, provides a diagnostic procedure if your wing performance needs corrections. The "1st Adjustment" column is the recommended first corrective action. If the problem persists, the "2nd Adjustment" can be made. The code letters in the columns refer to the list of Corrective Adjustments in the following Table 4.2-2: Wing Corrective Adjustments. If neither of these two adjustments correct the problem, contact a North Wing dealer.

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Symptom	1 st Adjustment	2 nd Adjustment
Tail heaviness (flies too slow)	B	
Nose heaviness (flies too fast)	A	
Wing pulls to the right with hands off straight and level flight	Q,F	L,D
Wing pulls to the left with hands off straight and level flight	R,E	K,C
Yaw unstable (roll response lag)	G	I
Roll is unstable (difficult to keep from rolling)	M	O,J
Roll too stable (heavy force required to enter into roll)	G	P,I
Wing Breaks to left in a stall		E,K
Wing breaks to the right in a stall		F,L
Trailing edge flutter	N	J

Table 4.2-1: Wing Tuning Diagnostics

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Code	Description of Corrective Adjustments
A	Move hang block back (1/2" at a time)
B	Move hang block forward (1/2" at a time)
C	Increase camber on the last 2 cambered left tip ribs by 1/4", or decrease the same on right tip by 1/4"
D	Increase camber on the last 2 cambered right tip ribs by 1/4", or decrease the same on left by 1/4"
E	For a strong turn, increase the tension of the right leading edge pocket, or loosen the tension of the left leading edge pocket by inserting or removing shims respectively. See description below for inserting shims.
F	For a strong turn, increase the tension of the left leading edge pocket, or loosen the tension of the right leading edge pocket by inserting or removing shims respectively. See description below for inserting shims.
G	Loosen leading edge pocket on both sides by removing shims respectively. See description below for inserting shims.
H	Tighten leading edge pocket on both sides by inserting shims. See description below for inserting shims.
I	Loosen rib tension on both sides symmetrically except for #1 and the last 2 ribs
J	Tighten rib tension on both sides symmetrically starting at the tips
K	Tighten rib tension on the left side ribs #1 – 4
L	Tighten rib tension on the right side ribs #1 – 4
M	Loosen tension on ribs #2-4 on both sides to remove excess reflex from these ribs
N	Tighten rib tension in the locality of each problem area
O	Tighten the rigging tension of the cross bar restraining cable using the adjustable tangs on the rear shackle
P	Loosen the rigging tension of the cross bar restraining cable using the adjustable tangs on the rear shackle
Q	To correct a mild turn to the right, twist both left and right wing tips "counter" clockwise looking at the wing tip. Notice that even though you are twisting both wing tips "counter clockwise", the wing tip on each end moves in opposite directions because you are looking at it from opposite ends.
R	To correct a mild turn to the left, twist both left and right wing tips clockwise.

Table 4.2-2: Wing Corrective Adjustments

Descriptions of how to perform these adjustments is given in the following paragraphs. However, the amount of adjustment required is dependent upon the specific problem and varies from wing to wing. Therefore, it is important to make only one change at a time. Make a small change and then test the effect of those changes by flying the wing. It is best if these adjustments are made by someone with wing tuning experience since it takes practice and patience to tune a wing properly.

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Moving the Hang Point (Adjustments A and B):

The hang point is easily adjusted to any location within the acceptable range. See description in **Section 2.2 Weight and Loading**.

Changing Wing Camber (Adjustments C and D):

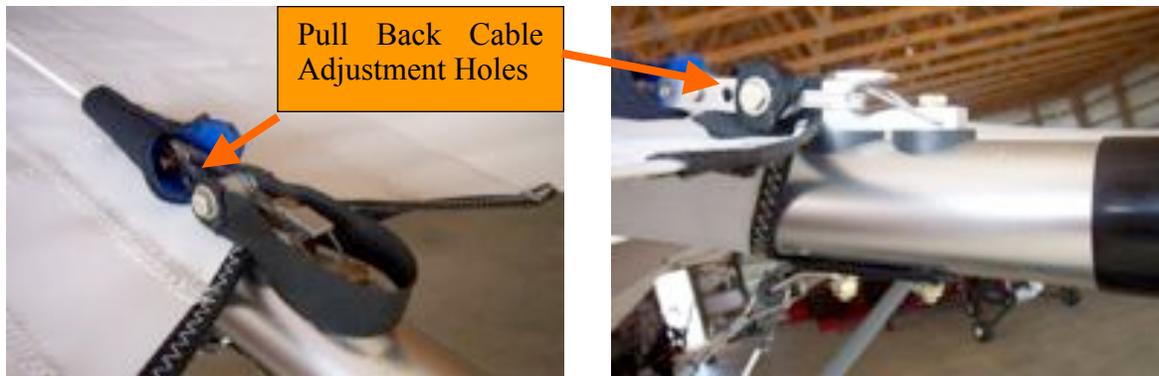
Changing wing camber is done by reshaping the ribs selectively. It is seldom if ever needed except in the case of wing damage due to impact. Since this is a very delicate task, this must be done by a North Wing dealer. Contact North Wing to find the nearest location to you where this can be done.

Rib Tension (Adjustments I, J, K, L, M, N):

Rib tension is easily adjusted in one of two ways. For slight adjustments, the leech lines holding the ribs in the pockets can be crossed and then re-attached. This will essentially make the loop distance shorter and put more tension on that rib. If even more tension is required, the knot in the leech line must be untied and re-tied at a short loop length.

Crossbar Rigging Tension (Adjustments O and P):

Rigging tension is adjusted using the pull back cable adjustment shackle as shown in the picture below. Wing must be removed from the trike and de-tensioned to do this adjustment.



Leading Edge Tension (Adjustment E,F,G, and H):

Adjusting the leading edge pocket tension on the MPulse II or GT5 wings requires inserting or removing shims in the leading edge under the trim tip using the following procedure.

1. Remove the last three ribs and de-tension the sail so it can be closed about 25 to 35%. This allows enough slack in the sail to remove it from the trim tip as described below. Note that a leading edge cannot be “loosened” if there are no shims in the side needing to be loosened.

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Leading Edge Tension Adjustment cont'd:



Step 2: Loosen both trim tip screws 4-5 full turns. Using the Philips screwdriver, “pop” the screws in with the heel of your hand to loosen the trim tip. (For more detail on how the trim tip works, see next section on **Wing Twist**.)



Step 3: Using the black strap attached to the sail, pull the yellow strap out of the groove in the trim tip. This may require removing the sail screw at the nose going into the leading edge so the sail can slide back to allow slack in the yellow strap.



Step 4: Slide the trim tip out of the end of the leading edge.



Step 5: Slip shim over the trim tip, and reinsert trim tip into leading edge. Shims range from 1/4” to 3/4”.



Step 6: Realign screws with marks on leading edge as it was when disassembled. Otherwise, wing twist will be changed as well as LE tension. Note! Tighten the screws 1-2 turns per side. Not



Step 7: Re-attach yellow strap into trim tip groove making sure strap is fully in groove.

Wing Twist (Adjustments Q and R):

Twisting the wing is done by loosening the wing trim tip and then simply twisting the sail at the tip by hand to a new position. The operation of the wing trim tip is described below. It is also helpful to review the description of “Inserting Shims” above since it shows how to release the trim tip so it can be turned.

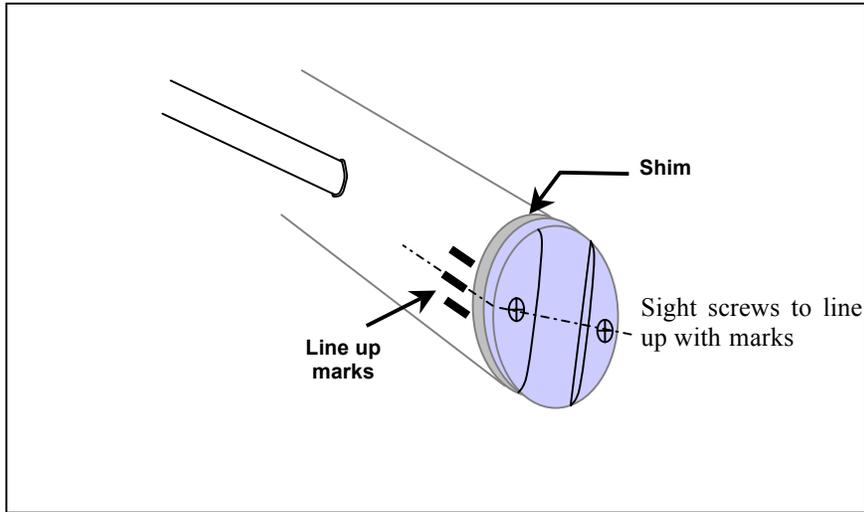


Figure 4.2-1: Wing Trim Tip End Cap Adjustment

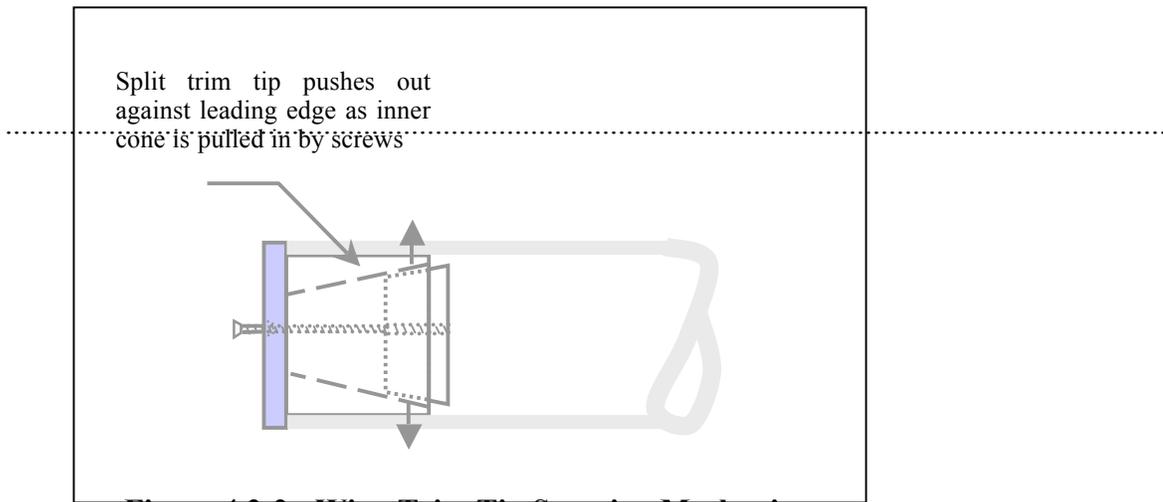


Figure 4.2-2: Wing Trim Tip Securing Mechanism

Sail Tears Less than 1” Long

Skill Level: *Owner or higher*

Tools: Scissors

Parts: Adhesive sail repair cloth from sail repair shop or aviation materials supplier

Task Description:

Sail tears up to 1” in length can be repaired using an adhesive sail repair cloth provided the tear is NOT within 1” of a seam or an edge of sail. Most sail color can be reasonably matched or coordinated. The patch should extend at least 1” in all directions from the tear.

Follow these steps:

1. Prepare the surface where the patch will be applied by washing it with a damp cloth and letting it dry thoroughly. If the patch area feels contaminated with any substance, try a mild detergent followed by thorough rinsing with clean water and drying. You can also use alcohol or acetone to clean the area.
2. Cut the patch material to the required size. Since this task is only approved for tears up to 1” long, the maximum patch size should be 2” wide by 3” long. Rounding the corners of the patch will reduce the tendency of the patch to peel off or snag on something.
3. Remove the backing from the patch and apply patch to torn area.
4. Using a smooth hard material as a backer board under the patch area, roll the patch with a small roller such as a wall paper seam roller.

The wing can be flown immediately after applying an adhesive patch.

Sail Tears Greater Than 1” Long

Skill Level: Factory Repair or North Wing Approved Sail Repair Shop

Tools: Not applicable

Materials: Dacron sail material in several colors

Task Description:

Sail tears longer than 1”, or tears that are within 1” of an edge or seam must be repaired by a certified sail repair shop or returned to North Wing for repair. In most cases, the sail must be removed from the frame and shipped to the sail repair shop. For instruction on sail removal, see Section 4.2.5.

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Sail Removal from Frame Mustang 3 / MP series (Recommended after 300 hours)

Skill Level: LSR-M, or A&P

Tools: Two 7/16" wrenches, one 9/16" wrench, Phillips screw driver, preferably a second person

Materials: None

Task Description:

The sail should be removed for inspection of the frame every 3 years or 300 hours, OR if the wing has experienced any type of hard impact e.g. hard landing or striking an object.

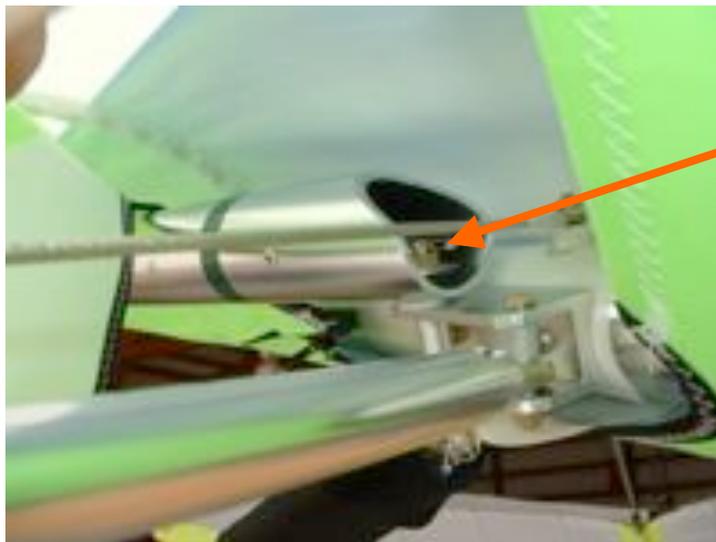
Prepare a clean area about 40' x 40' to remove the sail, preferably shielded from the wind. The wing should be protected from coming into direct contact with the ground using either cardboard, a large paint cloth, or a clean floor surface. Clean dry grass can be used, but be careful when moving the wing on the grass to avoid permanent stains. If it is not possible to avoid the wind, face the nose of the wing into the wind.

1. Remove the wing from the trike using the procedure described in the Owner's Manual.
2. Remove wing struts and ribs following the procedure shown in the Owner's manual as if you were going to put wing in bag for transporting.
3. Disconnect the nose wires from the swan hook and lay the wing flat on the ground with top of wing up. Pull the washout tubes out of their sockets and fold back toward the tips. Fold the sprogs back toward wing tips.
4. Bring wing tips together simultaneously (requires 2 people) or in 3-4 small stages (if only one person) being careful not to force them together. The tensioner cable must slide clear of the wing penetration hole when bringing the wing tips together. If the tensioner hardware catches on the sail, it can easily tear the sail causing significant damage.
5. Lift the nose and rest it on a raised surface, e.g. a saw horse as shown below.



Nose resting on elevated surface

6. Remove Philips screw holding sail in place at nose on each side located up near nose on leading edge.
7. Remove rear wires from keel tube noting order of washers and saddles.
8. Unzip crossbar/leading edge inspection zipper and remove crossbar attachment bolts on both sides. This requires using a box wrench or socket on the nut inside the crossbar end and a screw driver inserted in the strut attachment hole to keep the eye bolt from turning. (Note! There is no need to remove the sprog or the sprog-to-leading edge attachment bracket.)



Remove crossbar attachment bolt. Note sequence of washers and saddles.

9. Un-velcro the sail-to-keel tube restraint webbing in front of C.B. apex.
10. Slide sail toward rear slightly on both sides and open velcro straps that are holding yellow sail straps in place a couple inches from the wing tips. Lift yellow sail strap from groove in trim tip cap.



Velcro straps (white)

11. Pull the sail out and over the top of the leading edge and the outside of the entire frame as shown below.



Pull sail up and over top of frame on both sides

12. Bring wing tips together again being careful not to force them. If any resistance is encountered, stop and check that the sail is clear of all parts, especially the tensioner cable attachments.
13. Slowly slide the frame out the nose of the sail guiding the crossbars and sprogs as required to clear the sail openings.

If the sail is to be shipped to a repair site, it is recommended that the mylar inside the leading edge be removed. If this is the case, continue with the following steps.

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14. Remove the mylar from the leading edge by laying the sail flat on the ground with the leading edges laying straight and slowly and carefully pull the mylar out. If any resistance is encountered, stop and pull the leading edge of the sail flat and straight again. Having a second person slightly “fluff” the wing at the tip end as you pull the mylar out will help. Note the orientation of the mylar as it is removed so you will re-install it the same way.
15. Fold the sail first in half along the center line (keel tube pocket) with the top side out keeping the sail as flat as possible.

Replacing Sail on Frame

When replacing the sail on the frame, allow the same 40 foot clean working space preferably shielded from the wind.

1. If the mylar were removed for shipping, re-install it in leading edges first. Lay the wing on a clean surface with the top side up. Re-installing the mylar is reasonably easy to do if the leading edge pocket is laid “very” flat from nose to tip. This means the edges of the LE pockets cannot be folded over slightly or even bent a little, otherwise the mylar will buckle and bind as it is pushed in. Be sure the mylar is oriented properly with the relief cuts on the bottom side. Lay the mylar out straight on the ground aligned with the LE pocket that it will be going into. Slide the mylar into the LE “MYLAR POCKET” by grasping it on both edges and pushing it gently into the pocket. Note there is a separate pocket that runs parallel to the LE pocket for the mylar. It will go very easily for about three quarter of the way. To get it fully in place, it may require a second person pulling and working the tip end of the sail pocket to relieve and resistance the mylar encounters. The slightest curve or bend will create a significant amount of resistance and prohibit the mylar from easily sliding into place.

If it becomes impossible to replace the mylar using the above method, it will be necessary to use an 18ft light weight pole with a small peg on the end. Insert the peg in the hole at the tip end of the mylar and carefully push the mylar into the sail pocket.

2. Turn the sail over so the top side is now down and stretch it out fully from nose to tip but with the tips about 4 – 5 feet apart.
3. Lay the frame on the ground near the nose and oriented with the control frame up. Using a small cord or velcro strap to hold the tubes together on each side is helpful. The control frame and crossbars must be kept separate from the leading edges. The sprogs should be tied back so they are pointing toward the tips of the frame, not the nose.
4. With help from a second person, carefully slide the tips of the leading edges into their respective LE pockets until the sprogs reach their access zipper. Untie the sprogs and guide them out of the sail while continuing to push the frame on to the sail.

Leading Edge Replacement

Skill Level: LSR-M, or A&P

Tools Required: Two 7/16" and one 9/16" box or open end wrenches
Philips head screw driver

Materials: Replacement leading edges
AN4 Nylock nuts

Task Description:

Each leading edge has a rear section and nose section. Consequently, if damage to the leading edge occurs, it is important to determine if the damage is on the rear section or nose section, and on the right side or left side. The leading edges are color coded with green on the right and red on the left. Anytime the leading edge suffers a hit, both sections should be removed and inspected for any signs of dents, bends, or cracking including any signs of overstress or elongation around the bolt holes at the nose and the crossbar attachment points. The leading edge can be removed and replaced without removing the sail completely from the frame.

1. Perform Steps 1 – 5 described in Section 4.2.5, Sail Removal From Frame.
2. Remove the Philips screw from the damaged leading edge near the nose and save to re-install.
3. Pull the white velcro straps at the wing tips apart that hold the sail leading edge tight against the leading edge tube.
4. Pull the yellow sail retaining strap at the wing tip out of the trim cap groove using the loose black finger strap running parallel to the yellow strap but slight longer. Be sure the strap is pulled off the trim cap toward the front edge of the sail so the leading edge tube can be slid out without having to slide "through" the yellow strap.
5. Remove the trim cap following the instructions given in Section 4.2.2 on wing tuning. Be careful to note any shims that have been installed for proper re-assembly.
6. Unbolt the crossbar from the leading edge bracket noting the sequence of washers and saddle.
7. Unzip the mid-point sprog (long sprog) inspection zippers and fold the sprog back toward the wing tip to remove the tension from its support cable. Remove the front and rear LE attachment bolts (rear one attaches the sprog cable to the leading edge). This will require sliding a 7/16" open end wrench under the protective mylar wrapped around the leading edge to hold the head of the bolt. Note the sequence of washers on the cable attachment bolt. These are necessary to achieve the correct support of the sprog under load.



Remove front and rear LE attachment bolts.

Remove 2 bolts holding X-bar bracket to LE

8. Remove the two 1/4" bolts holding the attachment bracket for the sprocket and crossbar to the leading edge. Note how the mylar is wrapped so it can be properly re-installed. Leave the sprocket attached to the mounting bracket, and move the mounting bracket clear of the leading edge.
9. The rear leading edge section can now be removed by simply pulling it out through the wing tip being careful to fold the small sprocket inward as the leading edge is extracted.



Rear section of LE separating from front section

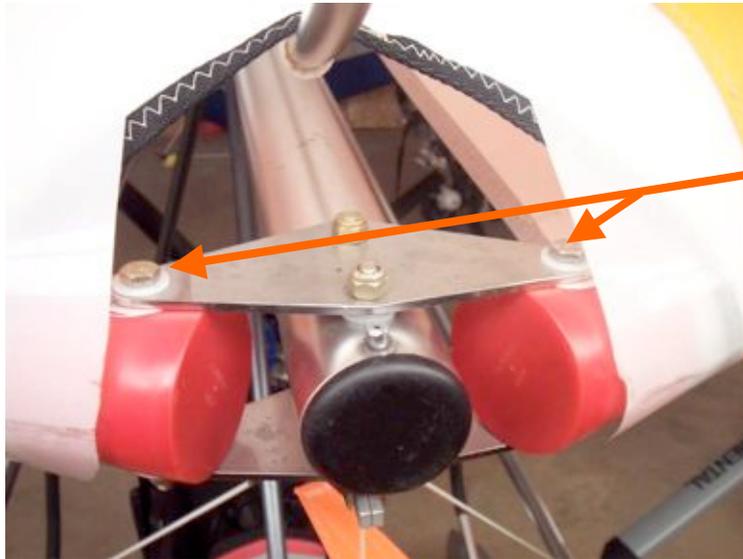
10. Once the rear LE section is removed, the rear sprocket assembly can be removed by pulling the sprocket out of its socket a sufficient distance to cut the bungee cord that pulls it in and then pushing the socket out of its hole in the leading edge.

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11. Attach a new bungee cord 24" long to the sprog socket and install the socket in its hole in the LE. Remove the tip cover from the sprog and feed the long bungee cord through the sprog. While pulling the bungee with significant tension through the sprog, tie a knot in the bungee at a point that holds the sprog against its socket when in place.

If it is certain that this is the only section that is damaged, the new rear section leading edge can be installed and the leading edge reassembled. If the nose section of the LE must be removed or inspected, continue as indicated below.

12. Remove the LE bolt from the nose plate.



Leading edge
nose plate
bolts

13. Slide the nose section out through the crossbar zipped opening in the sail.
14. Slide the rear section together with the nose section and check for any bends by rolling the assembled LE on a large flat surface and viewing down the tube while supported at several points on a flat surface.

Reassembly:

1. In general, when re-assembling, simply perform the above tasks in reverse order. A few notes may be helpful.
2. Be careful to align the rear section LE properly. With the wing upside down it is easy to get the sprogs facing the front of the LE instead of the back. It may not be obvious this has happened until later in the re-assembly and some re-work will be required.
3. You will probably not be able to get the sail screw near the nose back in place until the wing is completely re-assembled and tensioned. At that time, the grommet in the sail can be more easily twisted by hand to align with the screw hole in the LE. It is helpful to have a second person assist with this.

Keel Tube Replacement

Skill Level: LSR-M, or A&P

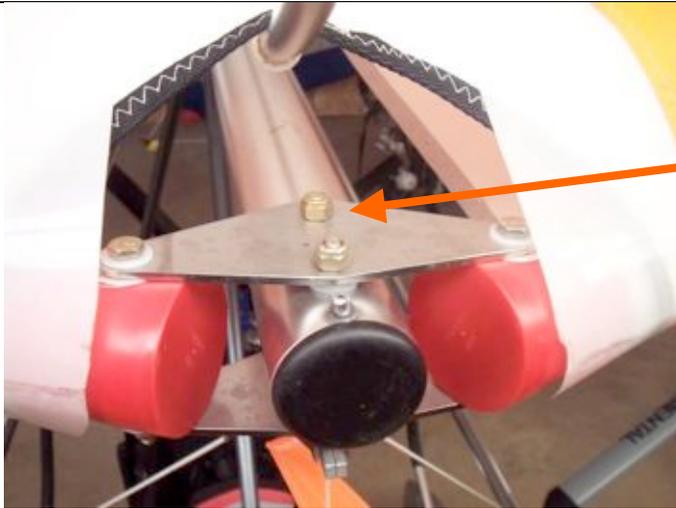
Tools Required: Two 7/16" box or open end wrenches
1/4" Hex wrench (Allen wrench)

Materials: Replacement keel tube
AN4 Nylock nuts

Task Description:

The keel tube can be removed and replaced without removing the sail or any other elements of the wing frame following the sequence outlined below:

1. Remove the wing from the trike using the procedure described in the Owner's Manual.
2. Remove wing struts and ribs following the procedure shown in the Owner's manual as if you were going to put wing in bag for transporting.
3. Disconnect the nose wires from the swan hook and lay the wing flat on the ground with top of wing up. Pull the washout tubes out of their sockets and fold back toward the tips. Fold the sprogs back toward wing tips.
4. Bring wing tips together simultaneously (requires 2 people) or in 3-4 small stages (if only one person) being careful not to force them together. The tensioner cable must slide clear of the wing penetration hole when bringing the wing tips together. If the tensioner hardware catches on the sail, it can easily tear the sail causing significant damage.
5. Roll the wing onto its back so the bottom of the wing is facing up. Spread the wing tips out until the wing is about one quarter open.
6. Remove rear cable assembly and tensioner hook assembly at the rear of the keel tube.
7. Remove both trike collars by removing both Allen bolts from the collar halves.
8. Remove the control frame apex block assembly.
9. Remove two 1/4" keel tube bolts from the nose plate. It may be helpful to slightly loosen the other bolts to slide the keel tube saddles and washers out easily. Note sequence of collars and washers for reassembly.



Keel tube bolts (2) on nose plate

10. Slide keel tube out of the nose plates toward the rear of the wing, then slide it out of the keel pocket forward.

Crossbar Replacement

Skill Level: LSR-M, or A&P

Tools Required: Two 7/16" box or open end wrenches

Materials:
Replacement crossbar
2 – Thin AN4 Nylock nuts
1 – Thin AN5 Nylock nut

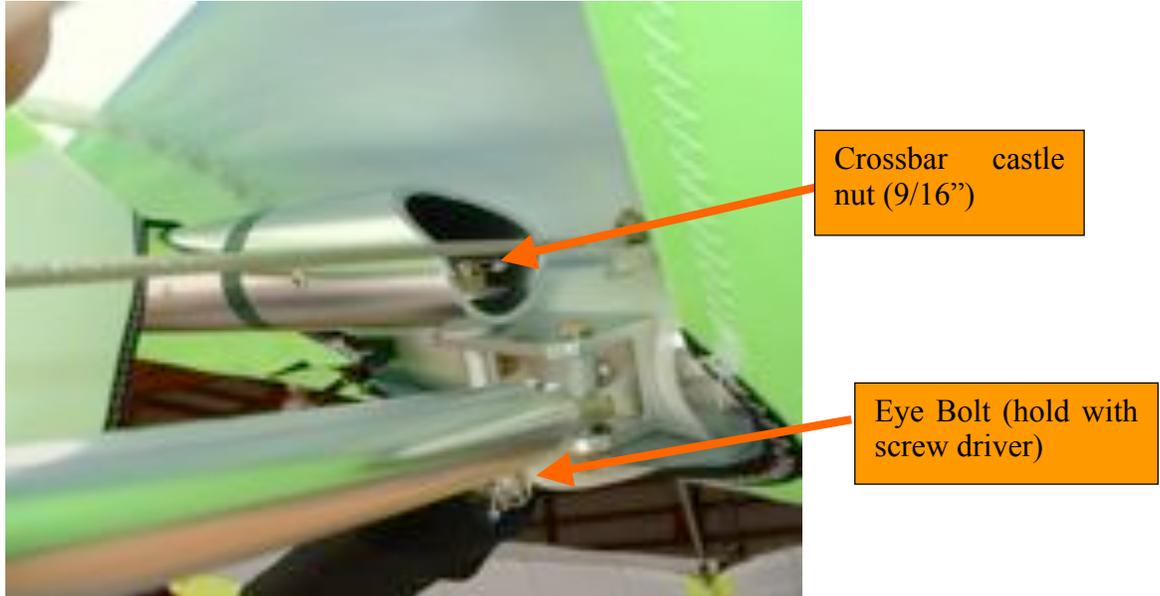
Task Description:

The crossbar can be removed and replaced without removing the sail or any other elements of the wing frame following the sequence outlined below:

1. Remove the wing from the trike using the procedure described in the Owner's Manual.
2. Remove wing struts and ribs following the procedure shown in the Owner's manual as if you were going to put wing in bag for transporting.
3. Disconnect the nose wires from the swan hook and lay the wing flat on the ground with top of wing up. Pull the washout tubes out of their sockets and fold back toward the tips. Fold the sprogs back toward wing tips.
4. Bring wing tips together simultaneously (requires 2 people) or in 3-4 small stages (if only one person) being careful not to force them together. The tensioner cable must slide clear of the wing penetration hole when bringing the wing tips together. If the tensioner hardware catches on the sail, it can easily tear the sail causing significant damage.
5. Roll the wing onto its back so the bottom of the wing is facing up. Spread the wing tips out until the wing is about one quarter open.

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6. Unbolt the damaged crossbar from the leading edge attachment by removing the castle nut on the inside of the tapered end of the crossbar using a 9/16" wrench with a screw driver to hold the eye bolt. Lift the crossbar off the bolt. Do not remove the bolt from the attachment bracket. Put the castle nut back on the bolt loosely until the new crossbar is attached.



7. Unbolt the crossbar from the crossbar center plate, and slide the crossbar free of the wing. To do this, it is necessary to slide a 7/16" wrench inside the crossbar to hold the nut from turning since the bolt does not go all the way through the cross bar.

Crossbar center plate
looking from back side



Crossbar center plate bolts
looking from front side



Re-assembly Note:

When re-assembling, remember to use a safety pin or ring on the castle nut on the crossbar attachment to the leading edge bracket.

Front and Rear Pitch Cables (Lower Rigging) Replacement

Skill Level: LSR-M, or A&P

Tools Required: Two 7/16" box or open end wrenches

Materials: Replacement cables
3 – 1/4" Thin Nylock nuts

Task Description:

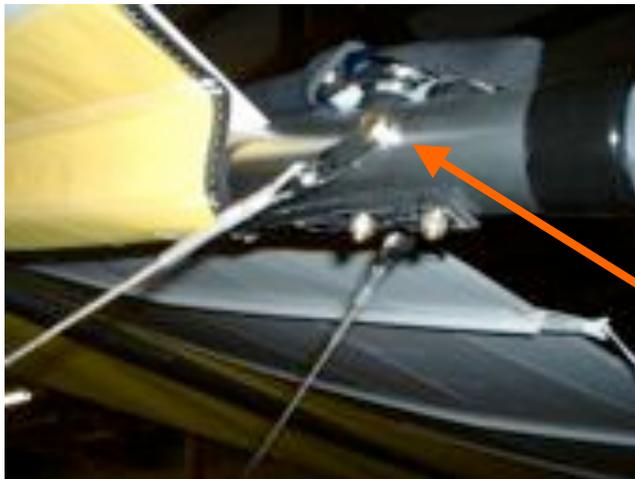
The front and rear pitch cables and mounting tangs come as two separate cable assemblies. Although they can be replaced separately if damaged, it is recommended both assemblies be replaced at the same time. These cables should be replaced every 400 hours of flight time or if any one of them becomes kinked or shows any sign of wear or abrasion.

1. Perform Steps 1-5 in Section 4.2.2, Sail Removal.
2. With the wing lying on its top side and the control frame folded "back" toward the rear of the wing, remove the cable attachment bolt (1) in each down tube and discard the bolt and nut.



Lower front and rear cables attachment to downtube

3. Remove cable attachment bolt at rear of keel tube. This is one of the two bolts that retain the tensioner hook to the keel tube. Inspect the bolt and replace bolt and nut if any signs of wear on the bolt.



Rear lower cables & tangs attached to keel tube

4. Replace the rear cable tang on the new nut and re-assemble at the keel tube and down tube attachment points. Tighten bolts to “SNUG” per torqueing discussion.

Replacing Wing Fittings and Hardware

Skill Level: LSR-M, or A&P

Tools Required: Two 7/16” box or open end wrenches

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Materials: Replacement Fittings and Hardware

Task Description:

Wing fittings and hardware include the following items:

- Nose plates
- Cross bar plates
- Crossbar to leading edge attachment hardware
- Sprog attachment hardware
- Front swan hook attachment
- Pull back cable attachment hardware

In all cases replacement of this hardware requires the removal of the wing from the trike. The common element among these items is that they all attach to the tubing and care must be taken to avoid over tightening bolts and thereby crushing or distorting the tubing excessively.

1. Remove wing ribs
2. Spread wing on clean floor or ground surface upside down.
3. Open wing zipper or nose cone to expose part to be replaced.
4. Remove safety wire and bolts securing hardware to wing tubes taking particular care to note the sequence of washers, saddles, and nut positions.
5. Replace the worn or damaged part checking the holes in the tubing at the same time for wear or fatigue cracks.
6. Replace the bolts and nylock nuts with new ones if there is any sign of wear or the nylock has been used more than 3 times.
7. Tighten the bolts to SNUG making sure the tubing is not distorted excessively which would weaken the tube.

15. Wing Retirement

With proper care and maintenance, the MUSTANG 3-15 will remain for some years at a high level of airworthiness. Each MUSTANG 3-15 has a patch sewn into the sail at the top center for UV testing. Simply cut out the panel and have a test performed.

There is much that we still don't know about trike wing longevity; such as what exactly is the effective lifetime of a trike wing before material fatigue and degradation compromise the airworthiness of that wing. We do know that there are forces in nature which can severely compromise the airworthiness of that wing, regardless of the quality of design or condition of the wing you are operating. Your safety is ultimately your own responsibility.

However, there is one subject in particular which needs to be addressed at this point--and this is wing retirement. There comes a time when the sail of any trike wing simply becomes too suspect to feel safe while flying it. Ultraviolet degradation will inevitably dictate the retirement of your wing. Judging when this occurs to your wing is best verified by an authorized service center.

All of us, as responsible and caring human beings, owe it to one another to do the responsible thing and remove any over-used equipment from the skies. We at North Wing abhor those whose method of dealing with a wing due for retirement consists of simply passing their problem along to an unsuspecting pilot in the used wing market place. The mature thing to do, at the appropriate time, is to destroy very old gliders to ensure that they cannot endanger an unknowing pilot.

Along these same lines, because wings do change hands, we feel that it is quite important to keep accurate records of tuning changes, and especially of repairs, in the maintenance log of this manual. Please consider the needs and safety of those other pilots down the road who may stand to gain from these records.

16. Limitation of Liability

The owner and operator of this trike wing 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. Practiced even under the best circumstances, trike flying is a high-risk sport. By purchasing this wing, the owner and operator of this Trike wing assumes complete responsibility for their use of this equipment, and specifically, agrees to release North Wing and/or their agents, from any and all liability.

17. Technical Specifications/ Compliance Verification Sheet

Wing Model: MUSTANG 3-15

Manufactured by: North Wing Design

Note: These specifications are intended only as a guideline for determining whether or not a given wing conforms to current production specifications, and whether it is in a configuration as originally designed.

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 is in the same configuration in which it was designed, or has those performance, stability, and structural characteristics required by the compliance standards.

SPECIFICATIONS

Glider, Weight, without cover bags	120 Lbs.
Leading Edge tube	
A. Distance from the nose plate anchor hole to:	
1. Cross tube attachment hole	122.5"
2. Rear most sail attachment point	212" +/- .50"
B. Outside Diameter at:	
1. Nose	2.375"
2. Cross tube	2.5"
3. Rear sail attachment point	2.25"
Cross tube	
A. "Pin to Pin"	110.5" +/- .25"
B. Outside diameter	2.5"
Keel tube - least and greatest distance from Front of keel:	
A. Cross tube Hinge pin plates (Must be resting on keel)	43" +/- 1.5"
B. Trike hang point (for front of keel)	54" +/- 1.5"
Sail chord length	
A. 3' from root	76"
B. 3' from tip	40.00"
Total span	31.5' +/- 2"
Placard and test flight sticker location:	On Left X-Bar
Weight range for wing (Minimum / Gross)	725 / 1060 lbs.

