

# Assembling Your Ball Link Control System.

Your ball link control system has been carefully engineered. It offers many advantages over conventional control systems:

- 1) It allows free movement with a minimum of play
- 2) It combines great strength with light weight.
- 3) It provides easy assembly (no solder joints are required).
- 4) It's easy to adjust.

## Making the Pushrods

1) With the bellcrank, flap horn, and elevator horn all positioned at neutral measure the distance between the holes where each pushrod will mount. For the flap pushrod measure the distance between the hole in the bellcrank and the hole in the flap horn. For the elevator pushrod measure the distance between the hole in the flap horn and the hole in the elevator horn. These are very important measurements. Be sure everything is at neutral and double check your measurements.

2) The measured distance will be the finished length of the pushrod assembly (carbon-fiber tube, threaded ends, and ball links). Determine the length of each carbon-fiber tube by subtracting 2 5/8 (2.625) inches from the measured distance. (This will provide a pushrod assembly with nominal thread engagement of 1/2-inch in each ball link and 1/8-inch of adjustment in either direction for each ball link). See Photo below.

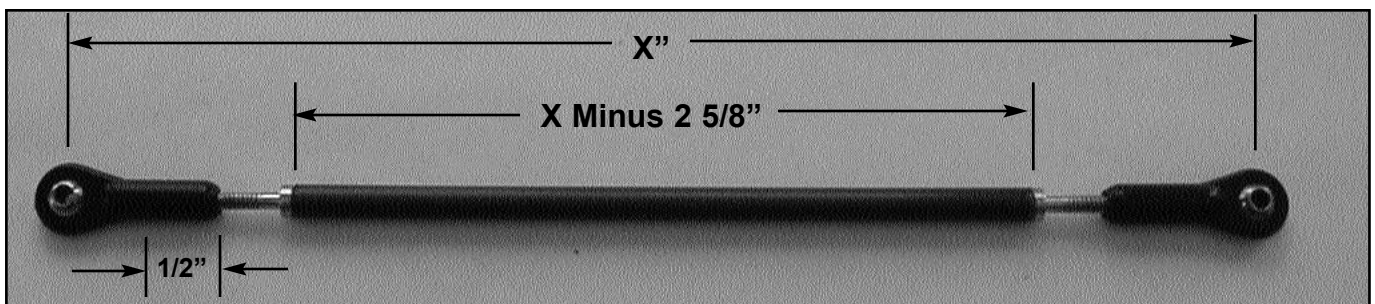
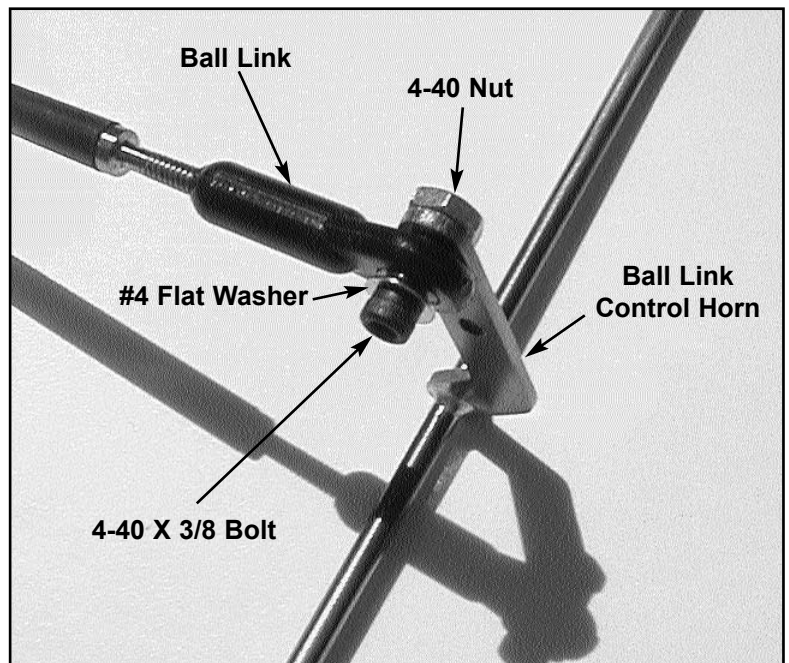
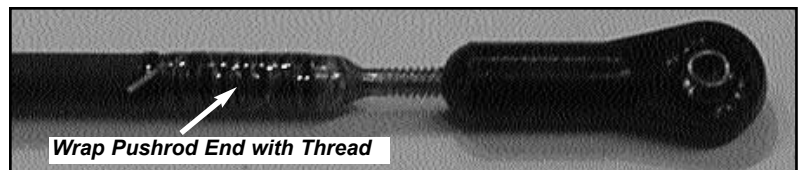
3) Cut the carbon-fiber tubes (a razor saw works well for this). Be careful not to split the ends. Make the saw cut slightly long and then sand the tube to make the ends square and exactly the right length. (Sanding the ends square makes a

tight fit for the threaded ends).

4) Prepare the threaded ends and carbon-fiber tubes for gluing by cleaning them carefully with acetone, lacquer thinner or alcohol.

5) Use J.B.Weld epoxy (available at most hardware stores) to glue the threaded ends into the carbon-fiber tubes. Don't use JB Weld Quick. Wipe off any excess J. B. Weld. With epoxy on them, the threaded ends act like little pistons in a cylinder. When you push them into the carbon fiber rod, air pressure wants to push them back out. Place the pushrods between building weights to keep the ends in place while the J.B Weld dries (24 hours).

6) Clean and lightly sand the ends of the pushrods around the joint with the threaded inserts. Apply a light coat of epoxy around the joint and about 3/4" of the pushrod end. Wrap strong thread around the insert and the pushrod to insure the pushrod won't split and to give an external lock on the insert (see photo).



## Assembling the Control System

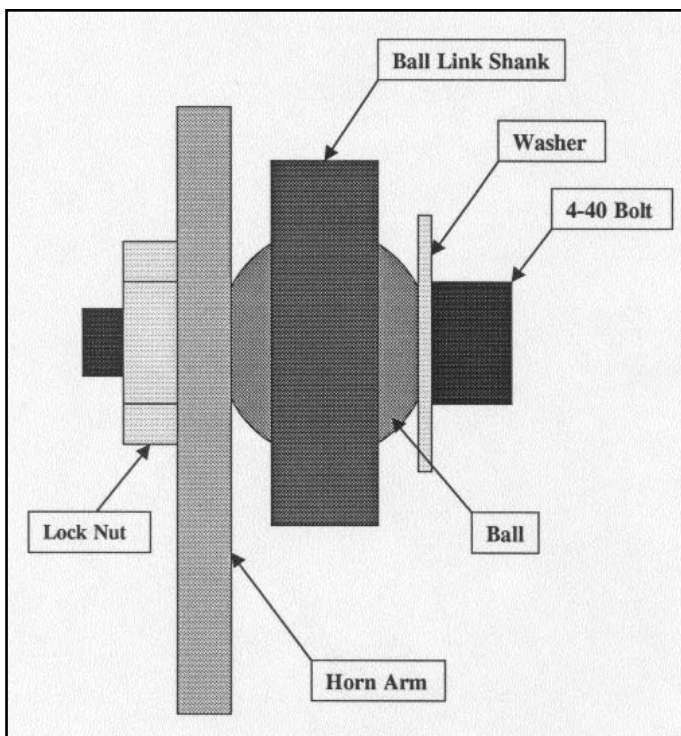
1) Thread the ball links provided (Rocket City #87 or #57) onto the pushrod ends so that 1/2-inch of pushrod threads is inserted into each ball link. (The distance between the ball link centers should now be the distance you measured for the pushrod). Each ball link can be adjusted 1/8-inch (five full turns) in either direction while maintaining a minimum of 3/8-inch thread insertion. Note that no thread locker (either a lock nut or Loctite) is required since the threads in the barrel of the ball link are very tight.

2) Assemble the pushrods to the bellcrank and horn arms in accordance with the drawing below. Check for proper alignment of the system. With the flap horn at neutral both the bellcrank and elevator horn should be at neutral. (Tip — this is easier to see if you slide a straight 12-inch piece of brass tubing over the horn arms). Adjust the ball links until proper alignment is achieved (disassembly is required to turn the ball links). Remember to maintain at least 3/8-inch thread insertion in each ball link.

3) When the pushrods have been adjusted to the proper length you're ready for final assembly:

4) Mounting ball link to horn.

a) First put the washer and ball link onto the 4-40 bolt. Thread the bolt into the threads in the horn arm. Put a drop of Loctite 271 (red) on the threads of the bolt where it comes through the horn arm. Work the bolt back and forth until Loctite is in the threads of the horn. Tighten the 4-40 bolt and wipe off any excess Loctite. Make sure that no Loctite is on the ball part



of the ball link. Don't go crazy and over-tighten the bolt — there is only 1/16-inch of threads in the horn arm..

b) Finally, install the lock nut. This can be a plain 4-40 hex nut. If you want extra security use a nylon-insert lock nut. In either case use a drop of Loctite 271 and work it into the threads. Tighten the nut with a wrench and you're done. Again wipe off any excess Loctite. After the Loctite sets up (1/2-hour, 24 hours for full strength) you will have an assembly that will never come loose. It can be disassembled, but only with great difficulty.

5) Mounting ball link to bellcrank.

a) Ball links are normally mounted to the bellcrank arm the same as to the horn arm (ball directly against the arm). However, if your flap pushrod makes a steep angle with the horizontal, you may need a conical standoff between the ball and the bellcrank to provide clearance. Don't use a standoff unless it's needed to prevent the shank of the ball link from hitting the bellcrank arm.

b) If your bellcrank is threaded, a plain 4-40 nut can be used as a lock nut. If it is not threaded, a nylon-insert lock nut is recommended. In either case use Loctite 271 as was done on the horn arms.

## Notes

1) It's important to use J.B.Weld epoxy to assemble the pushrods. Substitutes are not recommended.

2) It's also important to use Loctite 271 threadlocker when assembling your control system. This ensures that your system will never come apart.

3) Don't forget the washer when mounting your ball links. This ensures that the shank cannot jump off the ball under load.

4) If extra space is needed (like in a narrow tail section) the width of the assembly can be reduced by using a button-head cap screw instead of a regular socket-head cap screw.

