X-Cell Furion 450
Assembly Manual
Version 1.1
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Revisions to this Manual

R1.0

- **07/01/08 –** Initial Release

R1.1

- **07/05/08 –** 3B.1.a added note
  4A.5.c changed part #130-076 to the correct #130-074
  4A.5.g changed part #130-016 to the correct #130-070
  4A.7.j-k changed part #130-150 to the correct #130-030
- **07/12/08** - IV.C added warning about throttle reversing
  4A.1.d added warning about t/r belt routing
- **08/10/08** - 4A.2.f-h renumbered part #130-450 to #130-460

For the most current version of this manual, please refer to www.miniatureaircraftusa.com, visit the Furion helicopter kit and download the assembly manual

Errata

R1.0

- The finish on some metal parts and fasteners in the production kit may differ from that shown in this manual. This will not result in any change to the assembly process
- Some square head socket bolts shown in the manual were replaced with button head socket bolts in the production kit. The threaded dimensions are identical.

I. Kit Introduction

R/C Helicopter Safety

A radio controlled model helicopter is a technically complex device that must be built and operated with care. It is also a fascinating and challenging part of the R/C sport, the mastery of which is very rewarding.

A model helicopter must be built exactly in accordance with the building instructions. The kit manufacturer has spent much time and effort refining his product to make it reliable in operation and easy to build. The essentially bolt together construction can proceed quite rapidly, giving the builder a strong sense of accomplishment that encourages hasty progress from one construction phase to the next, so that the completed model can be more quickly seen and enjoyed. It is essential to recognize and guard against this tendency. Follow building instructions exactly. Vibration and stress levels are high and all fasteners and attachments must be secure for safe operation.

Note that this is the first use of the word SAFETY in these comments. Previously the kit manufacturer's efforts to ensure reliable operation were mentioned. That is ALL that he can do. Safe operation is the responsibility of the builder/flyer and starts with careful construction and continues with selection and installation of reliable radio equipment and engine.

The need for safety is nowhere greater than at the flying field. A number of guidelines for safe flight have been developed by experienced flyers and are set down here. It is urged that they be read, understood and followed.

Guidelines for Safe R/C Helicopter Flight

- Fly only at approved flying fields and obey field regulations.
- Follow frequency control procedures. Interference can be dangerous to all.
- Know your radio. Check all transmitter functions before each flight.
- Be aware that rotating blades are very dangerous and can cause serious injury.
- Never fly near or above spectators or other modelers.
- If a beginner, get help trimming the model first and flight training later.
- Don't "track" the main blades by holding the tail boom. This is a temptation to builders who cannot hover yet and is very dangerous.
- Follow all recommended maintenance procedures for model, radio and engine.

WARNING!

This helicopter is not a toy, but a complex flying machine that must be assembled with care by a responsible individual. Failure to exert care in assembly, or radio or accessory installation, may result in a model incapable of safe flight or ground operation. Rotating components are an ever present danger and source of injury to operators and spectators. Since the manufacturer and his agents have no control over the proper assembly and operation of his products, no responsibility or liability can be assumed for their use.

X-CELL Limited Warranty

The warranty covers defects in material or workmanship or missing components to the original purchaser for 30 days from the date of purchase. Miniature Aircraft, USA will replace or repair, at our discretion, the defective or missing component. Defective components must be returned to us prior to replacement.

Any part, which has been improperly installed, abused, crash damaged or altered by unauthorized agencies, is not covered. Under no circumstances will the buyer be entitled to consequential or incidental damages. The components used in this kit are made form special materials designed for special applications and design strengths. We recommend that all replacement parts be original parts manufactured by Miniature Aircraft, USA, to ensure proper and safe operation of your model. Any part used which was manufactured by any firm other than Miniature Aircraft, USA, VOIDS all warrantees of this product by Miniature Aircraft, USA.

Warranty Procedures

Mail all warranty information within 15 days of original purchase date. If service is required, send the component in question (if not missing) together with a photocopy of your bill of sale and an accurate description of the problem and part. Ship components fully insured and prepaid. Miniature Aircraft, USA is not responsible for any shipping damages. We will, at our discretion, notify you of any costs involved, or ship it COD. You are required to pay all postage, shipping and insurance charges.

X-Cell Furion 450 Warranty Registration

Please print or type, filling in the information listed below and mail immediately

Model No:_____ Serial No:_____ Price paid:_____

Owners name:_____ Age_____

Address:_____ Phone:_____

City:_____ State:_____ Zip:_____

Purchased from: _____

Dealer's address _____

Comments: _____

_____

_____

_____

_____

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II. Kit Prerequisites

In order to assemble this kit, you will need a number of additional supplies and tools to ensure the best final result. They are as follows:

Supplies Needed for Assembly

Blue Thread Lock

Green Thread Lock

Oil

Grease

Adhesives Used

Slow Cyanoacrylate

Tools Needed for Assembly

1.5mm allen driver
2.5mm allen driver
M5 Nut Driver

Needle Nose Pliers
Flat Screwdriver 2.5mm
Phillips Screwdriver #0
Phillips Screwdriver #1

Ball Link Pliers

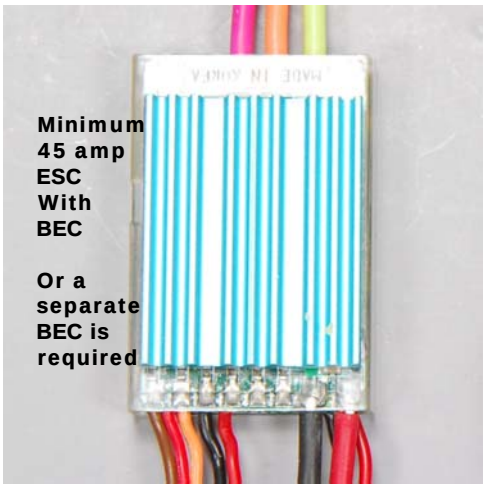
Additional Components Needed (as shown or compatible)

Gyro Servo
1 each

Cyclic
Servos
3 each

Battery
LiPo 2500 mah
3S1P

Receiver



Minimum 45 amp ESC With BEC

Or a separate BEC is required

Motor

Rotor Blades
SAB 320-325mm

Paddle / Pitch gauge tools

Documentation

The most recent version of all of the documentation can be found on the website:

www.miniatureaircraftusa.com

III. Kit Assembly Process

Assembly Tips

1. Please note that this assembly manual consists of a photographic journal of the steps necessary to construct this helicopter. The builder is encouraged to pay close attention to the "building notes" and other details noted in the pictures and to carefully review all the photo's in a given step. The placement of a given part may be better understood when viewing another view of the assembly.
2. Follow the order of assembly. The instructions have been organized into major sections and have been developed in such a way that each step builds upon the work done in the previous step. Changing the order of assembly may result in unnecessary steps
3. The photos in this manual are organized within each step to correspond with the order of assembly. The sequence of the photos within a step is from top to bottom and from left to right.
4. Clean all metal parts: All of the steel parts in this kit are coated with a lubricant to prevent them from rusting. This coating can interfere with the adhesives and thread locks needed for assembly. Use a solvent such as alcohol or acetone to clean the various metal parts, especially threads
5. Use only the formula of thread lock as indicated. Model helicopters are subject to vibration and failing to use the correct formula of thread lock on any non-locking assembly may result in a part becoming loose or falling off.
6. Sand sharp edges on any frame plate that Velcro® or wires may rub against to prevent them from being damaged over time by vibration
7. Make sure every bearing runs smoothly after component assembly. If it does not find out why. A rough running bearing will fail prematurely.
8. **As a general rule any bolt that threads into a metal part should have thread lock applied and any screw or bolt that threads into a plastic part should have thick (ONLY) Cyanoacrylate adhesive applied**
9. Assembly sections contain the following content:
    a. The contents of each bag
    b. An overview of part relationships
    c. Assembly overview
10. Photographs will contain assembly icons that indicate use of thread lock, adhesive or lubricant as needed. If an assembly has more than one of the same part number, application of thread lock, adhesive or lubricant will apply to all of the same numbered parts in that photograph Examples of the icons are as follows:

Thick Adhesive

Blue Thread Lock

Green Thread Lock

Lubricant

Grease

Fastener Guide

This page contains a list of all of the threaded fasteners in this kit. They will print at actual size. If it is not clear what the part number of a fastener is, simply find the fastener on the chart and match its part number and description

Fasteners – Threaded Bolts, Washers, Nuts, Screws

Part #	Description
130-002	m2 Washer
130-004	m2 x .150" x .020" Shim Washer
130-006	m2.5 Washer
130-008	m3 Washer
130-010	m2 Hex Nut
130-012	m3 Locknuts
130-014	m2 x 3 Phillips Flat Head Bolt
130-016	m2 x 4 Phillips Flat Head
130-019	m2 x 6 mm Phillips Tapered Head Bolt
130-020	m2 x 8.00 Phillips Tapered Head Bolt
130-022	m2 x 8.50 Phillips Tapered Head Bolt
130-024	m2 x 3 Phillips Self-Tapping Screw
130-025	m2.2 x 6 Phillips Self-Tapping "Flat Head" Screw
130-028	m2 x 13 Phillips Self-Tapping Screw
130-030	m2 x 8 Shouldered Bolt
130-032	m3 x 3 Socket Set Screw
130-035	m2 x 4 Socket Bolt
130-037	m2 x 6 Socket Bolt
130-038	m2 x 8 Socket Bolt
130-040	m2 x 10 Socket Bolt
130-041	m2 x 12 Socket Bolt
130-044	m2.5 x 6 Socket Bolt
130-046	m3 x 8 Socket Bolt
130-049	m3 x 14 Socket Bolt
130-153	Machined Washout Link Screw

Actual Size

Assembly Components – Unbagged Parts

Decals

Building Notes – These parts will be found in the kit box. They are not part of a parts bag.

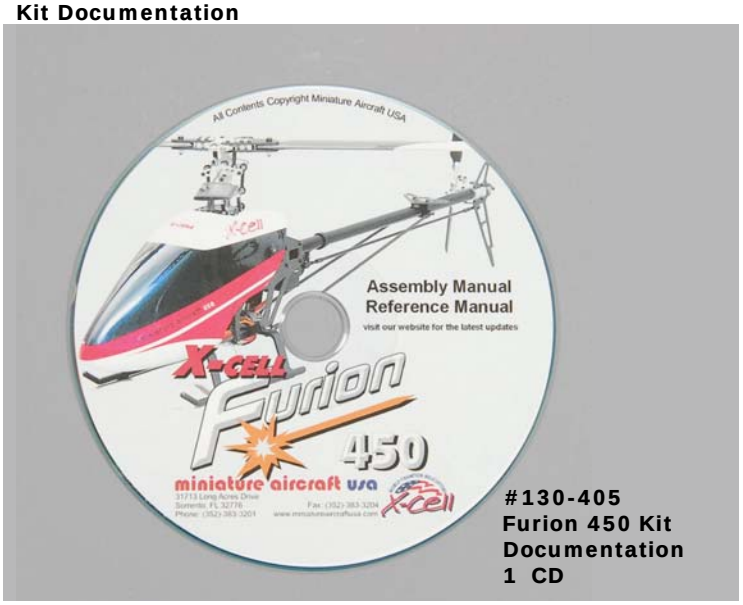
#130-253
Furion 450
Decal Sheet
1 each

Canopy

#130-251
Furion 450
Canopy
1 each

#130-252
Furion 450
Windshield
1 each

Kit Documentation



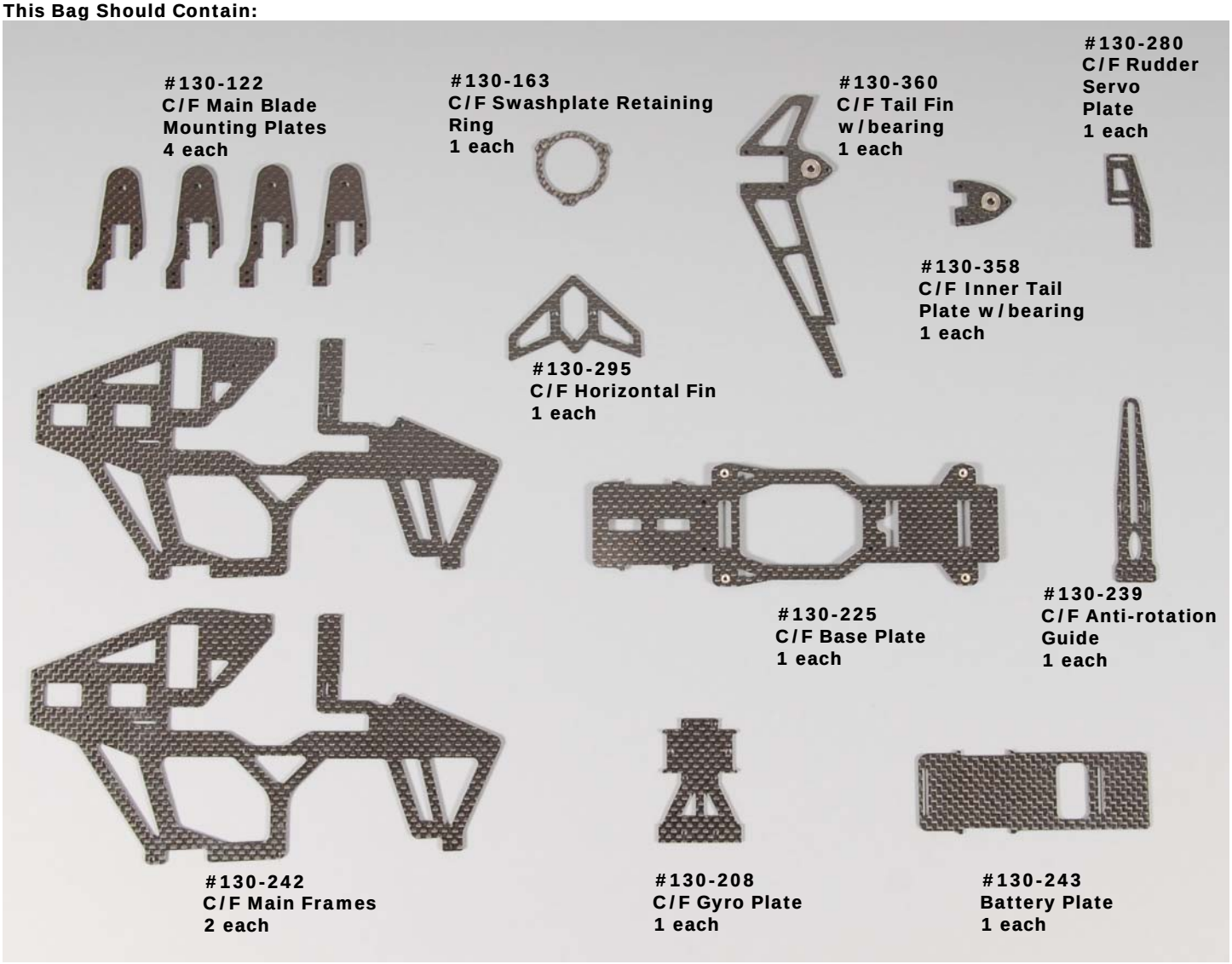
#130-405
Furion 450 Kit
Documentation
1 CD

#130-400
Foam Blade
Guard
1 each

Locate Carbon Fiber Parts Bag

Carbon Fiber Parts - Bag #1

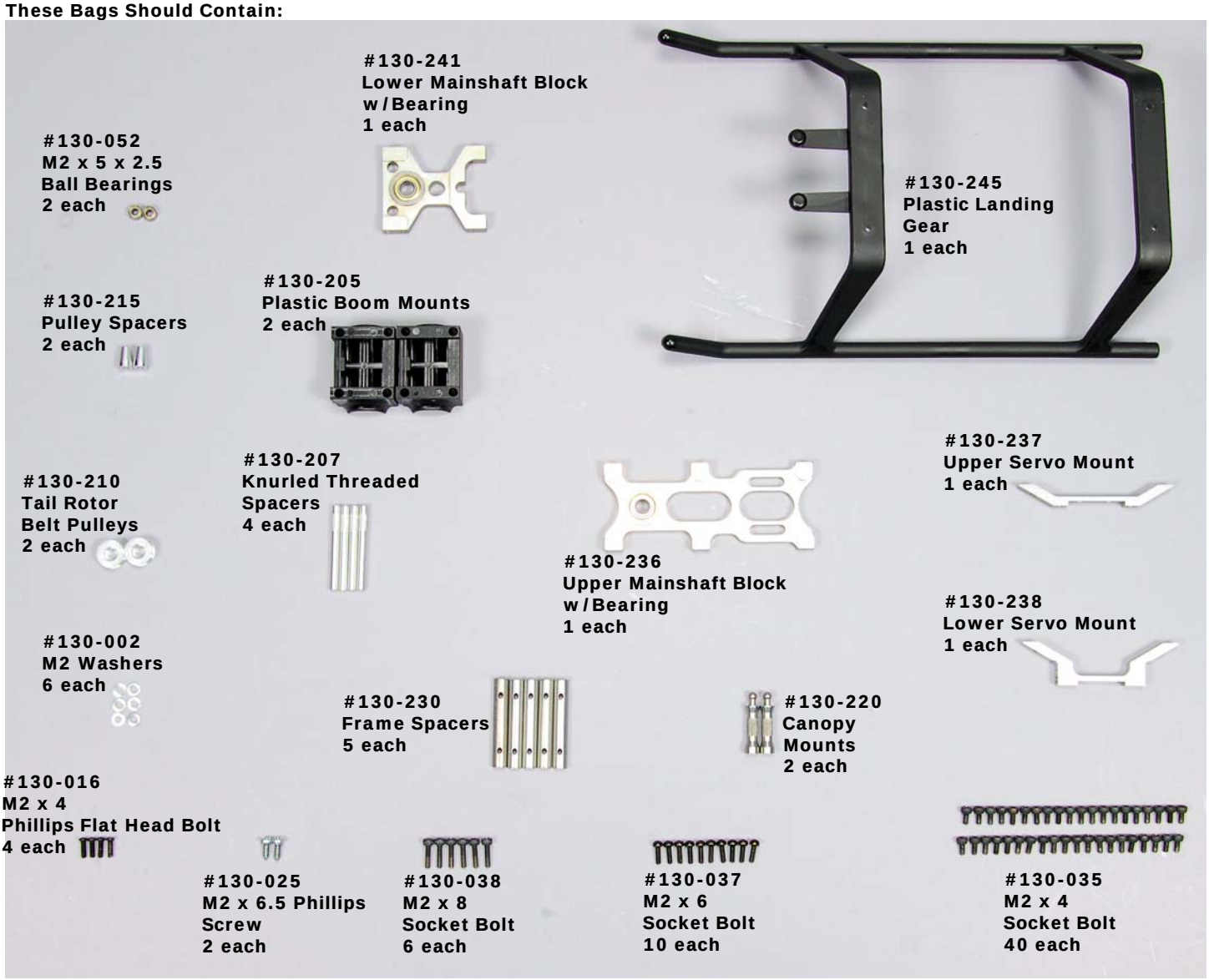
This Bag Should Contain:



Assembly Step #1 – Chassis

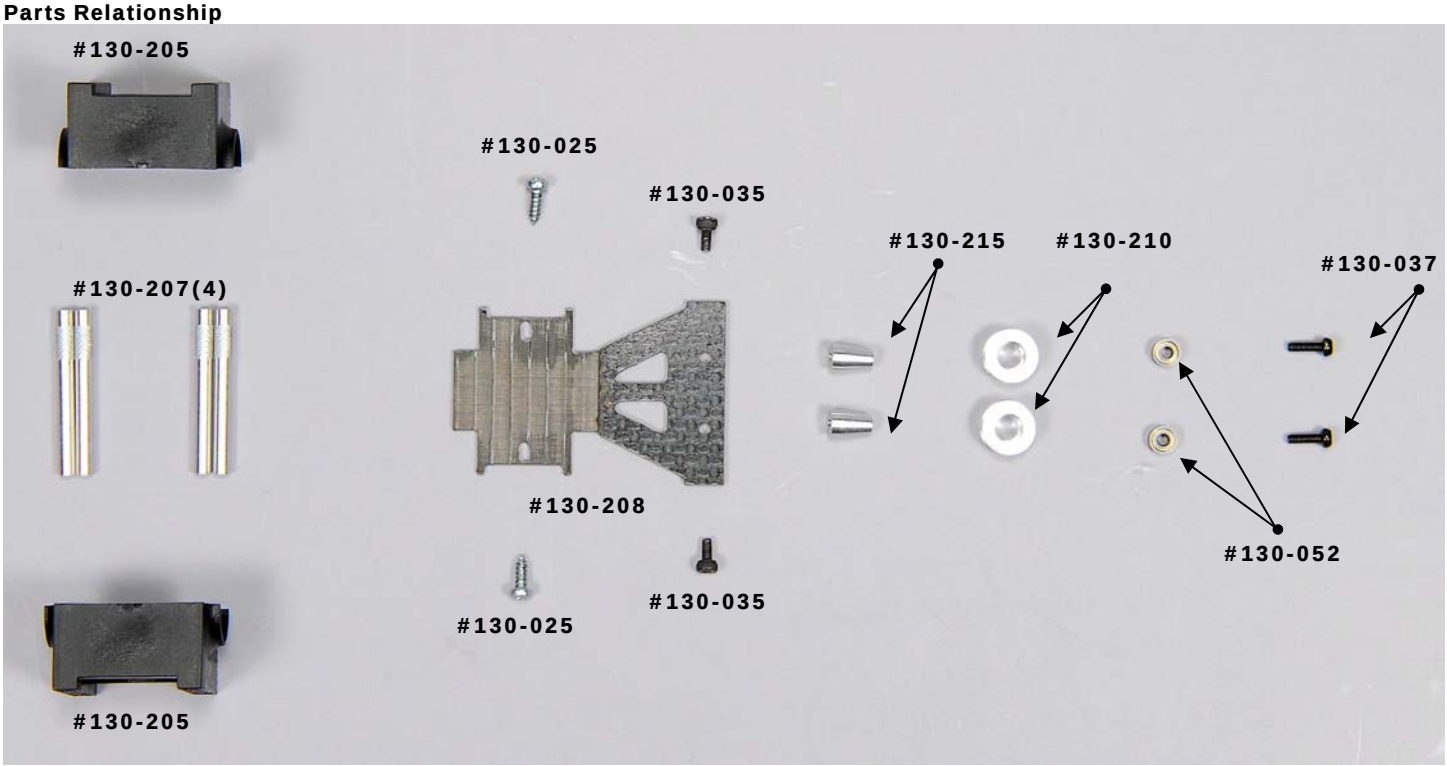
1A) Frame Components - Bags #2A, #2B, #2 Hardware

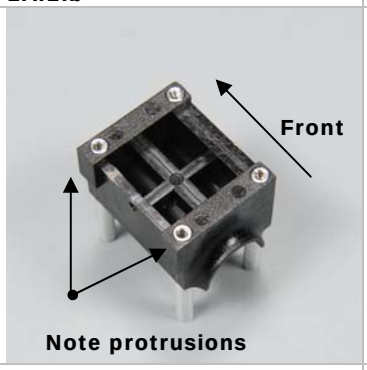
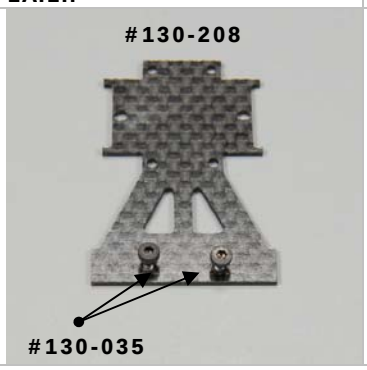
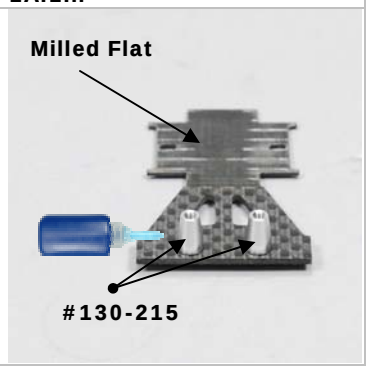
These Bags Should Contain:



1A.1 - Assemble Tail Boom Clamp/Pulleys

Parts Relationship



1A.1.a	1A.1.b	1A.1.c	1A.1.d
			
1A.1.e	**1A.1.f**	**1A.1.g**	**1A.1.h**
Building Notes: Don't push the two halves completely together, leave a small gap as the tail boom will be inserted into this later Note the location of the protrusions on the blocks		**Building Notes:** Note when building the gyro plate that one side has a milled section on it. The pulleys mount on the side of the plate with the milled flat.	

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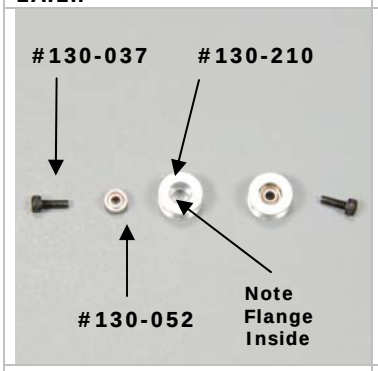
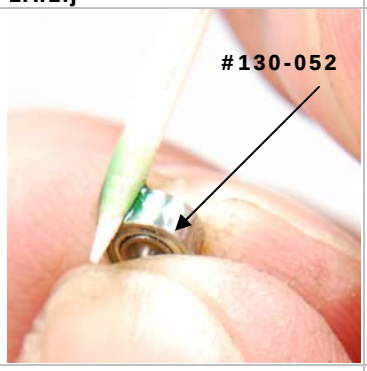


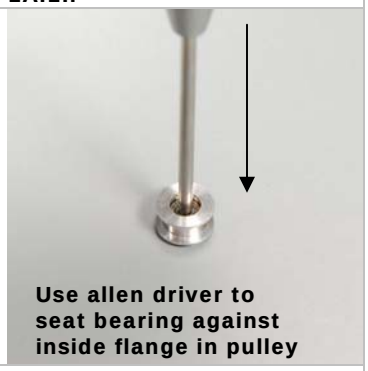
1A.1.j



1A.1.k

Building Notes:
Apply a thin coat of green thread lock on the bearings using a toothpick. Place a drop of thread lock on the end of the toothpick and then smear it around the bearings. Wipe away any excess and be careful not to get any in the bearing

1A.1.l



1A.1.m

Building Notes:
Note that each pulley has a flanged side.

Use an allen driver to push a bearing into each pulley and seat against the flange

Set aside allow the thread lock to dry before installing the pulleys.

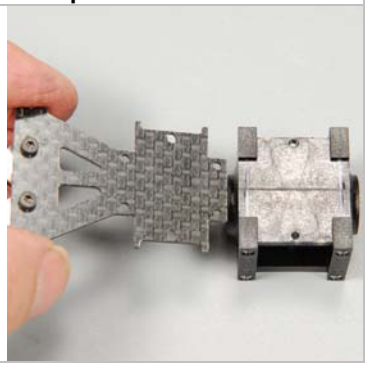
1A.1.n

1A.1.o

Building Notes:
Do not over tighten bolts. Make sure pulleys spin freely

Be careful not to get any thread lock in the bearings.

1A.1.p



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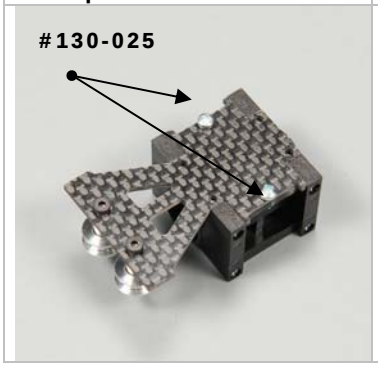
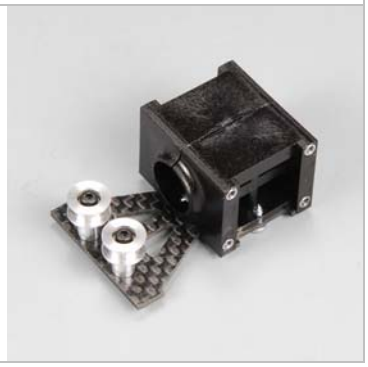
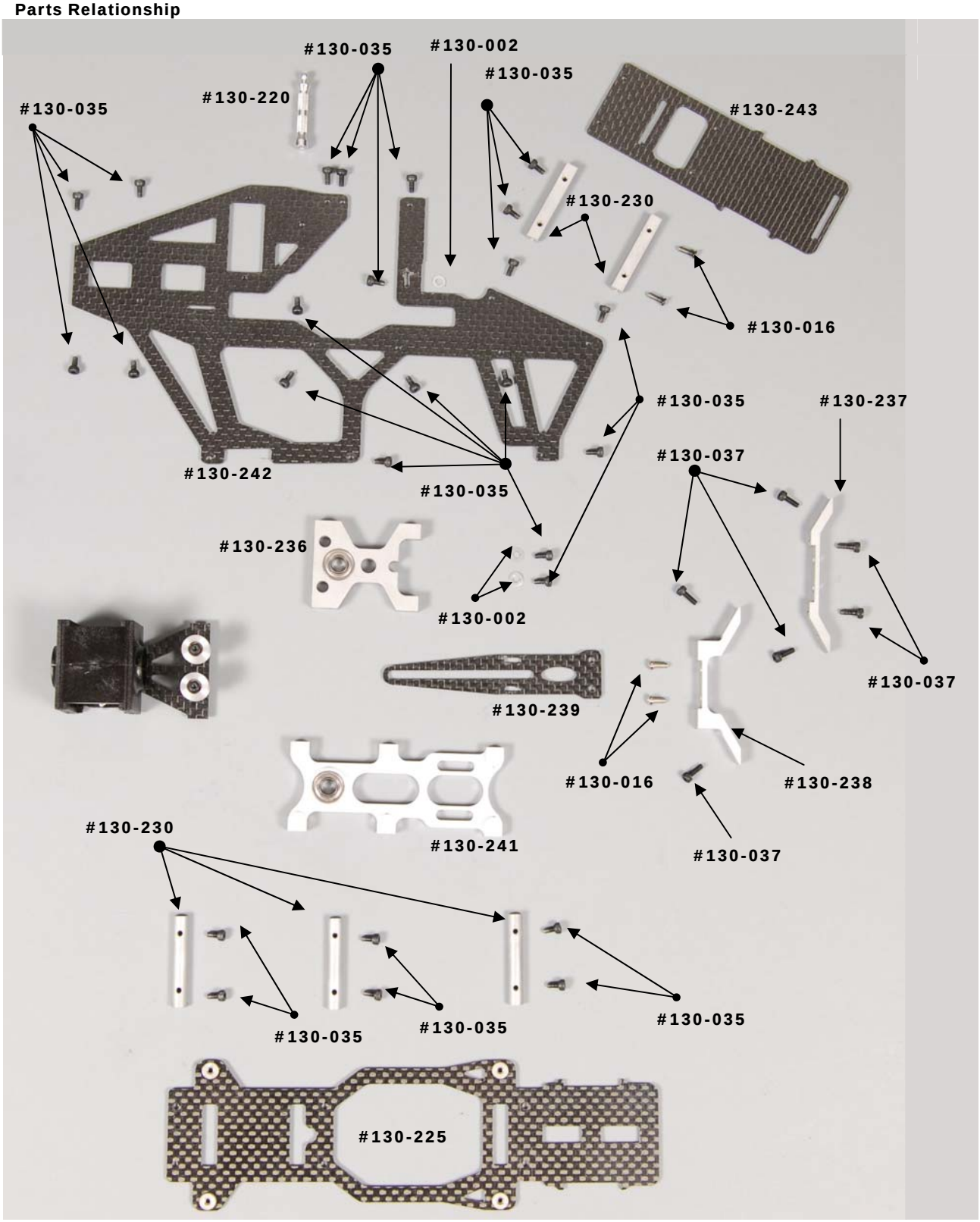


1A.1.r

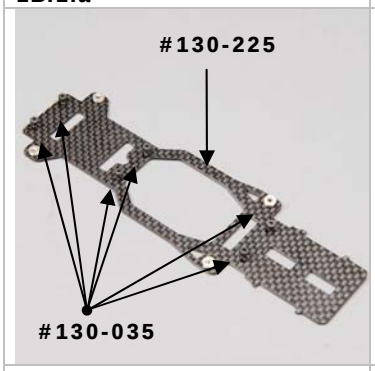


1B.1 - Assemble Left Frame Components

Parts Relationship



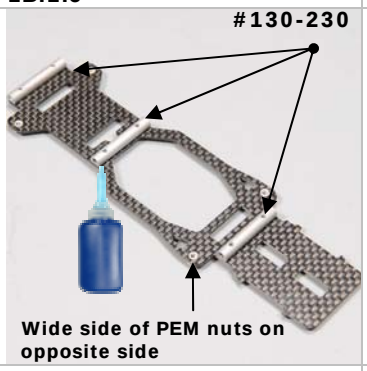
1B.1.a



1B.1.b

Building Notes:
Note that the bottom plate contains 4 PEM nuts. One side of each PEM nut is wider than the other side. The side of the lower plate which shows the wide PEM is the TOP of the plate. Install the frame spacers on the BOTTOM of the plate as shown. The flat side of the spacer is against the carbon plate.

1B.1.c



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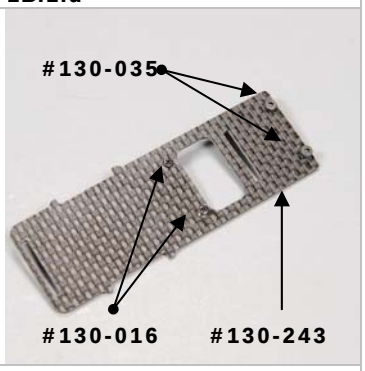

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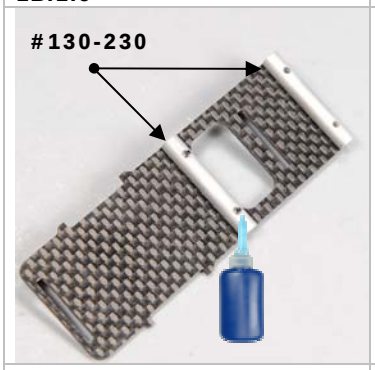

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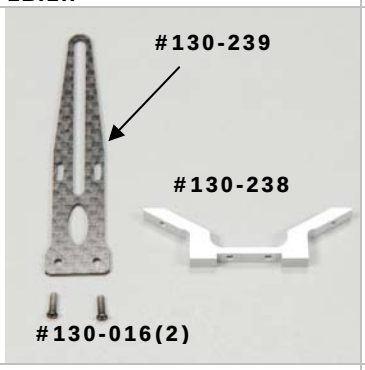
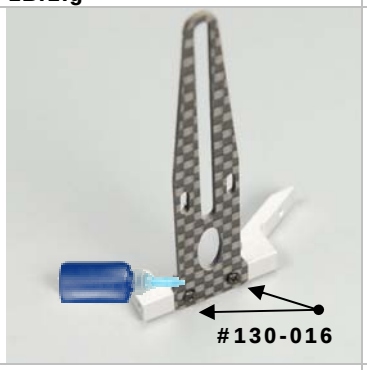
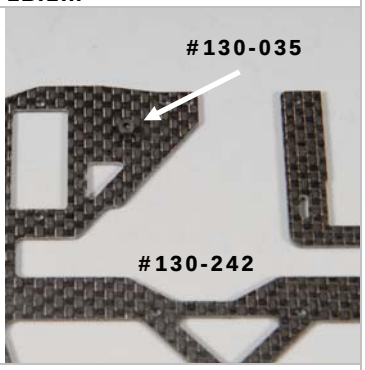


1B.1.g



1B.1.h



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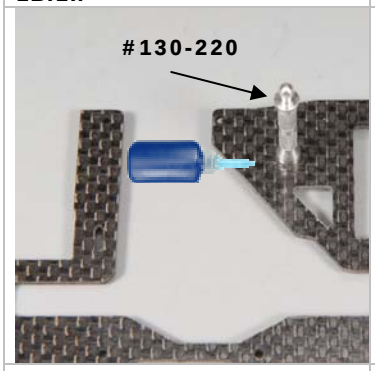
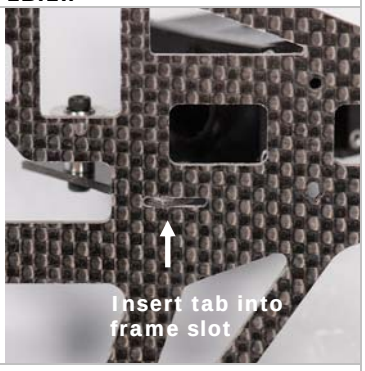


1B.1.j

1B.1.k

Building Notes:
The tail boom block plate installs into the left frame from the inside. The tab on the lower pulley plate slides into the left frame tab as shown

1B.1.l



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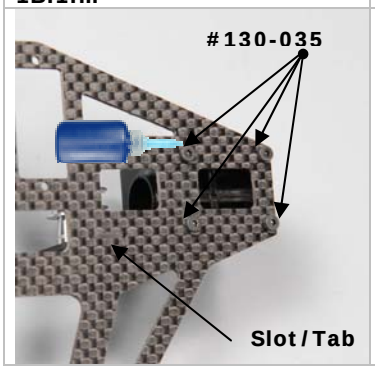
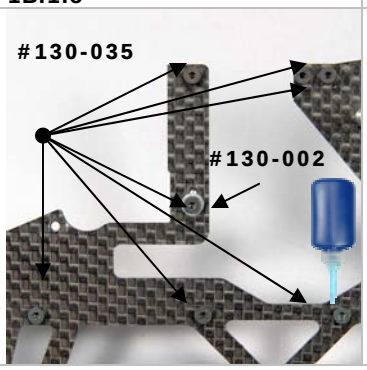


1B.1.n

Building Notes:
Install frame blocks on inside of frame using bolts seen on bolt map which follows while applying thread lock (except on the lower servo mount bolts)

Note that the protrusions on the bearing blocks faces downwards and the upper and lower bearing flanges face each other.

1B.1.o



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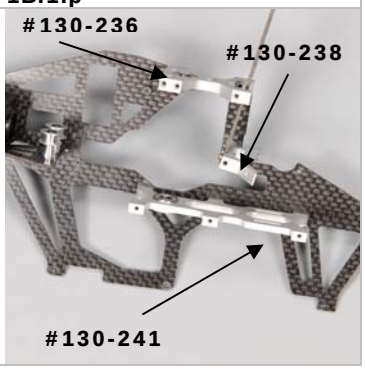
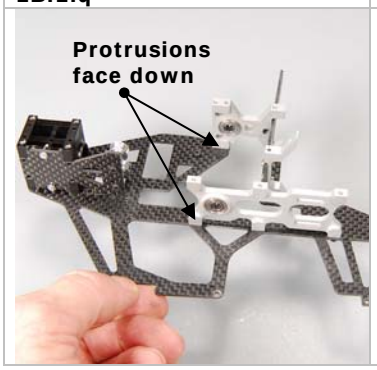
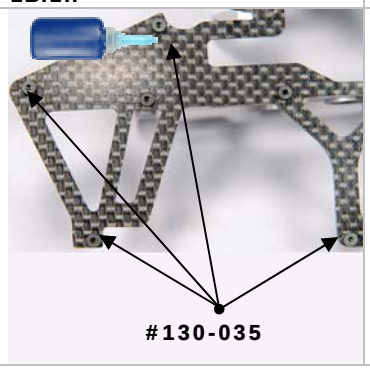
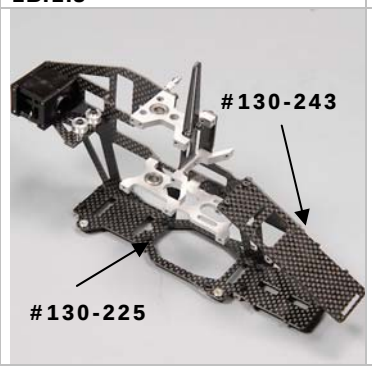
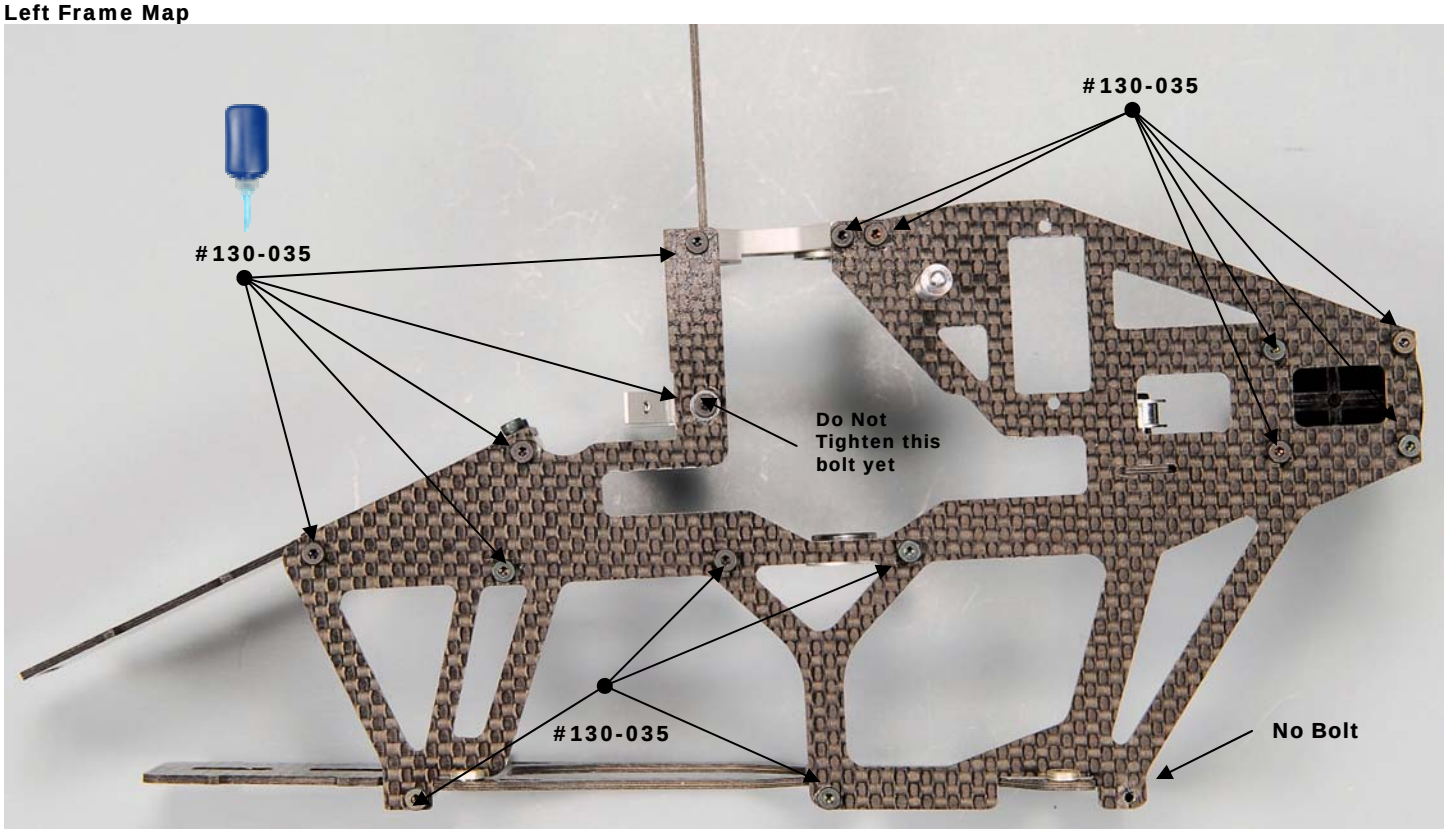
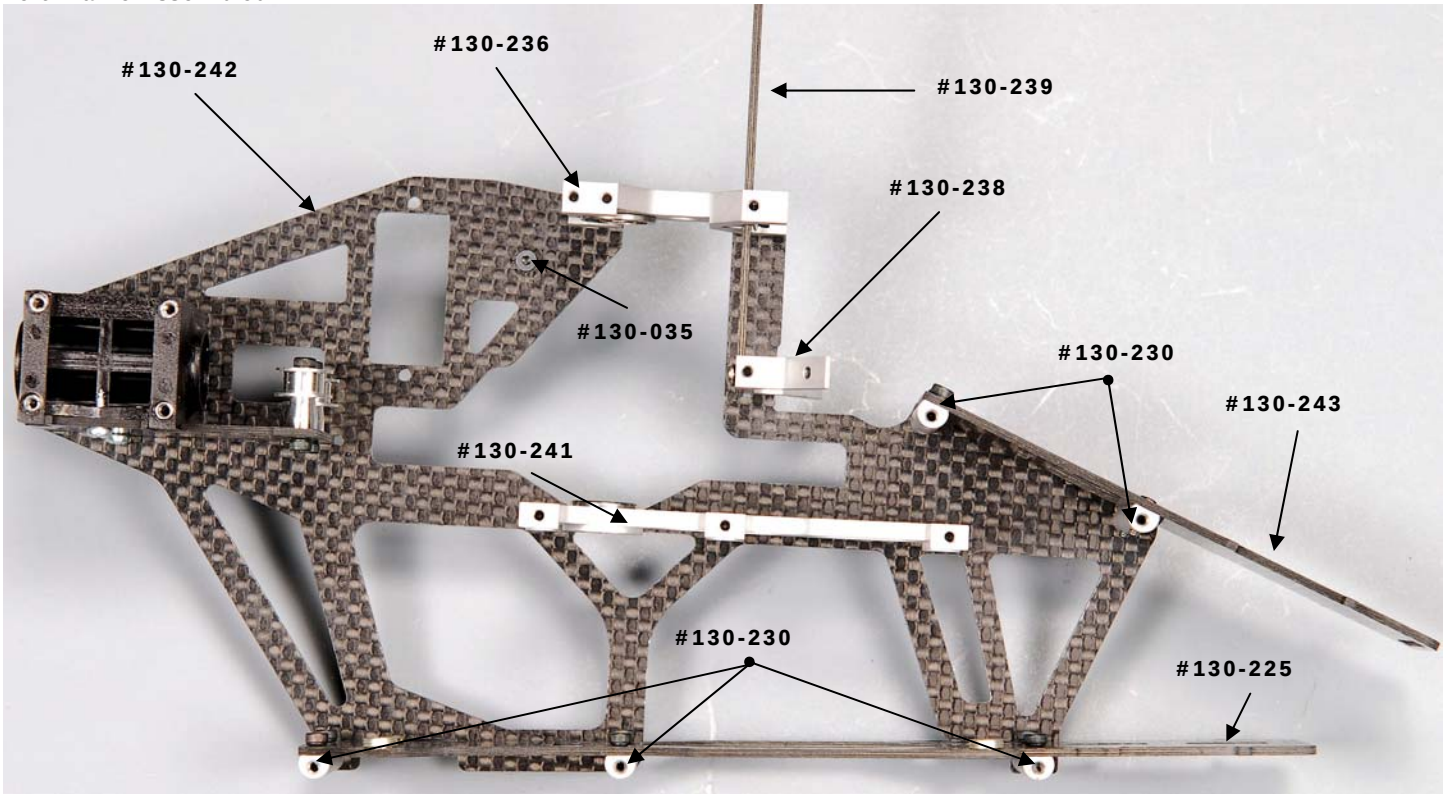


1B.1.q	1B.1.r	1B.1.s	1B.1.t
			

Left Frame Map

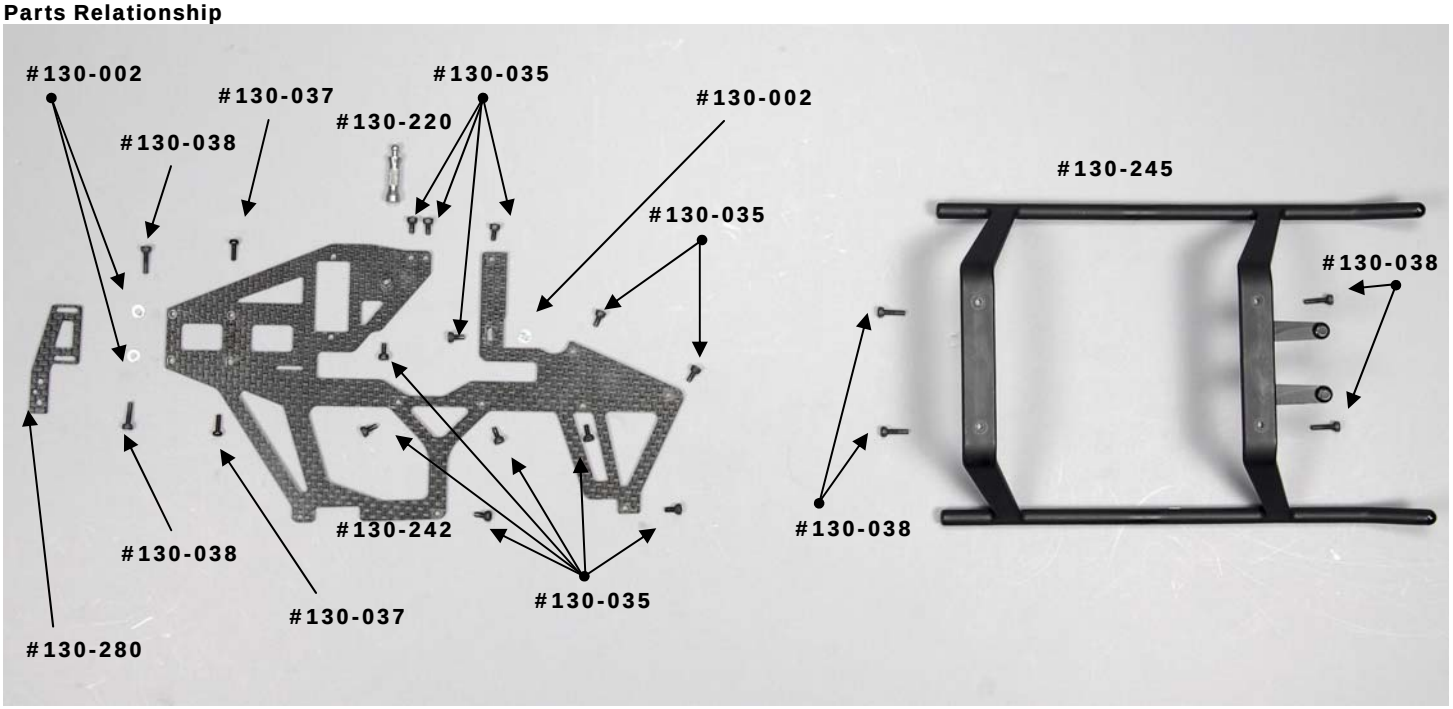


Left Frame Assembled

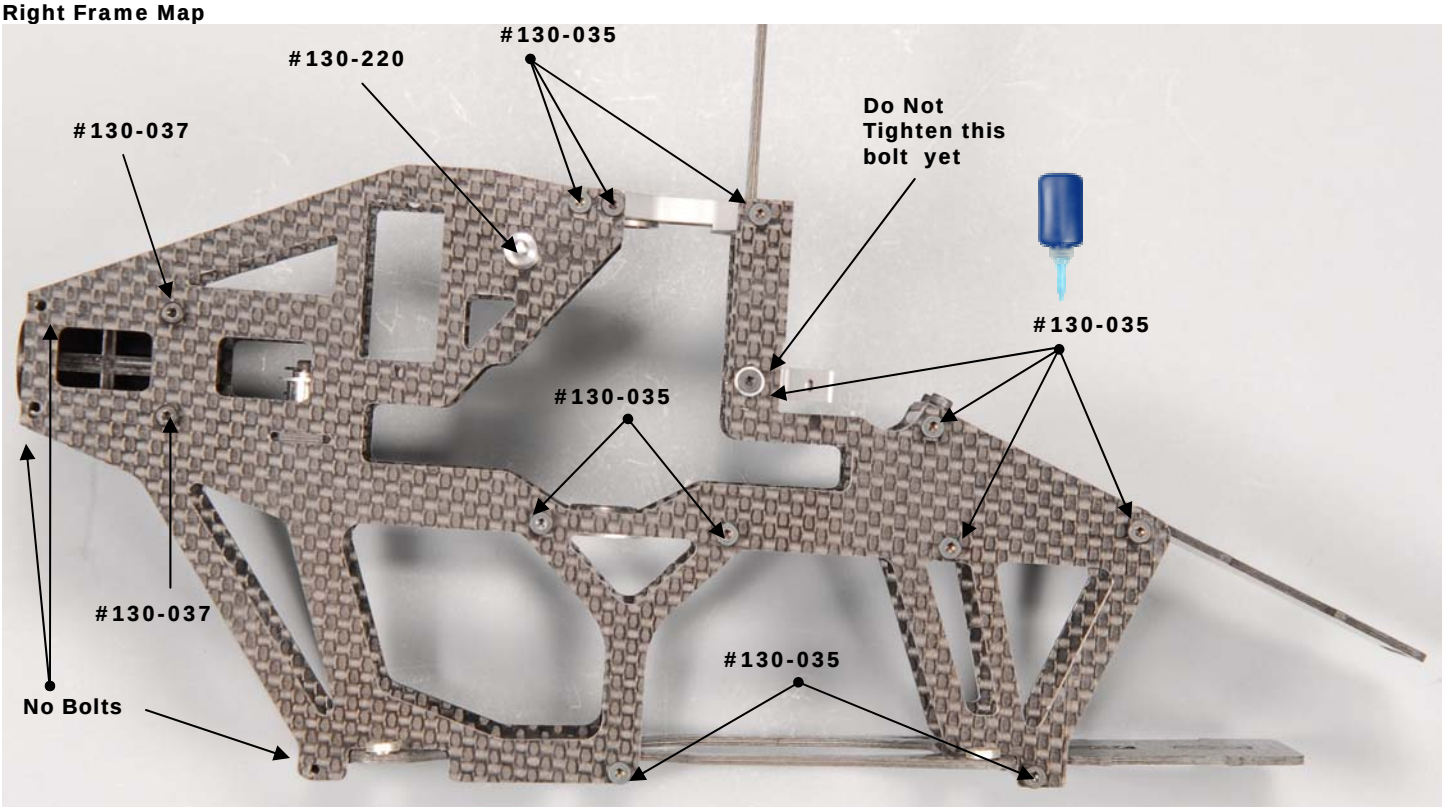


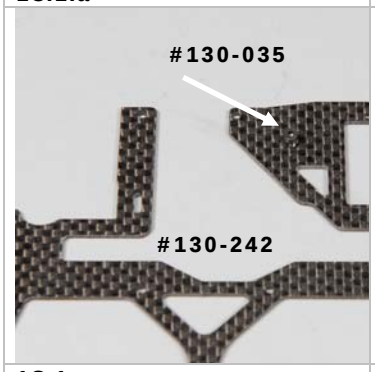
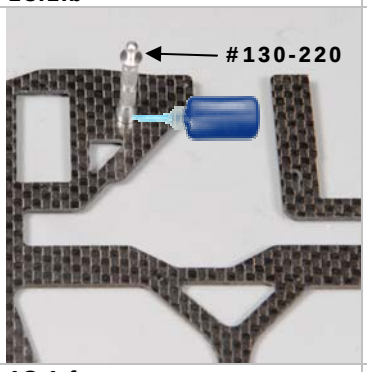
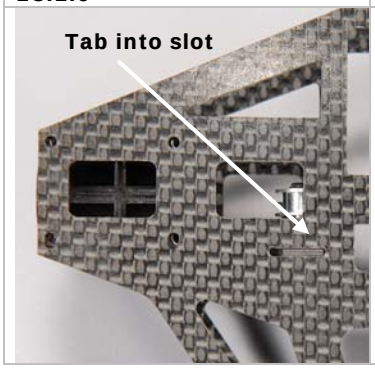
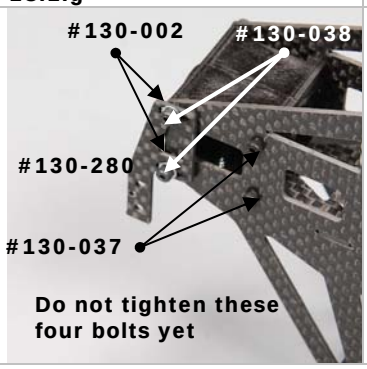
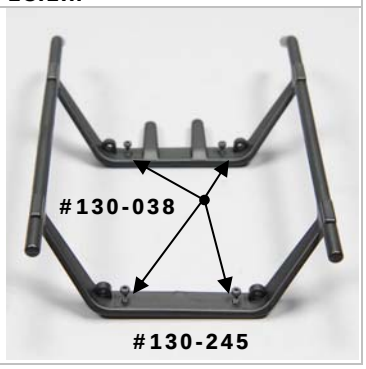
1C.1 – Install Right Frame/Landing Gear

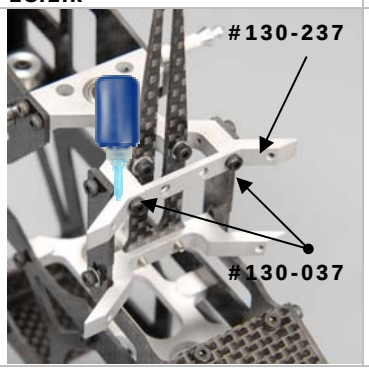
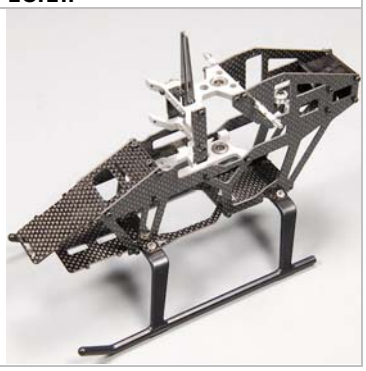
Parts Relationship



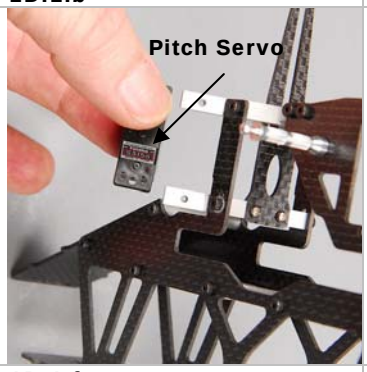
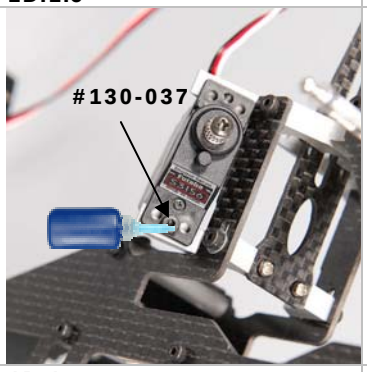
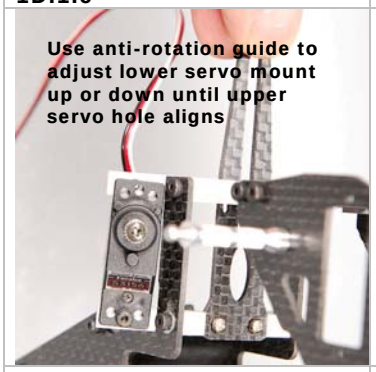
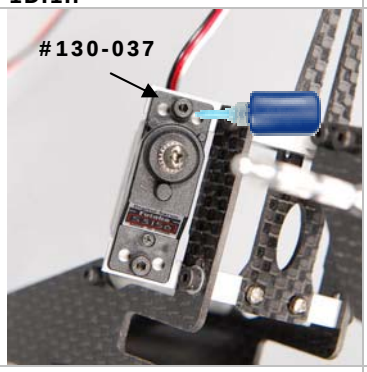
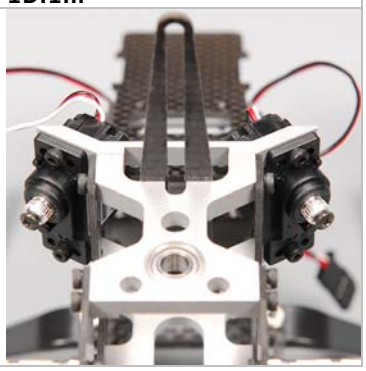
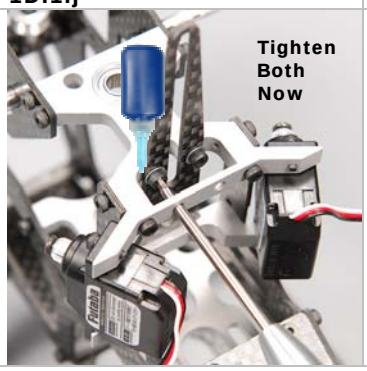
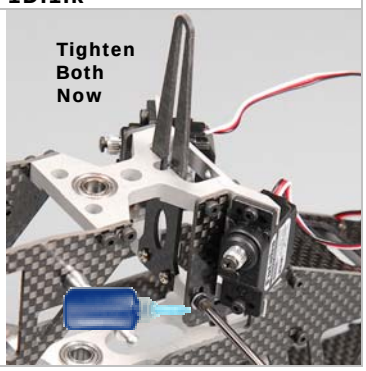
Right Frame Map



1C.1.a	1C.1.b	1C.1.c	1C.1.d
			**Building Notes:** Install the right frame onto the assembled left frame Begin the alignment by inserting the t/r pulley plate tab into the slot on the right frame
1C.1.e	**1C.1.f**	**1C.1.g**	**1C.1.h**
	**Building Notes:** Install the t/r servo mount onto the right frame as shown Don't tighten these bolts until a later step when the tail boom is installed.		

1C.1.i	1C.1.j	1C.1.k	1C.1.l
	**Building Notes:** The landing gear installs onto the bottom of the frame lower plate as shown. The bolts thread into the PEM nuts on the bottom of the plate The angled ends of the landing gear face forward		

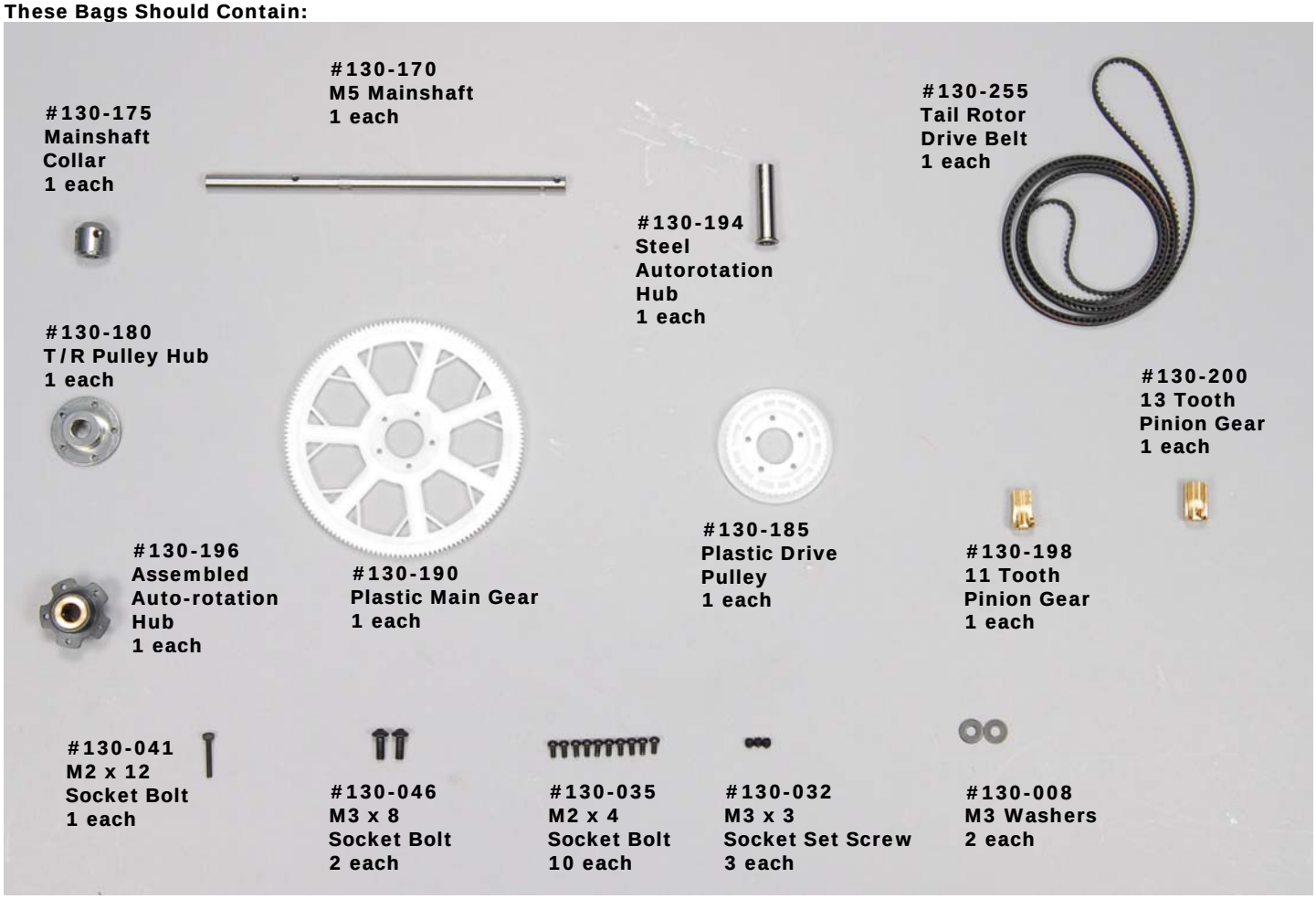
1D.1 – Install Pitch/Aileron Servos

1D.1.a	1D.1.b	1D.1.c	1D.1.d
Building Notes: The servo that will become the "pitch" channel goes on the left side of the model and the servo that will be come the "aileron" channel goes on the right side of the model			**Building Notes:** The servo mounts are adjustable to work with many types of servos. The lower mount can be adjusted up and down by moving it by holding the anti-rotation guide.
1D.1.e	**1D.1.f**	**1D.1.g**	**1D.1.h**
			
1D.1.i	**1D.1.j**	**1D.1.k**	
Building Notes: Once the servos are installed you can tighten the 4 bolts that hold the anti-rotation guide/lower servo mount into place. Use thread lock as shown The servo horns will be installed in a later step.			

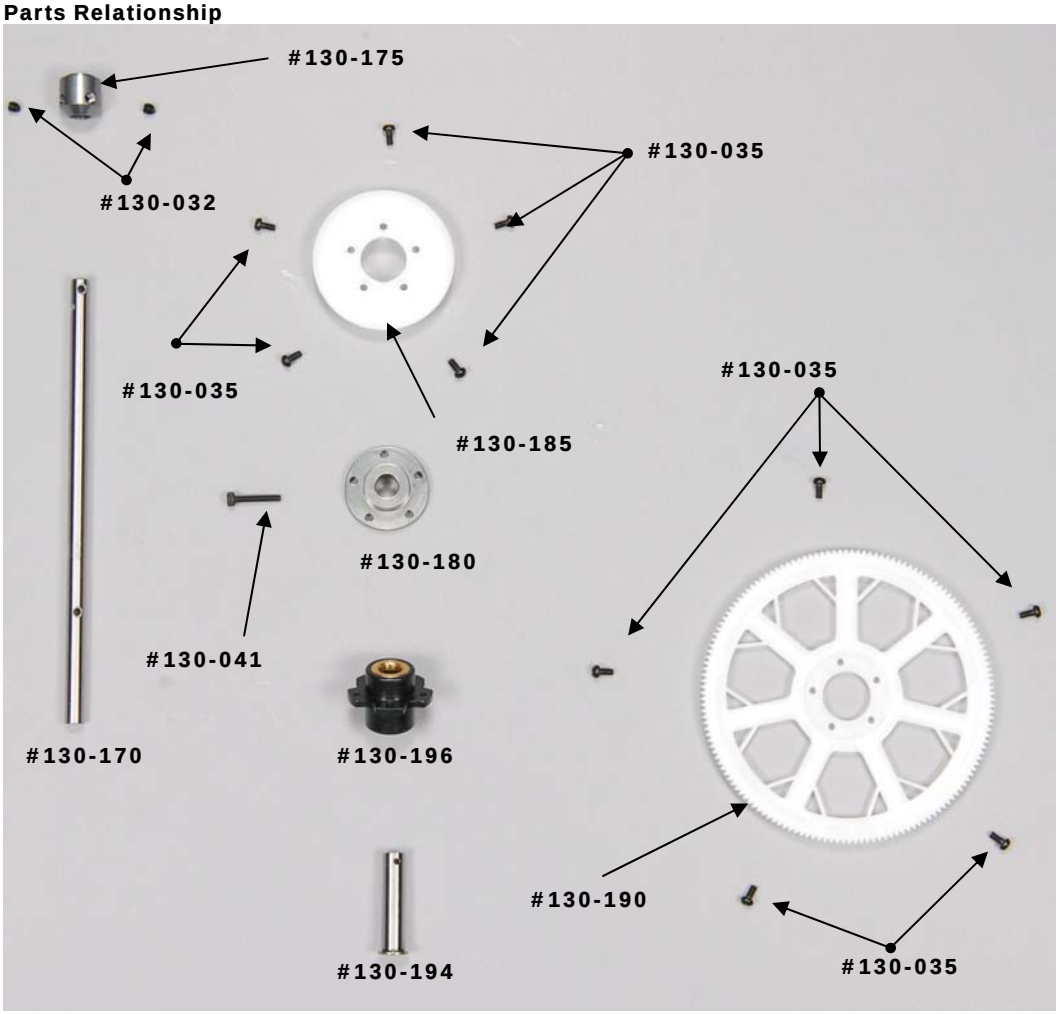
Assembly Step #2 – Primary Drive

2A) Drive Train Components - Bag #3A, #3 Hardware

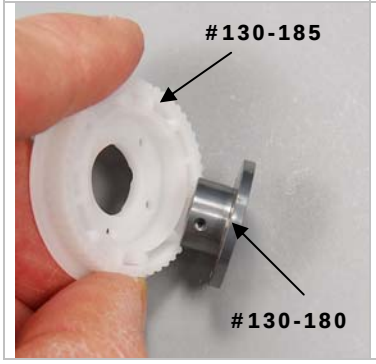
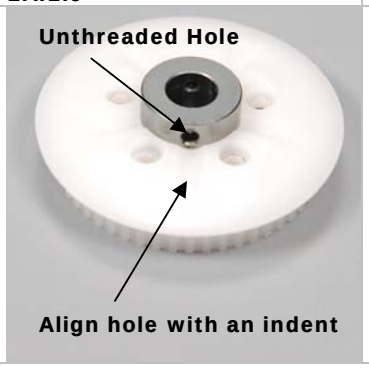
These Bags Should Contain:



Parts Relationship



2A.1 - Assemble T/R Pulley

2A.1.a	2A.1.b	2A.1.c	2A.1.d
			**Building Notes:** Rotate the pulley or hub until the unthreaded mount hole aligns with the indents on the pulley as shown

2A.1.e

2A.1.f

2B.1 - Assemble Main Gear

2B.1.a

2B.1.b

Building Notes:
Fill the bearing cavity inside the auto hub with lubricant.

Note the orientation of the hub before inserting the main shaft sleeve.

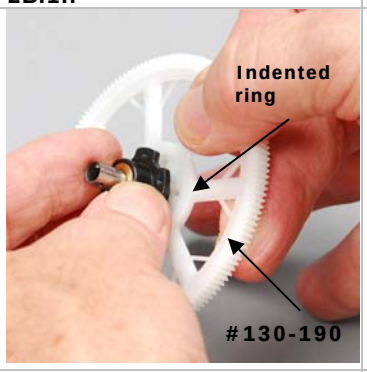
2B.1.c

2B.1.d

2B.1.e

Building Notes:
Note that the main gear has an indented area on one side. Insert the auto hub from that side as shown until it seats on the gear

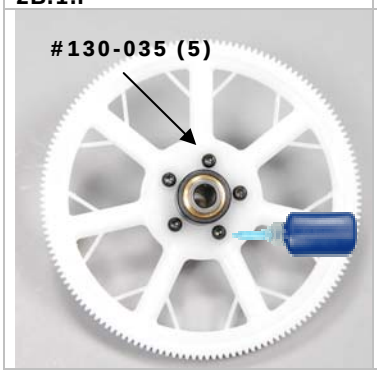
2B.1.f



2B.1.g

2B.1.h

2B.1.i



2B.1.j

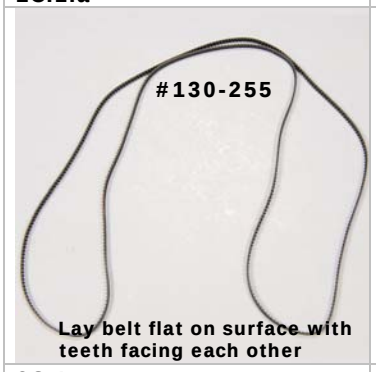
2B.1.k

Building Notes:
Install the t/r drive pulley over the main shaft sleeve as shown. Note that you need to align the holes on the pulley with those on the main shaft sleeve. This will be important when it is installed in a later step.

2B.1.l

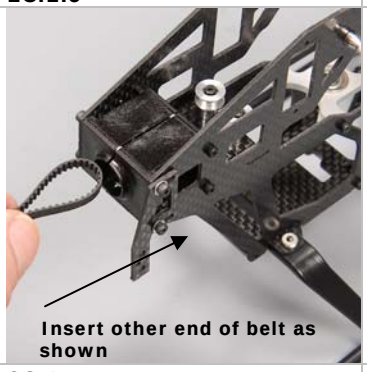
2C.1 – Install Drive System

2C.1.a

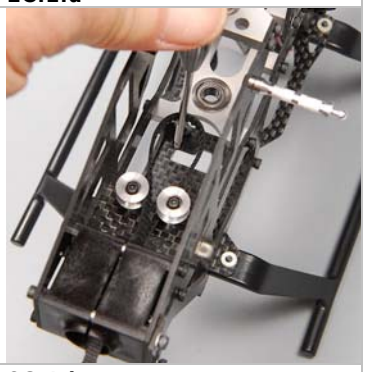


2C.1.b

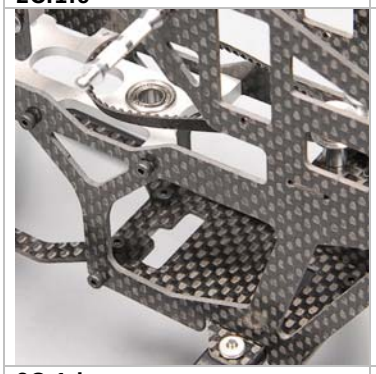
2C.1.c



2C.1.d



2C.1.e



2C.1.f

Building Notes:
Thread the belt through the pulleys and position it over the main shaft bearing as shown

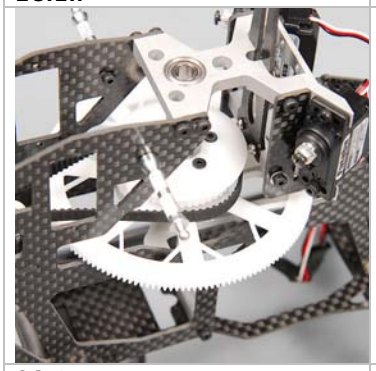
2C.1.g

2C.1.h

Building Notes:
Insert the main gear assembly into the frames from the right side.

Lift the belt over the tail rotor pulley being careful not to twist it or change orientation

2C.1.i

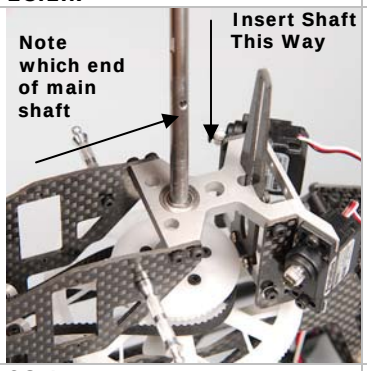


2C.1.j

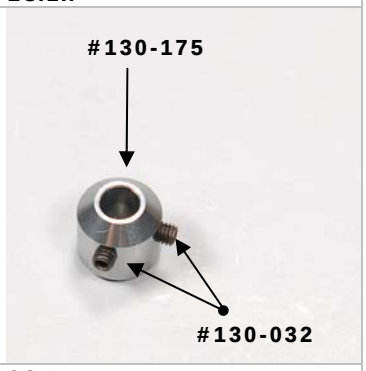
Building Notes:
Insert the main shaft from the top as shown through the top bearing, the retaining collar, the main gear and the bottom bearing as shown

Note which end of the main shaft to insert first.

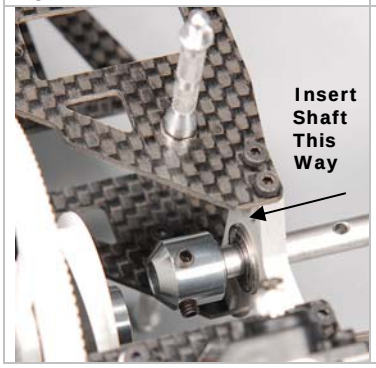
2C.1.k



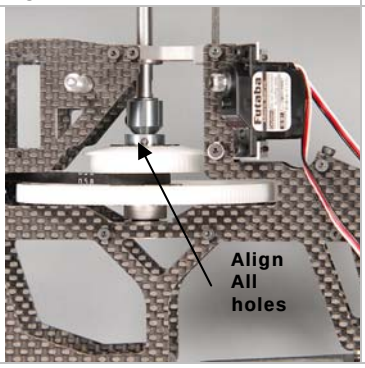
2C.1.l



2C.1.m



2C.1.n

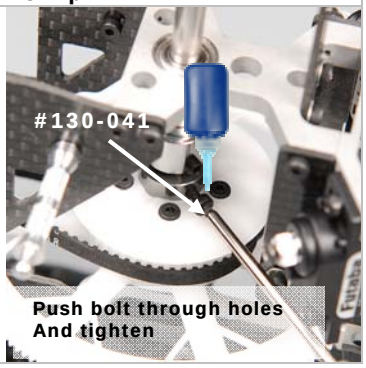


2C.1.o

Building Notes:
Align the holes in the t/r drive collar, the main shaft sleeve and the main shaft.

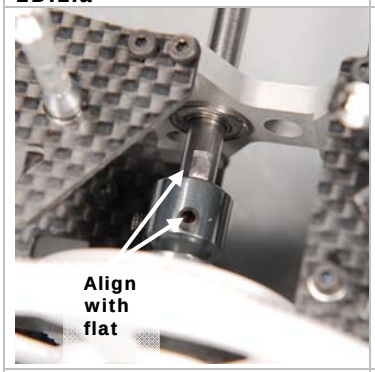
Insert the bolt through the unthreaded side of the tail drive collar and tighten using thread lock

2C.1.p



2D.1 – Install Motor

2D.1.a



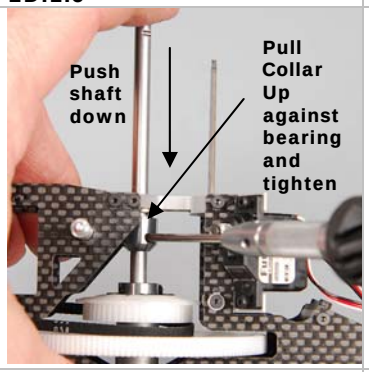
2D.1.b

Building Notes:
Align one of the set screws on the retaining collar with the flat on the main shaft.

Hold the assembly as shown and first tighten the set screw against the shaft flat and then tighten the other one. Apply thread lock to the set screws don't put in the hole.

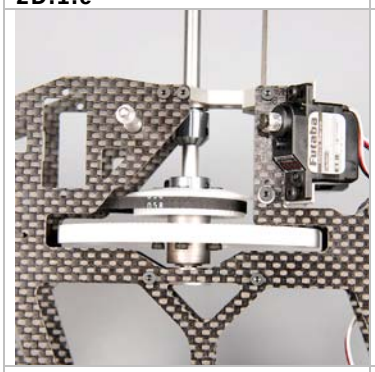
There should be no vertical play in the assembly when complete.

2D.1.c

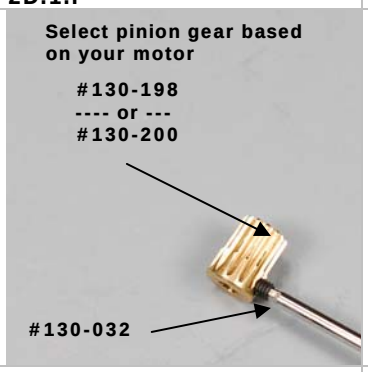


2D.1.d

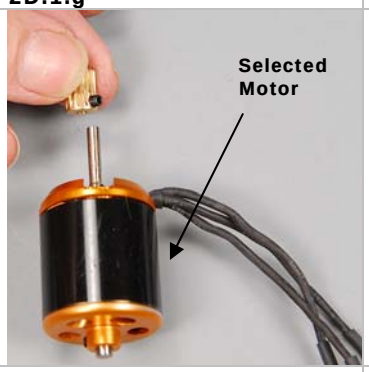
2D.1.e



2D.1.f

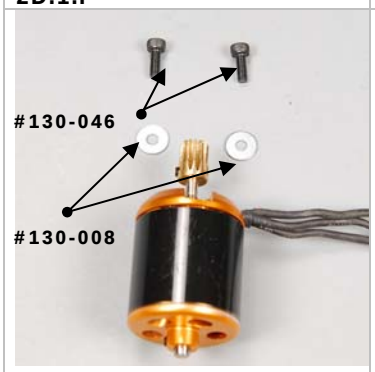


2D.1.g



2D.1.h

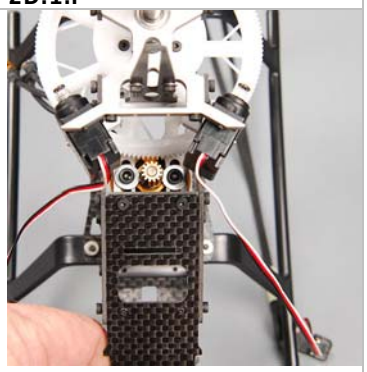
2D.1.i



2D.1.j

2D.1.k

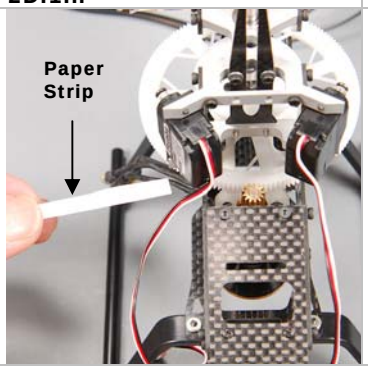
2D.1.l



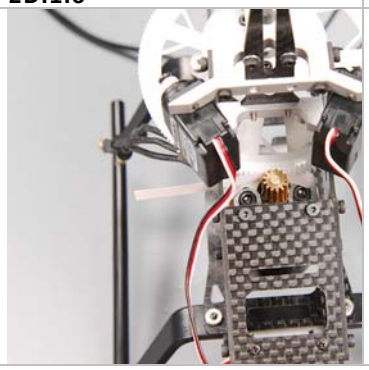
2D.1.m

Building Notes:
Motor bolts should not yet be tight. Insert paper strip between gears and push motor/gears together

2D.1.n

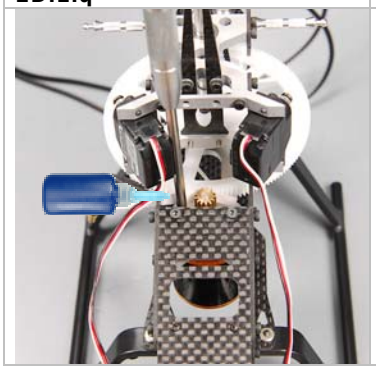
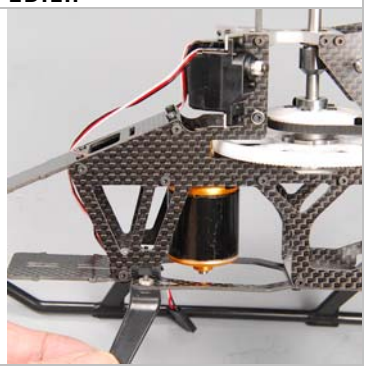


2D.1.o



2D.1.p

Building Notes:
Tighten motor bolts using thread lock and remove paper strip.

2D.1.q	2D.1.r
	

Locate Long Parts Bag

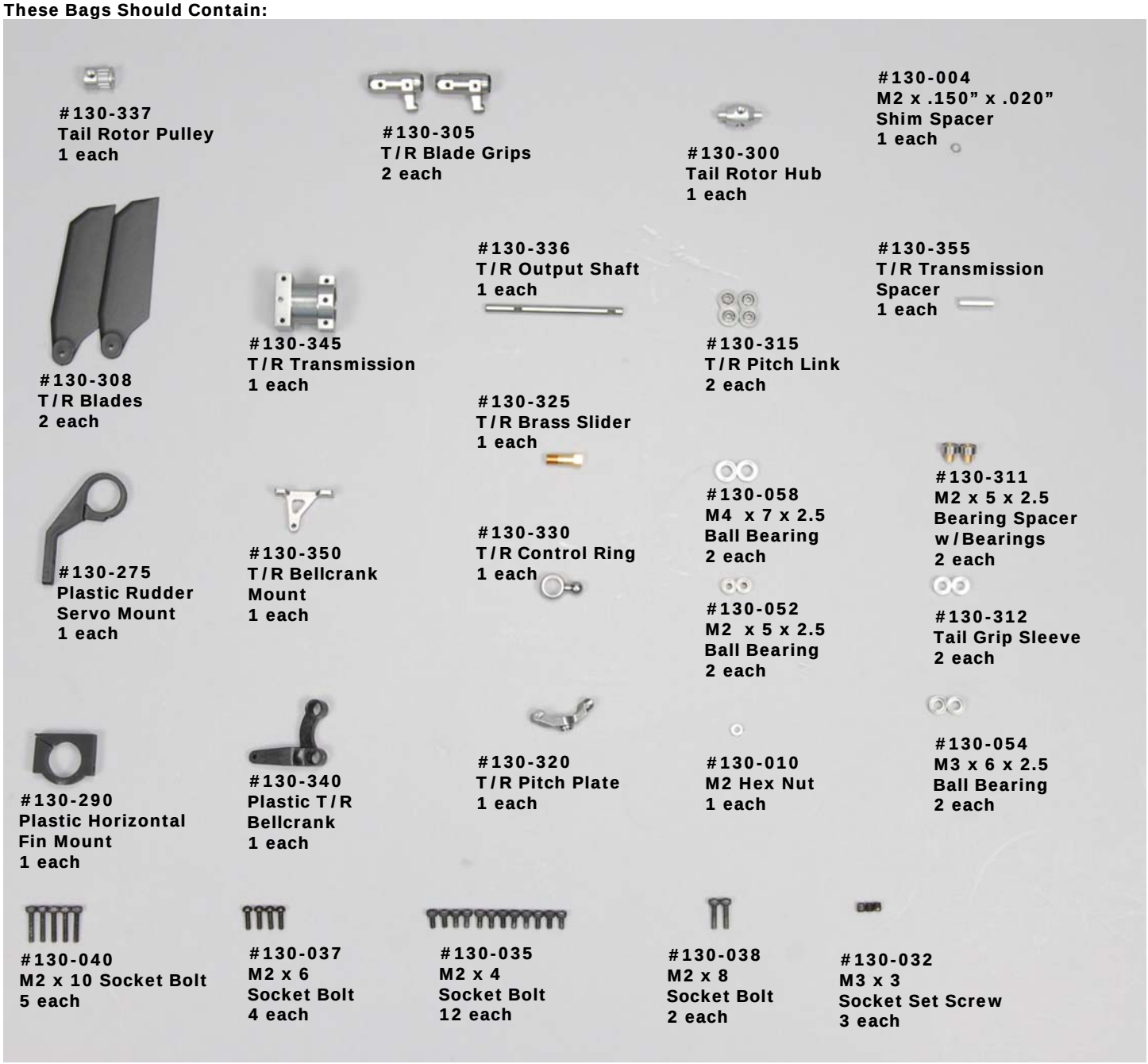
Long Parts - Bag #4

This Bag Should Contain:

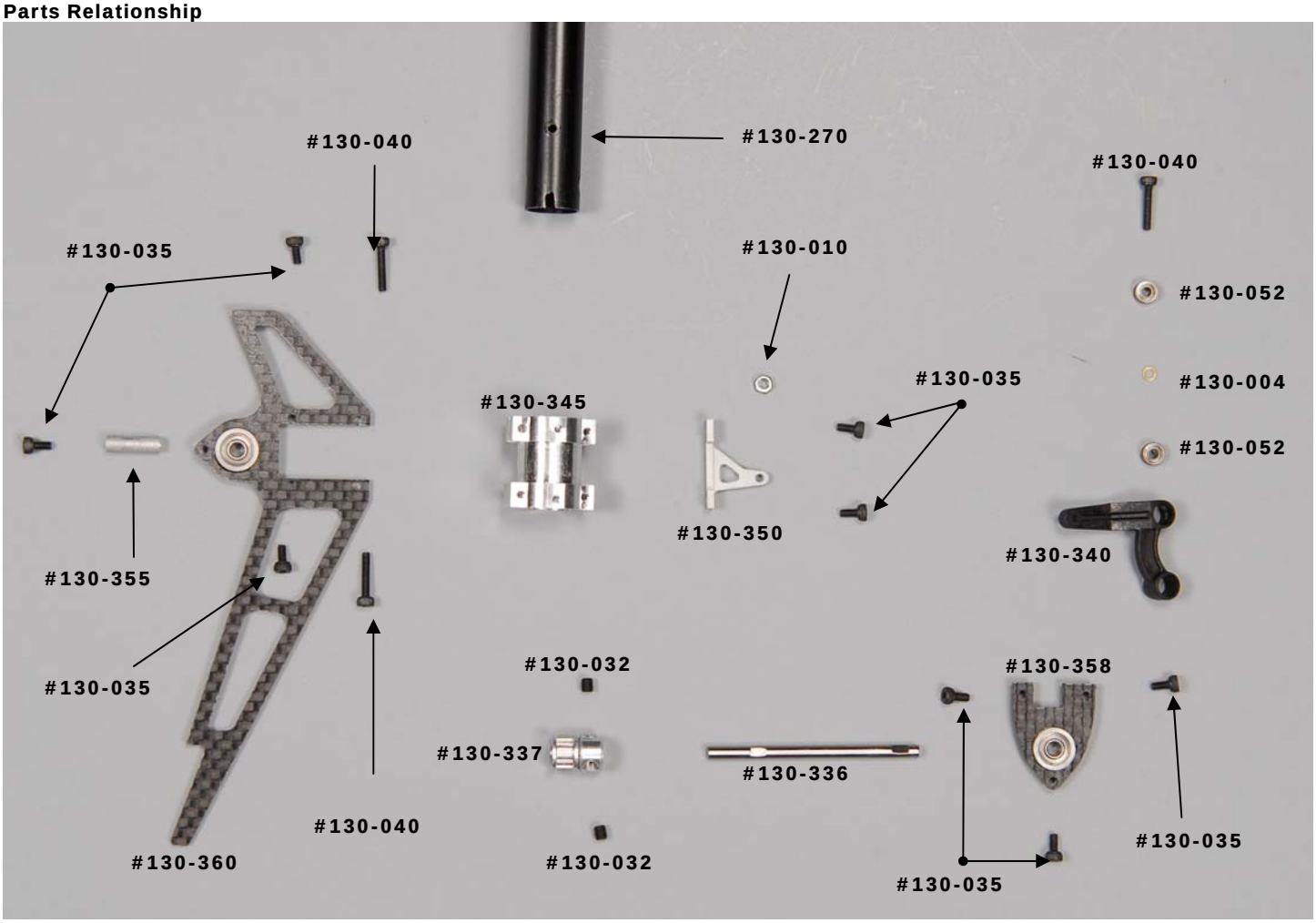
Assembly Step #3 – Tail Rotor/Tail Boom

3A) Tail Rotor Components - Bag #5A, 5B, 5C, #5 Hardware

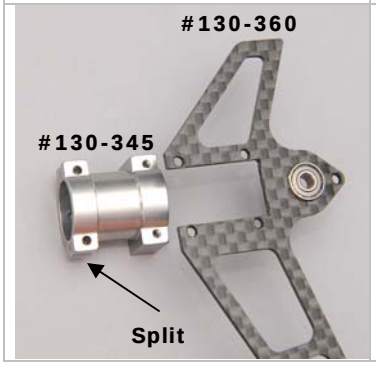
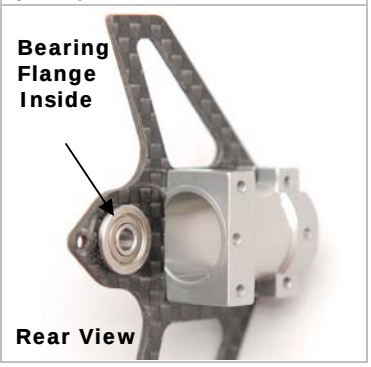
These Bags Should Contain:

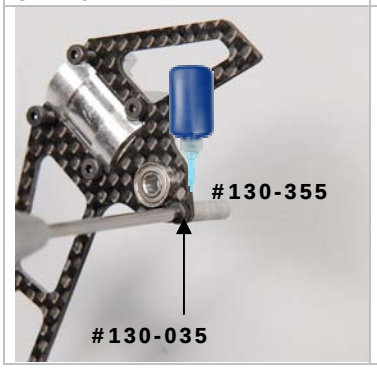
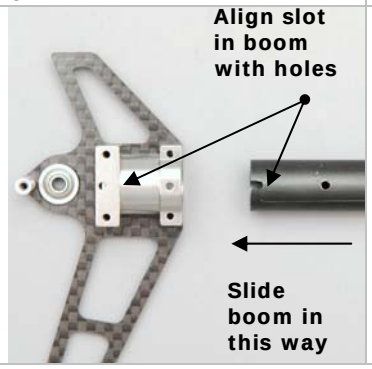
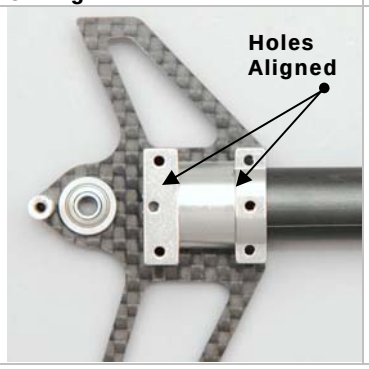


Parts Relationship

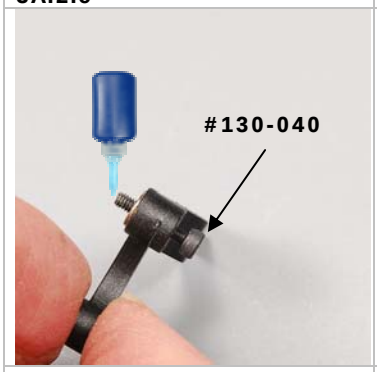


3A.1 - Assemble T/R Fin

3A.1.a	3A.1.b	3A.1.c	3A.1.d
			

3A.1.e	3A.1.f	3A.1.g	3A.1.h
			**Building Notes:** Slide the boom into the transmission case as shown until the tail fin stops it at the rear and then twist as necessary to align the holes in the boom with the holes in the transmission case.

3A.2 – Assemble/Install T/R Bellcrank

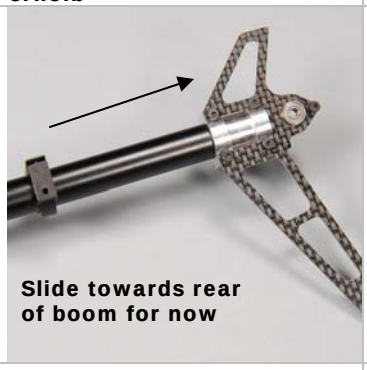
3A.2.a	3A.2.b	3A.2.c	3A.2.d
			**Building Notes:** Press the bearings into the bell crank as shown. Make sure you drop the spacer washer between the bearings.
3A.2.e	**3A.2.f**	**3A.2.g**	**3A.2.h**
			
3A.2.i	**3A.2.j**	**3A.2.k**	**3A.2.l**
	**Building Notes:** Before tightening the two bell crank bracket bolts, make sure the holes in the transmission case are aligned with those in the tail boom. When properly aligned, these will thread in with little effort.		

3A.3 – Assemble/Install Tail Boom

Parts Relationship

3A.3.a

3A.3.b



3A.3.c

Building Notes:
Slide the rear boom support over the front of the boom with the slot on the same side of the boom as the t/r fin. Slide it to the rear of the boom for now.

Now install the t/r servo rear mount over the front of the boom as shown. The slot and servo mount are on the opposite side of the boom from the fin.

3A.3.d

3A.3.e

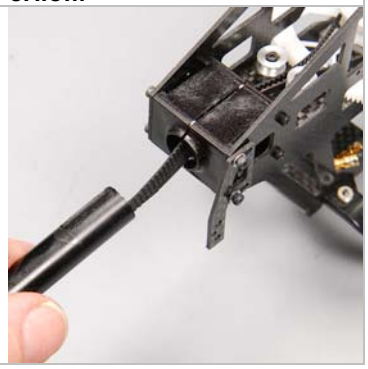
Building Notes:
Stretch the t/r drive belt out to make sure it is straight and not twisted.

It should appear as shown

3A.3.f

3A.3.g

3A.3.h



3A.3.i

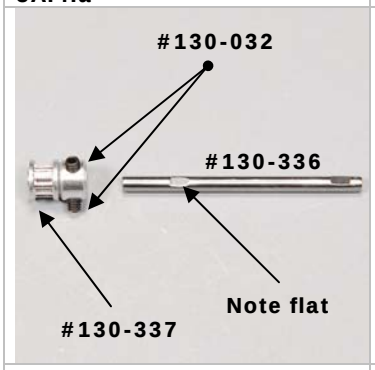
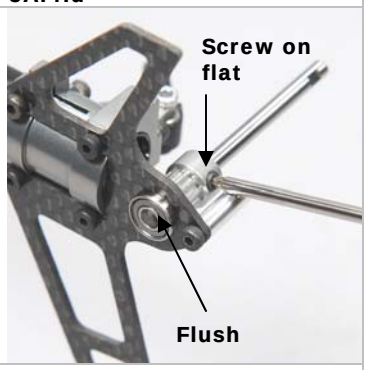
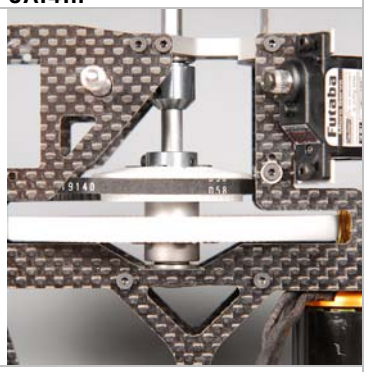
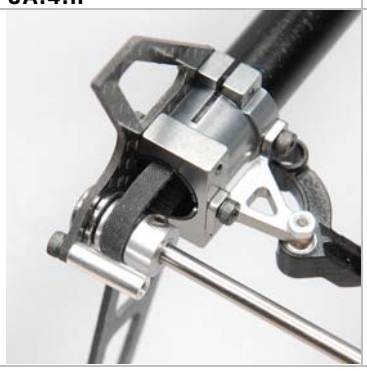
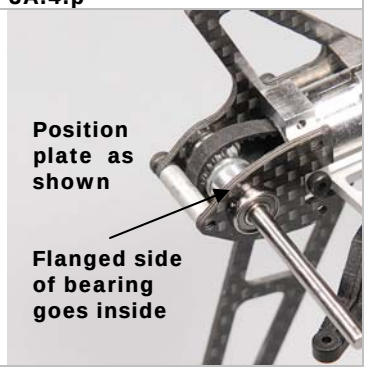
Building Notes:
Slide the belt through the boom as you slide the boom into the tail boom mount previously installed on the frame.

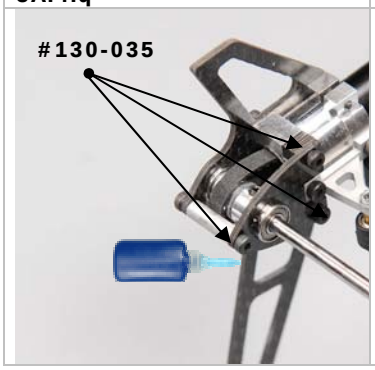
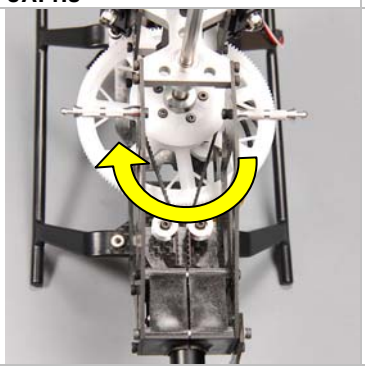
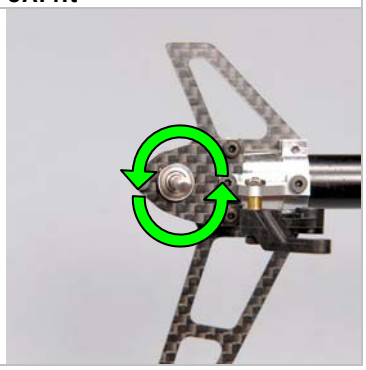
You may have to twist the boom slightly. Continue to push the boom forward until the belt extends out the back of the boom.

3A.3.j

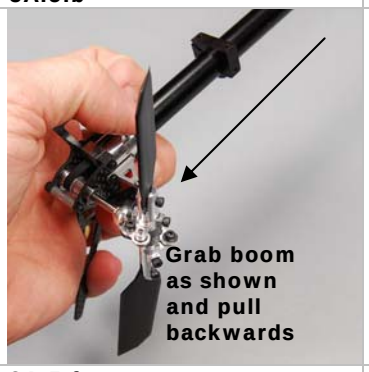
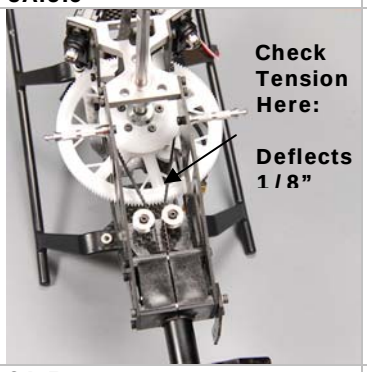
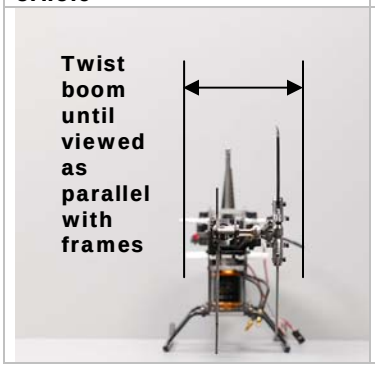
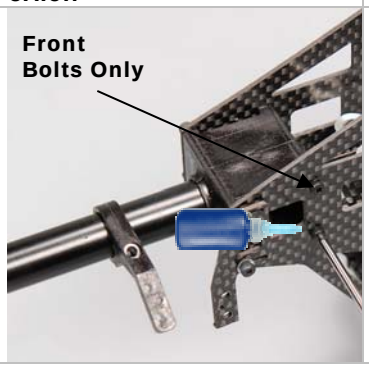
3A.3.k

3A.4 – Assemble T/R Transmission

3A.4.a	3A.4.b	3A.4.c	3A.4.d
		**Building Notes:** Align one of the set screws with the flat on the t/r shaft as shown but only tighten enough to so that the pulley can still move but movement is limited by the shaft flat.	
3A.4.e	**3A.4.f**	**3A.4.g**	**3A.4.h**
Building Notes: Now slide the short end of the tail shaft into the bearing in the vertical fin. Slide the shaft into the bearing as shown. When the shaft is flush with the outside of the bearing tighten the set screw on the flat		**Building Notes:** Tighten the set screw that is NOT on the flat using thread lock. Now remove the remaining set screw, apply thread lock and tighten. The correct pulley position is now set.	
3A.4.i	**3A.4.j**	**3A.4.k**	**3A.4.l**
Building Notes: Remove the tape from the rear of the T/R belt but be careful not to change its orientation. Fit the front of the belt over the pulley as shown and slide the tail boom outward slightly to reduce the amount of belt exposed in the back.			**Building Notes:** Insert the T/R pulley/shaft into the belt as shown and twist counter clockwise ¼ of a turn as shown. MAKE SURE YOU ONLY TWIST ¼ OF A TURN. Insert the short end of the t/r shaft through the bearing in the t/r fin. Push the shaft in until the pulley fully seats.
3A.4.m	**3A.4.n**	**3A.4.o**	**3A.4.p**
Building Notes: Ease the tail boom out to take the slack out of the tail drive belt. **Note** – if during assembly of t/r transmission, the bearings in the graphite become loose, apply green thread lock to the bearing and push bearing back into graphite.			

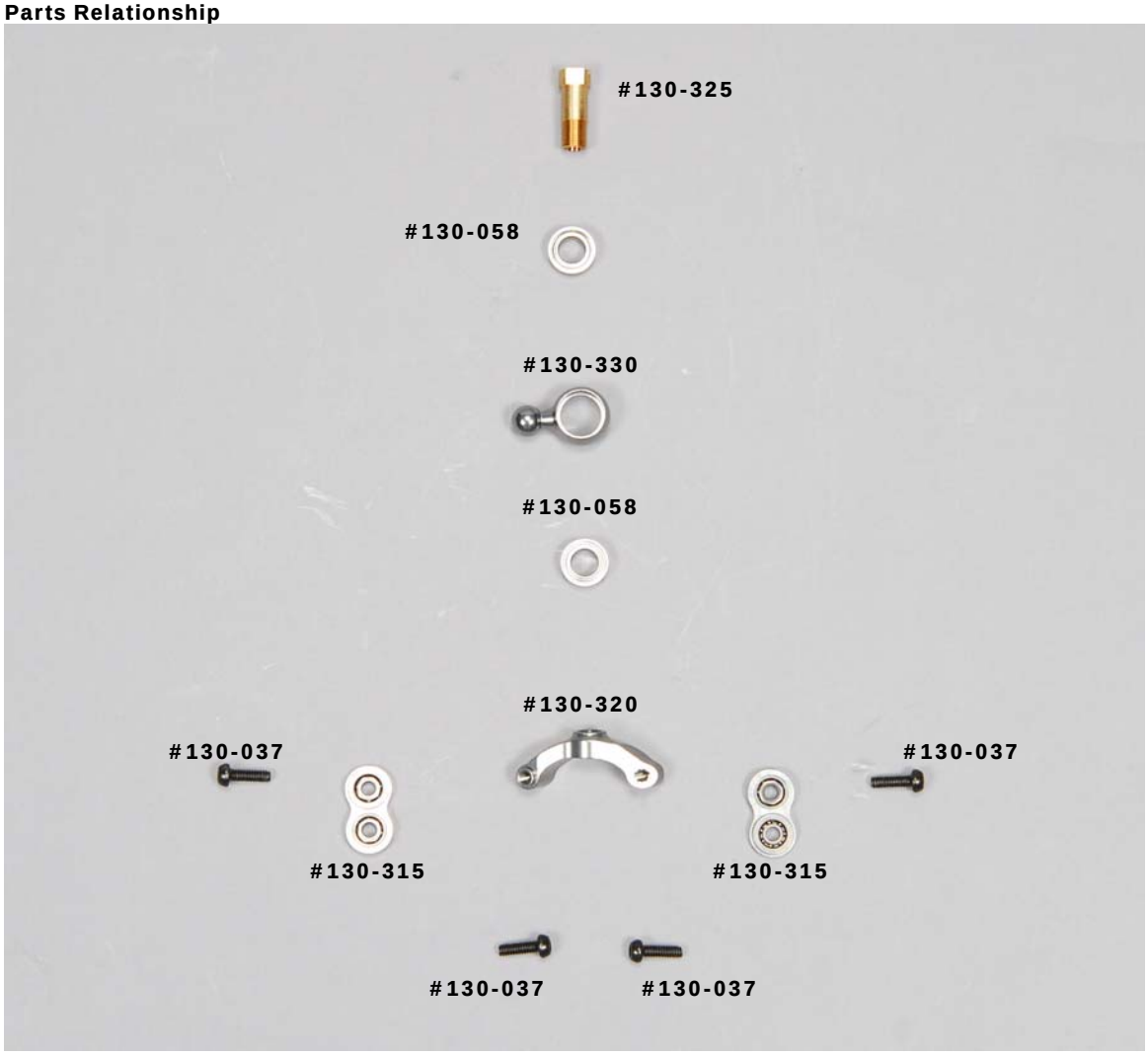
3A.4.q	3A.4.r	3A.4.s	3A.4.t
	**Building Notes:** It is critical that you ensure the t/r rotates correctly. When you turn the main gear clockwise (from the top), the t/r shaft must turn counter-clockwise when looking at it from the right side of the model. If it does not, the belt is twisted in the boom. Remove and correct.		

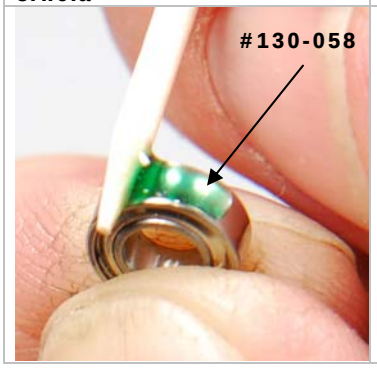
3A.5 – Set T/R Belt Tension

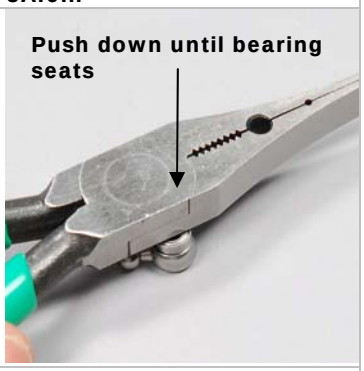
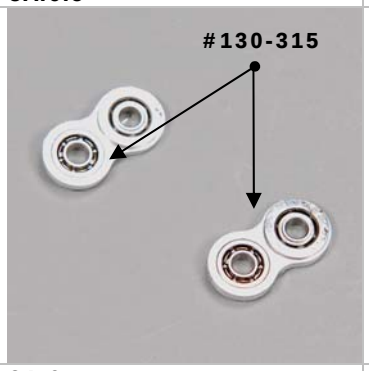
3A.5.a	3A.5.b	3A.5.c	3A.5.d
Building Notes: If the tail rotor rotation is correct then pull the tail boom out slightly by grasping the t/r fin with one hand and the chassis with the other. Adjust until the belt will deflect at the point shown by only about ⅛". This is the correct belt tension.			**Building Notes:** Align the t/r vertical fin as shown so that the tail rotor is parallel with the side frames. If necessary slightly twist the tail boom assembly for proper alignment.
3A.5.e	**3A.5.f**	**3A.5.g**	
		**Building Notes:** Tighten ONLY the two front boom mount bolts at this time using thread lock	

3A.6 – Assemble T/R Pitch Change Mechanism

Parts Relationship

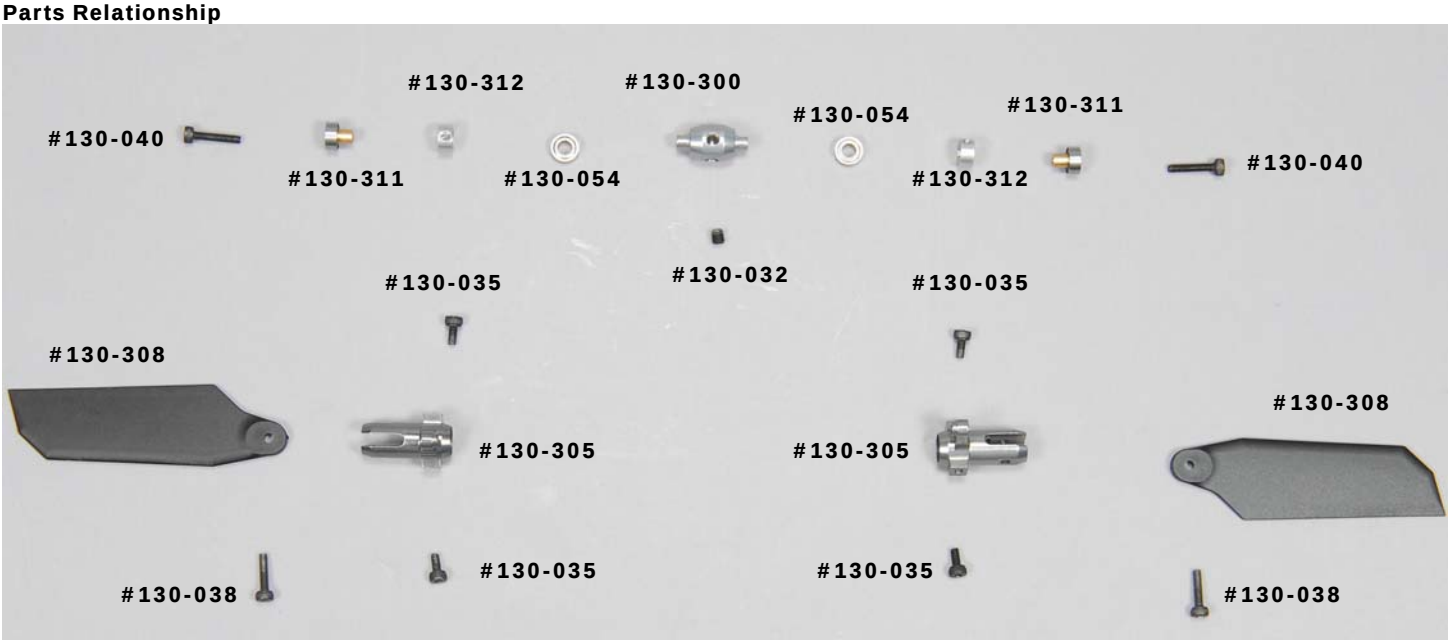


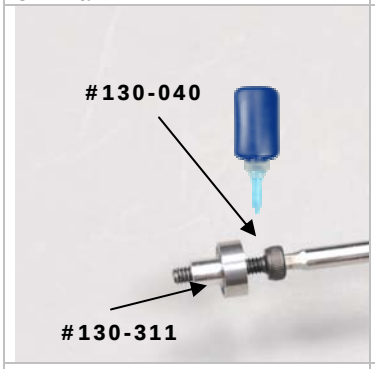
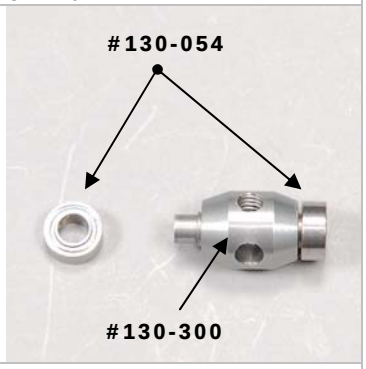
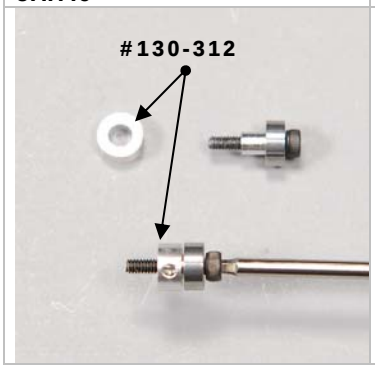
3A.6.a	3A.6.b	3A.6.c	3A.6.d
	**Building Notes:** Apply a thin coat of green thread lock on the smaller bearings using a toothpick. Place a drop of thread lock on the end of the toothpick and then smear it around the bearings. Wipe away any excess and be careful not to get any in the bearing		**Building Notes:** Position the first bearing on the t/r pitch control ring as shown. Install it as follows

3A.6.e	3A.6.f	3A.6.g	3A.6.h
Building Notes: Find a metal tool with a large flat surface like shown in the example		**Building Notes:** Use the tool to press in the first bearing. Make sure it is square on the pitch control ring before you apply pressure. Do not drive or hammer the bearing in, simply apply pressure to the tool until the bearing slides in and bottoms in the ring. Repeat for the second bearing.	
3A.6.i	**3A.6.j**	**3A.6.k**	**3A.6.l**
			**Building Notes:** Tighten the pitch plate onto the pitch slider only tight enough to remove all the slack. If you over tighten it the bearings will bind up and be notchy. If this happens simply loosen the plate until it turns smoothly Be careful not to get thread lock in the bearings
3A.6.m	**3A.6.n**	**3A.6.o**	**3A.6.p**
			**Building Notes:** Use a toothpick to apply thread lock around the edges of the bearing flanges on both pitch links and allow it to "wick" in. Be careful not to get any in the bearing itself Wipe off any excess thread lock.
3A.6.q	**3A.6.r**	**3A.6.s**	**3A.6.t**
		**Building Notes:** Install one of the pitch links onto the pitch plate as shown. The bolt goes through the flanged side of the bearing and threads into the one of the flat ends on the pitch plate Be careful not to get thread lock into the bearings	

3A.7 – Assemble T/R Hub

Parts Relationship



3A.7.a	3A.7.b	3A.7.c	3A.7.d
	**Grip the sleeve on the bearing spacer and tighten only until the bolt is just snug** 		
3A.7.e	**3A.7.f**	**3A.7.g**	**3A.7.h**
	**Building Notes:** The sleeves simply slip over the bearing spacers. Use green thread lock on the bolts. Be careful not to get thread lock in the bearings		

3A.7.i

3A.7.j

Building Notes:
Install the blade grip over the bearing stack as shown. The mount holes on the blade grip must align with the holes in the bearing sleeve as shown. Use a small allen tool to align if necessary. Push the t/r grip towards the center of the hub until it bottoms out. Then install the mount bolts.

3A.7.k

3A.7.l

3A.7.m

3A.7.n

Building Notes:
If the grips and spacer are properly aligned, the mount bolts will install with little effort.

If they do not thread in easily re-check the alignment and repeat.

3A.7.o

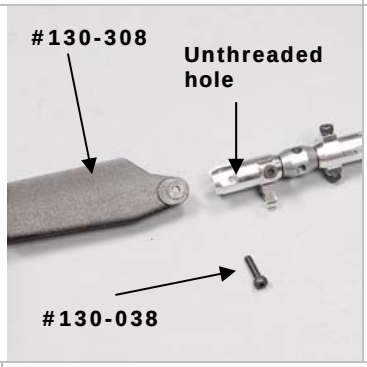
3A.7.p

3A.7.q

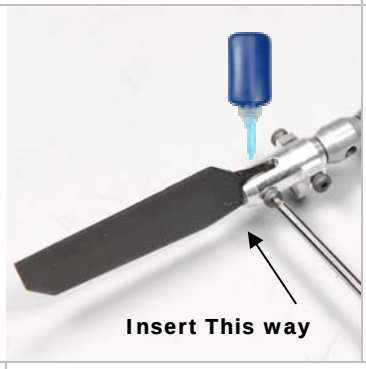
Building Notes:
Install the t/r blades as shown. The leading edge of the blades should install as shown.

Look closely at the blade arms, one side of the hole is threaded and the other is not. The bolts pass through the side that is not threaded, through the blade and then thread into the other side

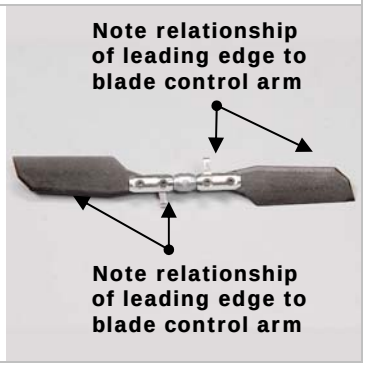
3A.7.r



3A.7.s



3A.7.t

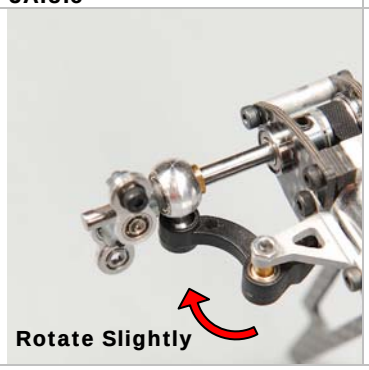


3A.7.u

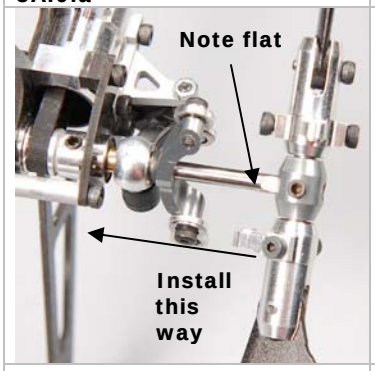
3A.7.v

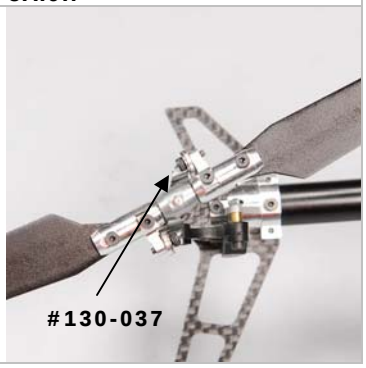
Building Notes:
Partially thread the set screw into the threaded hole on the t/r hub. It should not protrude into the inside of the t/r hub. Do not use thread lock at this time.

3A.8 – Install T/R Pitch Change Mechanism

3A.8.a	3A.8.b	3A.8.c	3A.8.d
	**Building Notes:** Position the t/r bell crank as shown and slip the assembled pitch change mechanism over the t/r shaft. As you slide it in, rotate the ball portion of the slider into the bell crank as shown. Slide the mechanism all the way in on the shaft.		

3A.9 – Install Tail Rotor Assembly

3A.9.a	3A.9.b	3A.9.c	3A.9.d
	**Building Notes:** Install the assembled t/r hub over the t/r shaft as shown making sure that the set screw is aligned with the flat on the t/r shaft. Slide the hub onto the shaft until it is flush with the end of the shaft. Tighten the set screw using thread lock.		

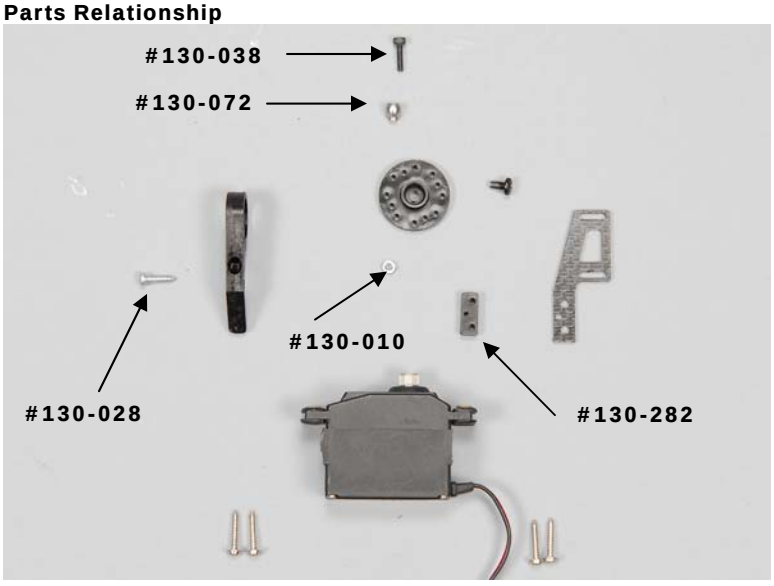
3A.9.e	3A.9.f
Building Notes: Attach the pitch links to the t/r blade grips as shown using thread lock. Note that the bolts pass through the shouldered side of the bearing. Also note the orientation of the t/r blades to the grips and links.	

3B) Tail Rotor Control - Bag #6A, #6 Hardware

These Bags Should Contain:

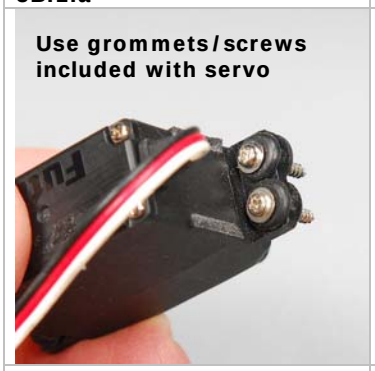
3B.1 Install T/R Servo

Parts Relationship



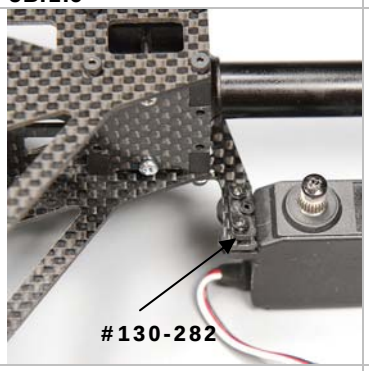
NOTE: The T/R Servo can optionally be installed on the left side of the model. In order to do this, the parts orientations must be reversed from what is shown.

3B.1.a

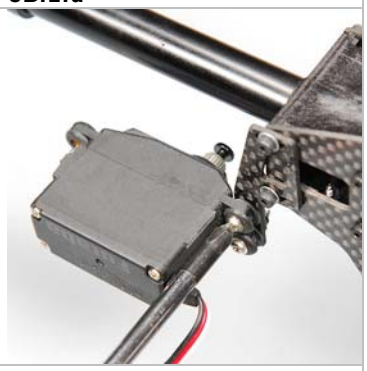


3B.1.b

3B.1.c

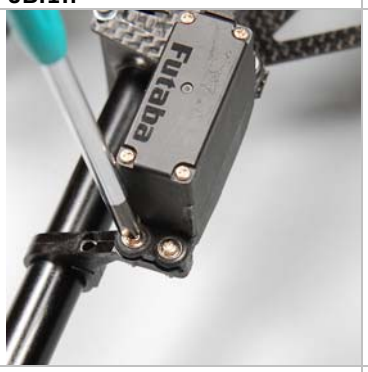


3B.1.d



3B.1.e

3B.1.f

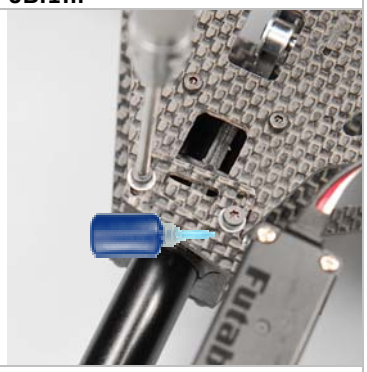


3B.1.g

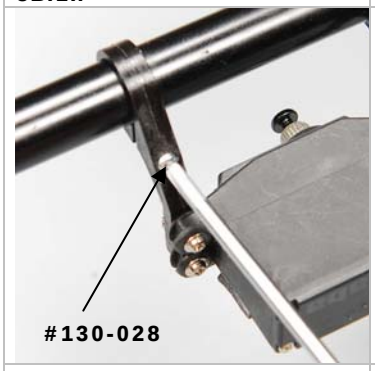
Building Notes:
Tighten the bolts on the front rudder servo mount using thread lock.

This mounts position can be moved to allow for changing the t/r belt tension without affecting the t/r pushrod length. The initial position of this is to center the bracket slots on the two bolts.

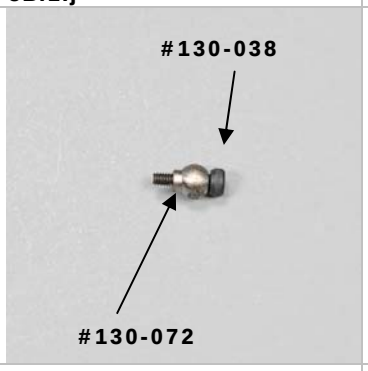
3B.1.h



3B.1.i



3B.1.j



3B.1.k

Use a servo wheel of the size shown

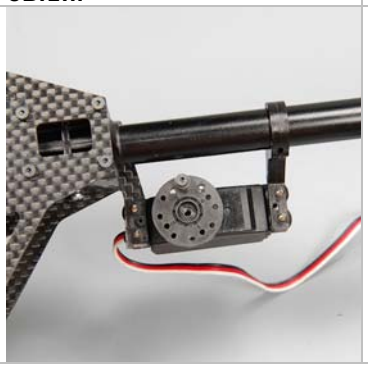
3B.1.l

3B.1.m

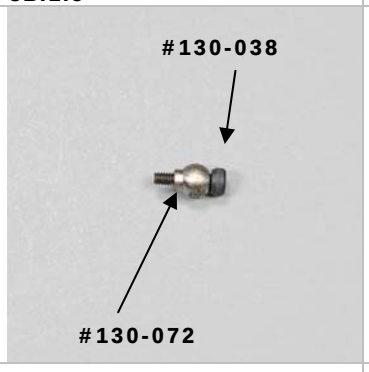
Building Notes:
Do not thread lock the t/r servo ball yet. It cannot be correctly installed until the electronics are powered up and the servo centered in a later step

Install the t/r bell crank onto the t/r servo but don't tighten at this time.

3B.1.n



3B.1.o

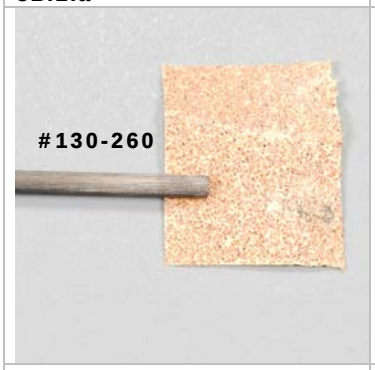
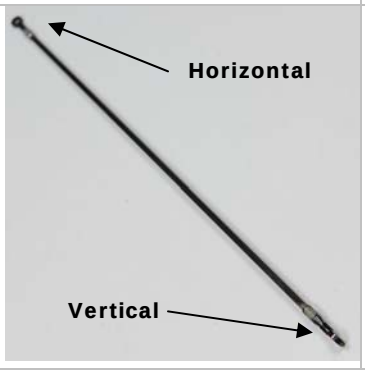


3B.1.p

Building Notes:
Install t/r control ball as shown using thick adhesive only.

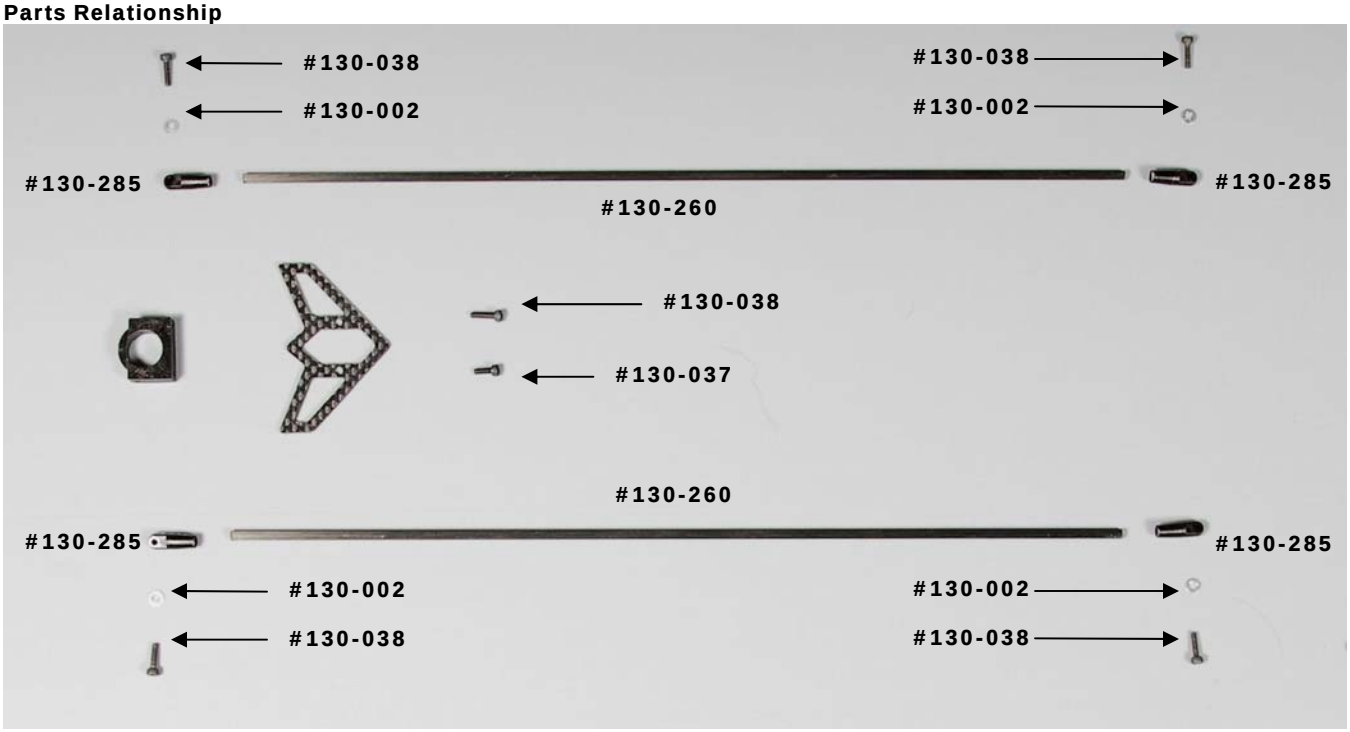
3B.2 Assemble T/R Pushrod

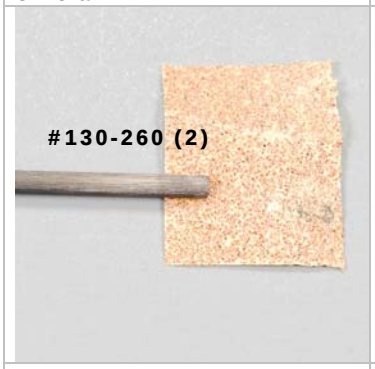
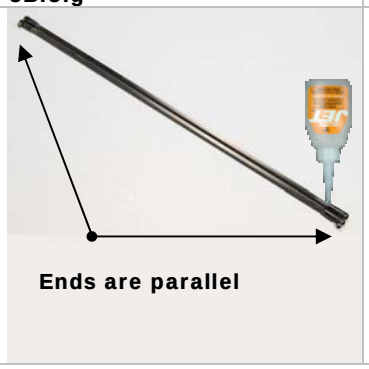
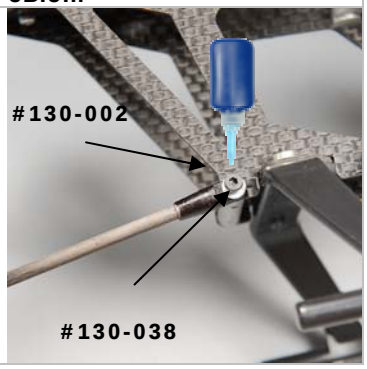
Parts Relationship

3B.2.a	3B.2.b	3B.2.c	3B.2.d
	**Building Notes:** Lightly sand the ends of the t/r pushrod to help the adhesive grip. Test fit the pushrod ends to make sure they slide fully over the end. Sand as necessary Attach the two ends as shown using adhesive		
3B.2.e	**3B.2.f**	**3B.2.g**	
		**Building Notes:** Repeat the process for the other end of the t/r pushrod. Align the two links so they are at right angles to each other The overall length will be approximately 312mm measured from end to end SET THIS ASIDE FOR NOW, IT WILL BE INSTALLED IN A LATER STEP.	

3B.3 Assemble/Install Tail Boom Supports

Parts Relationship



3B.3.a	3B.3.b	B.3.c	3B.3.d
	**Building Notes:** Lightly sand the ends of the boom supports to help the adhesive grip. Test fit the support ends to make sure they slide fully over the end. Sand as necessary Attach one end to each rod as shown using adhesive		
3B.3.e	**3B.3.f**	**3B.3.g**	**3B.3.h**
	**Building Notes:** Align one end of the supports using a spare 2mm bolt or other object. The other ends need to be installed parallel to these two using adhesive. You can use a bolt or other object to align the other end as shown.		

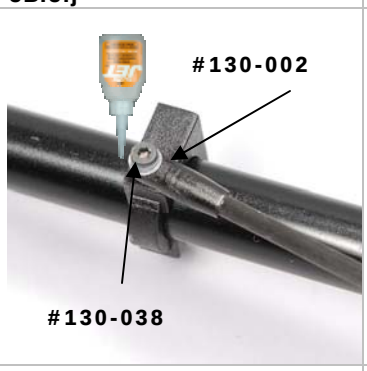
3B.3.i

Building Notes:
Install one of the tail boom supports as shown. They attach to the bottom of the rear frame and to the horizontal fin mount

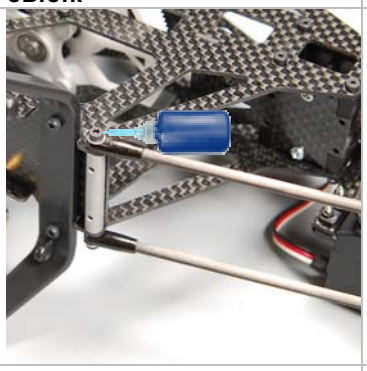
Repeat for both supports

Use adhesive and thread lock as shown

3B.3.j

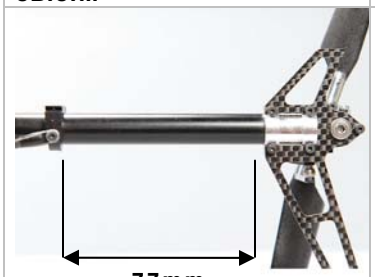


3B.3.k



3B.3.l

3B.3.m



Dimension is approximate

3B.3.n

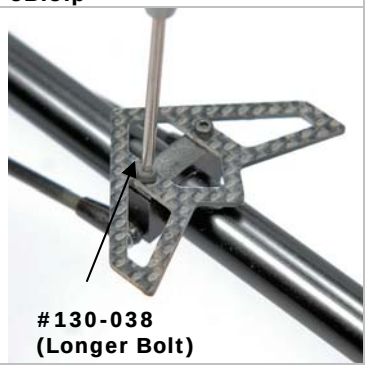
Building Notes:
When initially assembled, the horizontal fin mount will be spaced from the t/r transmission as shown.

Depending on the belt tension this may vary slightly

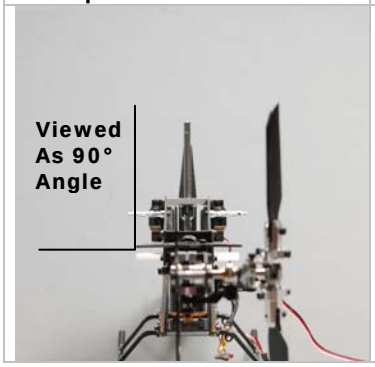
Install the horizontal fin in two steps as shown

3B.3.o

3B.3.p



3B.3.q



3B.3.r

Building Notes:
Align the horizontal fin so that it is at a right angle to the tail fin and main shaft.

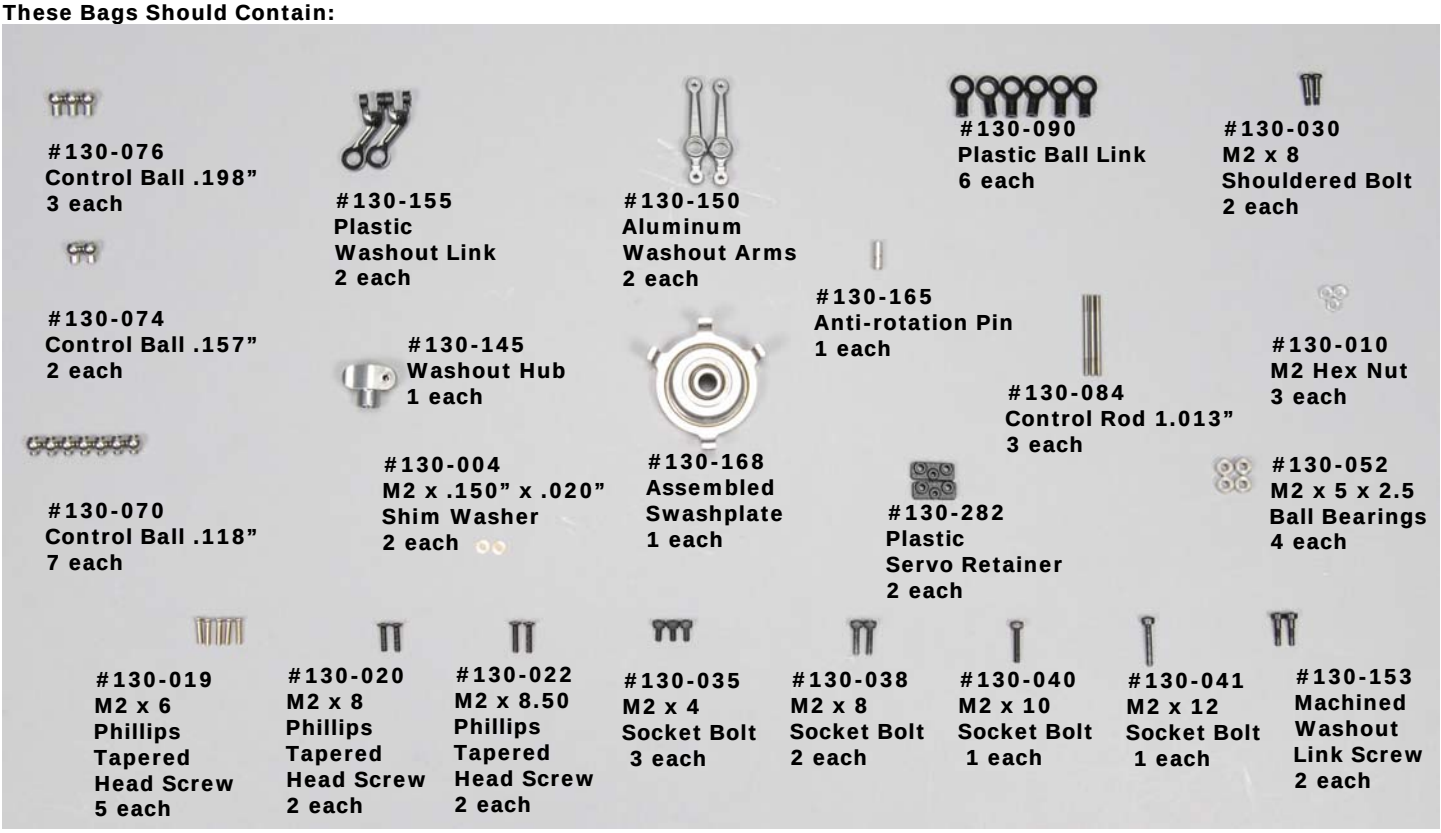
Note that tightening the left horizontal fin bolt tightens the clamp and will rotate the fin slightly counter-clockwise.

3B.3.s

Assembly Step #4 – Control Systems

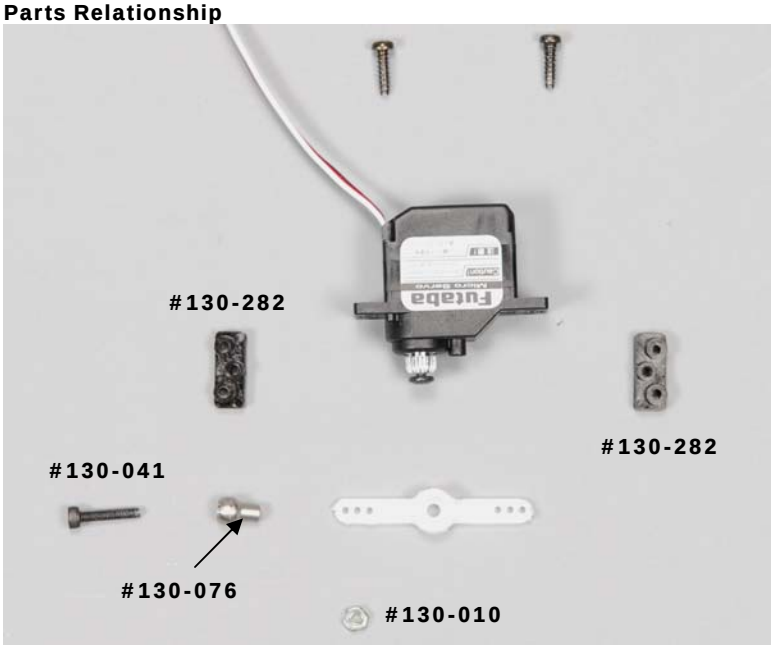
4A) Electronics Installation/Main Control Components - Bag #7A, #7B, #7 Hardware

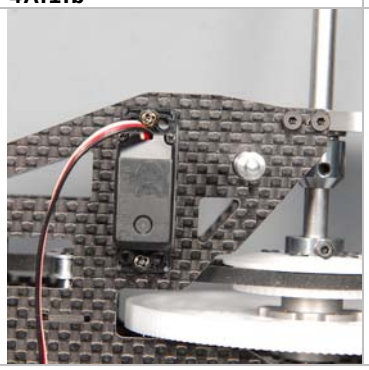
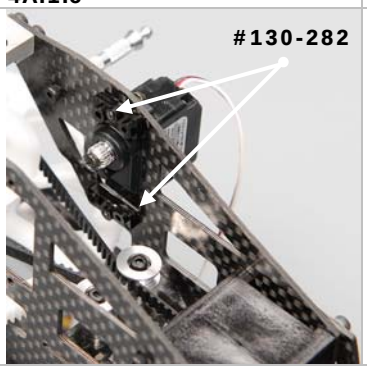
These Bags Should Contain:



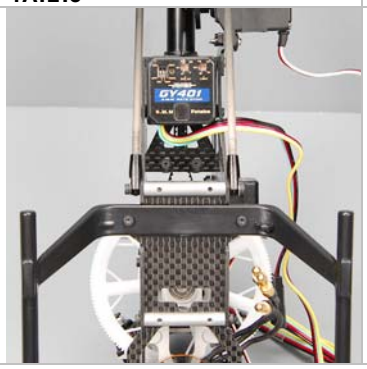
4A.1 Install Elevator Servo

Parts Relationship

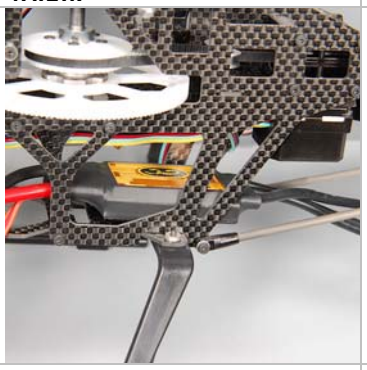
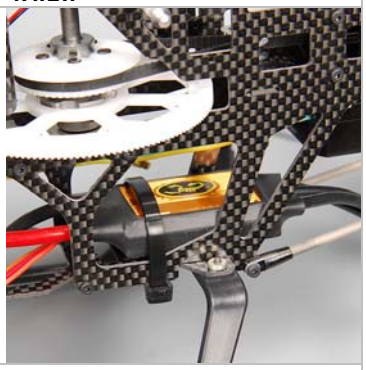
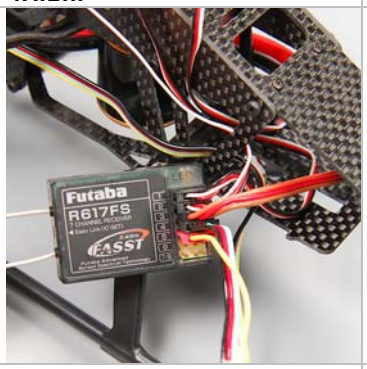
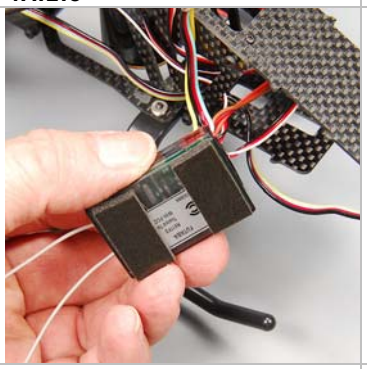
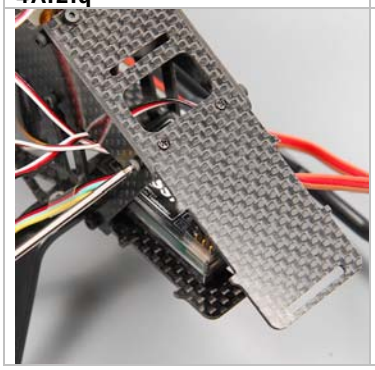
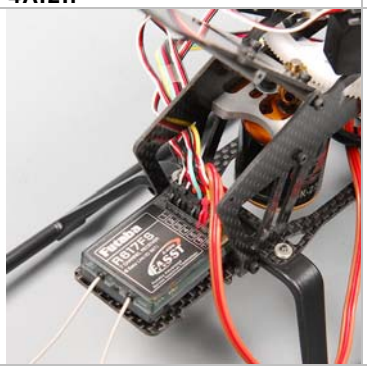
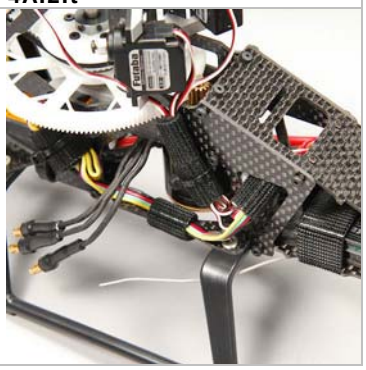


4A.1.a	4A.1.b	4A.1.c	4A.1.d
			**Building Notes:** Install the elevator servo as shown. Use short servo screws or cut longer ones off to ensure that the servo screws do not hit the t/r belt Be careful not to disturb the routing of the t/r belt during the servo installation

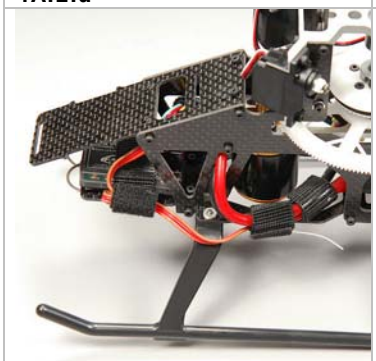
4A.2 Install Electronics

4A.2.a	4A.2.b	4A.2.c	4A.2.d
	**Building Notes:** Install your gyro on the plate underneath the tail boom. Use the mounting method specified by the gyro manufacturer. Connect the T/R servo to the gyro.		**Building Notes:** If it is not pre-wired, attach connectors to your ESC according to the manufacturer's recommendations. Do not connect it to the motor yet as you will need to power up the receiver/servos in the next section

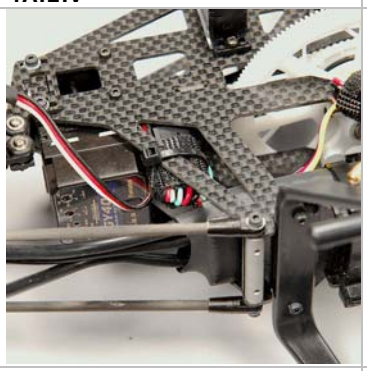
`

4A.2.e	4A.2.f	4A.2.g	4A.2.h
	**Building Notes:** You will need connectors to connect the speed controller/BEC and the battery. Dean's connectors have proven to be very efficient. They are available as part #130-460 Wire the connectors as shown		
4A.2.i	**4A.2.j**	**4A.2.k**	**4A.2.l**
	**Building Notes:** You will need the Velcro and tie wraps from Bag 9 to complete the remaining steps in this section. Mount the ESC either between the frames or on the frame side wherever it fits better. Secure the ESC with a tie wrap to prevent it from being ejected.		
4A.2.m	**4A.2.n**	**4A.2.o**	**4A.2.p**
Building Notes: Connect the receiver according to the manufacturer's instructions. Make sure you at minimum connect the • Elevator • Aileron • Rudder • Pitch • Throttle • Power			**Building Notes:** Remove the front bolts from the radio tray, lift it up and install the receiver. Then reposition the radio tray and reinstall the bolts with thread lock
4A.2.q	**4A.2.r**	**4A.2.s**	**4A.2.t**
		**Building Notes:** Now use Velcro to secure and organize the exposed wiring. Be careful to keep it away from turning objects and keep wires away from any sharp edges on the graphite.	

4A.2.u



4A.2.v

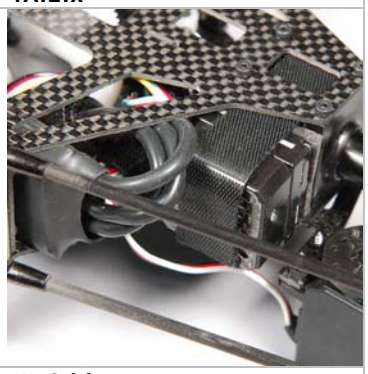


4A.2.w

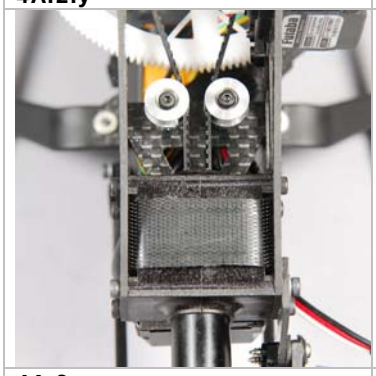
Building Notes:
Secure gyro using Velcro as shown.

You will need to slightly trim the Velcro width so that it fits into the slots on each side of the front boom support as shown.

4A.2.x



4A.2.y



4A.2.z

Building Notes:
Refer to the Initial Setup for Servo Centering procedure found in the Model Setup section of this manual

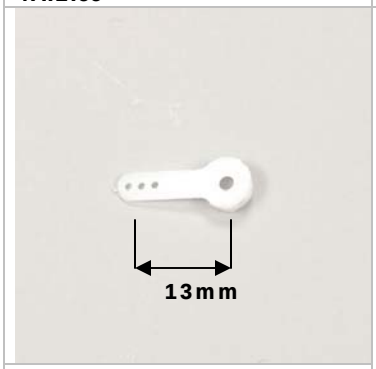
For each servo select a servo arm and find the position that the arms are nearly perpendicular to the servo. Trim and mount the arms as shown in the following steps

4A.2.aa

4A.2.bb

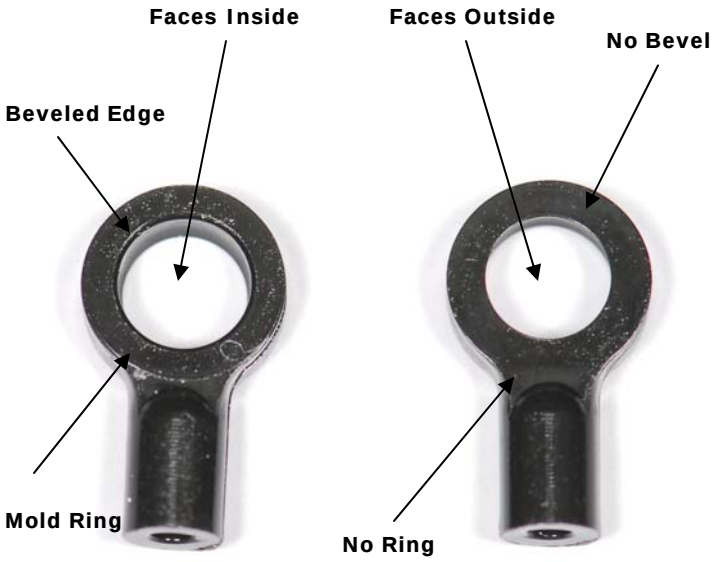
Building Notes:
In the following steps you will assemble the servo arms. Select arms that will allow the control balls to be placed at distance from the servo center shown.

4A.2.cc



4A.2.dd

Ball Link Orientation

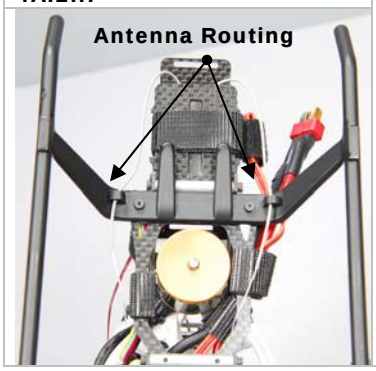


4A.2.ee

Building Notes:
Although the plastic links can be installed on either side, one side is molded differently and will install easier with less effort. Note the differences on the photo.

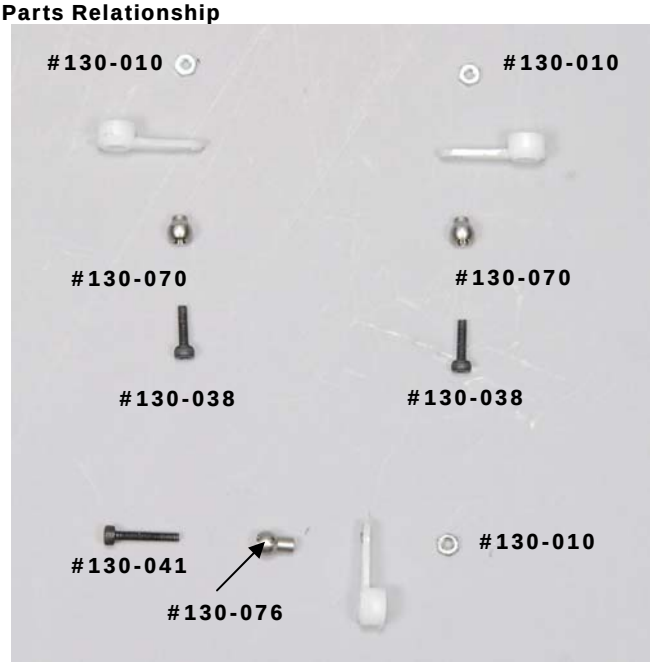
The side of the link with the beveled edge should be installed first over a ball or should face inside on a ball. The side of the link with no bevel should face outside on a ball.

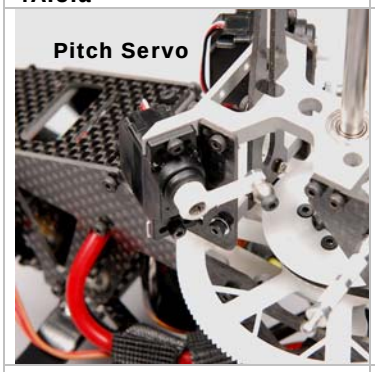
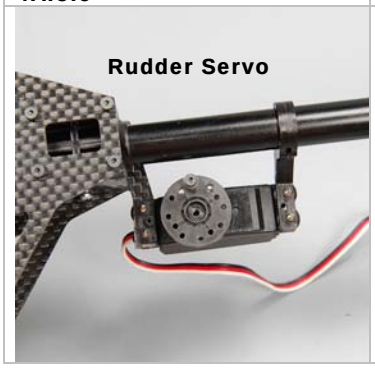
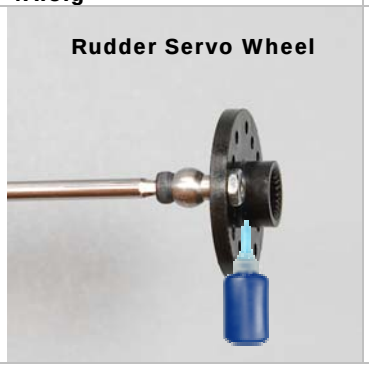
4A.2.ff

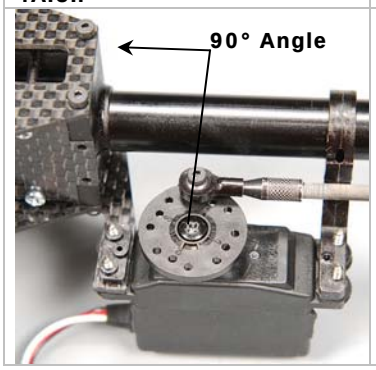
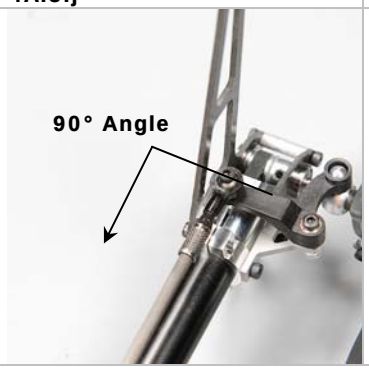


4A.3 Install Servo Arms

Parts Relationship

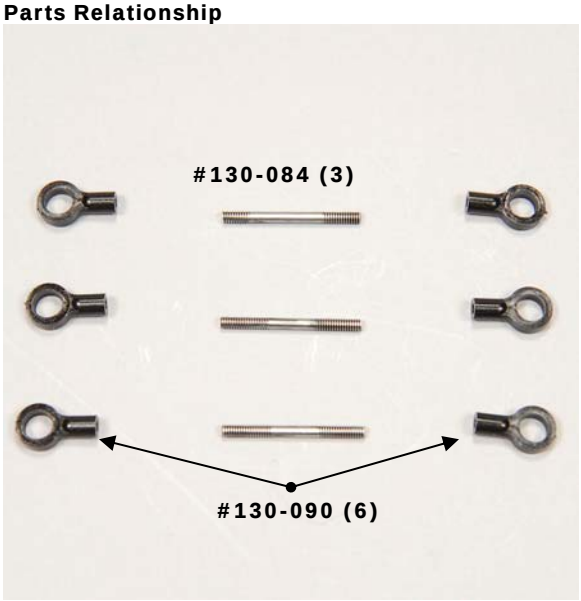


4A.3.a	4A.3.b	4A.3.c	4A.3.d
			**Building Notes:** Shape the proper length control arms as shown, then assemble each as shown. Install in their respective positions and don't forget the servo arm retainer screws
4A.3.e	**4A.3.f**	**4A.3.g**	**4A.3.h**
	**Building Notes:** Revisit the servo previously installed for the tail rotor. Make sure it is properly centered via the radio and that the servo arm and t/r bell crank are at right angles to the tail boom. If necessary move the servo arm ball installed earlier to a new hole and apply thread lock		**Building Notes:** Snap the ball links over the ball on the t/r servo and on the t/r bell crank If the servo arm and the bell crank are not at right angles to the tail boom, adjust the ball links as necessary until they are. Make sure you have installed a servo arm retainer screw.

4A.3.i	4A.3.j	4A.3.k
		

4A.4 Assemble Cyclic Control Rods

Parts Relationship

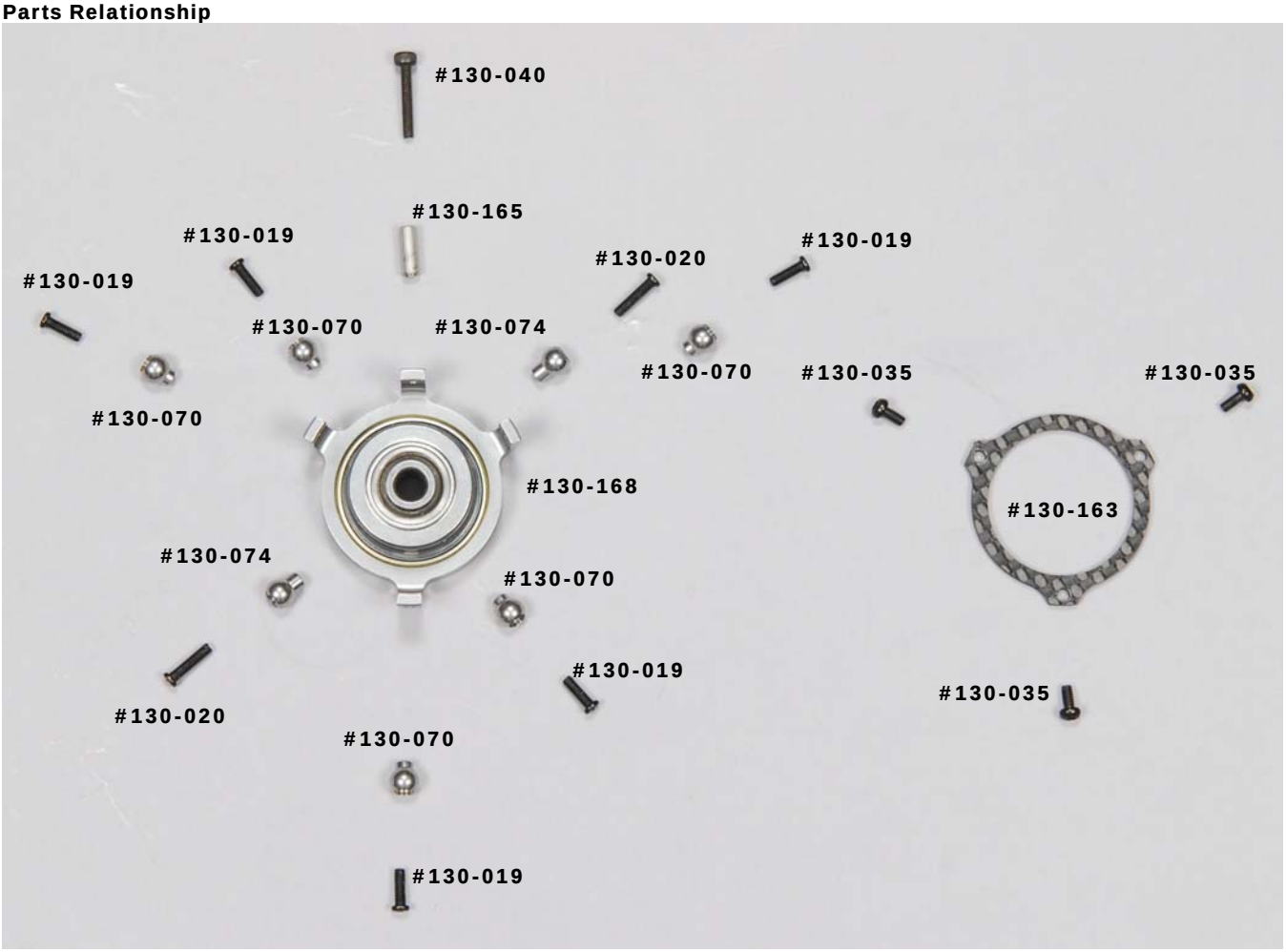


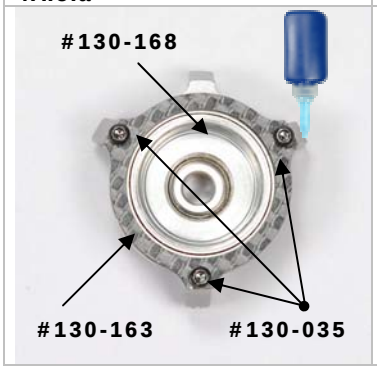
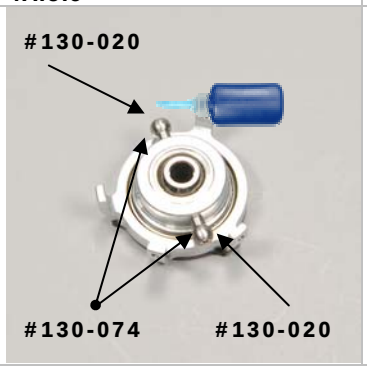
Building Notes:
Assemble three cyclic control rods as shown. These will print ACTUAL SIZE so you can lay them on the photo to determine the correct length

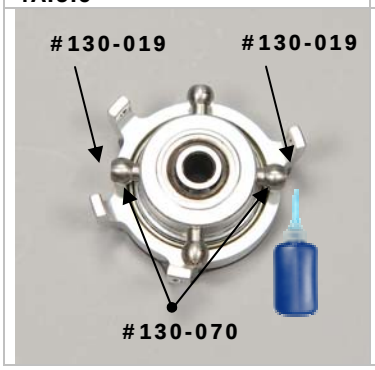
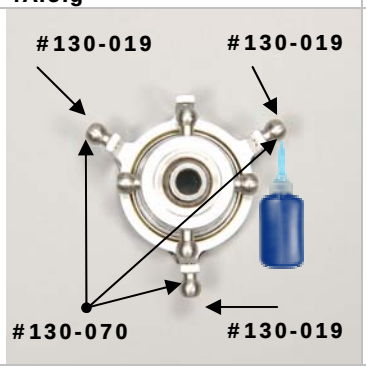
All "actual size" rod lengths in this manual assume you are using the exact servos shown. Use of different servos may require minor adjustments to obtain the proper settings due to minor differences in servo dimensions. The final length will be within the ranges listed.

4A.5 Assemble Swashplate

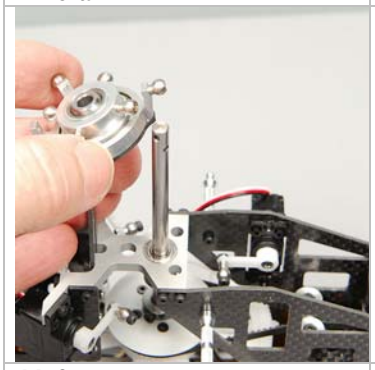
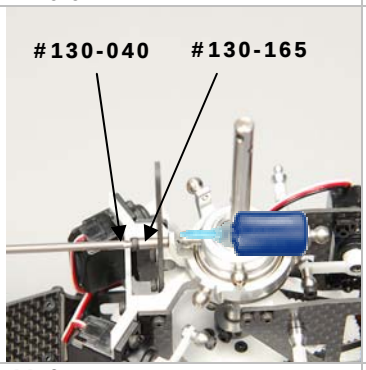
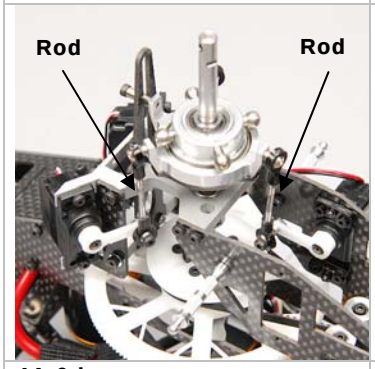
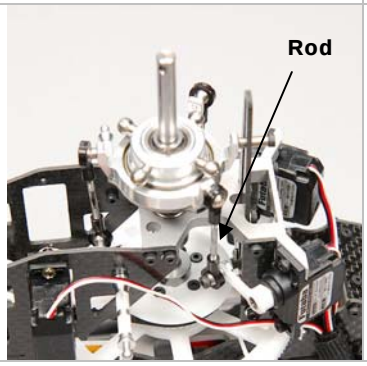
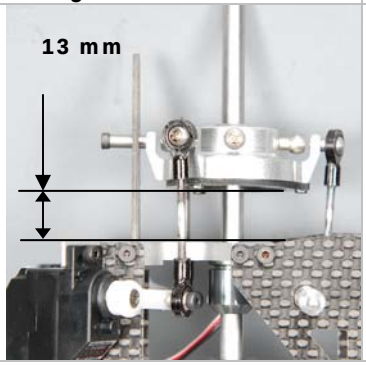
Parts Relationship



4A.5.a	4A.5.b	4A.5.c	4A.5.d
	**Building Notes:** Install the swashplate ring on the bottom of the swashplate as shown using thread lock		**Building Notes:** Install the two longer balls on the inside swashplate ring. Make sure you use the slightly longer bolts

4A.5.e	4A.5.f	4A.5.g	4A.5.h
	**Building Notes:** Install the two short balls on the inside swashplate ring. Make sure you use the right length bolts.		**Building Notes:** Install the balls on the outside swashplate ring. Note the positions on the ring.

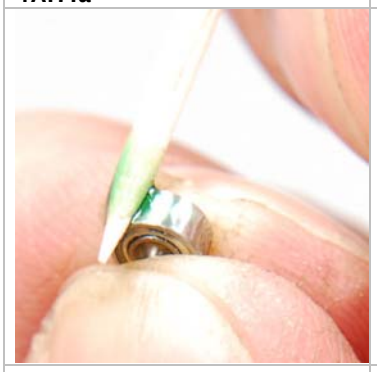
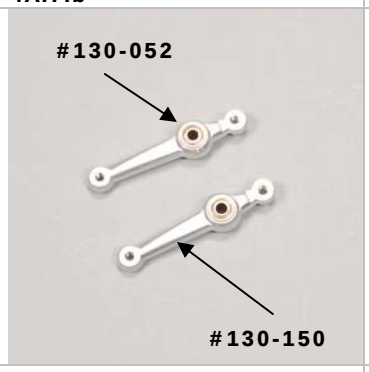
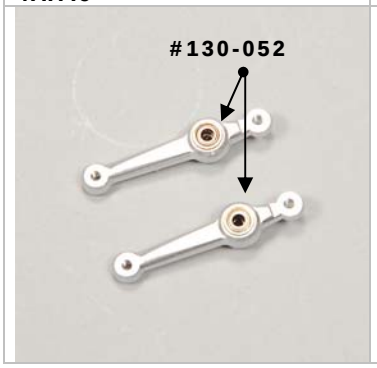
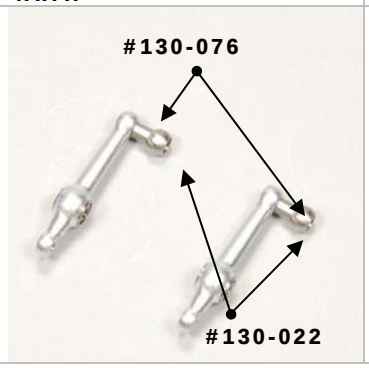
4A.6 Install Swashplate/Control Rods

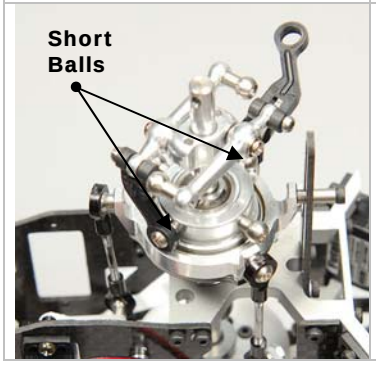
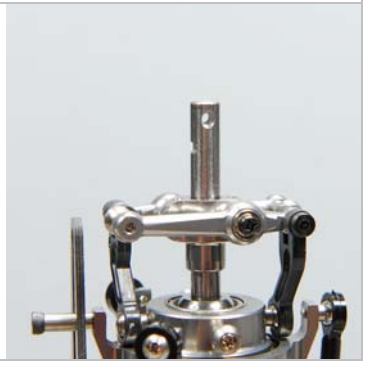
4A.6.a	4A.6.b	4A.6.c	4A.6.d
	**Building Notes:** Slip the swashplate over the main shaft as shown. Install the anti-rotation pin and bolt through the anti-rotation guide and into the remaining threaded hole on the outer swashplate ring		**Building Notes:** Install the three equal length cyclic control rods between the elevator, aileron, and pitch servo arms and the control balls on the swashplate
4A.6.e	**4A.6.f**	**4A.6.g**	**4A.6.h**
			**Building Notes:** With the servo arms centered, if the rods are the correct lengths the distance between the bottom of the swashplate plate and the top of the upper bearing block will be as shown. If it is not, adjust the lengths of all three rods accordingly.

4A.6.i
Building Notes: If the servo arms are the correct length, the rods will be parallel with the main shaft when the arms are in their centered position. This will ensure proper control authority.

4A.7 Assemble Washout Mixer

Parts Relationship

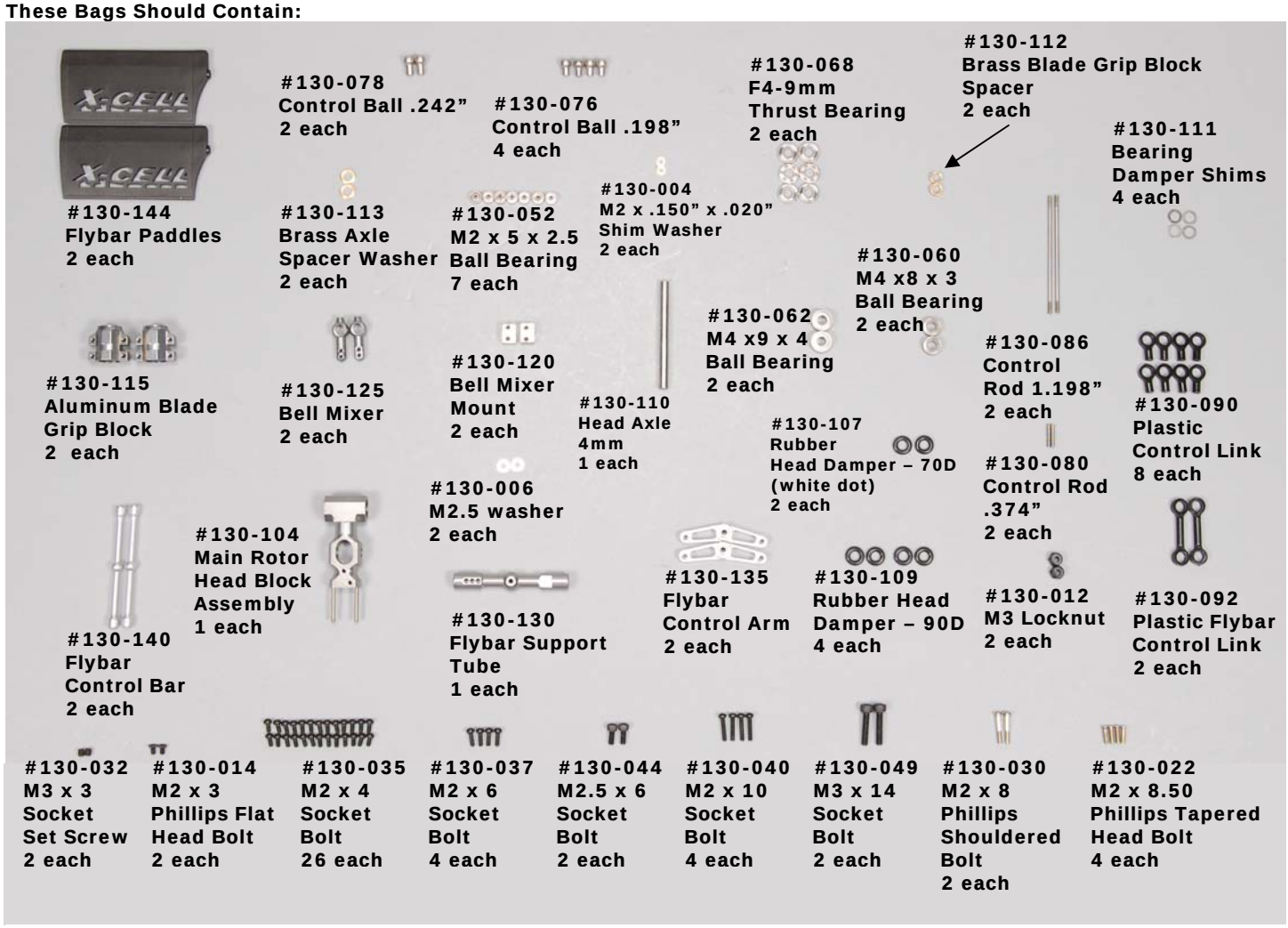
4A.7.a	4A.7.b	4A.7.c	4A.7.d
		**Building Notes:** Build the two mixer arms as shown. They are identically made. Make sure you drop the small spacer in between the bearings before you press in the second one.	
4A.7.e	**4A.7.f**	**4A.7.g**	**4A.7.h**
		**Building Notes:** Install the washout links as shown using the special screws. Use thread lock sparingly Do not overtighten the bolts, the links should move smoothly. You may also slightly heat the links with a heat gun to improve their fit on the mixer arms.	

4A.7.i	4A.7.j	4A.7.k	4A.7.l
Building Notes: Install the mixer arms onto the mixer base EXACTLY as shown using thread lock. Be careful not to get any in the bearings. The orientation of the links and balls are important The extended part of the washout base is the bottom			
4A.7.m	**4A.7.n**	**4A.7.o**	
	**Building Notes:** If the servos are properly centered and the swashplate rods are the correct lengths, when the collective is centered the mixer arms will be centered as shown.		

Assembly Step #5 – Rotor Head

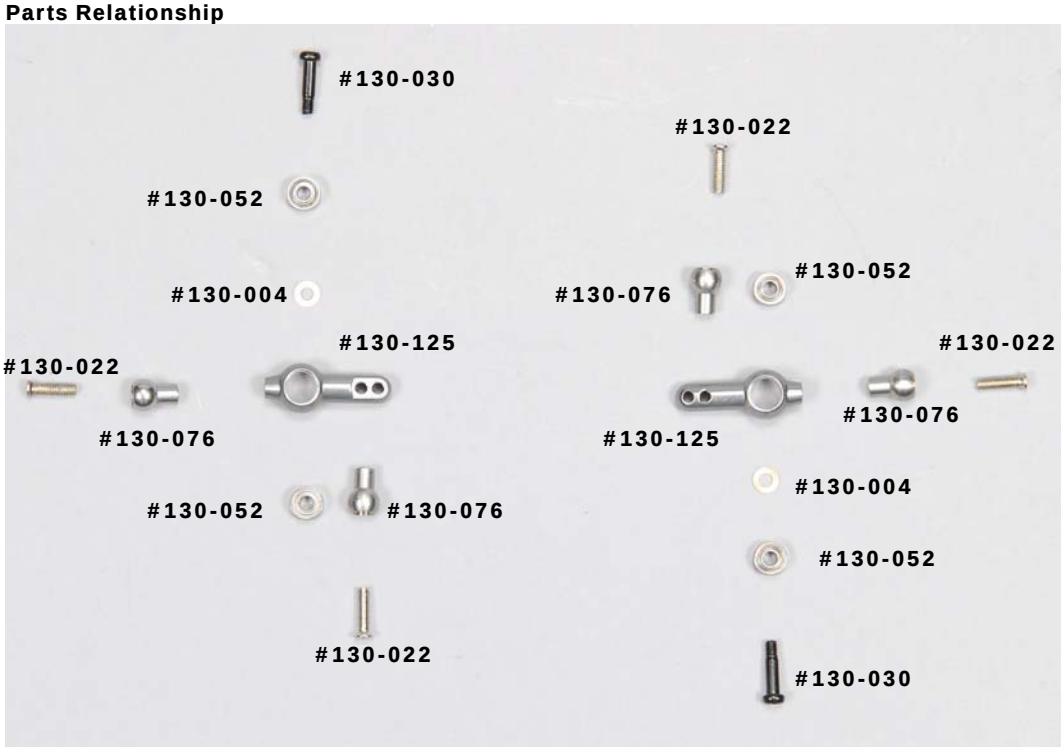
5A) Rotor Head Components - Bag #8A, #8B, #8C, #8 Hardware

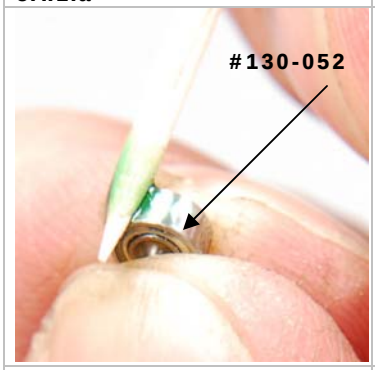
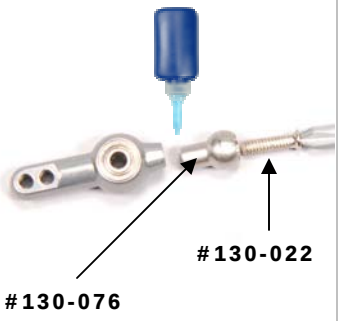
These Bags Should Contain:

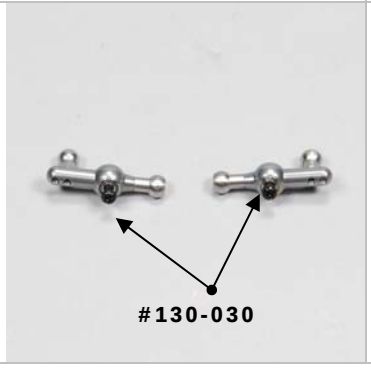


5A.1 Assemble Bell Mixers

Parts Relationship

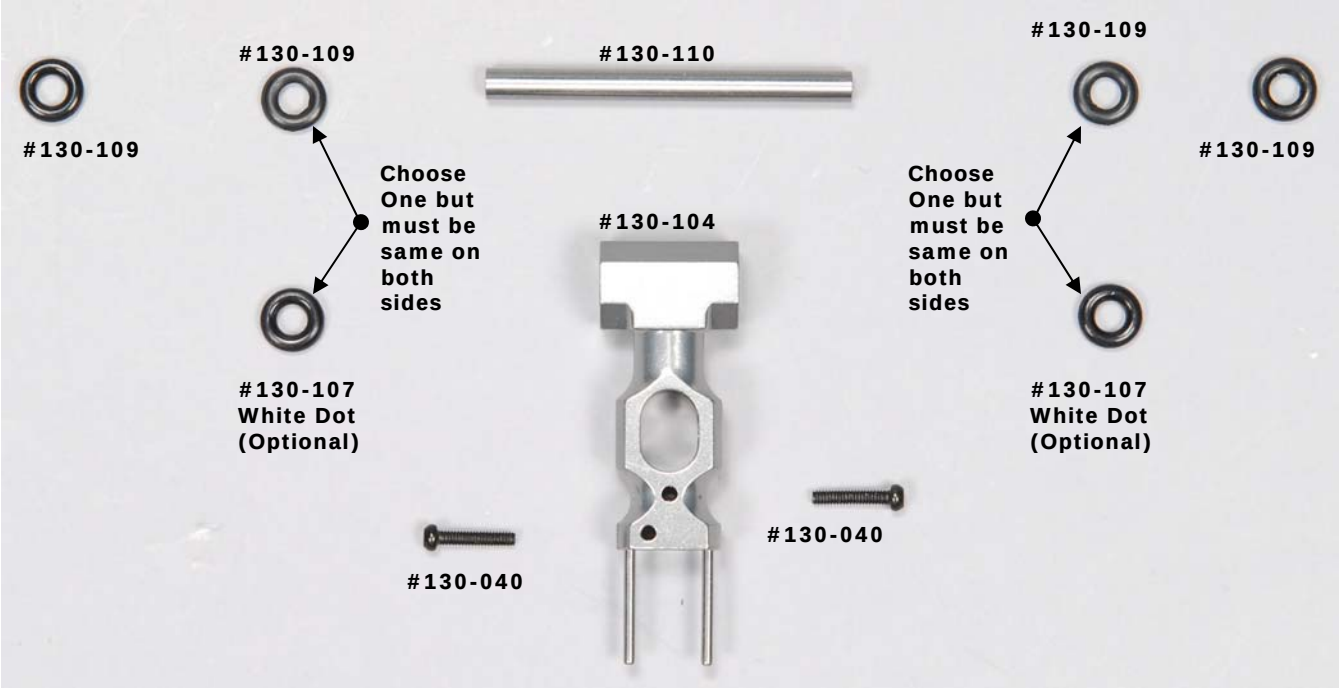


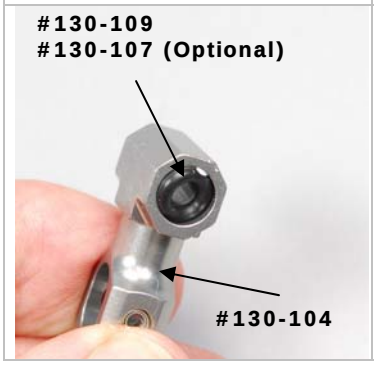
5A.1.a	5A.1.b	5A.1.c	5A.1.d
	**Building Notes:** Apply a thin coat of green thread lock on the small bearings using a toothpick. Place a drop of thread lock on the end of the toothpick and then smear it around the bearings. This must be applied to all four of the bearings in this assembly		
5A.1.e	**5A.1.f**	**5A.1.g**	**5A.1.h**
Building Notes: Be careful to wipe away any excess thread lock and don't get any into the bearing itself		**The spacer is captured between the two bearings** 	

5A.1.i	5A.1.j	5A.1.k	5A.1.l
	**Building Notes:** Install the swashplate input control balls on the "flat" side of the bell mixers. The default position is into the hole nearest the bearings.		**Building Notes:** Build the other bell mixer using the same assembly sequence. Insert the bolts to mount the mixers through the bearing/spacer stack as shown and set them aside until later.

5A.2 Assemble Main Rotor Block

Parts Relationship

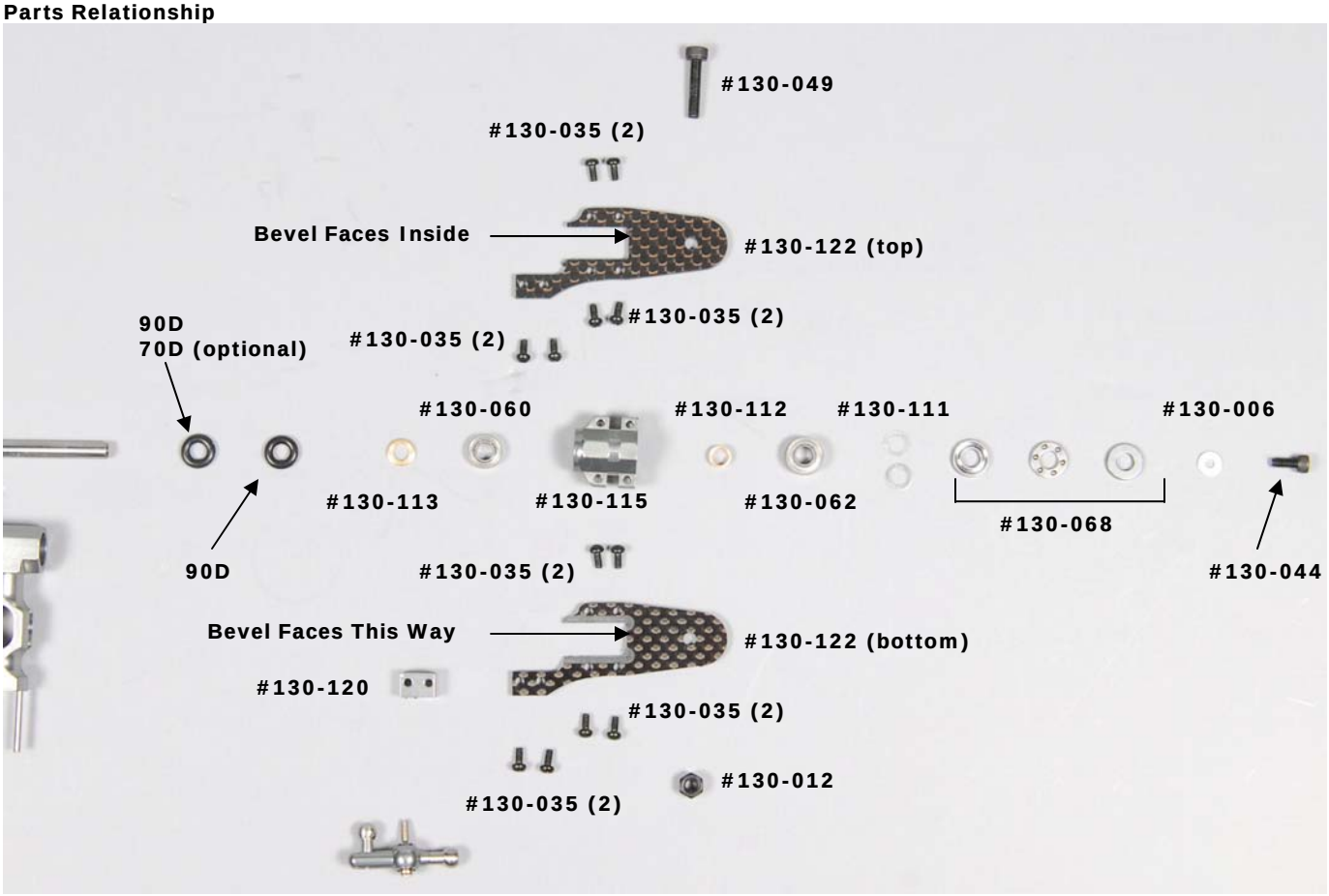


5A.2.a	5A.2.b	5A.2.c	5A.2.d
	**Building Notes:** Insert one of the 90D dampers into the head damper cavity or for less aggressive response use a 70D damper here. Then put one of the 90D dampers on top of that and press them into the cavity until flush. Repeat on the opposite side of the head block		

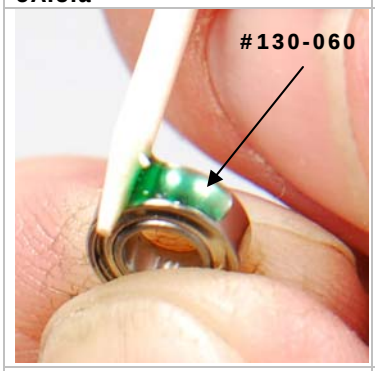
5A.2.e	5A.2.f	5A.2.g
		**Building Notes:** Center the axle in the head block as shown. It will slide easily in the dampers.

5A.3 Assemble Main Blade Grips

Parts Relationship



5A.3.a



5A.3.b

Building Notes:
Apply a thin coat of green thread lock on the smaller bearings using a toothpick. Place a drop of thread lock on the end of the toothpick and then smear it around the bearings. DO NOT APPLY TO THE BEARING INSIDE THE GRIP! Wipe away any excess and be careful not to get any in the bearing

5A.3.c

5A.3.d

5A.3.e

5A.3.f

5A.3.g

5A.3.h

5A.3.i

Building Notes:
Insert one of the damper shims on top of the inside bearing.

OPTIONAL: If you want stiffer damping for quicker response, then put a second spacer in each grip.

5A.3.j

5A.3.k

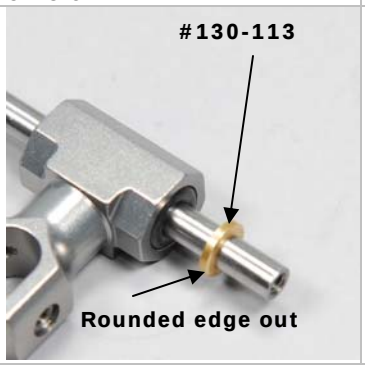
Building Notes:
Before installing thrust bearings, make sure the correct order is followed. There are two sizes of the hole in the bearing races. The race with the larger hole goes in first. Make sure the orientation of each bearing part matches the photos.

5A.3.l

5A.3.m

5A.3.n

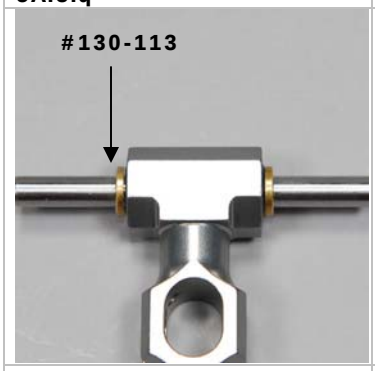
5A.3.o



5A.3.p

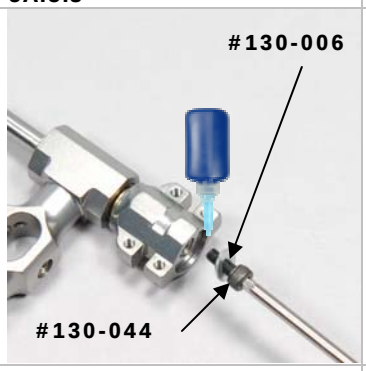
Building Notes:
Install the axle spacer washers so that the rounded edge faces outward

5A.3.q



5A.3.r

5A.3.s

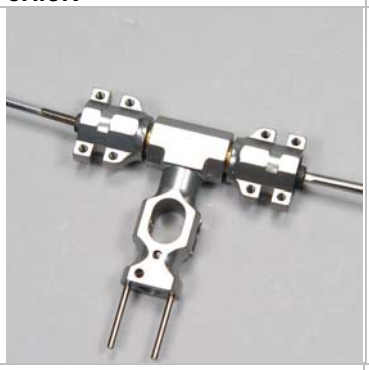


5A.3.t

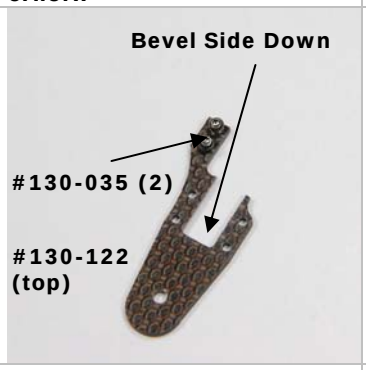
5A.3.u

Building Notes:
Install the other blade grip and retain it as shown. Use two allen drivers to tighten the bolts but do not overtighten as the axle ends may distort.

5A.3.v



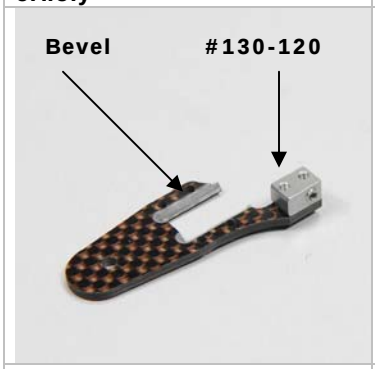
5A.3.w



5A.3.x

Building Notes:
When building the blade grips, note that they are cut in pairs. The beveled edges fit around the blade grip block as shown

5A.3.y

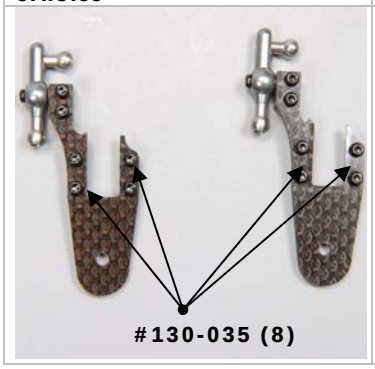


5A.3.z

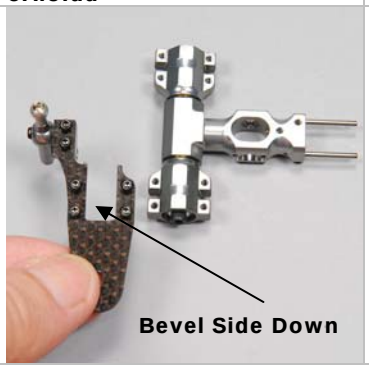
5A.3.aa

5A.3.bb

5A.3.cc

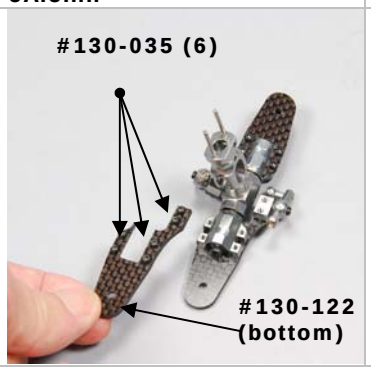
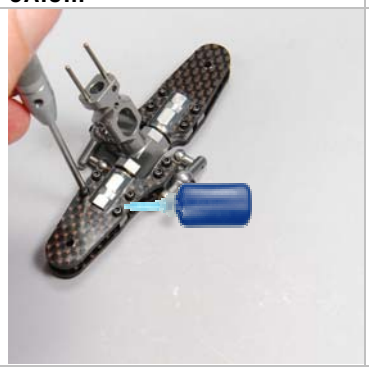
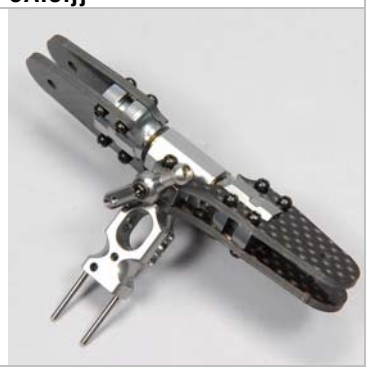


5A.3.dd



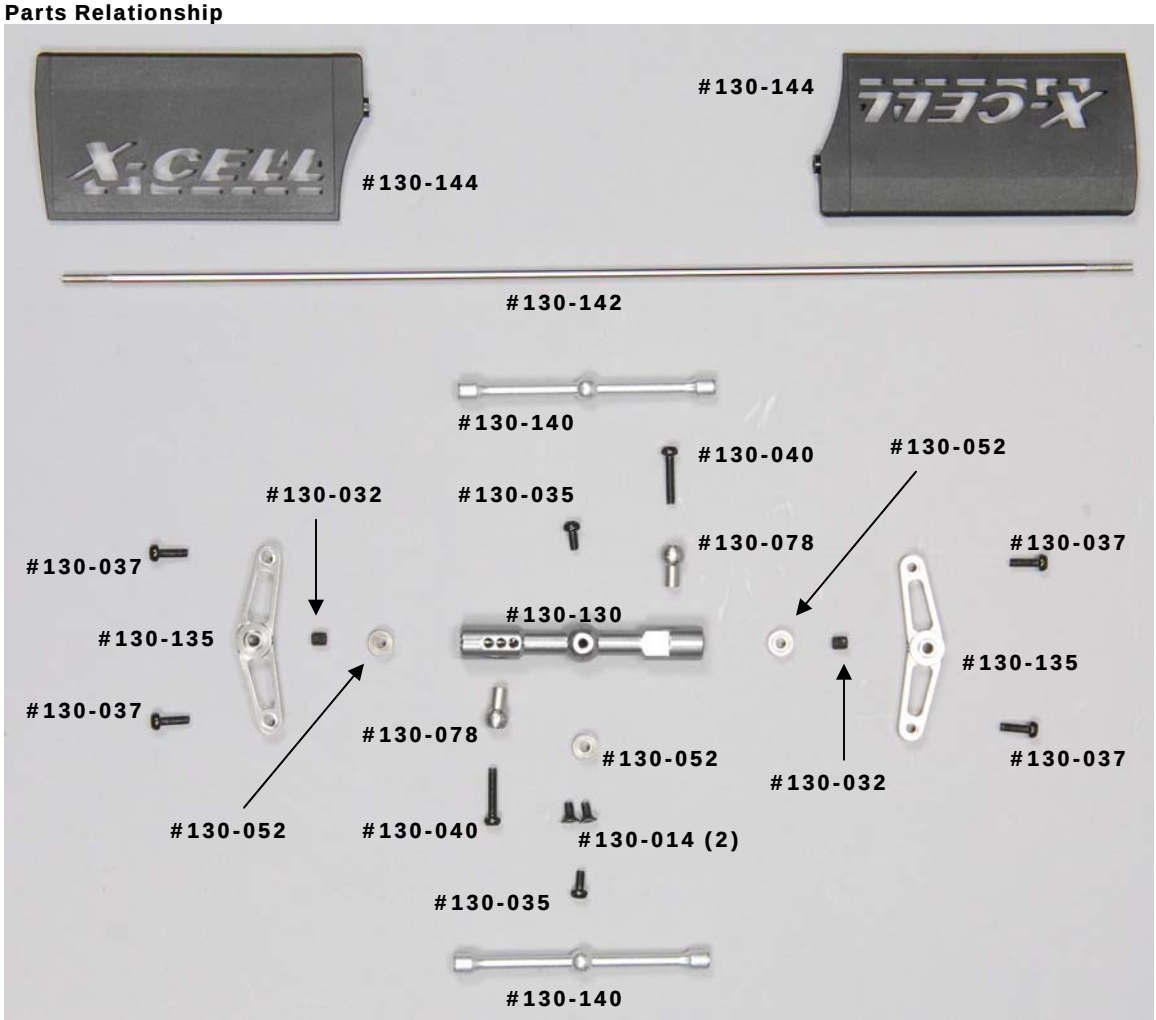
5A.3.ee

5A.3.ff

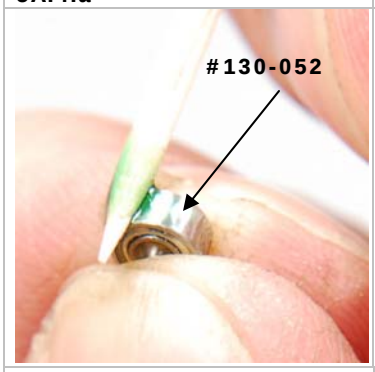
5A.3.gg	5A.3.hh	5A.3.ii	5A.3.jj
			

5A.4 Assemble Flybar Components

Parts Relationship



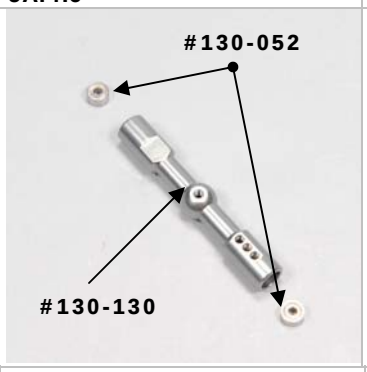
5A.4.a



5A.4.b

Building Notes:
Apply a thin coat of green thread lock on the smaller bearings using a toothpick. Place a drop of thread lock on the end of the toothpick and then smear it around the bearings. Be careful to not get any in the bearing and wipe off any excess

5A.4.c

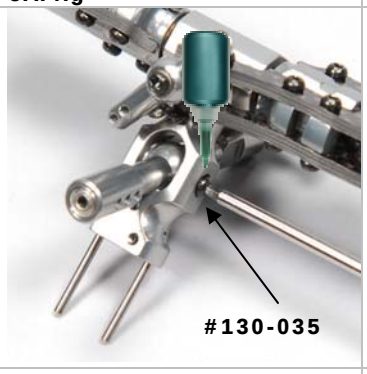


5A.4.d

5A.4.e

5A.4.f

5A.4.g



5A.4.h

Building Notes:
Apply a very small amount of thread lock on the bolt threads and be careful not to get any into the flybar pivot bearings.

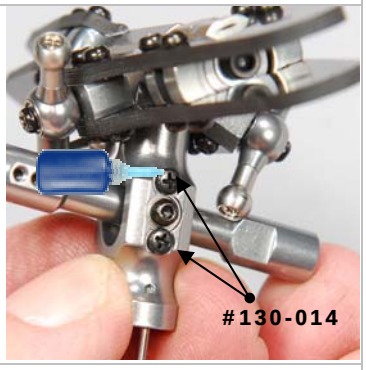
Allow the thread lock on the flybar pivot bolts to dry thoroughly before proceeding with the assembly.

5A.4.i

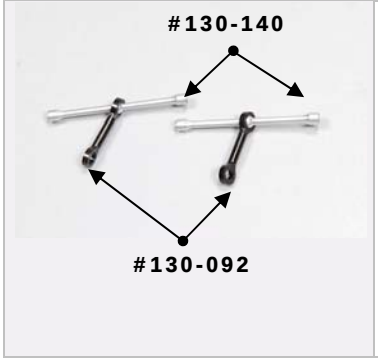
5A.4.j

5A.4.k

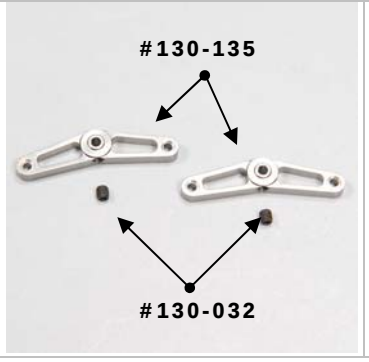
5A.4.l



5A.4.m

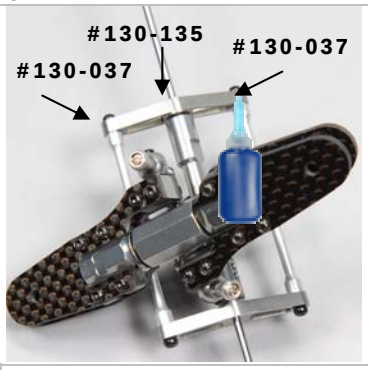
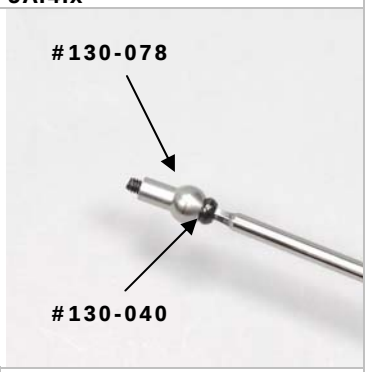
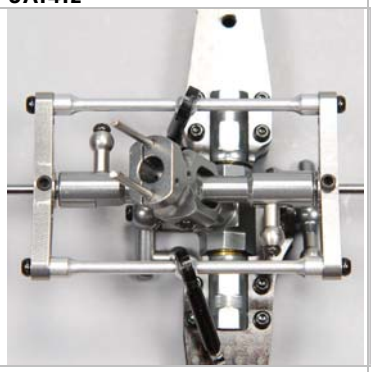
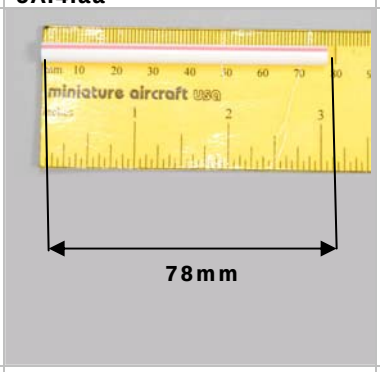
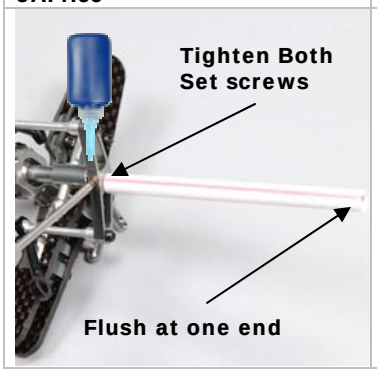


5A.4.n



5A.4.o

5A.4.p

5A.4.q	5A.4.r	5A.4.s	5A.4.t
Building Notes: Note that the flybar control arm posts have protrusions on each end and the correct side of the control arms has a matching recess.			
5A.4.u	**5A.4.v**	**5A.4.w**	**5A.4.x**
			
5A.4.y	**5A.4.z**	**5A.4.aa**	**5A.4.bb**
			**Building Notes:** To center the flybar, find a drinking straw and cut it to the exact length of 78mm. Slide the straw over one end of the flybar and then adjust the flybar in or out until the threaded end of the flybar is flush with the end of the straw
5A.4.cc	**5A.4.dd**	**5A.4.ee**	**5A.4.ff**
	**Building Notes:** Tighten both retaining set screws using thread lock. This will center the flybar.		**Building Notes:** Locate the decal sheet. The right hand lower corner contains two squares. These are for covering the flybar paddles. Follow the outline and cut these out with scissors

5A.4.gg

5A.4.hh

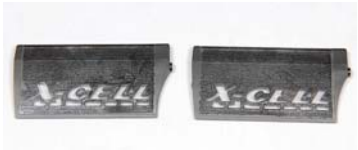
Building Notes:
Peel the backing off of one of the decals and apply it to a paddle. Note that the paddle has molded inlays where the decal goes.

Start applying on one side of the paddle and wrap around as shown. Press out air bubbles so it seals against the paddle body.

5A.4.ii

5A.4.jj

5A.4.kk



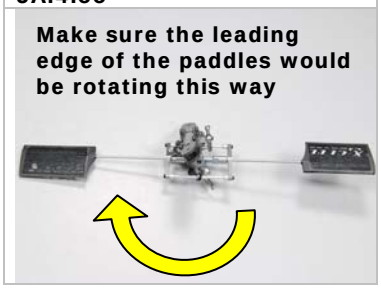
5A.4.ll

5A.4.mm

Thread on flybar paddles as shown

5A.4.nn

5A.4.oo



5A.5 Install Rotor Head

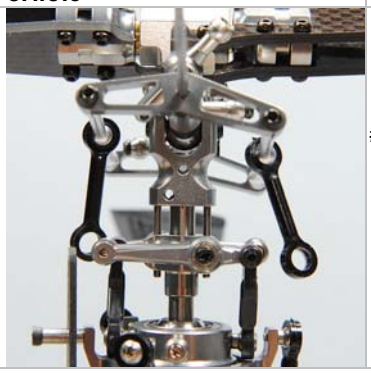
5A.5.a

5A.5.b

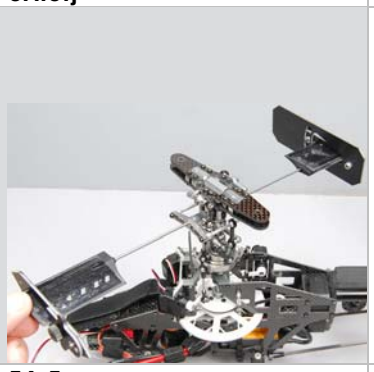
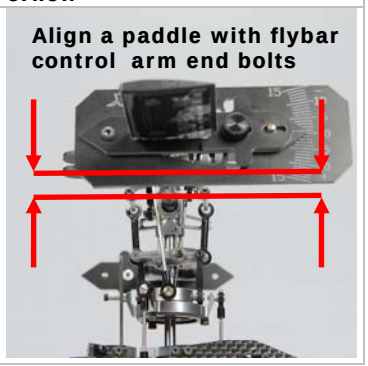
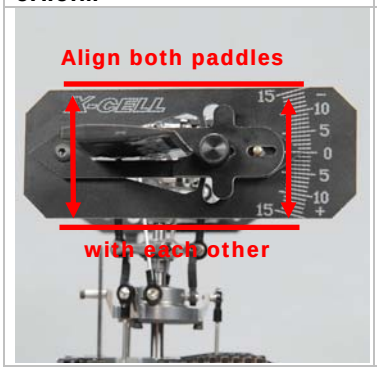
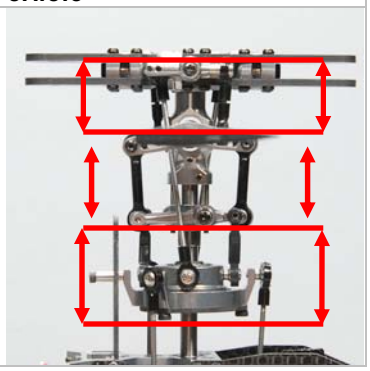
Building Notes:
Install the main rotor on the main shaft as shown. Be careful to align the side bolt hole with the slot on the main shaft as well as the center mount hole with the center hole on the main shaft. Install the two bolts with thread lock.

DO NOT OVERTIGHTEN THESE BOLTS.

5A.5.c

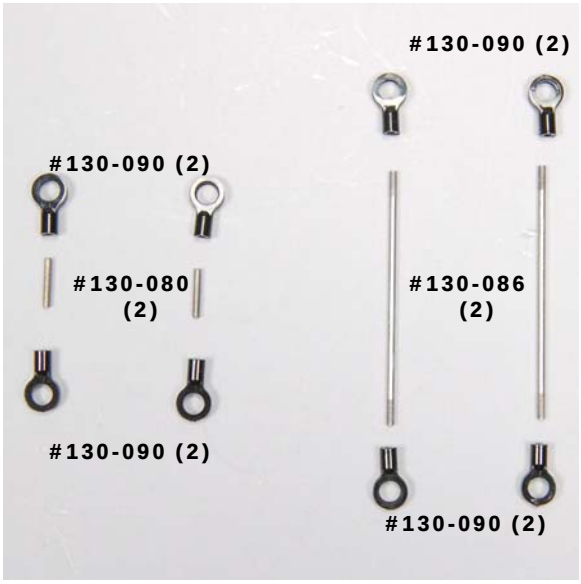


5A.5.d

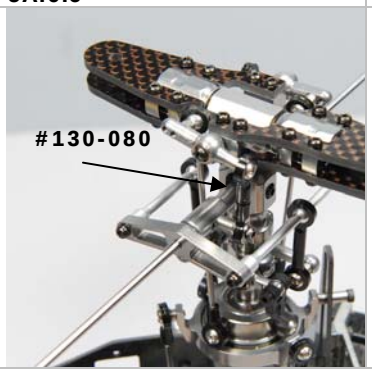
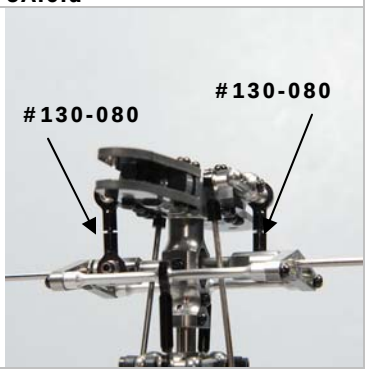
5A.5.e	5A.5.f	5A.5.g	5A.5.h
		**Building Notes:** Snap the two flybar control links onto the balls on the ends of the mixer arms as shown. Now you should align the flybar paddles with each other and with the centerline of the flybar control arms. Do this visually or acquire alignment tools such as these.	
5A.5.i	**5A.5.j**	**5A.5.k**	**5A.5.l**
		**Building Notes:** Install alignment gauges on the paddles as shown and sight down the length of the flybar to align them with each other and with the flybar control arms.	
5A.5.m	**5A.5.n**	**5A.5.o**	
	**Building Notes:** When installed and properly aligned, the paddles will look like this against the head at zero degrees collective. Adjust the paddles as necessary until they align as shown with the swashplate, flybar control arm, washout arms, and blade axle center line.		

5A.6 Assemble/Install Rotor Head Control Rods

Parts Relationship



Building Notes:
Assemble three cyclic control rods as shown. Lay the rods on the photo to determine correct length as they print actual size

5A.6.a	5A.6.b	5A.6.c	5A.6.d
			

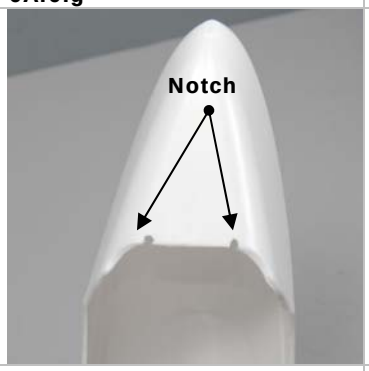
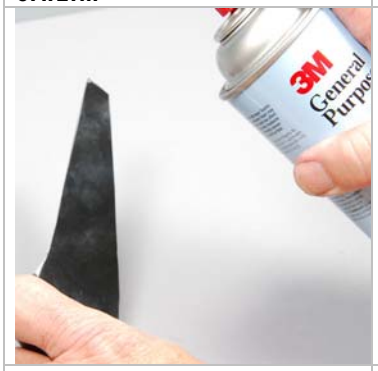
Assembly Step #6 – Complete Model Assembly

6A) Canopy Components - Bag #9A, #9 Hardware

These Bags Should Contain:

6A.1 Assemble/Install Canopy

6A.1.a	6A.1.b	6A.6.c	6A.1.d
	**Building Notes:** Use a #9 (.196") drill to open the two mount holes on the side canopy. Be careful to center the drill in the relief hole. Using scissors and/or a razor knife trim the flashing from the canopy edges and then open up the top of the canopy following the molded in outline.		

6A.1.e	6A.1.f	6A.6.g	6A.1.h
	**Building Notes:** Trim notches in the bottom of the canopy as shown so that it will fit flush against the front of the lower chassis. Insert the two grommets into the previously drilled mounting holes.		
6A.1.i	**6A.1.j**	**6A.6.k**	**6A.1.l**
	**Building Notes:** Trim the windshield along the molded lines using scissors. The material cuts easily. The finished shape should look like the following photo.		**Building Notes:** Using a light spray adhesive like 3M 77 or equivalent, spray the INSIDE of the windshield with the adhesive. Then apply the windshield to the canopy as shown. The windshield will cover and hide the previously installed grommets.
6A.1.m	**6A.1.n**	**6A.6.o**	**6A.1.p**
			**Building Notes:** Using a #55 (.052”) drill, mark and drill 6 holes through the windshield and canopy in the positions shown. (Two in the front, and then two on each side of the windshield)
6A.1.q	**6A.1.r**	**6A.6.s**	**6A.6.t**
	**Building Notes:** Screw the six self tapping mounting screws through the windshield into the canopy. Lightly tighten them to prevent “stripping” the plastic in the canopy.		**Building Notes:** Install the canopy by slipping it over the front of the chassis as shown Clean off any adhesive overspray on the windshield left from an earlier step

6A.1.u

6A.1.v

6A.6.w

Building Notes:
Slip the bottom of the canopy between the two landing gear canopy clamps and the bottom chassis plate. Push backwards until the chassis plates fit into the previously cut canopy notches.

6A.6.x

6A.1.y

Building Notes:
Attach the rear of the canopy by pushing the grommets at the rear of the canopy onto the canopy mounting studs on the chassis. This completes canopy installation.

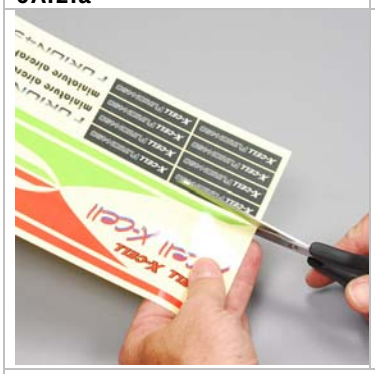
Make sure that the canopy clears all moving components such as the main gear, servo arms/rods or swashplate. Trim if necessary.

6A.1.z

6A.6.aa

6A.2 Install Decals

6A.2.a



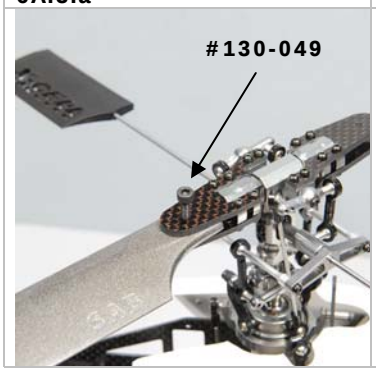
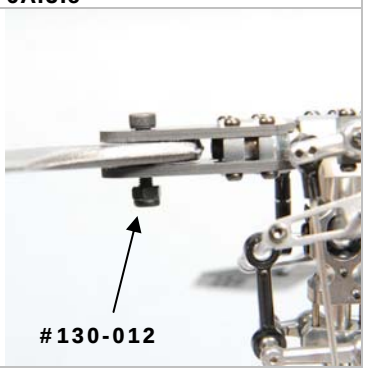
6A.2.b

6A.2.c

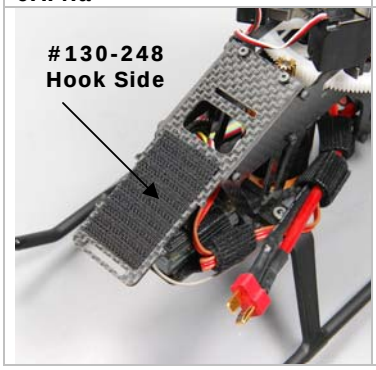
6A.2.d

Building Notes:
Trim the decals from the decal sheet with scissors. The standard decal layout is shown. Clean and degrease the canopy, then peel the backing off of each decal and apply into its appropriate position. Be careful not to get any air bubbles under the decals as this can cause wrinkles and collect dirt. Seal the edges of the decals with clear nail polish to further seal them.

6A.3 Install Rotor Blades

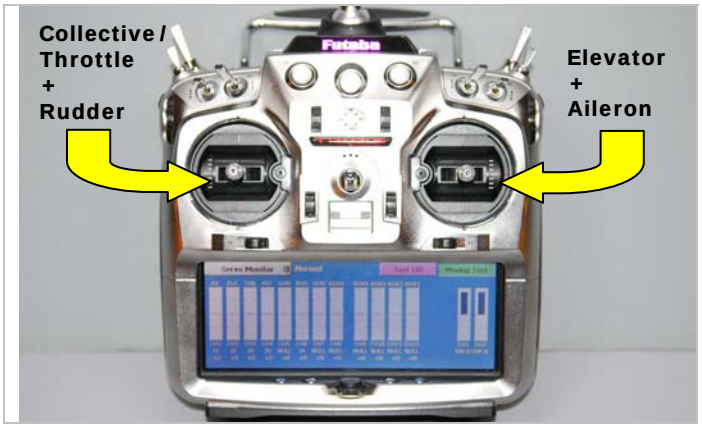
6A.3.a	6A.3.b	6A.3.c
	**Building Notes:** Insert the main rotor blade into the blade grip and attach as shown. Tighten the locknut until the rotor blade is tight in the blade grip. The blade should not be able to move in the grip easily. SAB 320mm rotor blades are recommended for best overall performance.	

6A.4 Install Battery

6A.4.a	6A.4.b	6A.4.c
		

IV. Basic Model/Radio Setup

The setup shown is for a Mode II radio system however it will apply to any style radio



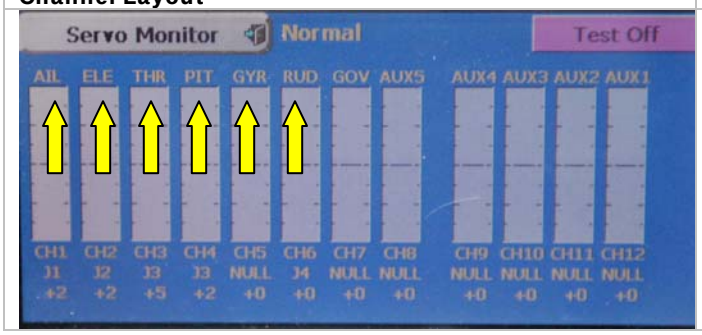
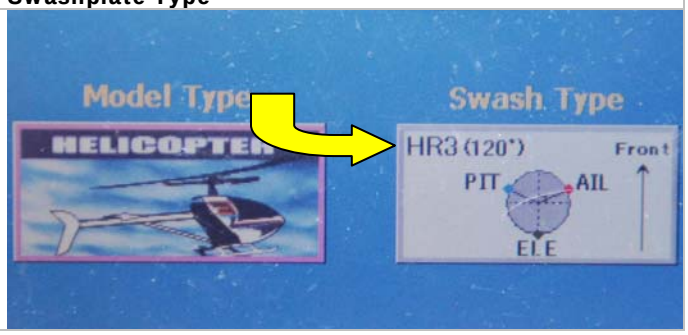
A) Initial Setup for servo centering

Plug in all servos according to manufacturer's channel assignments. It is not necessary to connect the throttle channel at this time.

For Futaba FASST, the following are the default assignments (your system may vary)

- Ch1 = Aileron Ch4 = Pitch
- Ch2 = Elevator Ch5 = Gyro
- Ch3 = Throttle Ch6 = Rudder

In your radio, set the model type for helicopter and set the swash type as 120° CCPM. Check the radio manual to find the correct swashplate setting and channel arrangement (For Futaba this is SR-3/HR-3).

Channel Layout	Swashplate Type
	

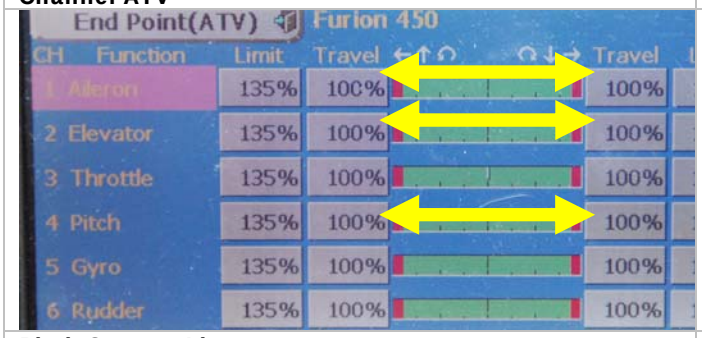
At this point in the setup you don't need to power up the ESC but only the receiver and servos. If you are using a separate Rx battery, plug it into the receiver and proceed. If you are only using an ESC with a BEC for Rx power, don't connect the ESC to the motor when you power up for this step.

For the pitch, aileron, and elevator servos:

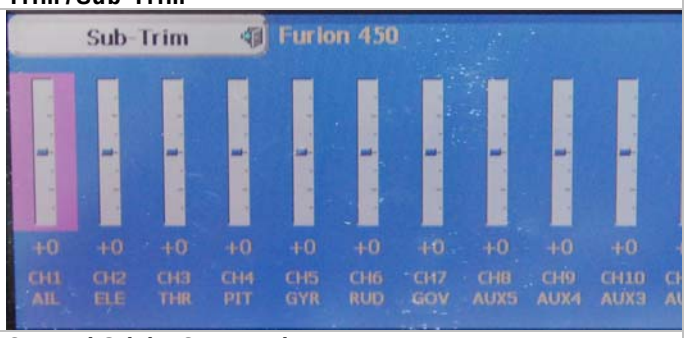
In your radio

- ATV (servo endpoints) should be at 100%
- Set all trims and sub-trims to center or zero.
- Set an initial linear pitch curve as a straight line (sample points: 0%, 25%, 50%, 75%, 100%)
- Make sure there is no mixing enabled for cyclic channels at this point
- Center the collective stick and make sure all the cyclic channels are centered

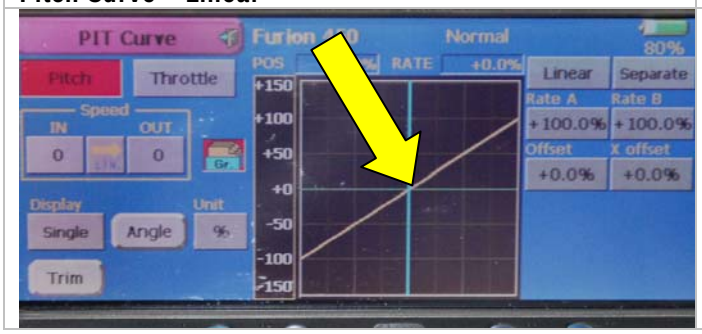
Channel ATV



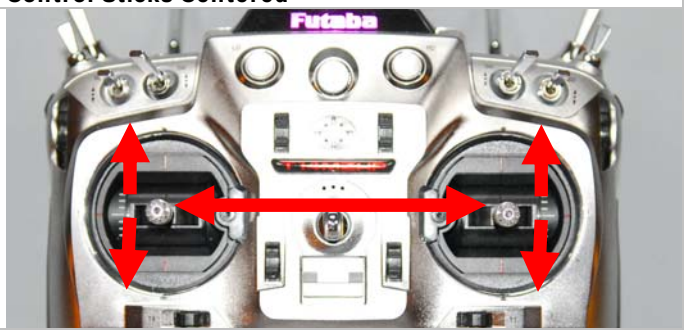
Trim / Sub-Trim



Pitch Curve – Linear



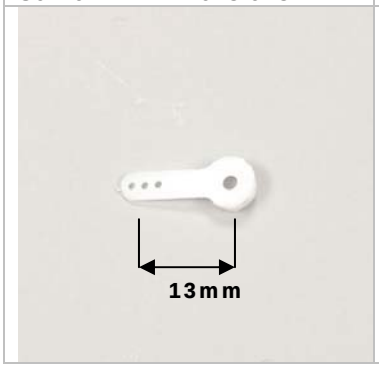
Control Sticks Centered



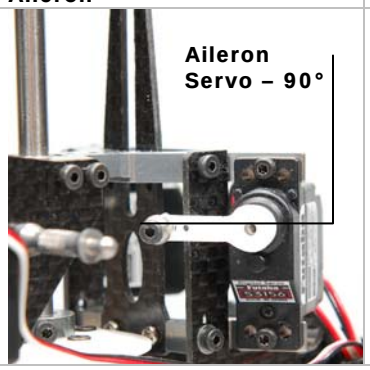
On your model

- Mount each ball into a servo arm hole approximately 13mm from the center of each arm as shown.
- Slide the servo horns for each channel onto each servo exactly in the middle of its travel as shown
- Failing to get them set at center will create interaction in your swash plate travel.
- If possible, center the horns on the servos without using any sub trim. As a last resort, use the sub trim function to precisely center each servo.
- Make sure you install hex nuts on the ball retainer bolts using threadlock
- Make sure you install servo arm retainer screws

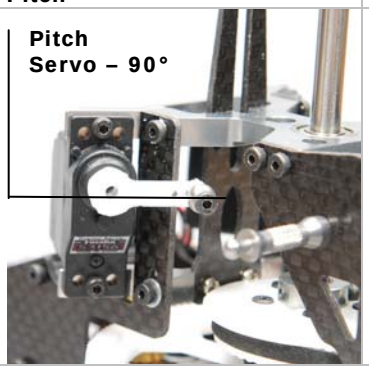
Servo Arm Dimensions



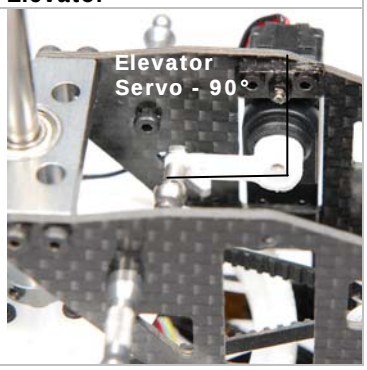
Aileron



Pitch



Elevator

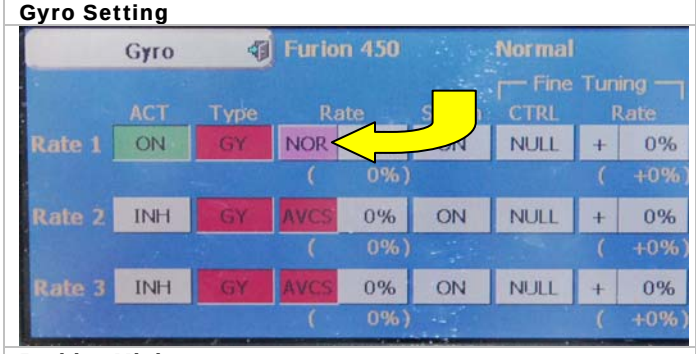


For the rudder servo:

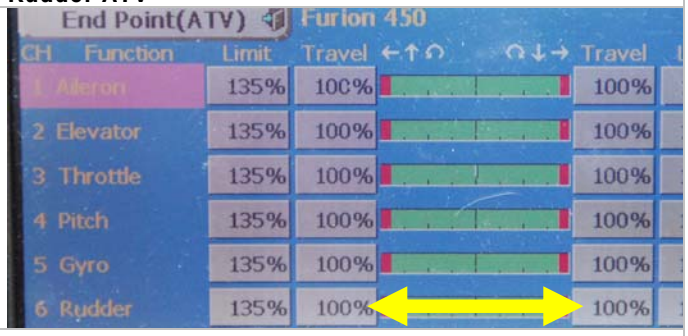
In your radio

- Make sure the gyro is in non-heading hold mode. Refer to your gyro manufacturer as to how to enable this.
- Rudder servo endpoints (ATV) should be at 100%
- Make sure there is no mixing enabled for rudder channel at this point (some radios mix throttle to rudder by default).

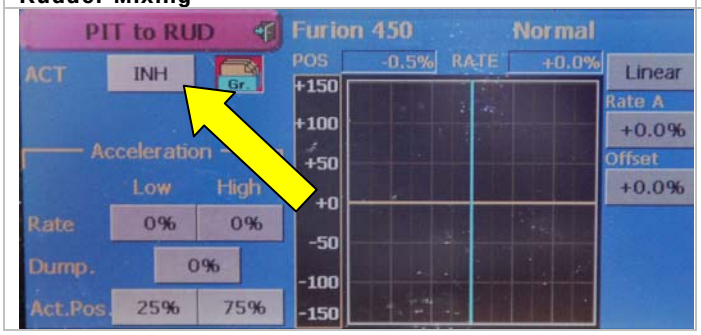
Gyro Setting



Rudder ATV



Rudder Mixing



On your model

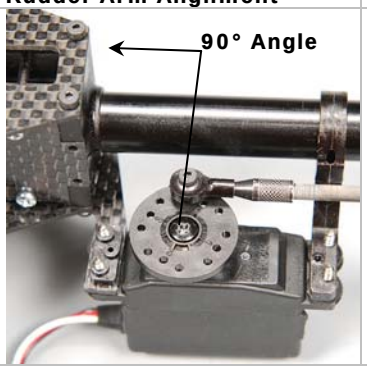
- The ball should go into a hole approx 8mm from the center of the servo wheel as shown.
- With your rudder stick centered, rotate the servo wheel until you find a spot that it aligns properly and then slide the servo wheel onto the servo exactly in the middle of its travel as shown. Do not use any sub-trim.
- Now make sure that the t/r bellcrank is aligned as shown. If the servo is positioned as shown and the t/r pushrod has been built to the recommended length, this will be very close. The 90 degree pitch slider on the tail case should be in the center of its travel. Adjust the links as necessary to ensure this is correct.
- Make sure you install hex nuts on the ball retainer bolts using threadlock
- Make sure you install servo arm retainer screws

Rudder Arm Dimension

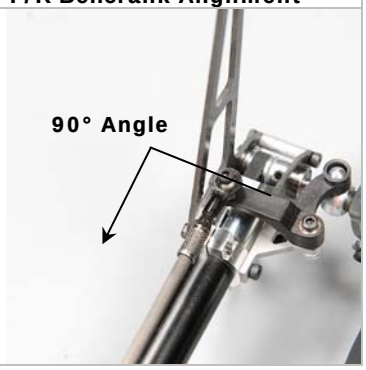
Use a servo wheel of the size shown

Rudder Arm Orientation

Rudder Arm Alignment



T/R Bellcrank Alignment



B) Setup for Collective, Cyclic and Rudder

For the following steps you don't need to power up the ESC, only the receiver and servos. If you are using a separate Rx battery, plug it into the receiver and proceed. If you are only using an ESC with a BEC for Rx power, don't connect the ESC to the motor when you power up for this step.

As you go through these setup procedures, make sure that none of the controls bind at full throw. If so, adjust the individual servo throws until the binding is resolved.

B.1 Setting Swashplate Movements

The first step is to make sure that the servo reversing and swash mix settings are correct for the controls to move properly.

B.1.1 Collective Movements

For a sport flying/3D setup, a linear pitch curve is appropriate (a straight line- 0%,25%,50%,75%,100%) as your pitch curve data points.

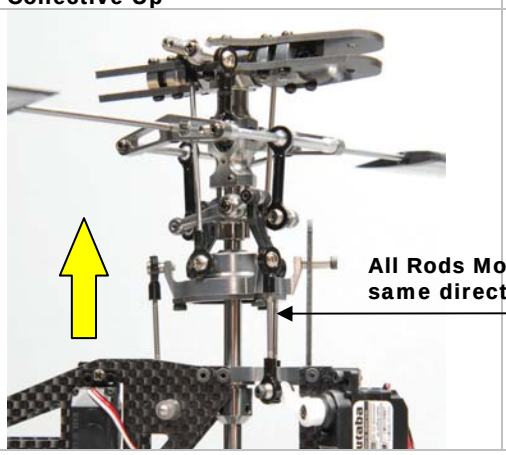
Pitch Curve - Linear

Check the movement of the collective commands

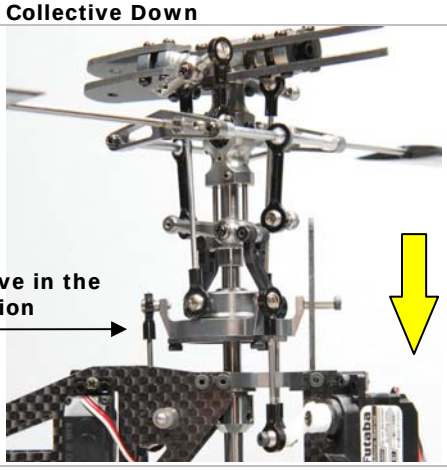
Starting with the collective, when moving the collective stick up and down, all three servos should work in unison to equally raise and lower the swash plate.

Collective Movement

Collective Up



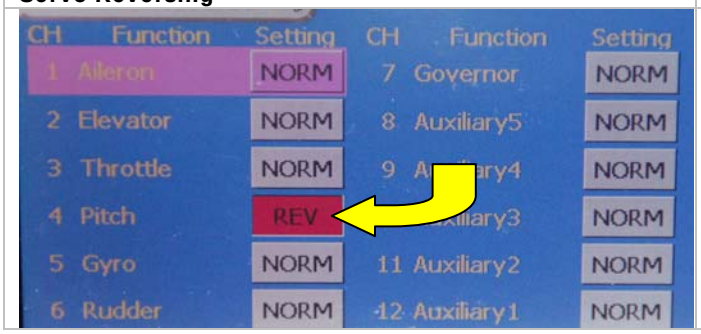
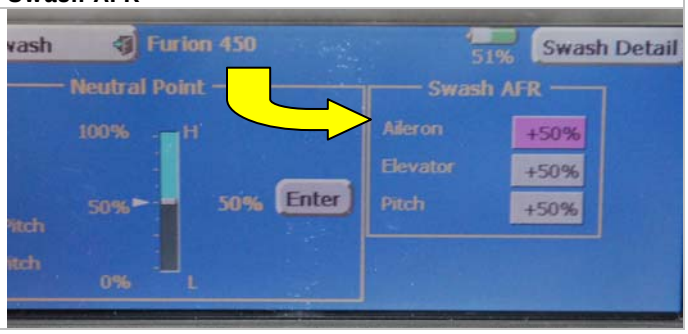
Collective Down



If the movements are not correct, first make sure that the servos are connected to the correct channel on the receiver.

If the servos do not move in unison, they can be adjusted by either:

- changing the servo reverse settings for one or more of the cyclic channels
- changing the "sign" of individual cyclic channels on the Swashplate mix menu (Swash AFR on Futaba radios). For example if it is a +50% for a channel, make it a -50% to make it correct. You may have to change this for one channel or all channels.

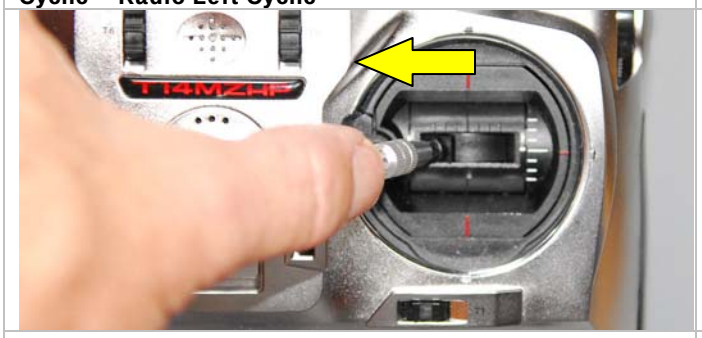
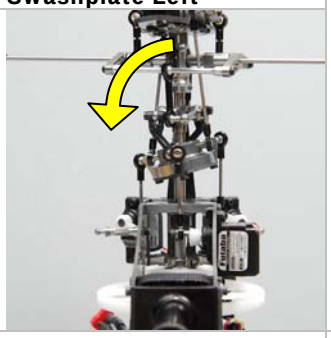
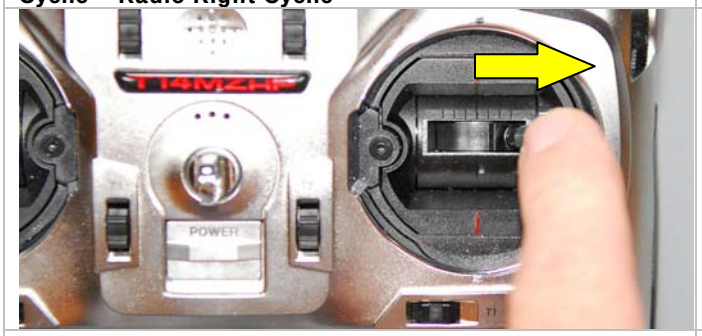
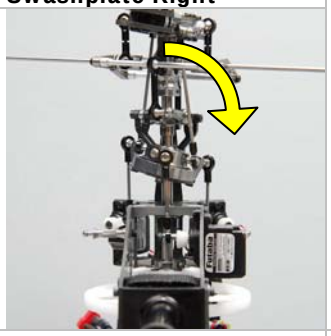
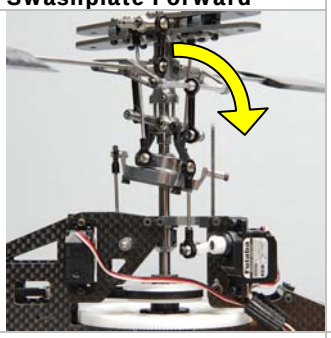
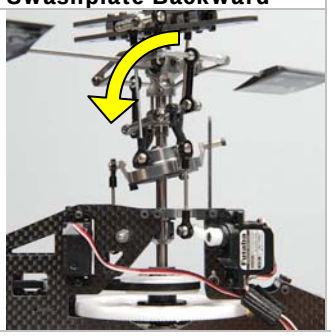
Servo Reversing	Swash AFR
	

For Futaba radios, the following settings are correct:

Channel	Servo Reversing	Swash AFR
Aileron	Normal	+50%
Elevator	Normal	+50%
Pitch	Reverse	+50%

B.1.2 Cyclic Movements

Check the movement of the cyclic commands.

Cyclic – Radio Left Cyclic	**Swashplate Left**	Moving the cyclic stick left should tilt the swash plate to the left when seen from behind the model.
		
Cyclic – Radio Right Cyclic	**Swashplate Right**	Moving the cyclic stick right should tilt the swash to the right when seen from behind the model.
		
Cyclic – Radio Down Elevator	**Swashplate Forward**	Moving the cyclic stick forward should tilt the swash plate forward when seen from the side of the model
		
Cyclic – Radio Up Elevator	**Swashplate Backward**	Moving the cyclic stick backwards should tilt the swash plate backwards when seen from the side of the model
		

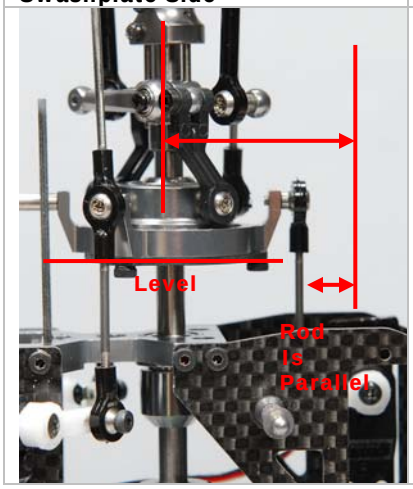
B.1.3 Swashplate – Center Level

With the collective and cyclic sticks centered, visually center the swash plate to ensure that it is straight. A swash plate leveling tool is also helpful in this case. If the swash plate is not 100% level at center collective, looking at it from the side, as well as the front, use a small amount of sub trim in the appropriate channel to make it level.

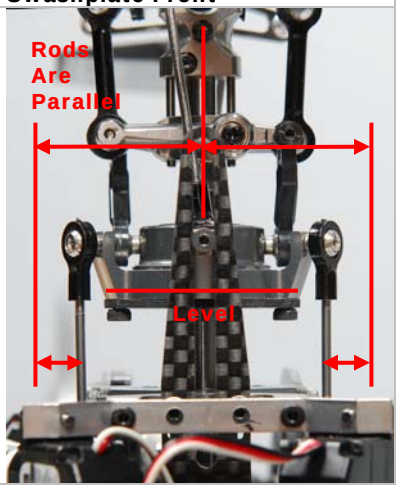
Collective Centered

When properly centered, the swashplate will be level from all viewed angles. Also, if the servo arms are the correct length, all rods will be parallel with the main shaft as shown

Swashplate Side



Swashplate Front

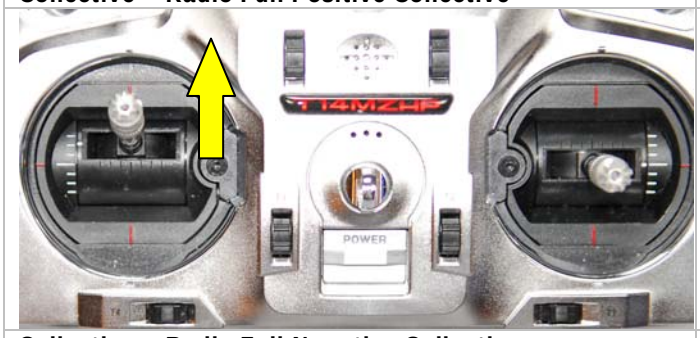
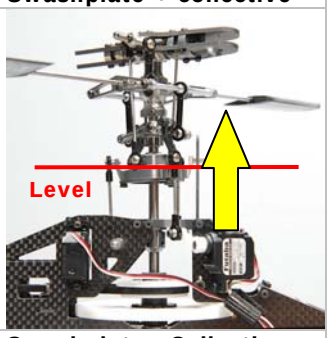
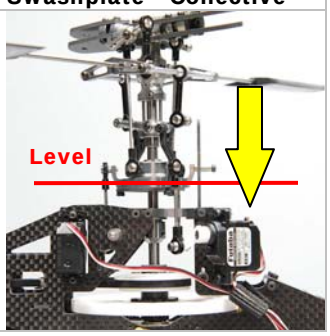


B.1.3 Swashplate – Extreme Throws Level

It is now time to make the swash plate level both at full positive and negative pitch. Raise the collective stick to its fullest position upwards. Visually inspect the swash plate. If the swash plate is not level, use your servo ATV's (Endpoints) to adjust each servo to create a level swash plate. Once again, inspect the swash from the front/ back and from each side to make sure that the swash is level.

Now lower your collective stick and follow the same procedure mentioned above to make your swash plate level when giving negative pitch.

What this has created is a totally level swash plate during its entire travel.

Collective – Radio Full Positive Collective	Swashplate + collective
	
Collective – Radio Full Negative Collective	**Swashplate - Collective**
	

B.2 Setting Blade Limits

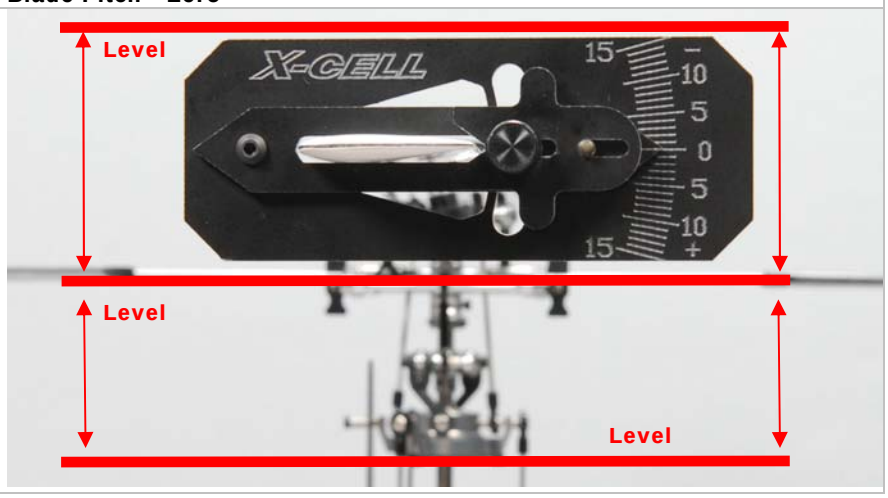
B.2.1 Install Flybar Lock/Blade Gauge

You will need to maintain the flybar at a level position in order to accurately set the blade pitch. The following shows how to install the optional flybar lock.

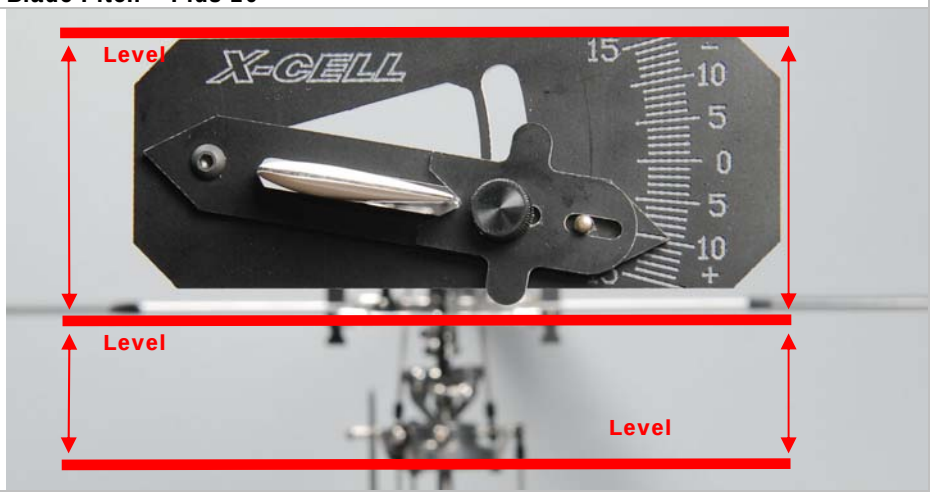
Flybar Lock	Installs Over Top of Head	Lock Both Ends Under Flybar	Install Pitch Gauge
			

B.2.2 Pitch Curve Setup

Now center the collective stick once again. If all links have been built per assembly manual's instructions, a check of the main rotor blade pitch should find it close to zero degrees pitch. Adjust either the double link from the flybar cross tube to the bell mixer, or the long linkage from the swash plate to the bell mixer to get the blade angle zero degrees.

Pitch Curve – Zero Degree	Blade Pitch - Zero
	

Once this is done, there should be equal amounts of pitch in both the positive and negative directions. +- 10 degrees pitch on the collective is recommended. This can be adjusted by changing the high and low points of the pitch curve

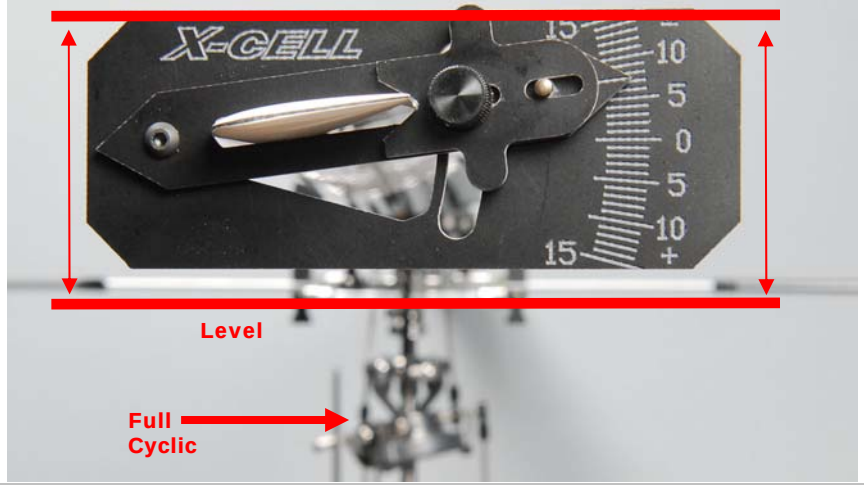
Pitch Curve – Full Positive	Blade Pitch – Plus 10
	

Measure blade pitch using a pitch gauge. These typically install on a blade tip as shown and readings are determined by sighting down an edge of the gauge against the flybar/swashplate as shown.

Pitch Curve – Full Negative	Blade Pitch – Minus 10
	

B.2.3 Cyclic Throw Setup

+- 7 degrees pitch on the cyclic is recommended for elevator and aileron channels

Cyclic – Full Throw	Blade Pitch – Full Cyclic
	

Measure cyclic throw by using a pitch gauge. Install on a blade tip as shown and readings are determined by sighting down an edge of the gauge against the flybar/swashplate as shown.

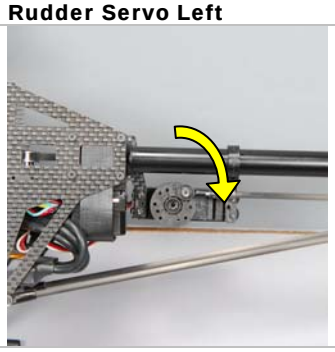
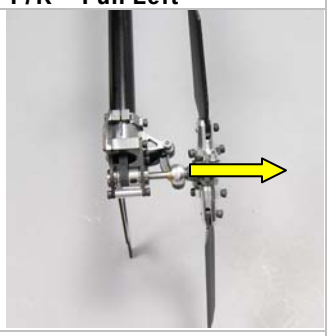
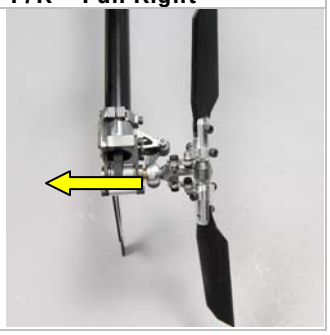
Turn the pitch gauge 90° from the cyclic throw being measured and read the throw on the blade gauge. The throw should be equal for forward, backward, left and right cyclic. If the throws are unequal, use a rate function in the radio to equalize them.

B.3 Rudder Setup

Make sure that the t/r servo and gyro are connected to the Rx according to the manufacturer's recommendations.

For a typical gyro (like the Futaba 401), set the gain on the tail to roughly 45%.

Set the limits for the tail servo for maximum throw to allow greater servo resolution. Use the Endpoint menu in the radio to adjust the Rudder ATV's to adjust your pirouette rate (A recommended starting value is 100%) or follow the instructions from your gyro manufacturer.

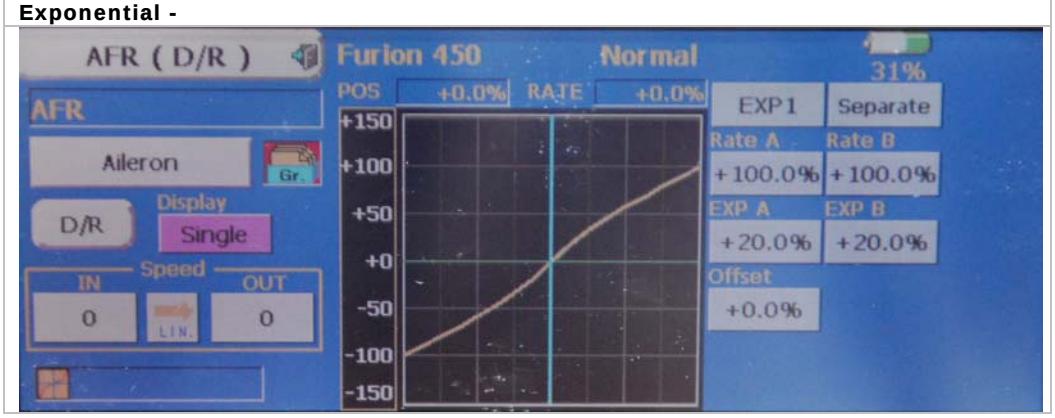
Rudder – Radio Left Rudder	Rudder Servo Left	T/R – Full Left
		
Rudder – Radio Right Rudder	**Rudder Servo Right**	**T/R – Full Right**
		

Now that the tail rotor slider has been adjusted for full travel, enable heading hold in the gyro using a gain of roughly 45%. Check to make sure that the heading hold is working properly. If not, refer to the gyro documentation to determine the cause.

B.4 Exponential

If desired, add a small amount of exponential (Expo) to both aileron and elevator. For a Futaba radio, start with -20% on each. For a JR/ Spektrum radio, start with +20%.

Exponential -



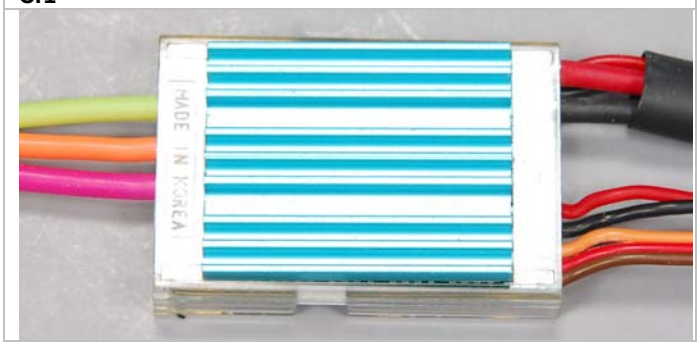
C) Setup for Speed Controller

Because of the wide variety speed controllers and the differences in their setup, refer to the manufacturer's recommended settings for your specific speed controller.

In some cases as with Futaba radios, you may need to "reverse" the throttle channel direction. Please note the manufacturers directions in regards to throttle direction settings.

MAKE SURE that the speed controller is properly setup BEFORE connecting the drive motor. If the ESC is improperly setup, the motor may start unexpectedly causing injury or damage. BE CAREFUL!! Electric motors are capable of making their full power immediately!

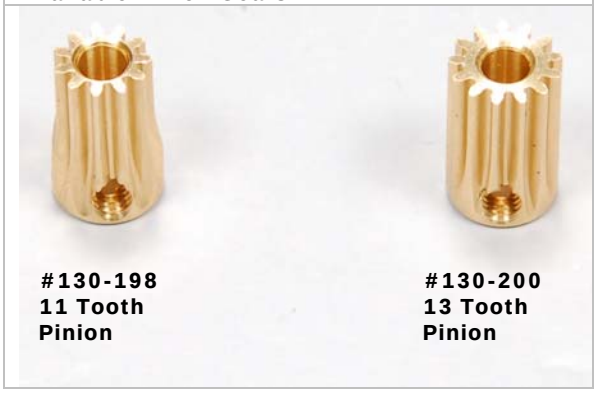
C.1



D) Battery/Motor/Pinion Recommendations

If using a Scorpion 2221-6 motor or similar, use the supplied 11T pinion.
If using a Scorpion 2221-8 motor or similar, use the supplied 13T pinion.

Available Pinion Gears



#130-198
11 Tooth
Pinion

#130-200
13 Tooth
Pinion

A 3 cell battery with a capacity of 2500mah is recommended.

Flight times will vary with flying style, condition of battery pack, ambient temperature, and setup, but average flight times will be roughly 4 to 6 minutes.

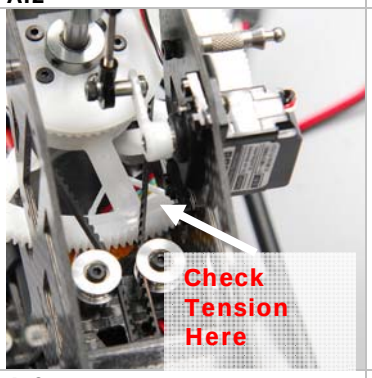
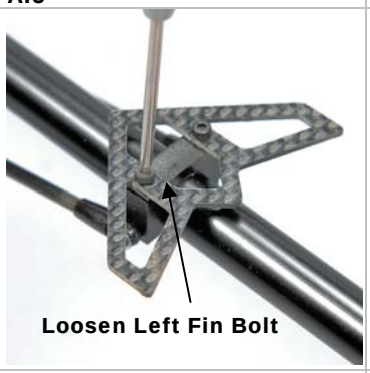
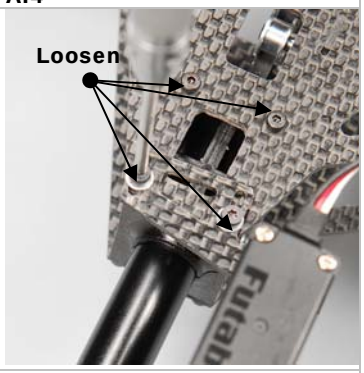
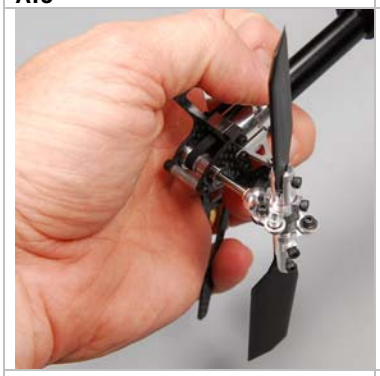
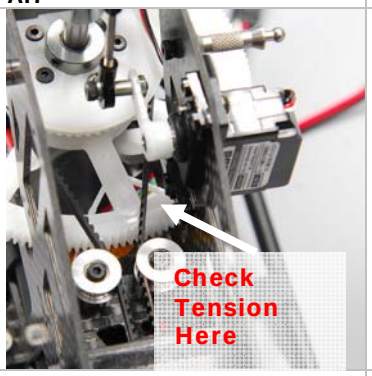
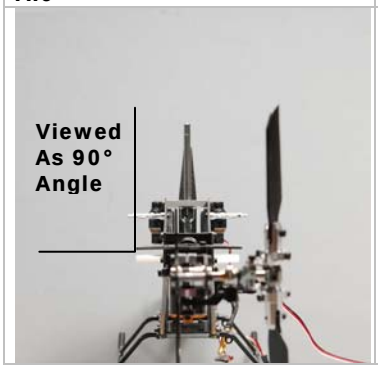
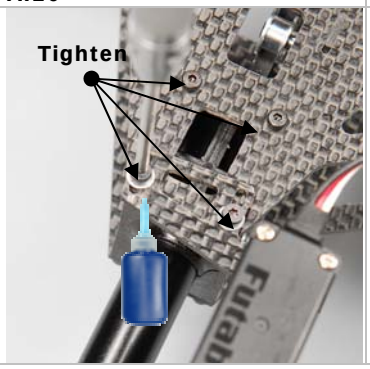
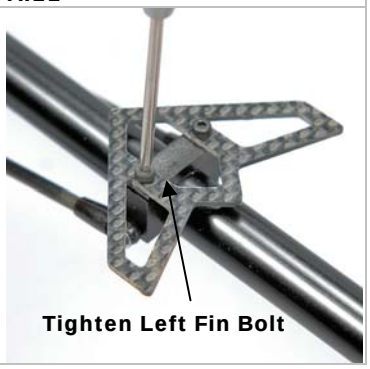
2500Mah Battery

V. Maintenance/Repair Notes

The following outlines some common maintenance/repair procedures

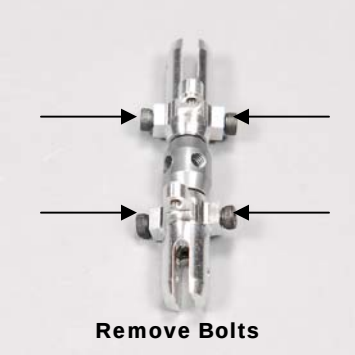
A) Tail Belt Tension

The tail rotor belt requires additional adjustment to ensure that it is at the proper tension. Use the following procedure for the adjustment.

A.1	A.2	A.3	A.4
Repair Notes: The correct tension for the tail rotor drive belt must be maintained and should be checked occasionally. If it can be deflected for than 1/8" at the point shown, it should be tightened. Use this procedure to set the t/r belt tension.			
A.5	**A.6**	**A.7**	**A.8**
	**Repair Notes:** Pull the tail boom backwards to tighten the belt. The slots in the front t/r servo mounts will allow the servo to move with the boom. This eliminates the need to readjust the t/r pushrod length Recheck belt tension. Tighten until it deflects 1/8" here.		**Repair Notes:** When the tension is correct, realign the tail boom by lining up the vertical fin with the side frame, and tighten the bolts using thread lock.
A.9	**A.10**	**A.11**	
			

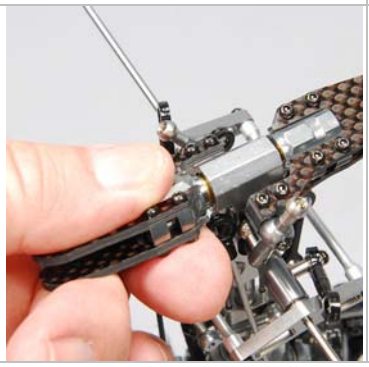
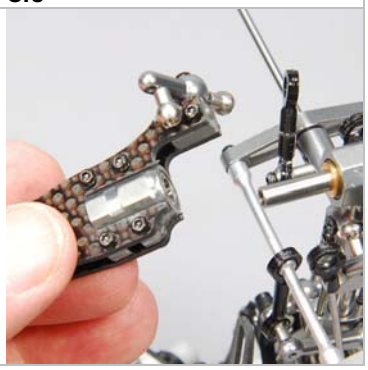
B) T/R Grip/Bearing/Hub Removal

If the t/r is damaged, the following outlines the correct procedure to remove the t/r grips.

B.1	B.2	B.3	B.4
Repair Notes: To repair the t/r blade holders, bearings, bolts or hub, first remove the blade grips from the bearing stack. Then you can repair as necessary Trying to remove the center bolt with the grips still in place will result in problems.	 **Remove Bolts**	 **Hold hub and slide the grips off of the bearing stack**	 **Remove Bolts, bearings, spacer, hub as necessary**

C) Main Blade Grip/Blade Axle Removal

If the rotor head is damaged, it may be necessary to replace the blade axle. The following procedure outlines how to remove the blade grips/axle.

C.1	C.2	C.3	C.4
Repair Notes: To repair the main blade axle, blade grips or bearings, use the following procedure. Note that it is slightly different than the original assembly procedure.	 **Remove Links**	 **Remove axle bolts using two allen drivers**	**Repair Notes:** When you remove the axle bolts, typically only one of them will loosen up. Remove it as shown. Take care to not lose the washer inside, it can fall out however the bearing stack is captured.
C.5	**C.6**	**C.7**	**C.8**
		**Repair Notes:** Grasp the blade grip that the axle bolt was removed from and pull it off the axle as shown. Also remove the brass spacer from the exposed axle.	

C.9	C.10	C.11	C.12
	**Repair Notes:** Now Grasp the remaining grip and pull out the axle. To remove the axle from the remaining grip, grasp the axle and using an allen driver remove the remaining axle bolt from within the blade grip.		

C.13
Repair Notes: Replace any damaged parts as necessary. If you need to replace bearings inside the blade grip, you will need to remove both of the graphite plates from the blade holder before the bearings can be removed. Reassemble using thread lock as per assembly manual.