

HELIBUG SPARK

Conversion Guide

For X-Cell Stratus
X-Cell Spectra-G

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Version 1.0
Last Revised: 10/15/2011

HeliBug Spark for X-Cell Stratus/Spectra-G

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Revisions to this Manual

R1.0

- 10/15/11 – Initial Release

For the most current version of this manual, please refer to www.helibug.com, visit the Spark conversion page for the Stratus or Spectra-G and download the most current guide

Errata

R1.0

None

Disclaimer

The author has made every attempt to depict the correct process for this conversion however ultimately the safe construction of this model is dependent upon its builder. The builder and pilot should follow all safety regulations and use common sense when operating this model.

The author has no responsibility for the integrity of any of the components of this assembly, the individual manufacturer's warranties apply to all components.

I. Safety Concerns

WARNING!

The radio controlled model helicopter built from this conversion kit is not a toy and is not meant for children. It is a flying machine capable of causing property damage and serious bodily harm to both the operator/assembler and/or spectator if not built and operated correctly and responsibly. Rotating components, especially the main rotor blades, are an ever-present danger. Model helicopters operate differently than model cars and airplanes. Helicopters by their nature are not positively stable, meaning that even if properly assembled and adjusted, helicopters will not recover from an unwanted flight attitude, nor will they hold any particular orientation without constant control inputs from the pilot.

IT IS YOUR EXCLUSIVE RESPONSIBILITY TO PROPERLY BUILD, MAINTAIN AND OPERATE THE HELICOPTER.

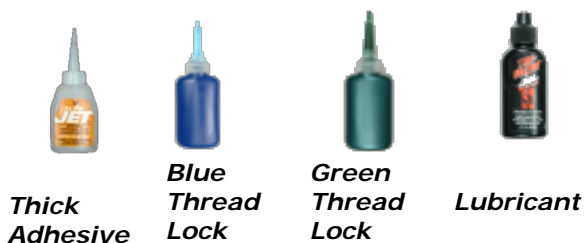
HELIBUG has spent considerable time making this product reliable and easy to build, but only the operator can insure that it is safe. Because the safe operation of this helicopter is beyond the control of the Manufacturer and distributor, the owner/operator assumes all risk of use.

II. Conversion Nomenclature

This conversion document will only address conversion specific differences from the standard Align build instructions. Unless otherwise indicated you should follow the original assembly instructions including all warnings, guidelines and tips.

2.A) Assembly Tips

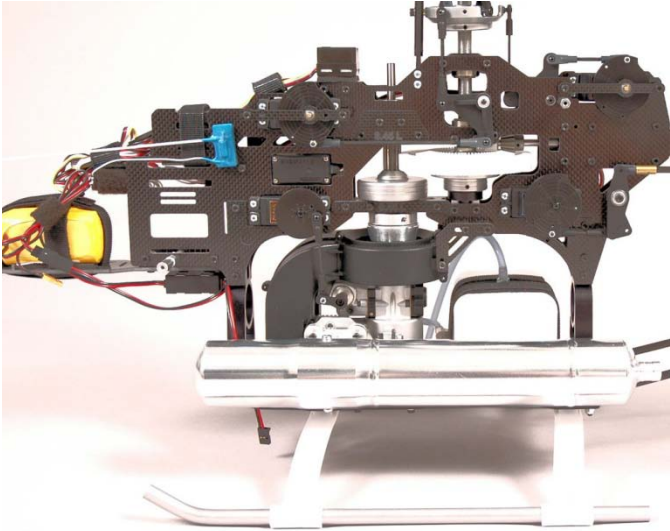
1. Follow the order of assembly. The guide has been organized into major sections and has been developed in such a way that each step builds upon the work done in the previous step. Changing the order of assembly may result in unnecessary steps
2. Sand sharp edges on any frame plate that Velcro® or wires may rub against to prevent them from being damaged over time by vibration
3. **As a general rule any bolt that threads into a metal part should have thread lock applied**
4. 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:



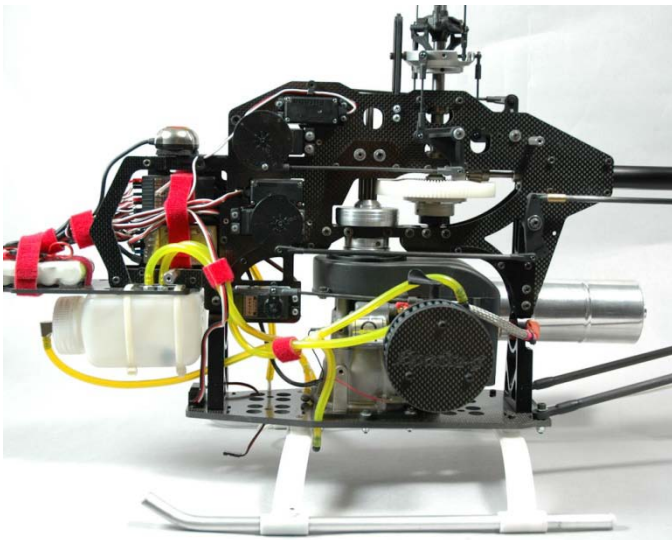
III. Conversion Prerequisites

In order to assemble this kit, you will need a complete XCell Stratus or Spectra-G model as well as some additional parts. They are as follows:

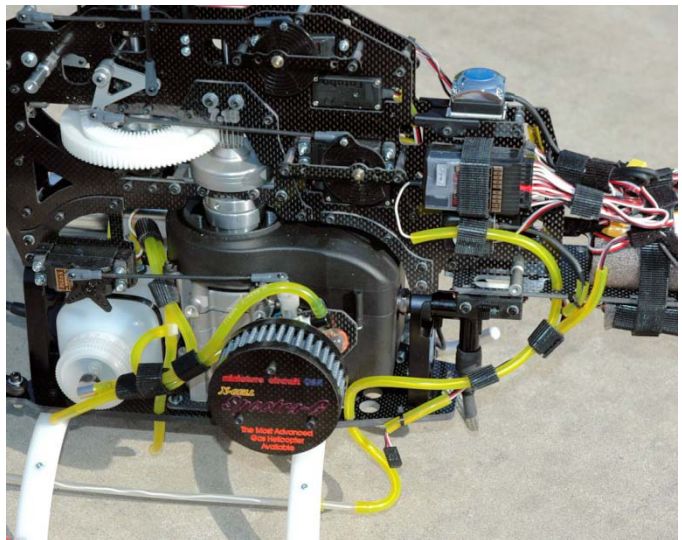
3.A) Donor Model Needed (as shown)



X-Cell Stratus 90



X-Cell Spectra-G (rear facing motor)



X-Cell Spectra-G (front facing motor)

You will need a complete X-Cell model, either a Stratus or a Spectra-G. The stock Spectra-G supports a front or rear facing motor configuration. You will need to acquire the appropriate Spark conversion kit that supports the engine configuration you want to use because the conversion kit is uni-directional.

3.B) Additional Required Components



Stratus

For this conversion, you will need the following parts

- 1 fuel tank, at least 10oz and gas compatible
- Tygon fuel line – 3 ft
- Servo capture (bolts, nuts, washer)
- 2 each 12" tie wrap
- 1 each Miniature Aircraft #122-94 throttle pushrod
- 2 each Miniature Aircraft #0133-1 ball links
- 1 each Miniature Aircraft #125-40 frame ladder
- Two sided tape (tank mount)

Motor



Spectra-G

For this conversion, you will need the following parts

- 2 each 12" tie wrap
- Two sided tape (tank mount)

This kit uses the Zenoah/CY RC series of motors.

This is a self contained motor that is practically ready to use right from the box.

The following motor sizes are acceptable for these models

Stratus

- Zenoah/CY RC230/RC240

Spectra-G

- Zenoah/CY RC230/RC240
- Zenoah/CY RC260/RC270
- Zenoah/CY RC290

Modified motors such as the TRM Power line offer balancing and power improvements. They are preferable to stock "out of the box" motors

Muffler

The RC style motors come standard with a muffler. It does not have a pleasant sound but will work acceptably.

If you are converting a Spectra-G, you will already have a muffler choice, it can be re-used on this conversion.

If you are converting a Stratus, you will need to either use the std Zenoah style muffler or acquire a third party muffler

The Hatori #956/957 Gas mufflers have proven to be acceptable alternatives.



3.D) Optional Components



You may want to add some optional parts that simplify or improve the conversion. They are:

- Stator Gator GGS233-RC
- Zenoah Fuel pickup (1 each #5500-85400)

Gear Ratios

Depending on which type of Stratus you are converting, you will need additional gear ratio options. These are discussed in detail later in the document

Stratus - FAI

- No additional parts needed

Stratus – Original – 8.18 or 8.45 ratio

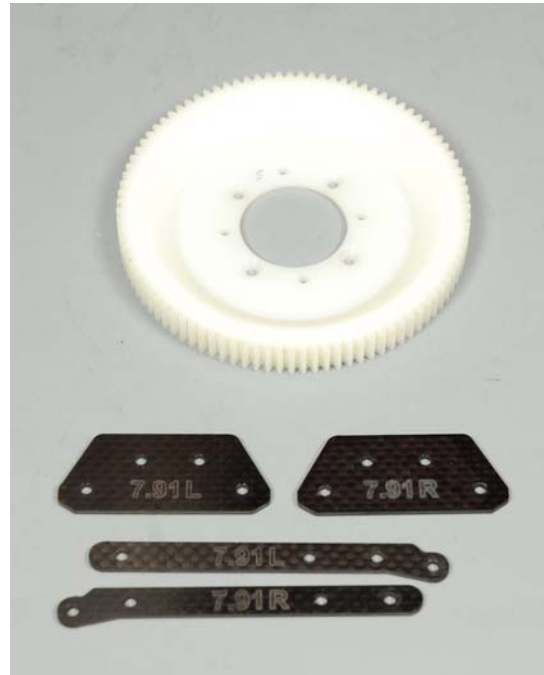
- MA#126-38 7.91 ratio plates
- MA#0865-87 main gear - 87 tooth

Stratus – Bobby Watts H/R - 8.18

- No additional parts needed

Stratus – Bobby Watts H/R - 8.45

- MA#126-40 8.18 ratio plates
- MA#0865-90 main gear - 90 tooth



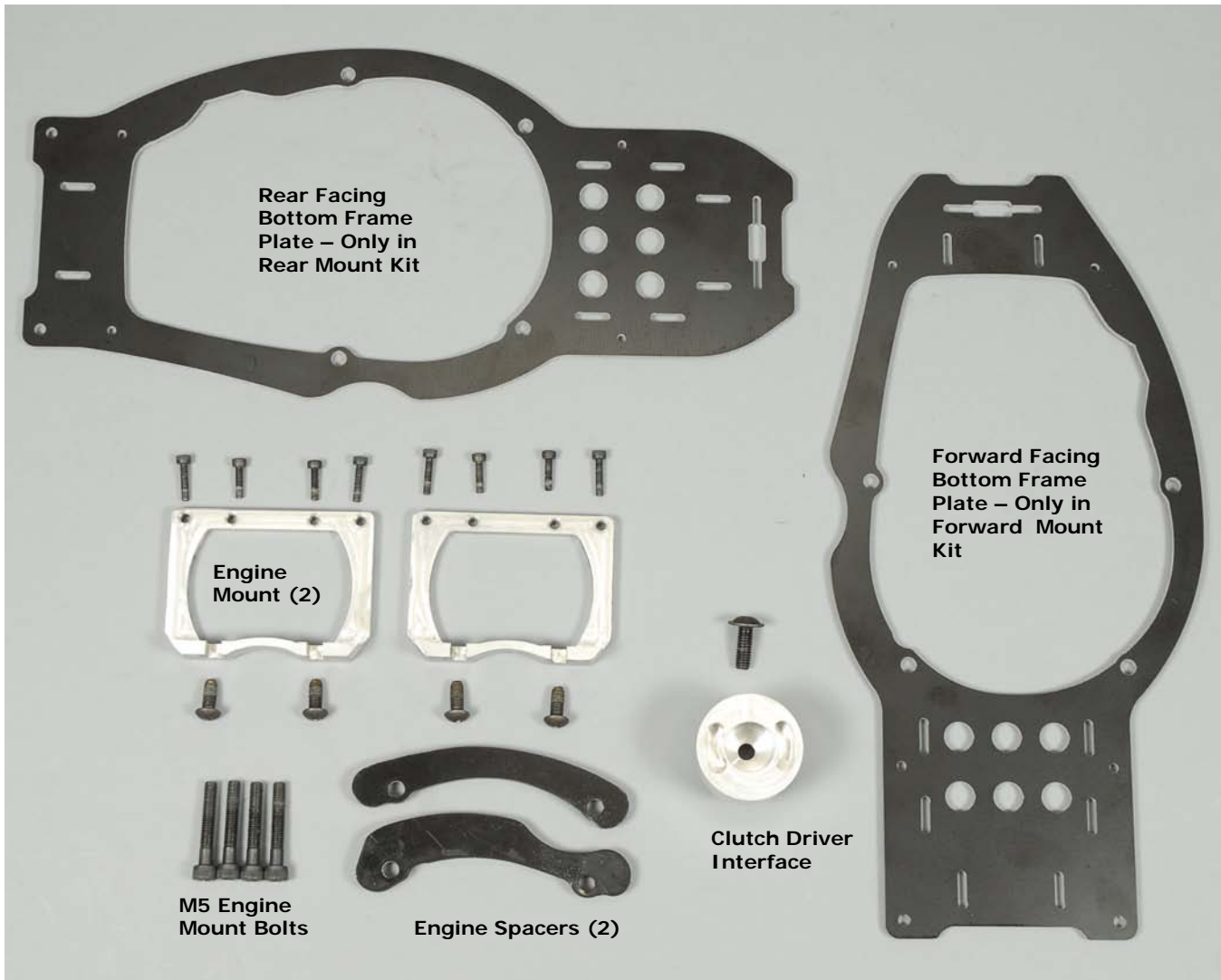
3.E) Documentation

The most recent version of this document can be downloaded from: www.helibug.com

IV. Pre Conversion Assemblies

Inspect the conversion package and locate each of the parts listed above. All relevant parts are required. If you cannot locate any part contact the manufacturer.

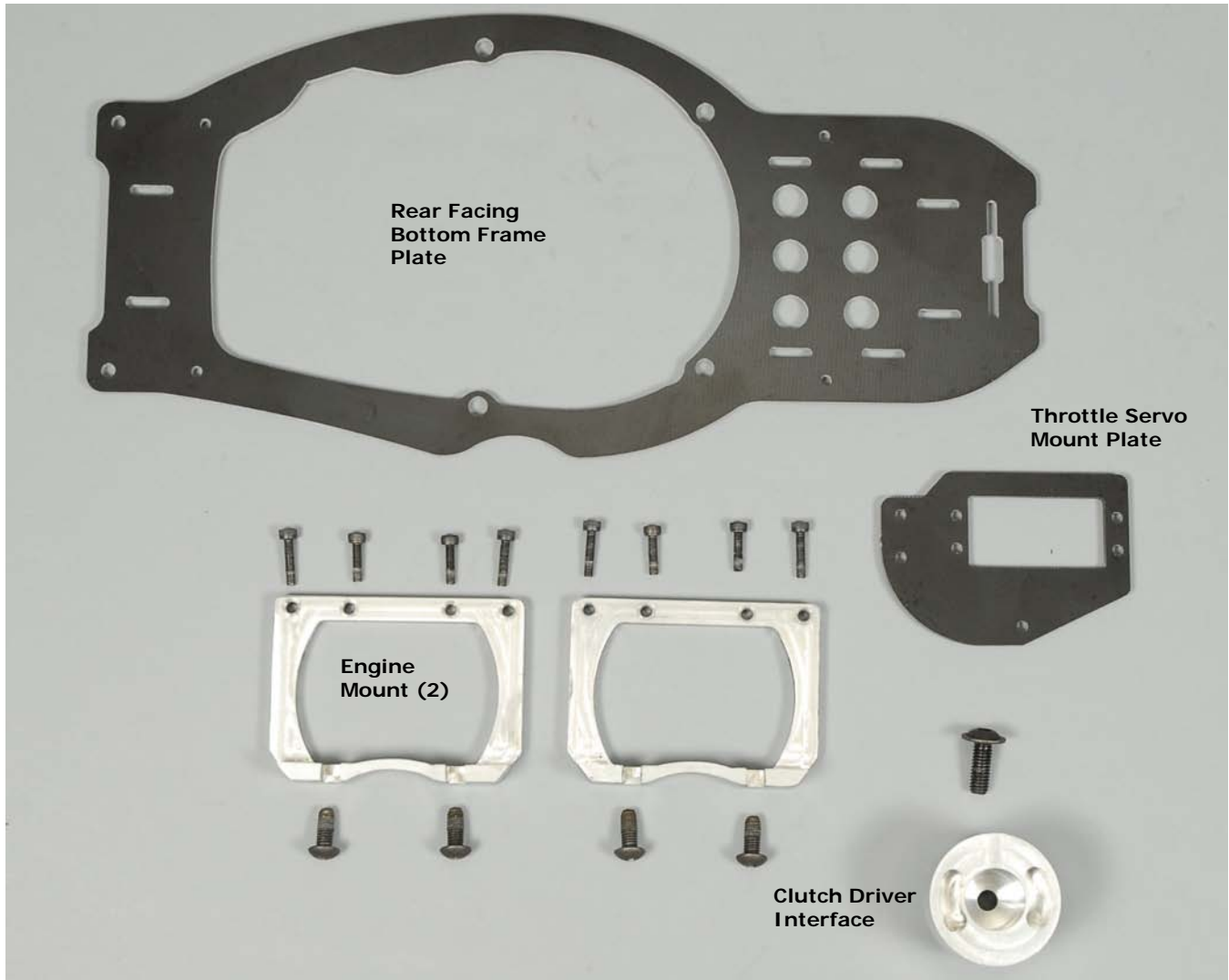
4.A) Inventory – Spectra-G



NOTE: Only one of the bottom plates will be included with your kit, depending on whether you selected the front or rear facing motor option

You will also need a donor Spectra-G model and additional required parts previously shown. This version of the kit is designed to be used with only the X-Cell Spectra-G model

4.B) Inventory - Stratus



You will also need a donor Stratus model and additional required parts previously shown. This version of the kit is designed to be used only with the X-Cell Stratus model

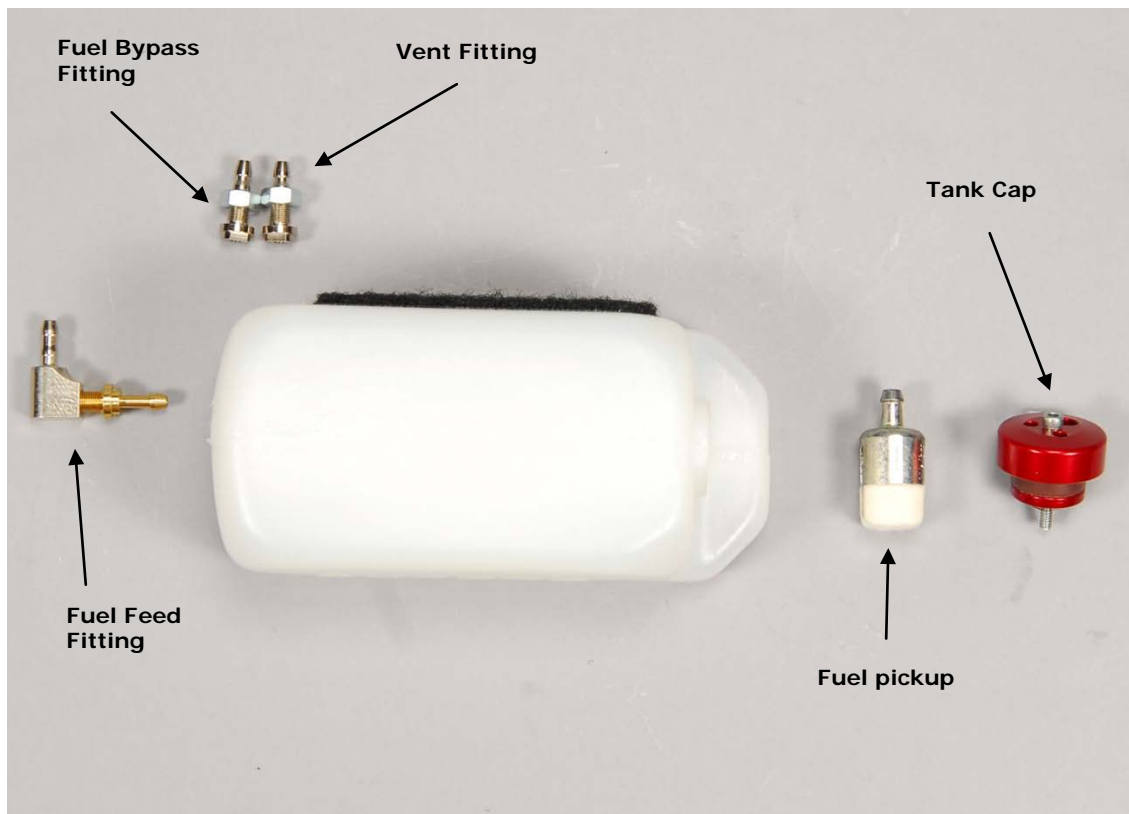
4.C) Assemble Fuel Tank

Spectra-G

If you are converting a Spectra-G model, you can use the original fuel tank. If you have front mounted the fuel tank, it will not be disturbed. If you want to rear mount the fuel tank you will need to locate it as shown in this manual

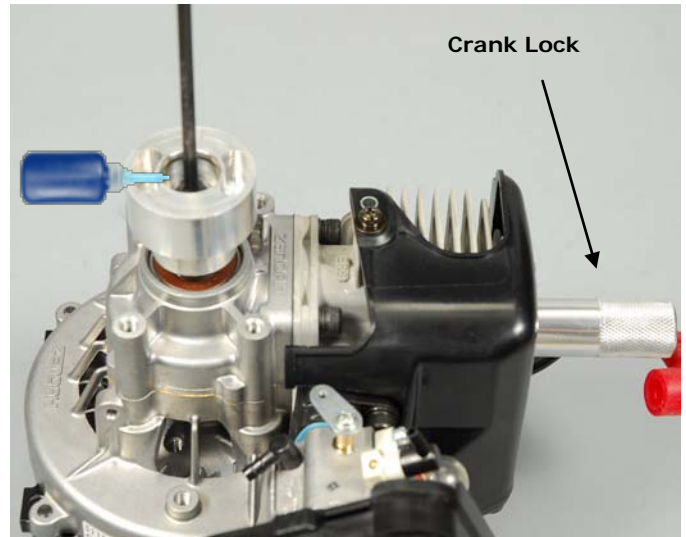
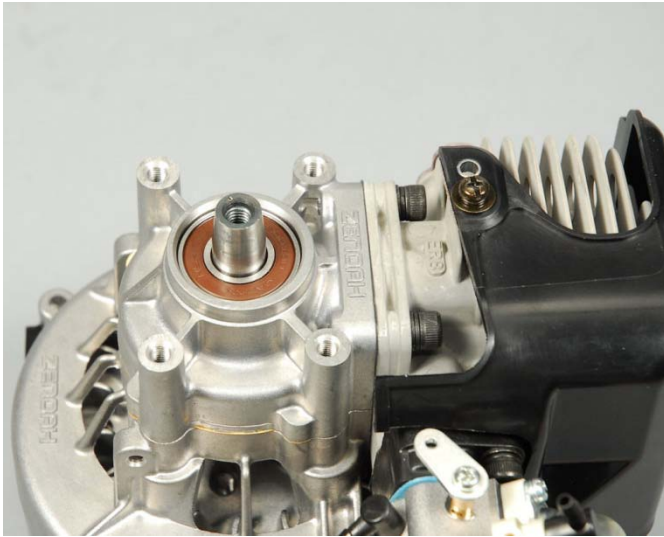
Stratus

1. The Stratus conversion does not allow the use of the original fuel tank or mounting position due to motor and tank size
2. You will need a fuel tank (10 oz Dubro tank with gasoline stopper). You can use the fittings from your Stratus tank
3. It is HIGHLY recommended that you use a felt fuel pickup filter common with these types of motors. This will result in more consistent fuel delivery to the motor and will not require a separate filter to be placed in the fuel tank pickup line
4. Make sure to use either neoprene or Tygon fuel line inside the tank and that it is long enough and flexible enough to allow the clunk to move around in the tank as the helicopter maneuvers
5. Adhesive backed Velcro will be used to help hold the tank into final position
6. Final plumbing will be addressed in a later step

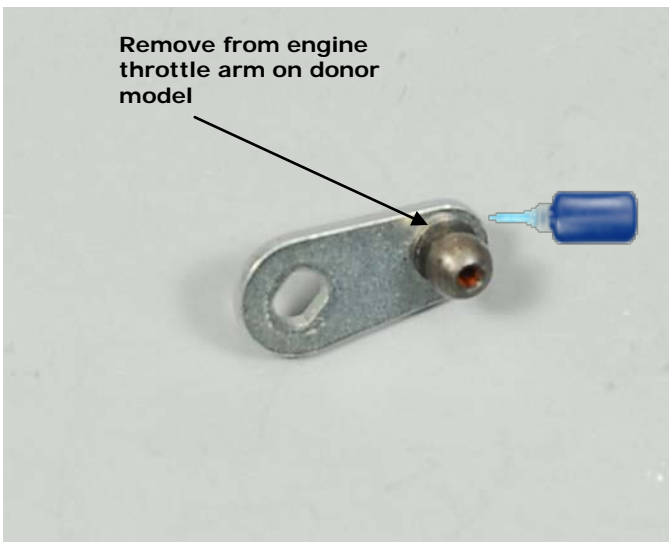


Tank Plumbing Components - Sample

4.D) Engine Preparation



1. There are a few steps needed to prepare the motor to be installed
2. Locate the clutch adapter hub and M6 button head bolt.
3. Use a piston lock to lock the motor into a fixed internal position.
4. Place a drop of oil on the end of the engine crankshaft and set the clutch hub on it. With the engine locked into position twist the hub around a few times so that it seats on the crankshaft.
5. Now using thread lock, install the M6 bolt and tighten the assembly firmly
6. If you have access to a dial indicator, check the run out on the top face and around the edge of the uni-ball cavity. These run out values should both be less than .002" total run out. If not take steps to improve this as you would with the original stock assembly.



The stock throttle control arm may need to be repositioned on the carburetor. Since this carburetor butterfly is typically spring loaded, the position it automatically closes in will be the closed position. Remove the stock carburetor control arm and position it as shown. Also at this time you will need to install a linkage ball from the donor kit engine throttle as shown. Make sure these are both secured with thread lock.

4.E) Gear Ratio Changes

Spectra-G

If you are converting a Spectra-G, it will come standard with either a 7.08 or 7.15:1 gear ratio. These are both appropriate for operation of the recommended gasoline power systems so no changes are needed.

Stratus

If you are converting a Stratus, it will come standard with one of the following ratios:

- 7.91:1
- 8.18:1 or
- 8.45:1 gear ratio

None of these are ideal for gas powered operation. Because of the higher engine RPM these gear ratios will produce, you should limit your power choices to the RC230/RC240 engine as they have the best balance for higher RPM operation.



Of the three, 7.91:1 is the most preferable to limit engine RPM's to an acceptable performance level

There were three basic versions of the Stratus produced and the available gear ratios were different for each

Stratus - FAI

This model came standard with the 7.91:1 gear ratio. (87 tooth main gear). If you have this version you are ready to proceed with the conversion.

Stratus - Original (not the Bobby Watts HR version)

This model came standard with either the 8.18 or 8.45 gear ratios. To convert it to use the 7.91 gear ratio acquire the parts listed in the Optional parts section of this document



The main gear and ratio plates are easily replaced as per the original assembly instructions. Make sure you set the gear mesh as originally instructed.

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Stratus - Bobby Watts HR version

This version also came as either 8.18:1 or 8.45:1 however you cannot easily install the 7.91 gear ratio.

In this case 8.18:1 is the preferable ratio. If you already have that version, you are ready to convert.

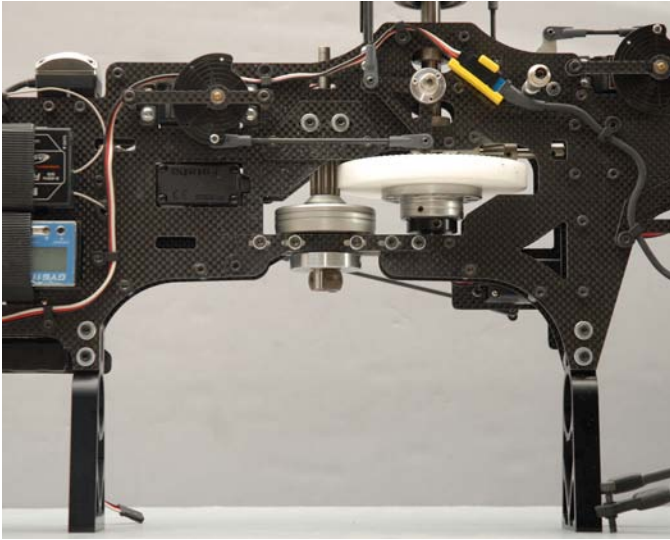
If you have the 8:45 ratio you can convert it to use the 8.18:1 ratio by acquiring the parts listed in the Optional parts section of this document

these parts can be installed according to the original model instructions.

All of the pre-conversion work steps are now complete and the conversion is ready to be completed.

V. Conversion

5.A) Chassis Conversion



First remove the landing gear, lower plate, motor and muffler

If you are converting a Stratus, also remove the fan support plates, throttle servo and the frame support plates (if this is a Stratus BW-HR version)

If you are converting a Spectra-G there is no need to remove the throttle servo unless you are changing the engine configuration

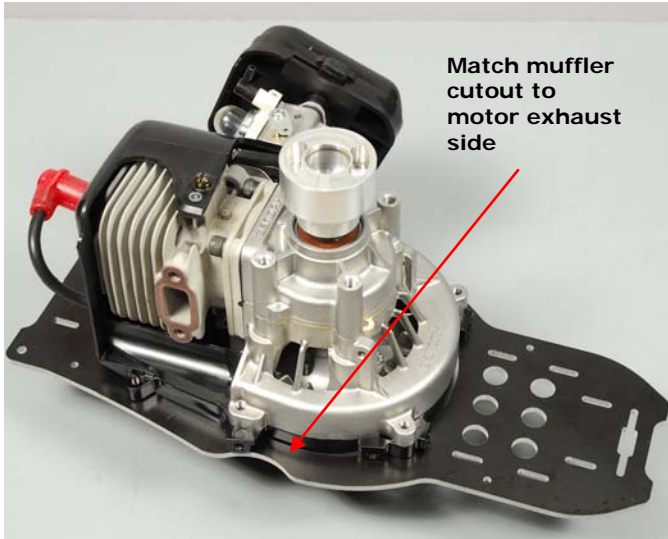
At this point the frame should look like this

first remove the four 5mm bolts that attach the fan shroud to the crankcase. If you are converting a Stratus they will be used in the next step. If you are converting a Spectra-G, they will be replaced with bolts from the conversion kit.



Next you are going to mount the motor assembly to the appropriate bottom plate

Stratus - Mount Engine



if you are converting a Stratus, set the motor into the bottom plate as shown and reinstall the shroud bolts to attach it.

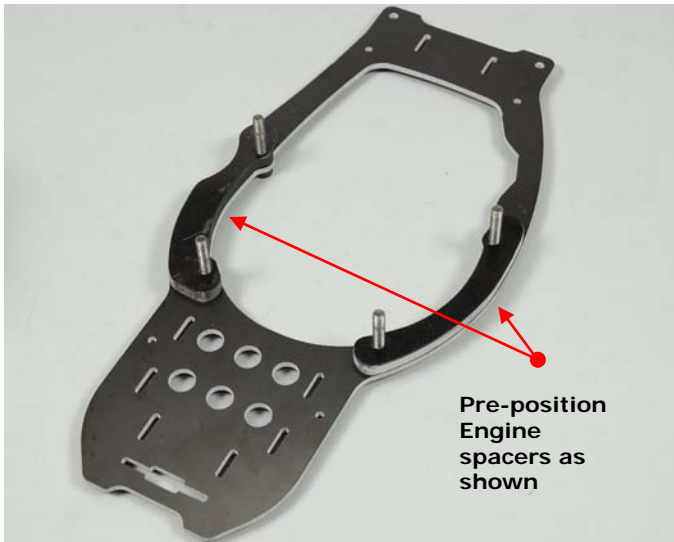
Note the plate alignment, the switch cutout will be at the front of the model

Using the bolts previously removed from the fan shroud, bolt the motor to the bottom plate

Don't fully tighten these bolts yet or apply thread lock at this point.



Spectra-G - Mount Engine – Rear Facing



Using the long 5mm bolts included with the conversion kit, position the engine spacers as shown on the bottom plate.

Note: make sure you align the muffler cutout on the right side spacer

As shown you are looking at the top of the bottom plate from what would be the front of the model

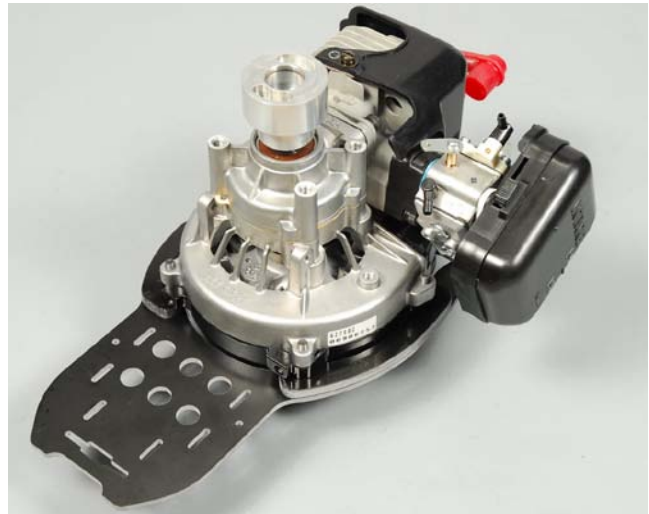
Spectra-G - Mount Engine – Rear Facing - Continued

Set the motor into the bottom plate and on top of the spacers as shown and lightly tighten the bolts to attach it.

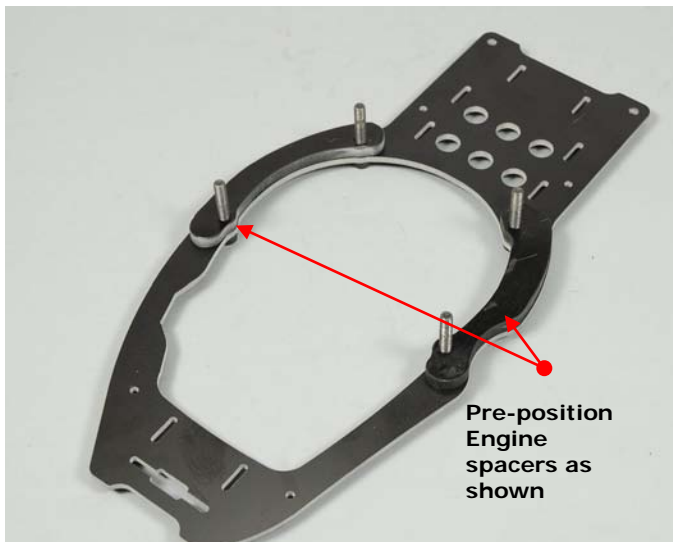
The muffler will be mounted on the right side of the model

Don't fully tighten these bolts yet or apply thread lock at this point.

Note the plate alignment, the switch cutout will be at the front of the model



Spectra-G - Mount Engine – Front Facing



Using the long 5mm bolts included with the conversion kit, position the engine spacers as shown on the bottom plate.

Note: make sure you align the muffler cutout on the Left side spacer

As shown you are looking at the top of the bottom plate from what would be the front of the model

Set the motor into the bottom plate and on top of the spacers as shown and lightly tighten the bolts to attach it.

The muffler will be mounted on the left side of the model

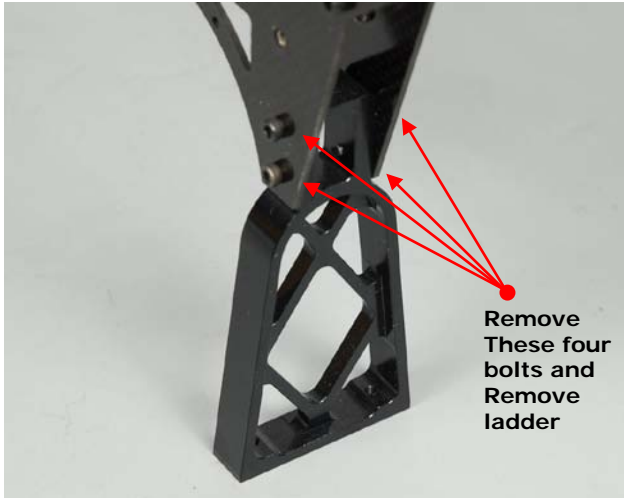
Don't fully tighten these bolts yet or apply thread lock at this point.

Note the plate alignment, the switch cutout will be at the front of the model



Stratus – Frame ladder/Throttle Servo

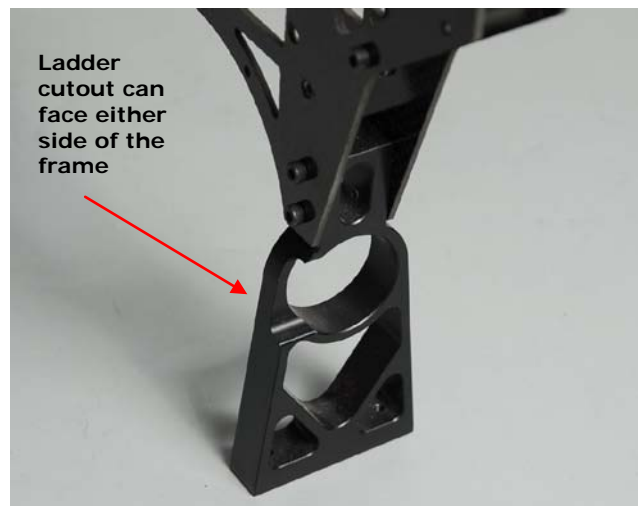
If you are converting a Stratus, you will need to replace the rear frame ladder and move the throttle position as shown, otherwise these steps do not apply to the Spectra-G conversion



Remove the four bolts that retain the REAR frame ladder and then remove the ladder itself

Replace it with the new MA#125-40 frame ladder from a Spectra-G. It is not important which side the spark plug cutout faces as it is not relevant for this motor

Thread the four M3 socket head bolts into the new ladder, don't fully tighten or thread lock them yet.



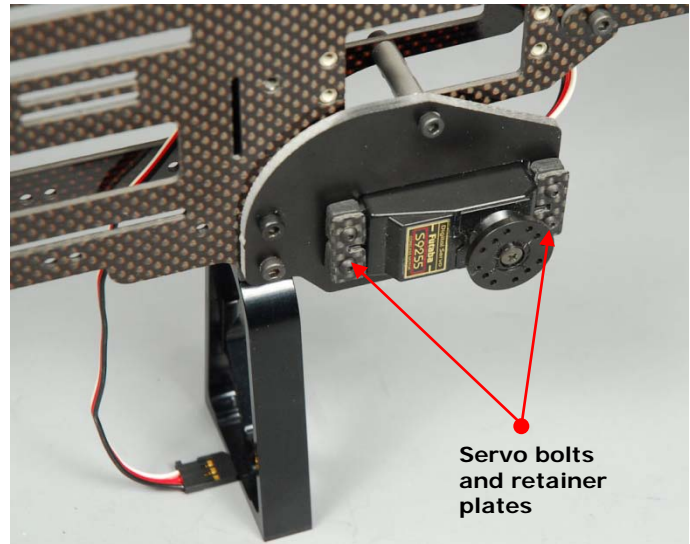
Remove the two M3 bolts on the left front side frame that support the FRONT frame ladder as well as the frame spacer bolt that's the next one on the bottom of the frame towards the back of the model

This where the new throttle plate mounts as shown. Replace all the bolts and tighten using thread lock

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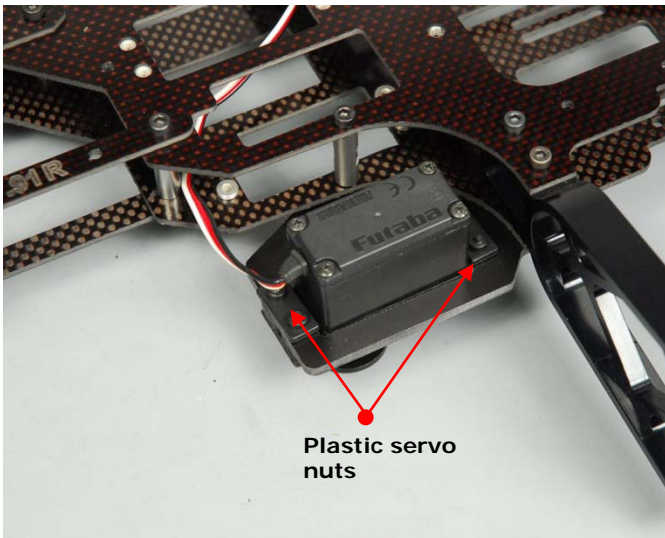
Install the throttle servo oriented as shown. You will need to provide mounting hardware as indicated in the required parts section of this document

The hardware shown is from an Align helicopter



The throttle servo can be retained from the back using plastic servo nuts that are commonly found in many helicopter kits today

The servo nuts shown are from an Align helicopter.

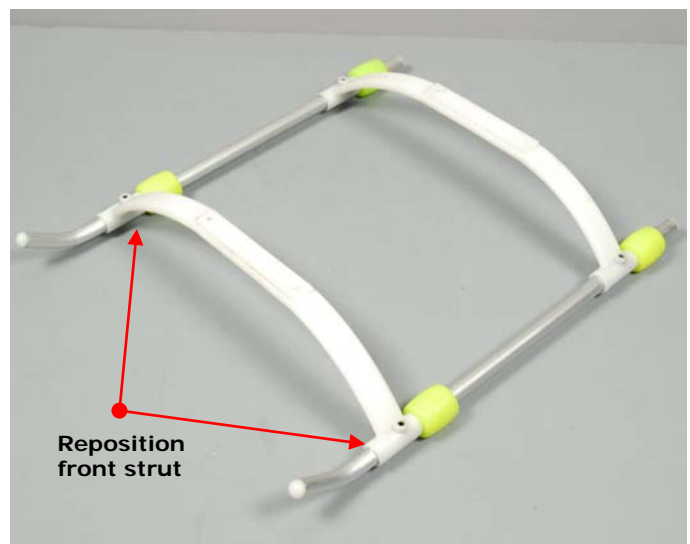


Landing Gear

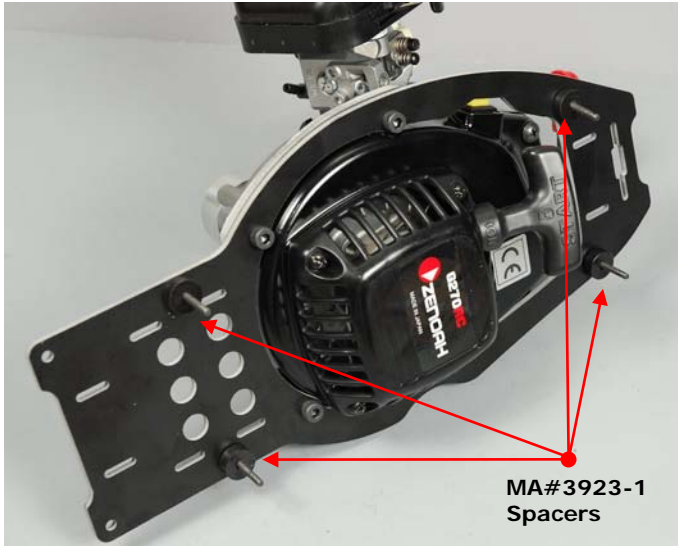
Select the landing gear that you removed from the donor model.

The mount holes in the new bottom plate are slightly further apart than on the original bottom plate so you will need to reposition at least one of the struts.

Typically the front strut is easier to do this with so match it up against the mount holes on the bottom plate and adjust accordingly



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Insert the original landing gear bolts through the mount holes in the bottom plate as shown. If you are converting a Spectra, transfer the MA#3923-1 plastic landing gear spacers from the donor model as shown.

Mount the bottom plate/engine assembly on the landing gear as shown



Secure landing gear struts from the bottom using M3 locknuts as with the original assembly.

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Fuel Tank

Spectra-G

If you are converting a Spectra-G, you can re-use the fuel tank supplied with the model. If you have mounted it at the front of the model under the radio trays, it will not need to be moved and is ready to use.

If you are mounting the motor facing forward, you have the option of installing the original tank behind the motor. The steps to do that are as follows:

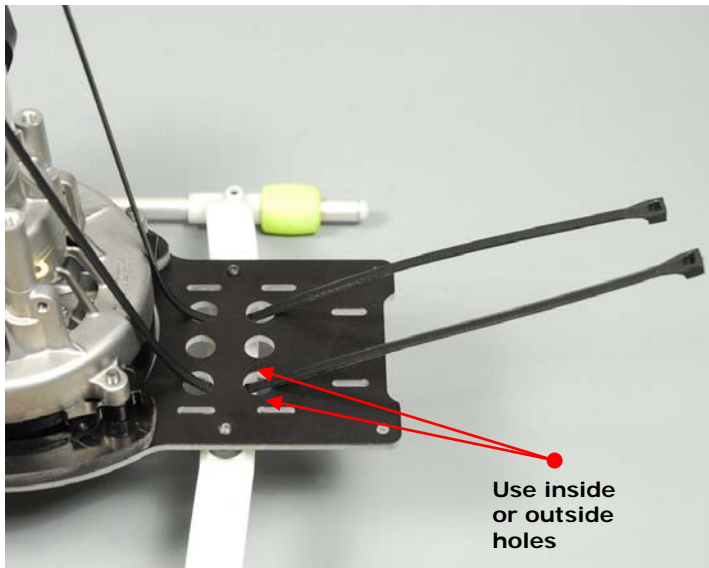
If you mount a fuel tank on the bottom plate, make sure you use thick foam tape to secure it.

This is required to prevent the tank from rubbing on the rear landing gear strut mount bolts.

Install two-sided foam tape on the bottom of the tank similar as to shown.



Two sided
foam tape



Use inside
or outside
holes

Insert two tie wraps through the fuel tank mounting slots cut into the left and right sides of the bottom plate or use the outer lightening holes as shown if you don't have access to thin tie wraps.

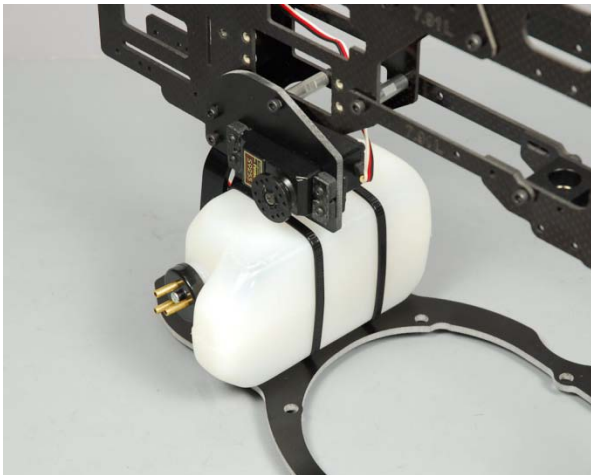
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Attach the tank to the bottom plate as shown and tighten the tie wraps. Pull the wraps tight to secure the tank against the plate and then clip off the excess ends of the wraps.



Stratus

The original stratus fuel tank is too large and cannot be reused so that is why an additional tank is required. It can be mounted underneath the radio tray or in front of the motor on the bottom plate as shown.

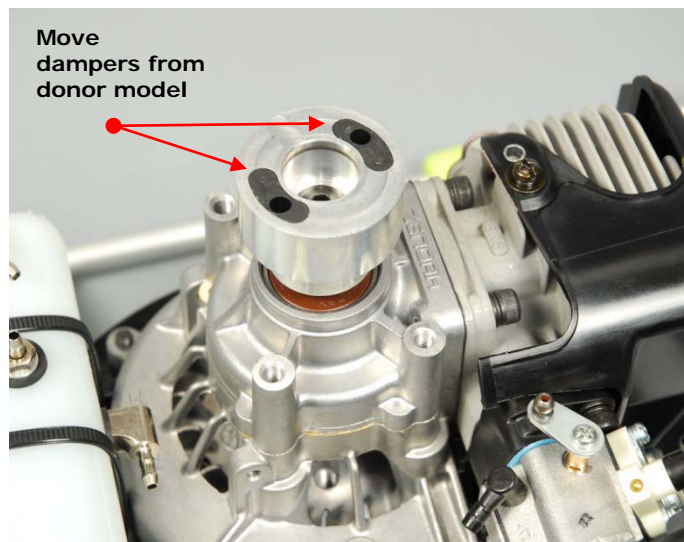


Use two sided tape and tie wraps to attach the tank as shown using the same procedure as the Spectra-G. This may be oriented in several different ways, only one of those orientations is shown

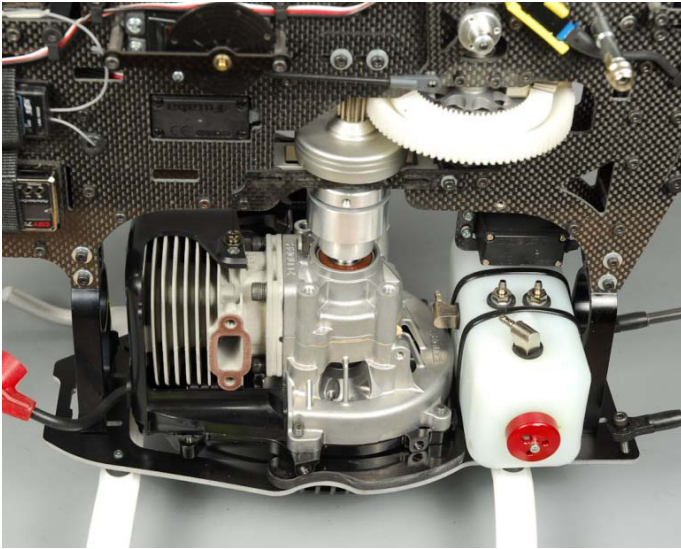
Install Motor/Complete Chassis

Remove the driver dampers from the cooling fan on the donor model and transfer them to the driver interface as shown

These simply push into the damper cavities on the driver interface



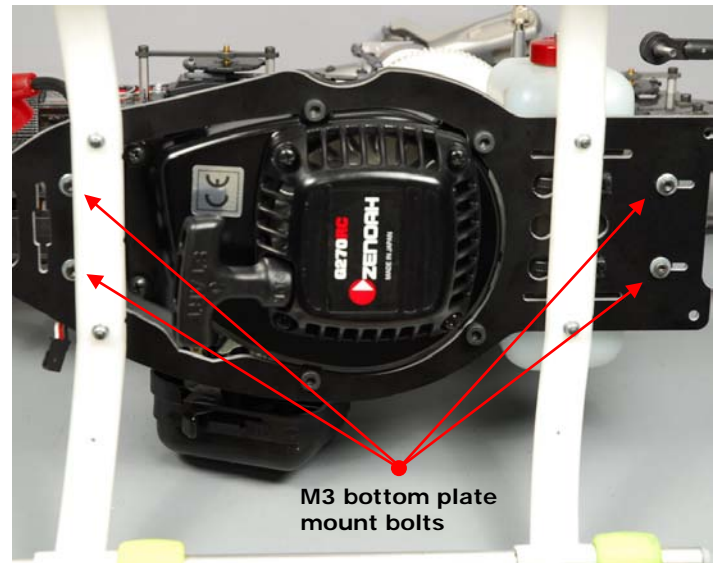
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Integrate the bottom and top frame sections as shown by inserting the uni-ball and driver pins into the damper and cavity in the driver interface on the motor crankshaft.

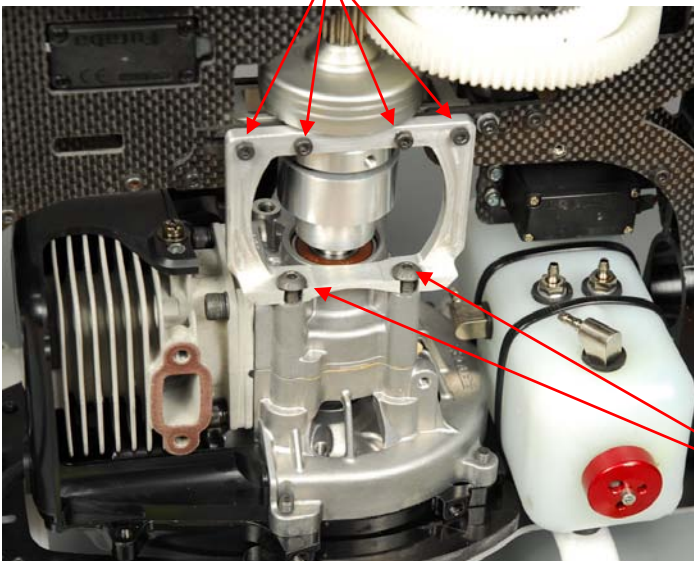
Insert the pins fully in the dampers, the spacing will settle as the parts are secured together

Re-install the four M3 socket bolts that secure the bottom plate to the frame ladders as shown. Do not fully tighten them or thread lock them at this point



M3 motor mount bolts

M3 bottom plate mount bolts



Remove the four bolts from one side of the lower clutch stack bearing block as shown and using the included longer bolts mount one of the two engine mounts.

Also select two of the M5 button head bolts and insert them through the bottom slotted holes on the engine mount into the engine mounting lugs.

Do not fully tighten or thread lock these bolts yet

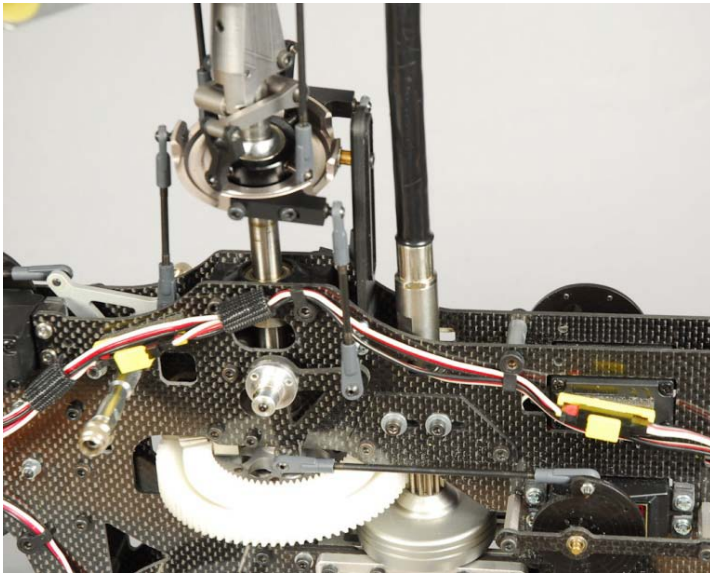
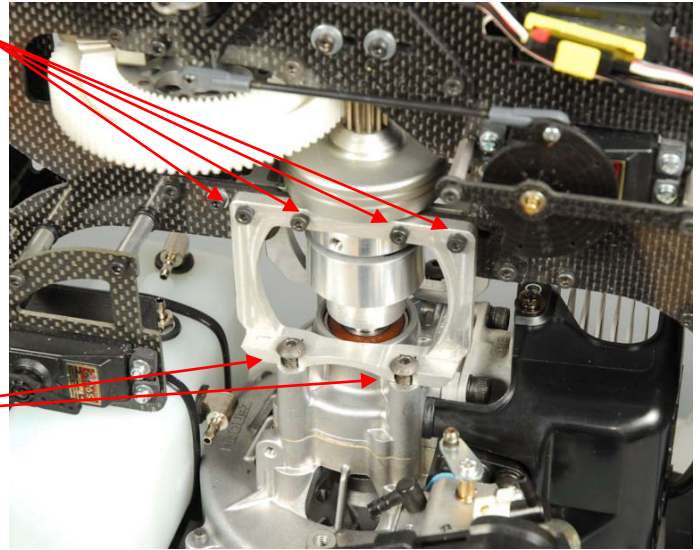
M5 motor bolts

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M3 motor mount bolts

Repeat the engine mount attachment procedure for the engine mount on the other side of the frame

M5 motor bolts



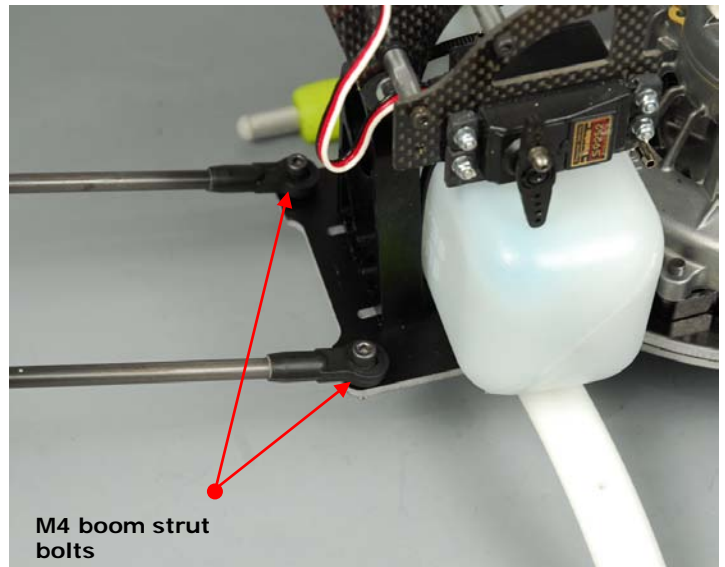
Using either a spin starter or by pulling the pull starter, spin the motor over a few times.

This will self align the various drive train components and frame mounts.

Now, remove each bolt individually on the engine mounts, bottom plate mounts and frame ladder, **apply blue thread lock** and tighten fully.

Reinstall the front boom strut mounts using the original M4 bolts and lock nuts.

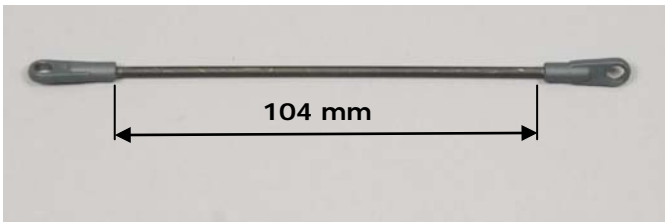
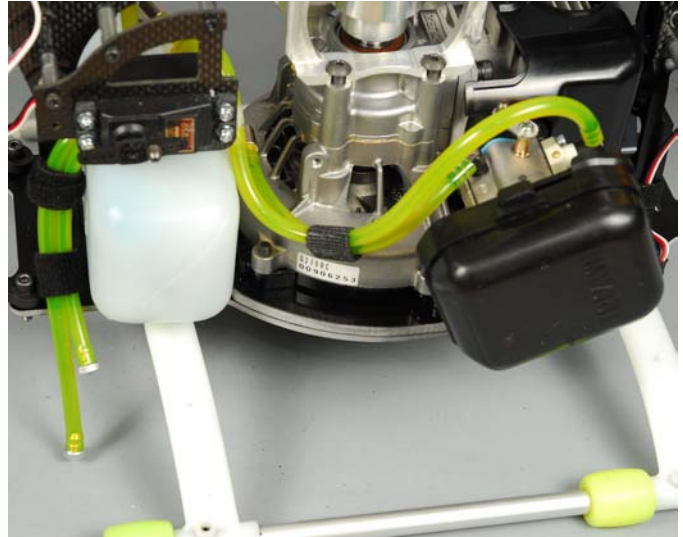
You may need to slightly reposition the horizontal fin mount clamp to relieve any tension on the front bolts that mount the boom struts.



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Plumb the fuel system using tygon fuel tubing. (see the detailed section of fuel tank plumbing later in this document).

If you are converting a Spectra-G and have not relocated the fuel tank all of your original tubing should work.



If you are converting a Stratus you will need to assemble the throttle control rod. See the parts list in the required parts section of this document. The length shown is an approximate starting point and may vary depending on the servo type used

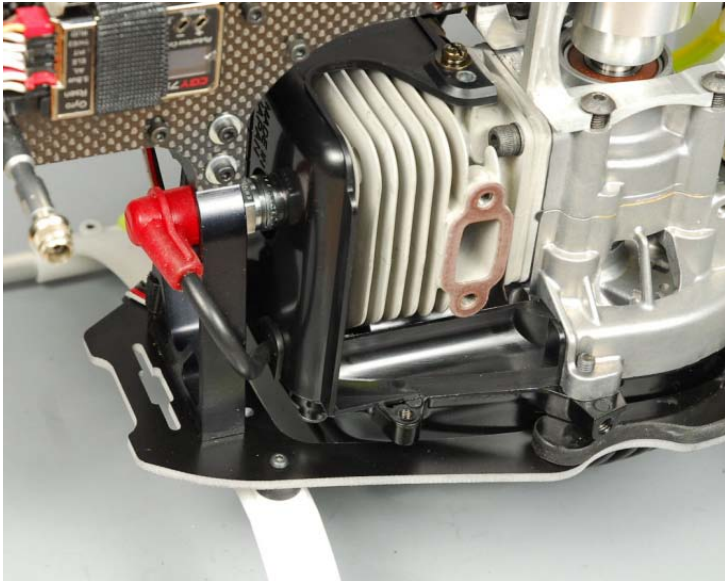
Connect the throttle servo to the throttle arm on the carburetor as shown. An initial throttle curve is shown elsewhere in this document.

The goal is for the throttle servo arm to be perpendicular and the carburetor control arm to be in the center or at the 50% position



Throttle rod installed

HeliBug Spark for Stratus/Spectra-G

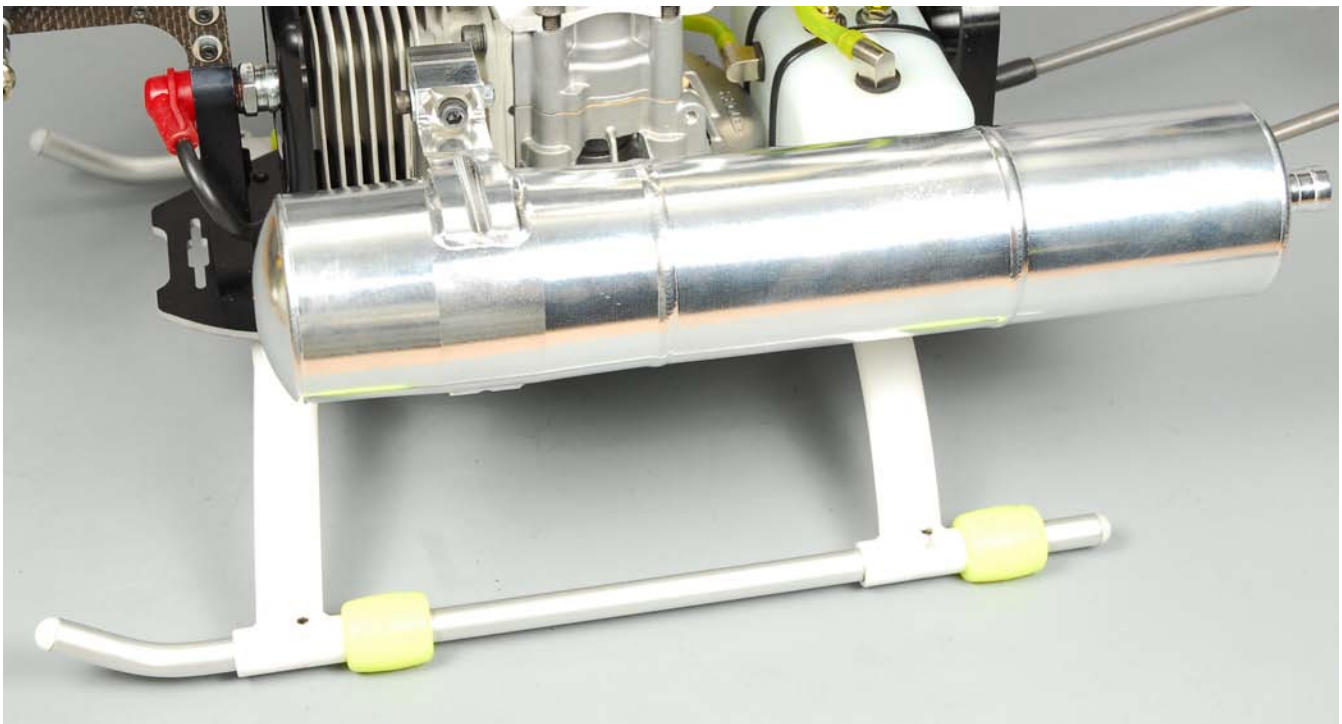


Re-Install the spark plug. It installs through the circular opening in the frame ladder next to the cylinder head. Fully tighten to compress the crush washer under the plug

Use the spark plug that came with the motor, you MUST use a "resistor" plug to avoid RF interference. These motors typically use an NGK CMR7H or equivalent spark plug

Push the spark plug cap fully onto the spark plug

5.B) Muffler Installation



Mount the muffler using the stock zenoah exhaust gasket.

If you are using the stock zenoah muffler, it will mount directly to the cylinder. Retighten it after running the motor while it is still hot

Some mufflers as the Hatori shown use a separate header plate. Use the std exhaust gasket to mount the header and then use high temperature silicone RTV to attach the muffler to the header. Retighten all of the accessible bolts while the engine is hot

5.C) Canopy Installation

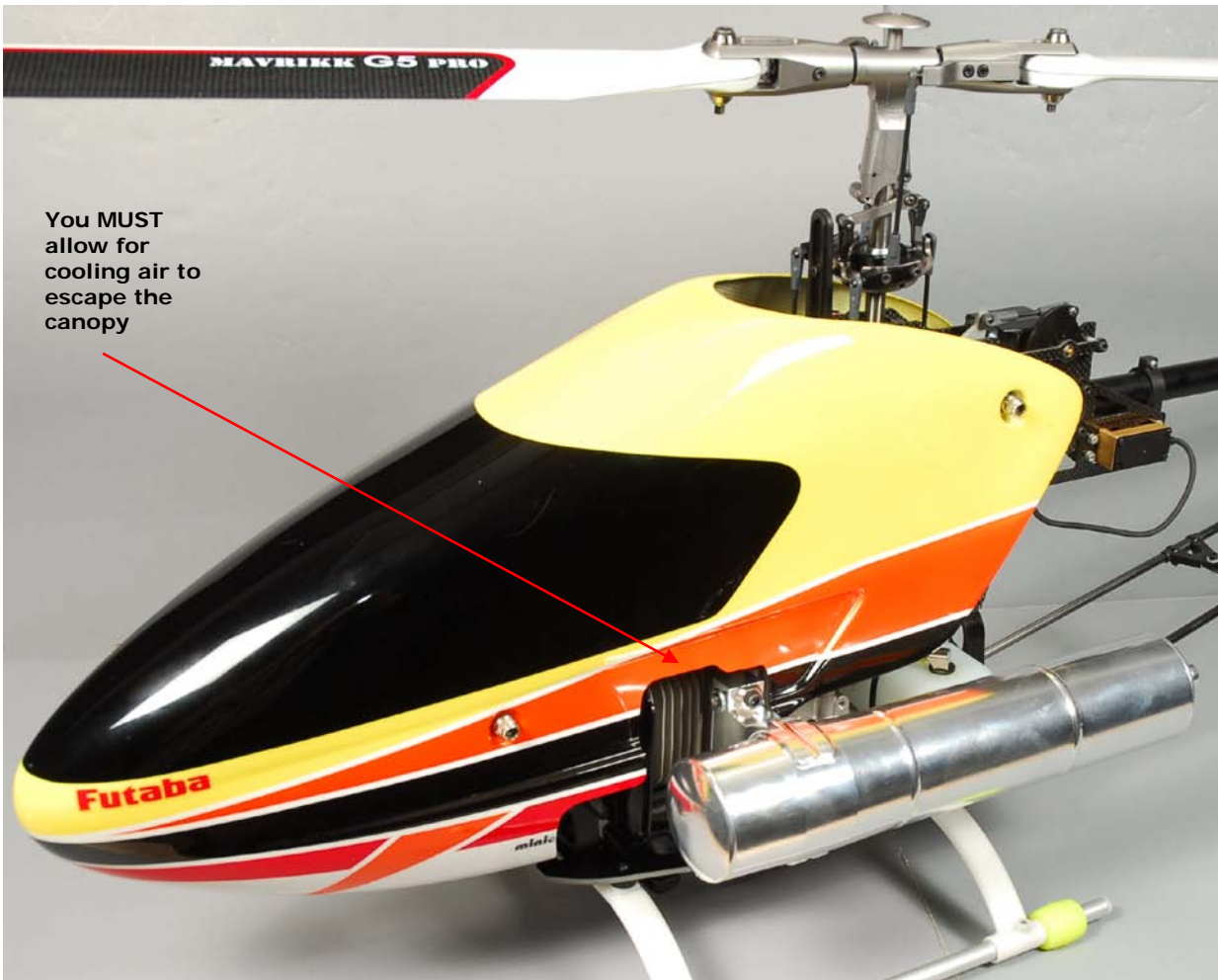
For the Spectra-G conversion, the canopy should install with no additional modifications.

For the Stratus conversion, the canopy will need to be cut according to the cutouts found in the Spectra-assembly manual to allow clearance for the carburetor and muffler

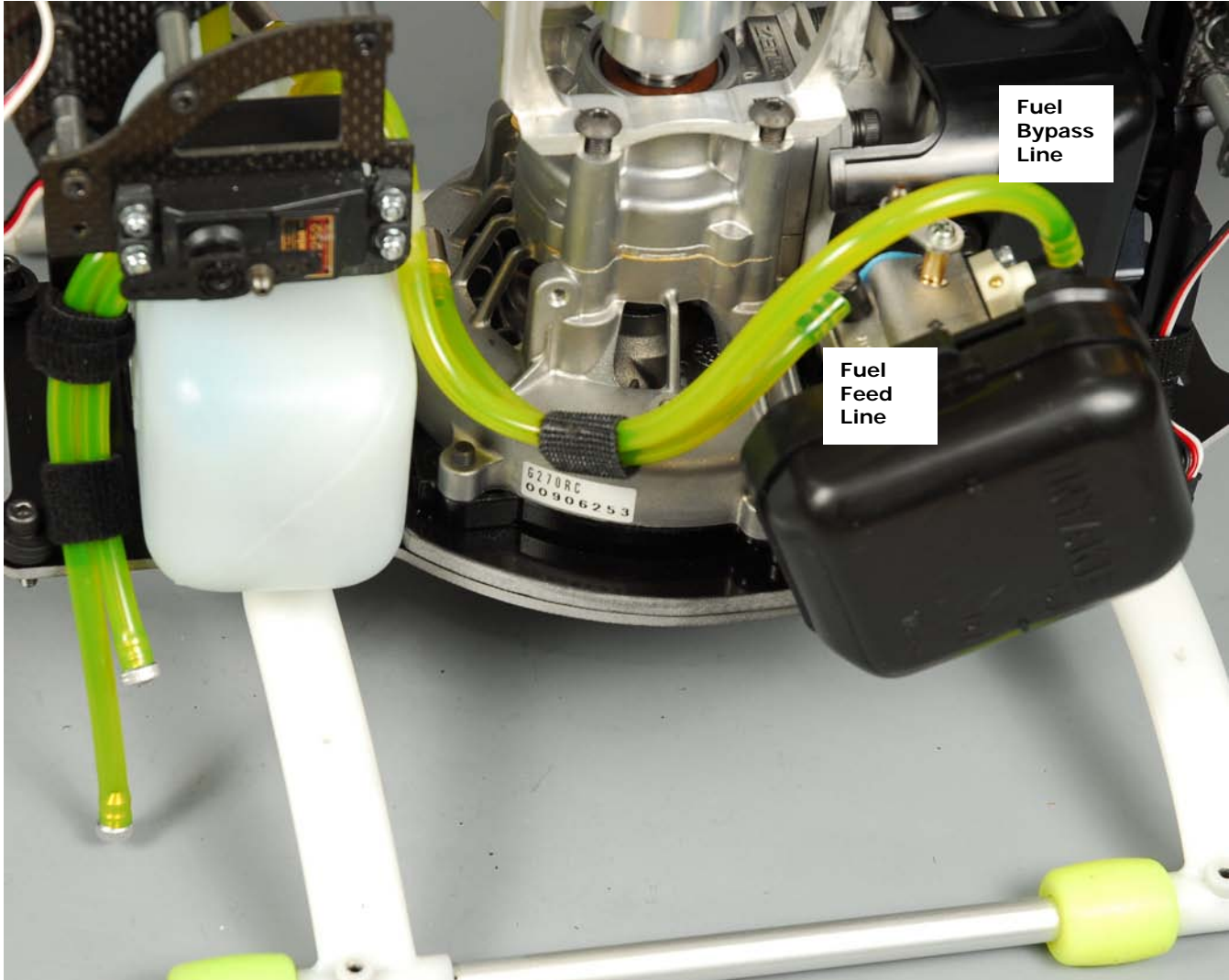
The RC format motor used in this model exhausts its air from the exposed cylinder side of the cooling shroud. You **MUST** allow canopy cutouts for this air to escape or it will overheat your electronics. This problem is more prevalent if you are converting the Spectra and have faced the motor forward as shown.

Fasten the canopy using the std Spectra/Stratus canopy mount nuts

NOTE: The Stratus and Spectra canopies are identical so they can be used interchangeably. On this model a Stratus canopy was cut to fit a Spectra-G with a forward mounted motor



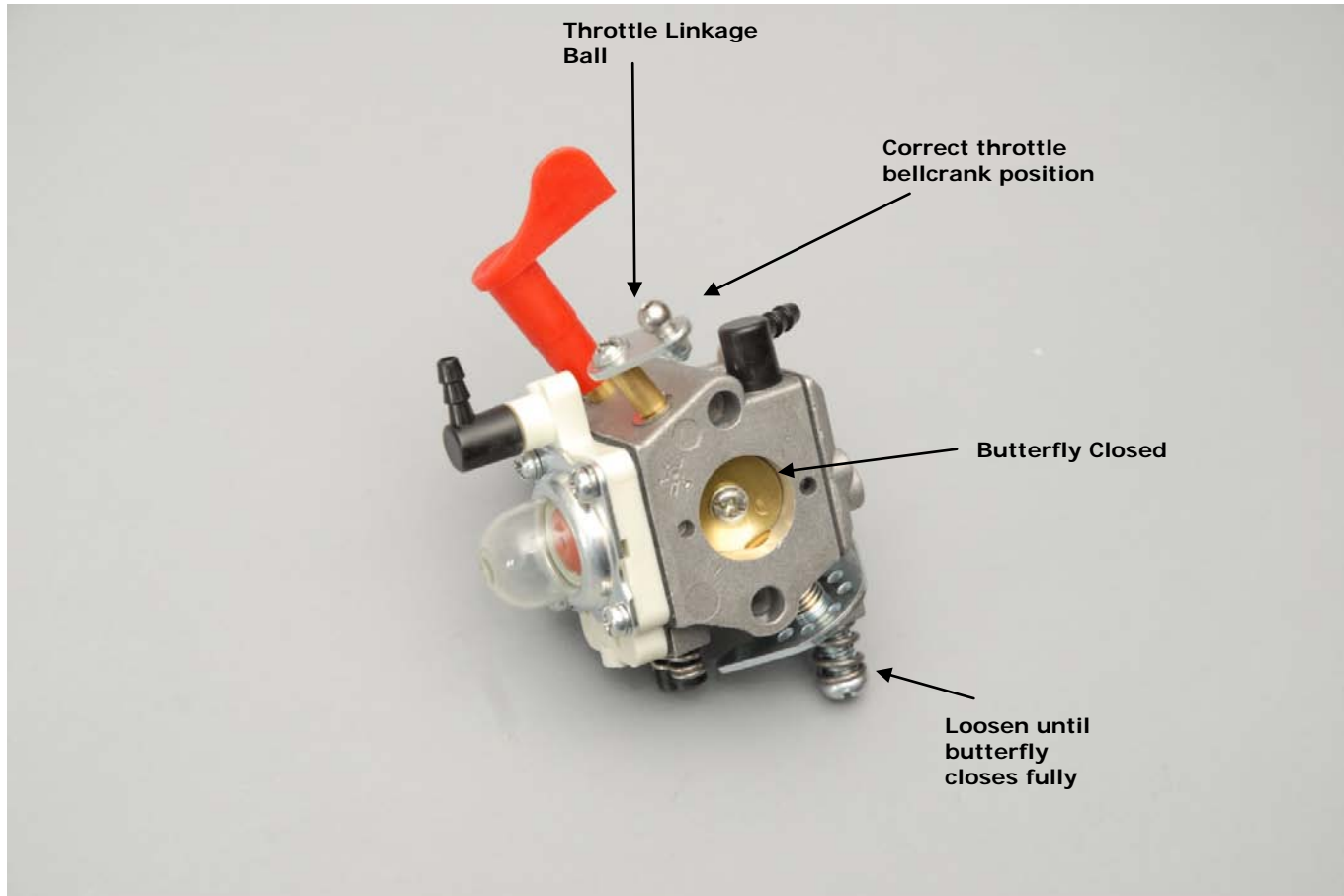
5.D) Fuel System Plumbing



This is only slightly different from normal glow plumbing

1. A fuel feed line is needed from the tanks fuel clunk to the inlet side of the carburetor
2. A fuel return line is needed from the carburetors primer outlet back to the fuel tank
3. Because these motors use a fuel pump, a vent is needed on the tank to prevent it from pulling a vacuum, which will cause the motor to go lean. This is typically done two ways, either by connecting a piece of fuel line to an additional fitting on the tank and then tightly looping the line into consecutive circles and binding them together. This acts as a fuel trap and lets air enter but makes it harder for fuel to escape.
4. You will still need a way to get fuel into the tank. You can either remove the fuel feed line from the carburetor and put fuel in/remove fuel through that line or you can use a T fitting in either the feed or overflow line to move fuel. Note - if you use the one way valve vent, you'll need an additional vent because it allows air INTO the tank not out as would be needed when filling the tank.

5.E) Throttle Setup



1. Throttle setup is considerably different for this gasoline powered motor than for a glow motor. The amount of throttle opening typically required is less.
2. The bell crank size on the carburetor is predefined
3. Make sure the linkage ball on the throttle servo is at approx 13mm from the arm center
4. The length of the throttle control arm will be approximately 80mm from the bottom of each ball link
5. Also make sure it's moving in the correct direction for opening/closing the throttle. If necessary remove the air cleaner cover and visibly inspect this. Having the throttle linkage reversed can be dangerous.
6. Adjust the "idle screw" on the carburetor so that the throttle butterfly can completely close
7. At full low throttle, low trim (or throttle cut) the butterfly should be completely closed
8. And at full throttle the butterfly will be fully open
9. A good starting place for a throttle curve will be: 10%,20%,30%, 75%, 100%
These settings may need to be field adjusted based on gear ratio, blades, flying style, etc.
10. If you are using a governor, make sure you change the gear ratio.

5.F) Pitch Setup

Initially use the manual recommended pitch settings. You will find that you will need to either reduce the max pitch settings or adjust your flying style to not use them for extended periods of time as they tend to bog the motor more which will cause it to overheat.

VI. Optional Parts

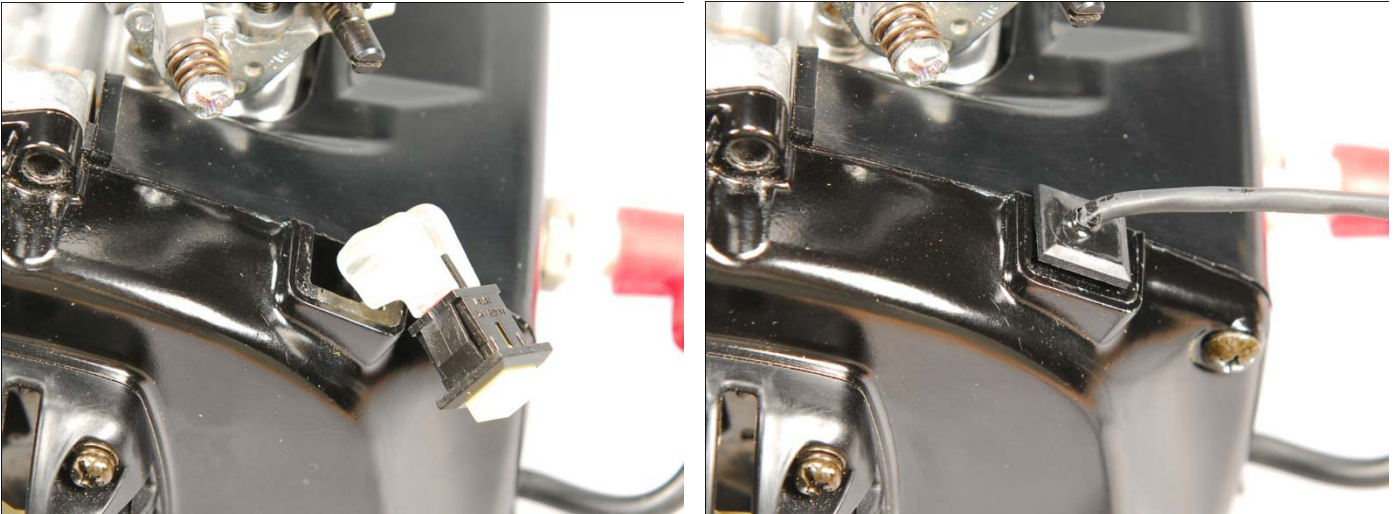
6.A) Pull Starter Replacement



If you do not intend to pull start your motor and wish to increase the ground clearance, you can replace the pull start mechanism using optional parts such as shown which will increase ground clearance by about 1 inch. The "air scoop" like the one shown comes in several colors that can match your model.

The pull starter can be re-oriented on the motor to four different positions by simply removing it and re-installing with the handle on either side as you see fit

6.B) Stator Gator Governor Sensor

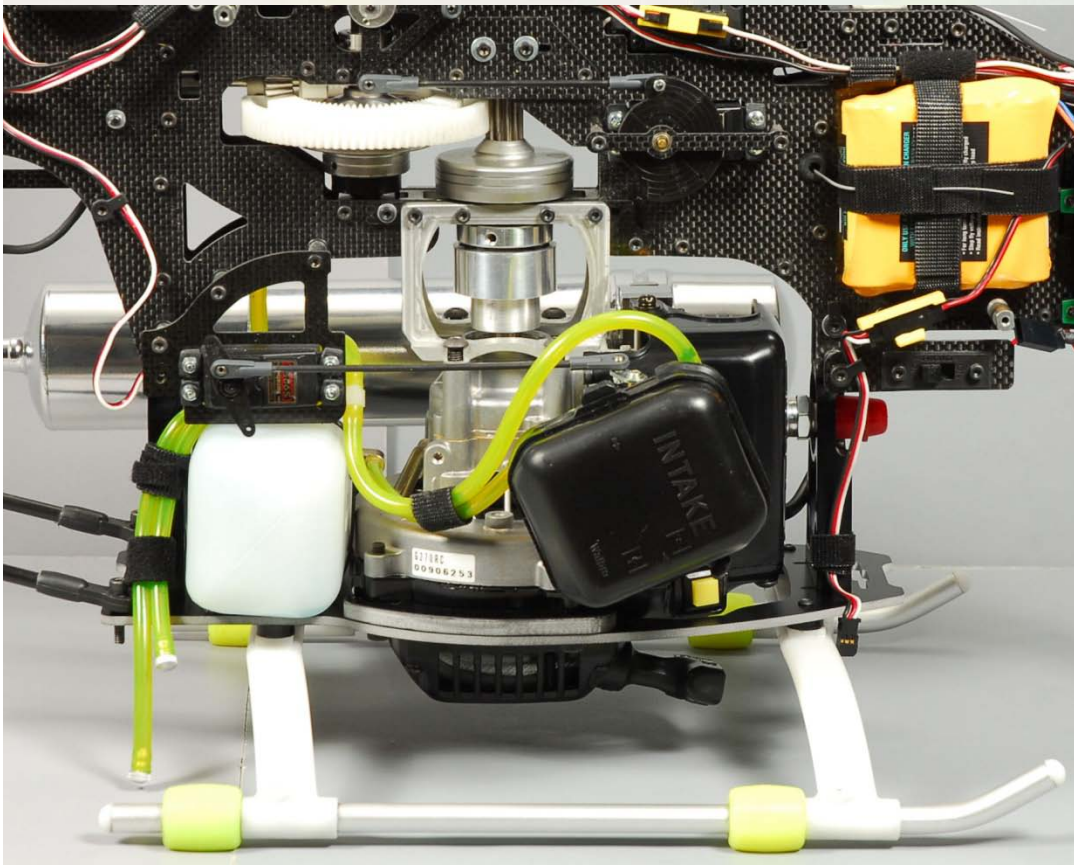
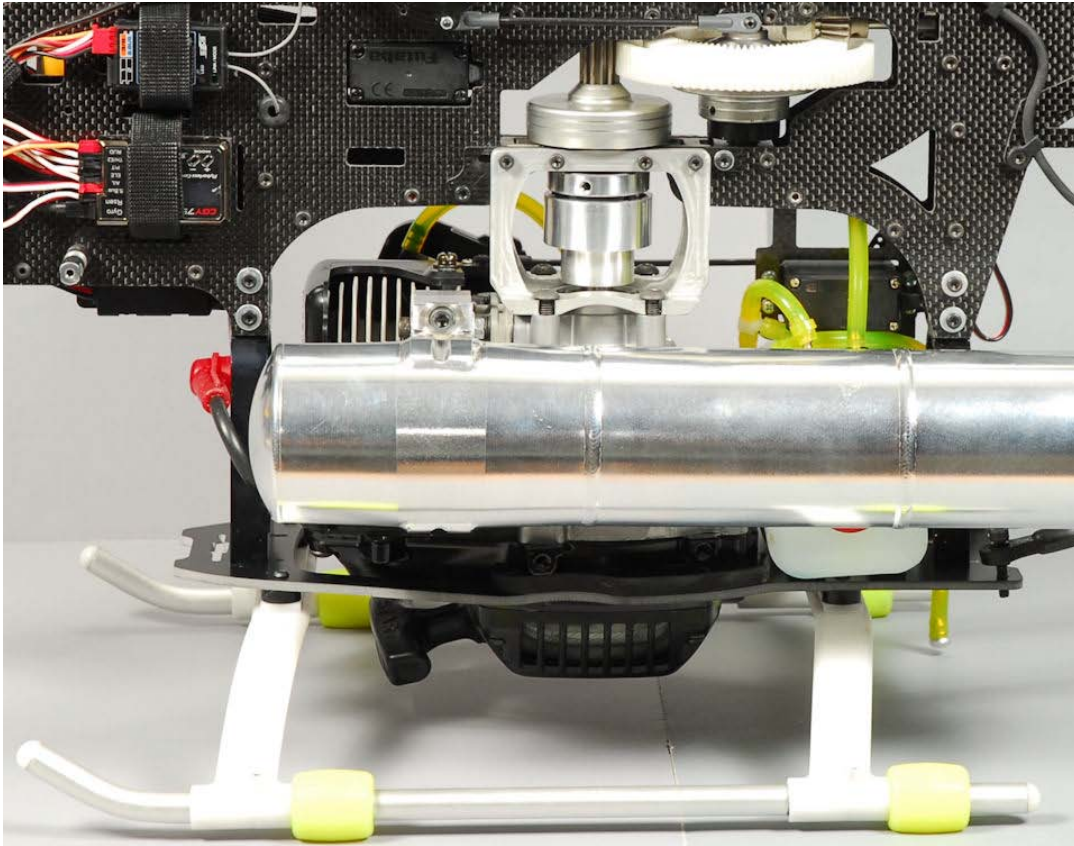


You may want to use an optional engine speed governor. If so you will need to adapt a sensor mount to detect engine speed.

One option is to use the Stator Gator sensor which replaces the kill switch button on the RC motor. To install the stator gator, simply remove the switch and plug the sensor in its place as shown.

This device is compatible with the Futaba GV-1, GY701/GY750 and Model Avionics Rev-Max/TJ governors

HeliBug Spark for X-Cell Stratus/Spectra-G



HeliBug Spark for Stratus/Spectra-G



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