

# P07122 - Autonomous Quadcopter Mechanical Assembly Instructions

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## Mechanical Assembly of Quadcopter

**Synopsis:** Herein are described procedures and parts for assembly of the quadcopter.

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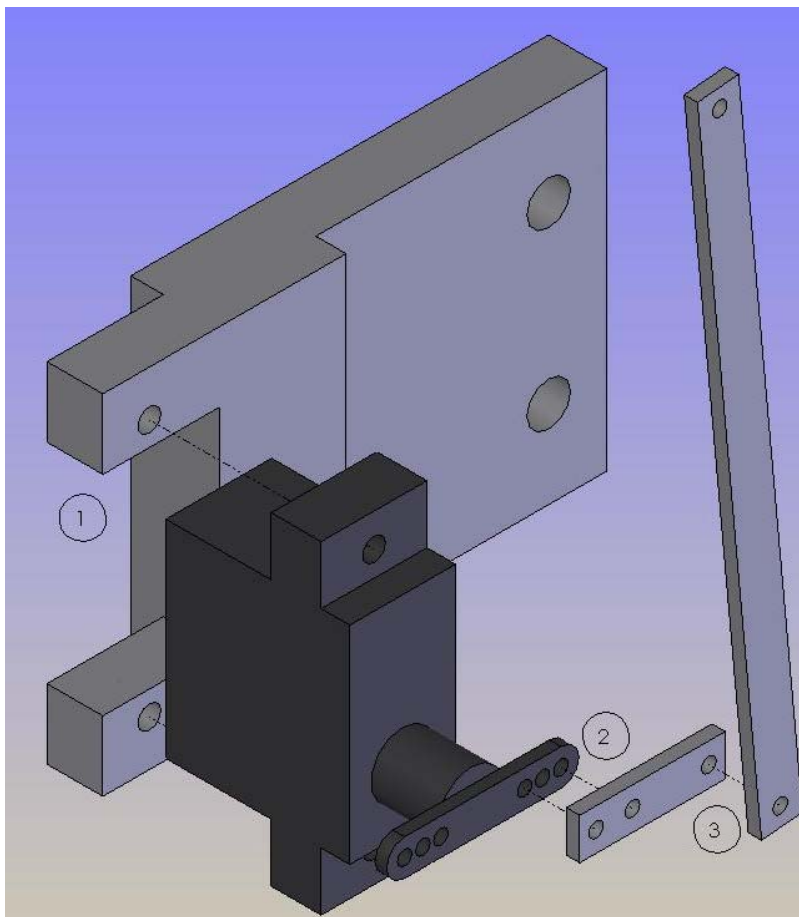
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## Subassembly #1: Servo & Throttle Linkage

### Parts Required

- Great Planes B-8 Micro Servo
- Throttle – Servo Mount
- Throttle – Servo Linkage
- Throttle – Main Linkage
- 2x M2.5 x 8mm socket head cap screws
- 3x #0-80 x 3/16" socket head cap screws
- 3x #0-80 nuts

### Procedure



*Figure 1: Subassembly #1*

1. Attach the B-8 Micro Servo to the servo mount using the M2.5 x 8mm socket head cap screws.
2. Attach the servo linkage to the long servo arm (with three holes) using the #0-80 x 3/16" socket head cap screws. Tighten using #0-80 nuts.
3. Attach the main linkage to the servo linkage using a #0-80 nut and bolt. Tighten so that connection is snug, but still allows unrestricted rotation.

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## Subassembly #2: Engine, Drivetrain, & Rotors

### Parts Required

- O.S. Engines 0.15LA RC airplane glow engine
- 2x Drivetrain – Motor Mount
- 4x Drivetrain – Motor Mount Spacer
- Frame – Vertical Rail
- Drivetrain – Connector
- Drivetrain – Rotor Mount
- JCS Semi-Symmetrical Plasti-Blade helicopter rotors (2 blades)
- Subassembly #1: Servo & Throttle Linkage
- 2x #10-24 x 2" socket head cap screws
- 2x #10-24 x 5/8" socket head cap screws
- 2x #10-24 nylon locknuts
- 4x #10 washers
- 4x #5-40 x 1/4" socket head cap screws
- 2x #5-40 x 3/4" socket head cap screws
- 2x #5-40 nylon locknuts
- 0-4x #5 washers
- #0-80 x 3/16" socket head cap screw
- #0-80 nut
- Loctite® threadlocking compound, blue

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## Procedure

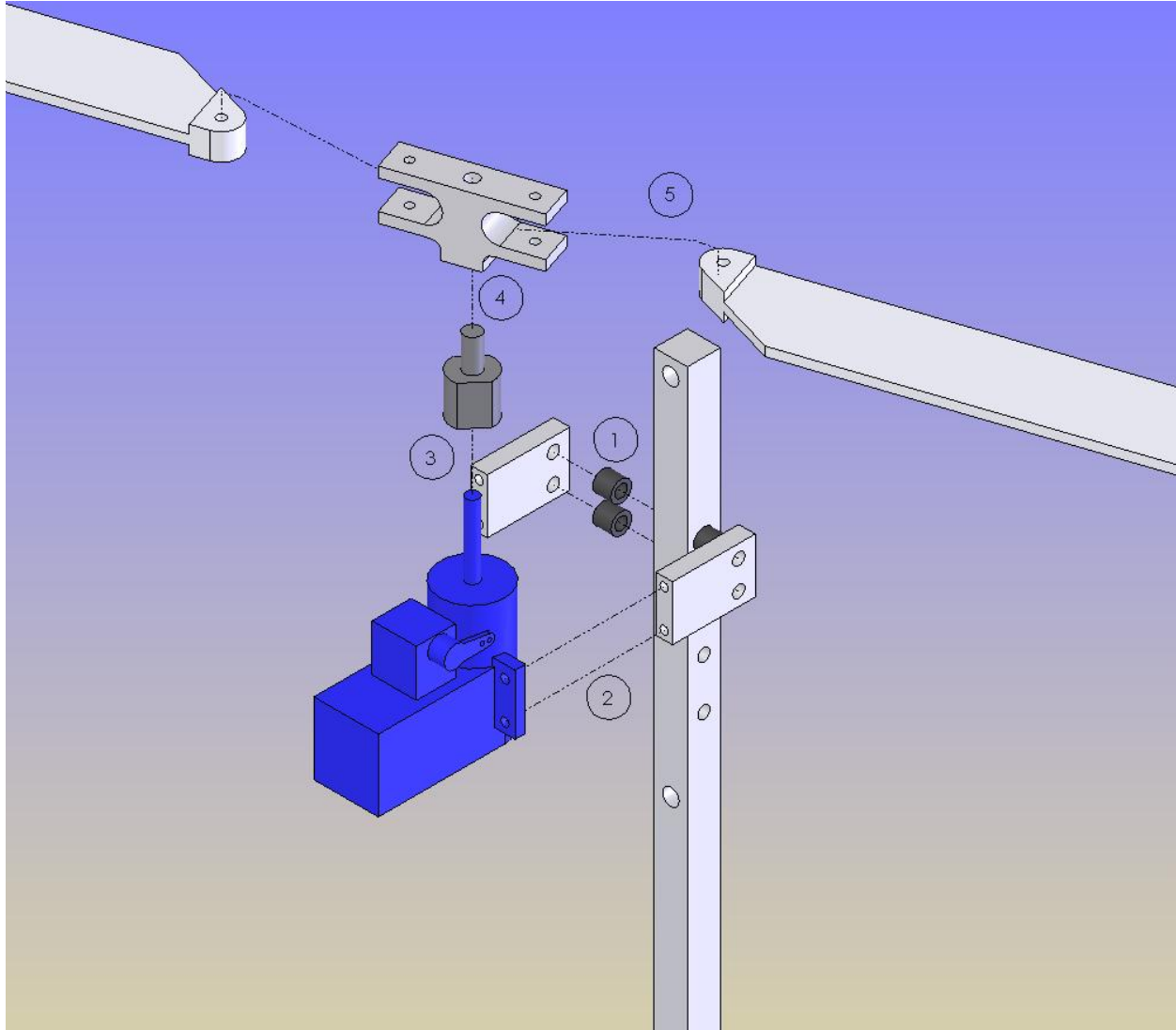


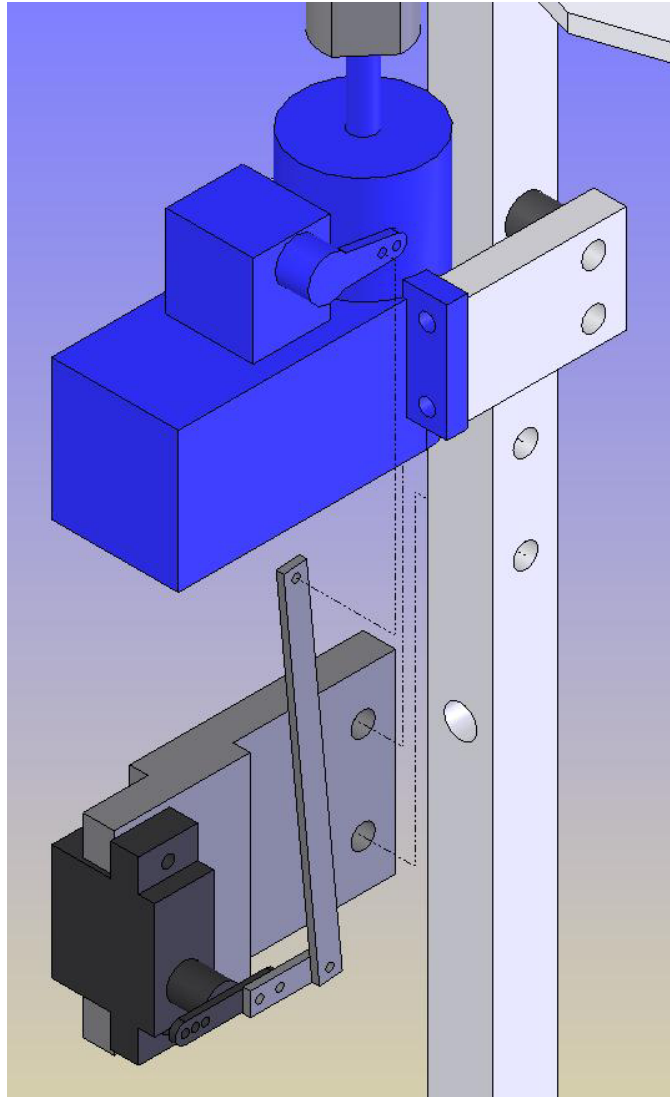
Figure 2: Steps #1-5

1. Place a washer under the head of each #10-24 x 2" socket head cap screw. Insert through motor mount, motor mount spacer, vertical frame rail, motor mount spacer, and motor mount as shown by line 1. Place washers and nuts on end of bolt and tighten.
2. Attach the O.S. 0.15LA engine to the motor mounts using four #5-40 x 1/4" socket head cap screws and tighten.
3. Provided with the engine is a M5 nut for the drivetrain. Screw this nut to the base of the engine's driveshaft. Apply a small amount of blue threadlocking compound to the driveshaft. Screw the drivetrain connector onto the driveshaft. Tighten the M5 nut and drivetrain connector against each other.
4. Apply a small amount of blue threadlocking compound to the shaft on the drivetrain connector. Screw the rotor mount onto the drivetrain connector and tighten.

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5. Insert the rotor blades into the slots on the rotor mount. Attach using #5-40 x 3/4" socket head cap screws and nuts. Use #5 washers to fill any space between rotor mounts and blades.



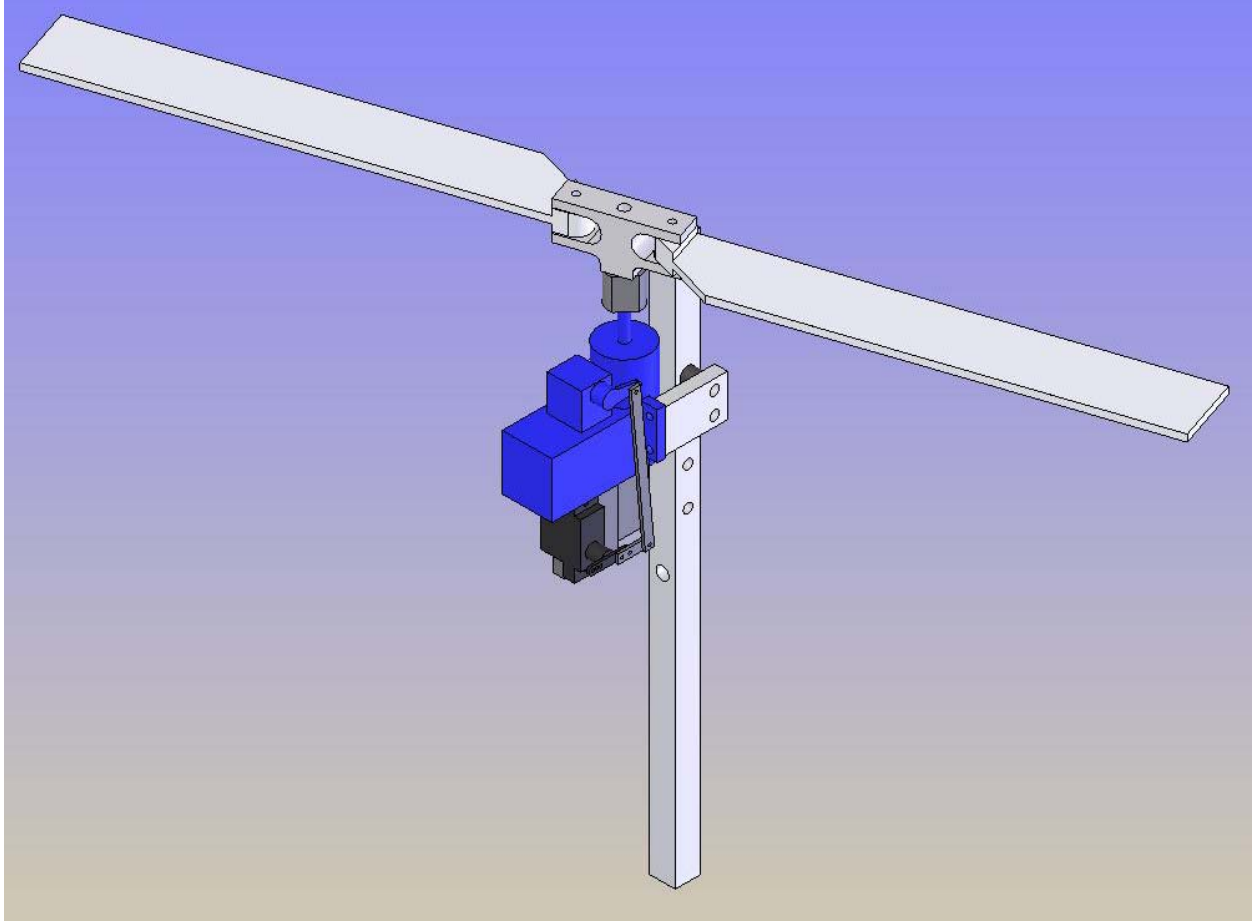
*Figure 3: Servo Assembly Mounting*

6. Place washers under the heads of both #10-24 x 5/8" cap screws. Insert through servo mount on servo subassembly and screw into vertical frame rail.
7. Attach main servo linkage to innermost hole on engine's throttle arm using the #0-80 nut and bolt.

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## Finished Subassembly



*Figure 4: Subassembly #2*

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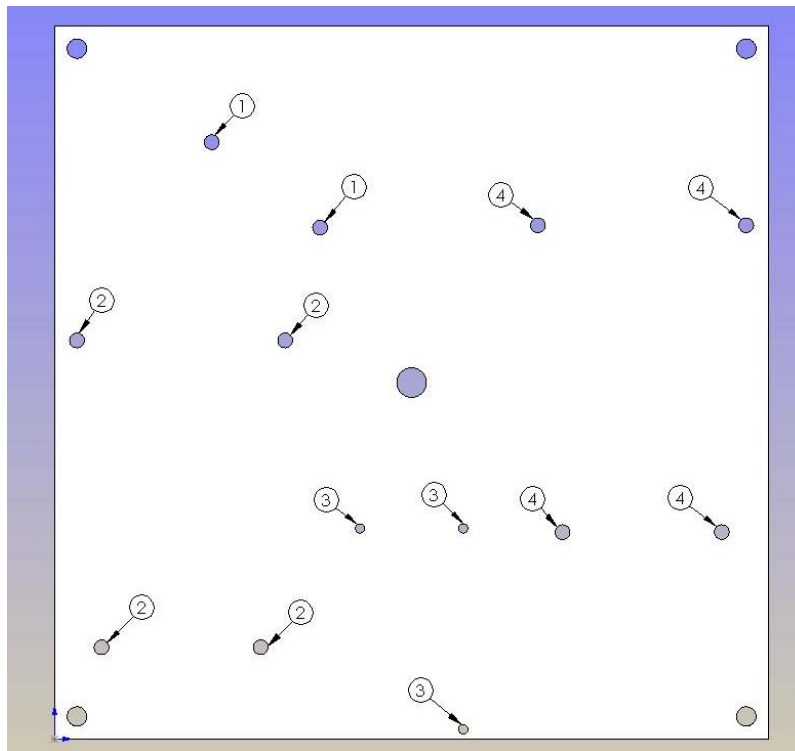
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## Subassembly #3: Main Controls Plate

### Parts Required

- Controls Compartment – Bottom Plate
- GPU
- Radar Altimeter
- PCB Board #1
- PCB Board #2
- PCB Board #3
- Wireless Modem

### Procedure



*Figure 5: Main Controls Plate*

1. Mount the GPU via its two mounting holes and appropriate bolts and standoffs to the 0.125” holes labeled (1). The holes are threaded for #5-40 screws.
2. Mount the radar altimeter and PCB board #1 to the four holes labeled (2). The radar altimeter and PCB board #1 should be stacked, with appropriate standoffs separating them, with the radar altimeter on the bottom and the PCB board on top. Total height for the stacked arrangement should not exceed 1.034 inches. The holes are threaded for #5-40 screws.
3. Mount the wireless modem to the three 2mm holes labeled (3). Antenna should extend vertically towards the top of the plate as shown (and will extend off the top of the plate). The holes are threaded for M2x0.4 screws. Use standoffs as needed.
4. Mount PCB boards #2 and 3 to the four holes labeled (4). The PCB boards should be stacked, with appropriate standoffs separating them. Total height for the stacked arrangement should not exceed 1.034 inches. The holes are threaded for #5-40 screws.

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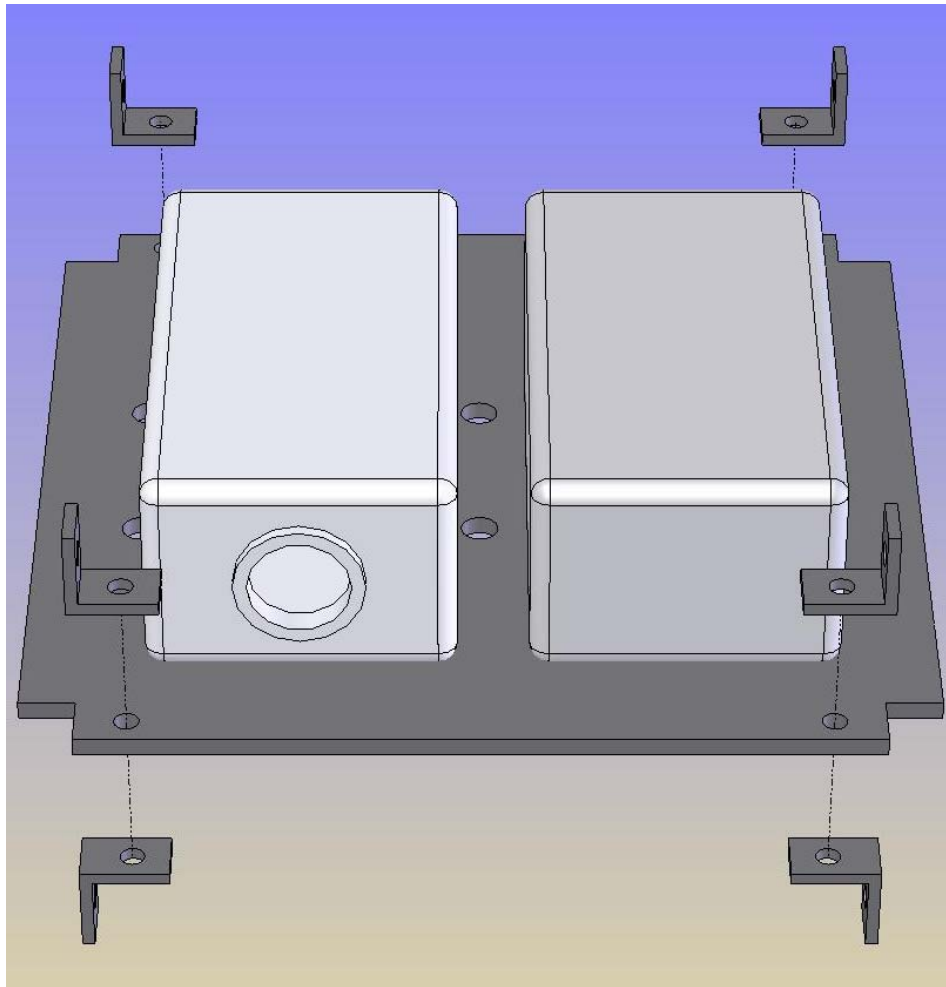
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## Subassembly #4: Fuel Storage Plate

### Parts Required

- Controls Compartment – Middle Plate
- 8x Controls Compartment – Plate Bracket
- 2x Sullivan RST-4 Rectangular Fuel Tank 4oz
- 4x Nylon Cable Ties, 8"
- 4x #8-32 x 5/8" socket head cap screws
- 4x #8-32 nylon locknuts
- 8x #8 ANSI washers

### Procedure



*Figure 6: Fuel Storage Plate*

1. Place the fuel tanks on Controls Compartment – Middle Plate as shown in Figure 6. Use the four cable ties to strap the tanks securely to the plate using the six holes provided.
2. Assemble the plate brackets to the plate as shown using the #8-32 nuts, bolts, and washers. Place one washer under the head of each bolt, and one under the each nut. Ensure that the brackets are square to the edges of the plate.

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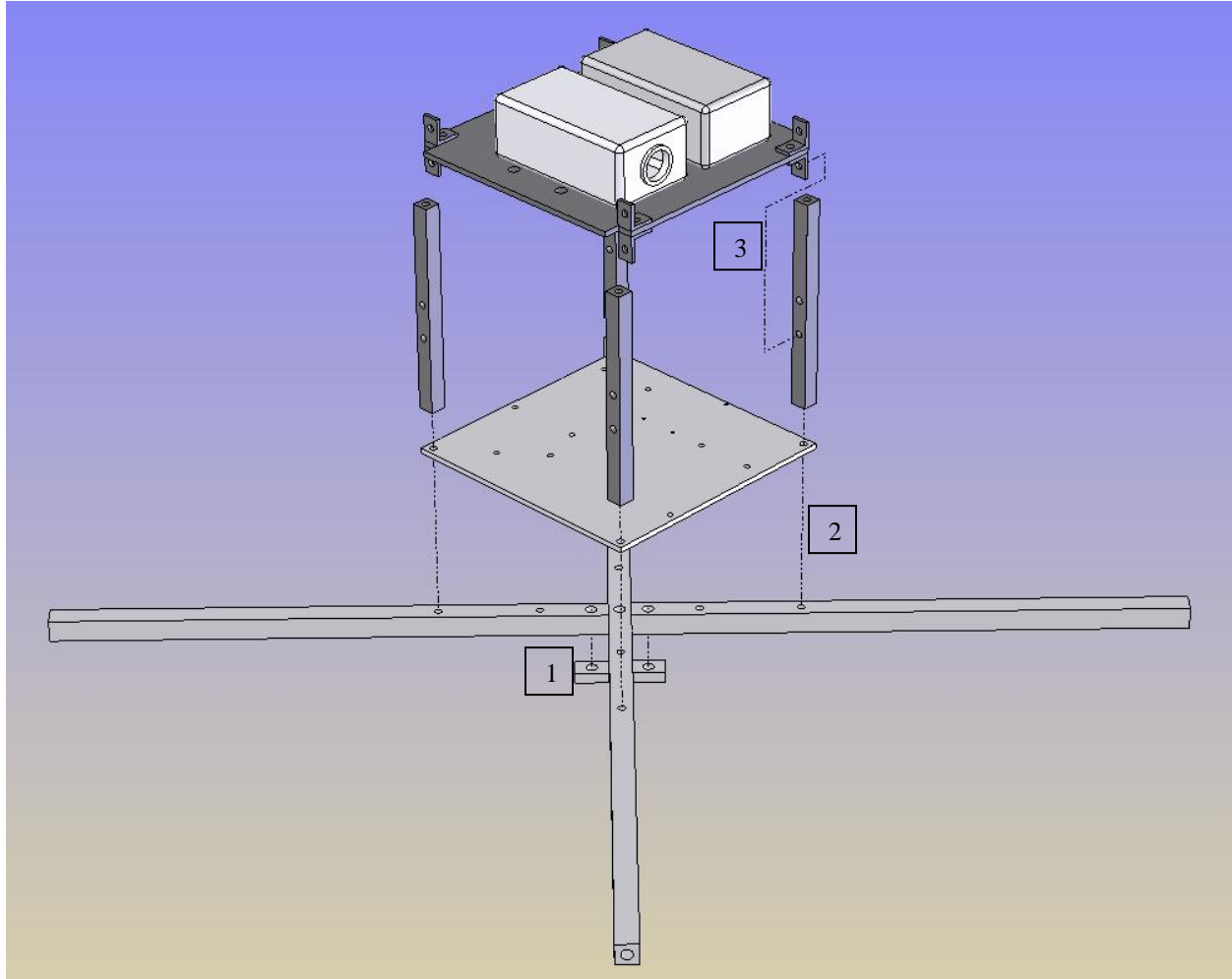
## Main Assembly

### Parts Required

- 4x Subassembly #2: Engine, Drivetrain, & Rotors
- Subassembly #3: Main Controls Plate
- Subassembly #4: Fuel Storage Plate
- Frame – Horizontal Long Rail
- Frame – Horizontal Long Top Rail
- 2x Frame – Horizontal Short Rail
- 2x Frame – Horizontal Short Top Rail
- Frame – Main Bracket
- Frame – Top Main Bracket
- 4x Controls Compartment – Vertical Rail
- Controls Compartment – Top Plate
- 4x ¼”-20 x ¾” socket head cap screws
- 2x ¼”-20 x 1-3/8” socket head cap screws
- 8x ¼”-20 x 1” socket head cap screws
- 2x ¼”-20 nylon locknuts
- 8x ¼” washers
- 8x #8-32 x 1” socket head cap screws
- 8x #8-32 x ½” socket head cap screws
- 4x #8-32 x 5/8” socket head cap screws
- 16x #8 washers

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## Procedure

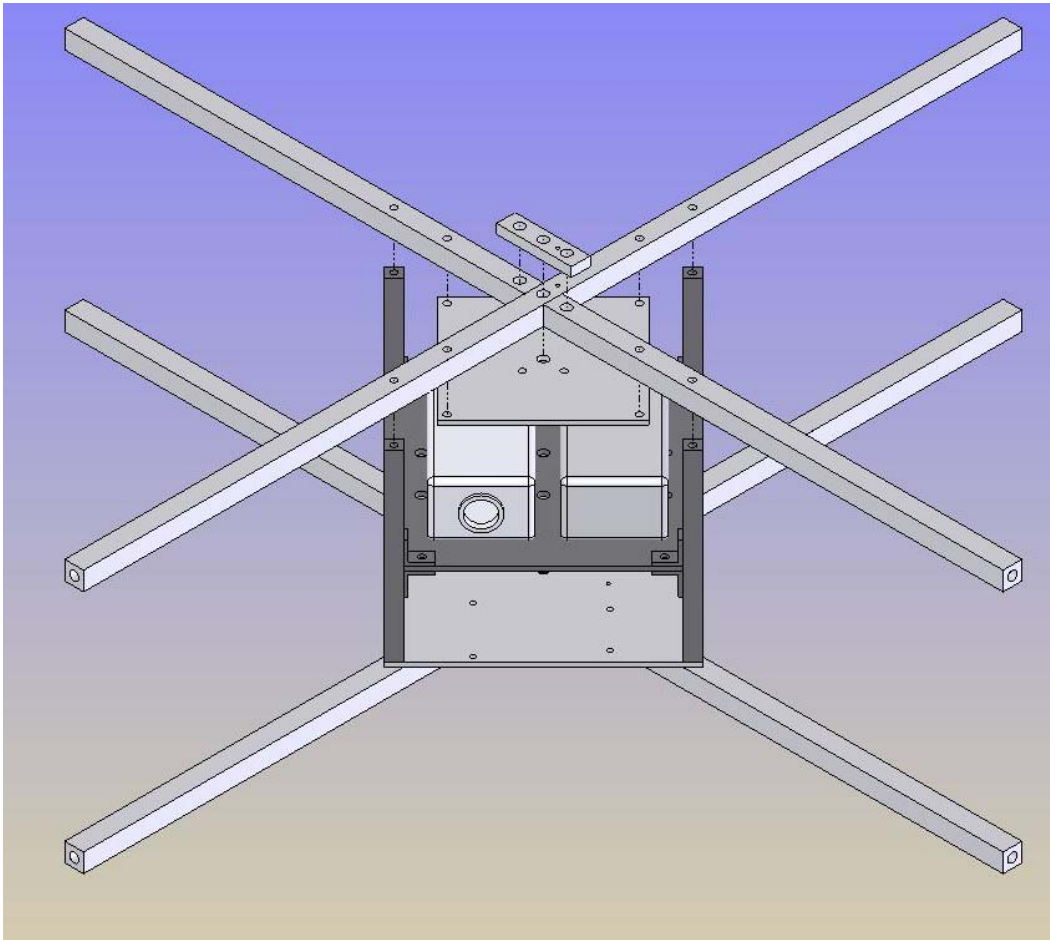


*Figure 7: Controls Compartment*

1. Arrange Frame – Horizontal Long Rail and two Frame – Horizontal Short Rail as shown. Use Frame – Main Bracket to join the short rails to the bracket using two 1/4”-20 x 3/4” bolts. Place a washer under the head of each bolt. Place Subassembly #3: Main Controls Plate onto frame rails. Use one 1/4”-20 x 1-3/8” bolt, two washers, and a 1/4” nylon locknut in center hole to fasten the long frame rail, the main controls plate, and the bracket together.
2. Place four Controls Compartment – Vertical Rails onto assembly from step 1. Attach using #8-32 x 1” bolts. Place a #8 washer under the head of each bolt.
3. Attach Subassembly #4: Fuel Storage Plate to the vertical rails using #8-32 x 1/2” bolts. Place a #8 washer under the head of each bolt.

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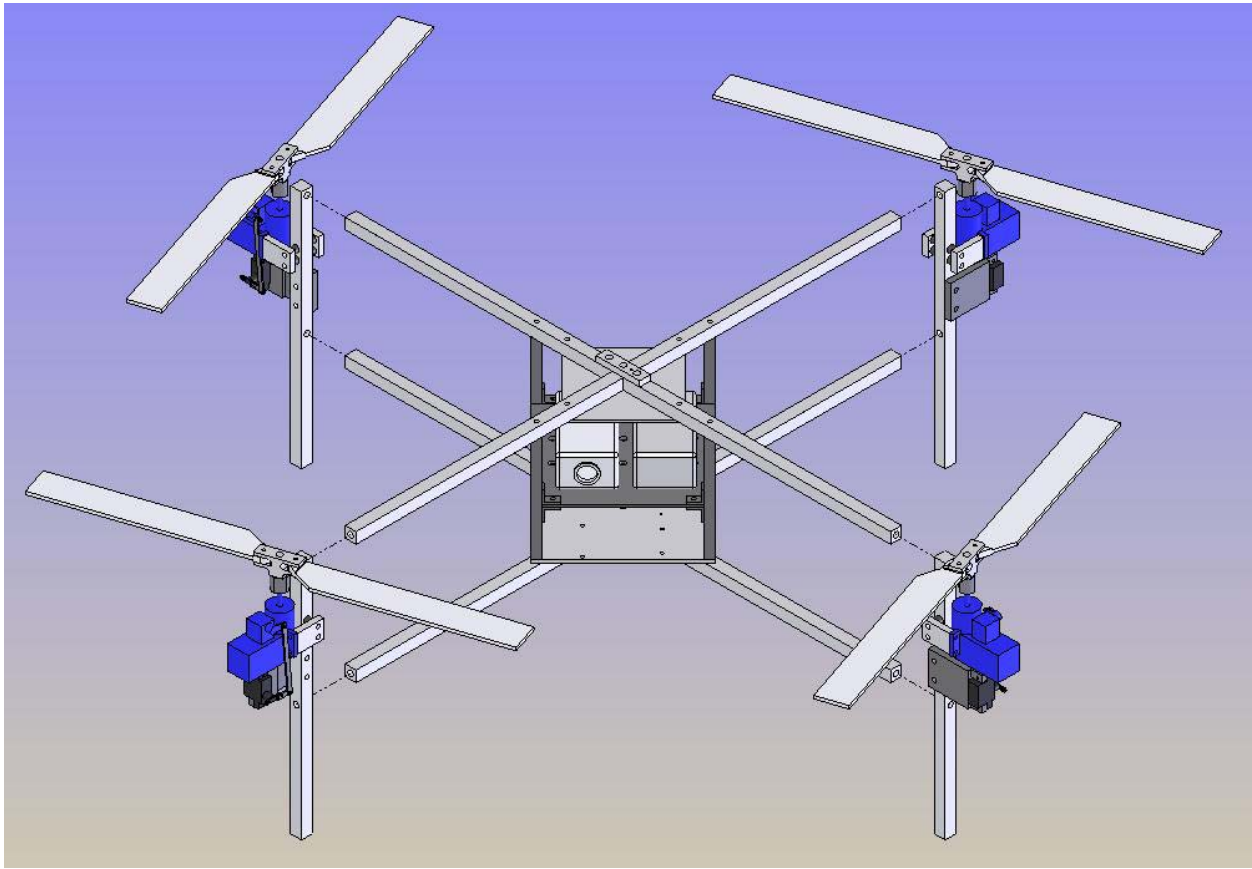


*Figure 8: Top Frame Assembly*

4. Attach Frame – Horizontal Long Top Rail and two Frame – Horizontal Short Top Rails to the tops of the Controls Compartment – Vertical Rails using #8-32 x 1” bolts. Place a #8 washer under the head of each bolt.
5. Attach Frame – Top Main Bracket to the short horizontal rails using ¼”-20 x ¾” bolts. Place a ¼” washer under the head of each bolt.
6. Attach Controls Compartment – Top Plate to the long horizontal rail using the center hole. Use a ¼”-20 x 1-3/8” bolt and ¼”-20 nylon locknut with washers under the nut and bolt head.
7. Attach the top plate to the four outer holes in the horizontal rails using #8-32 x 5/8” bolts with washers under the heads.

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*Figure 9: Drivetrain Installation*

8. Attach each Subassembly #2: Engine, Drivetrain, & Rotors to the assembly using  $\frac{1}{4}$ "-20 x 1" bolts. Place a  $\frac{1}{4}$ " washer under the head of each bolt.

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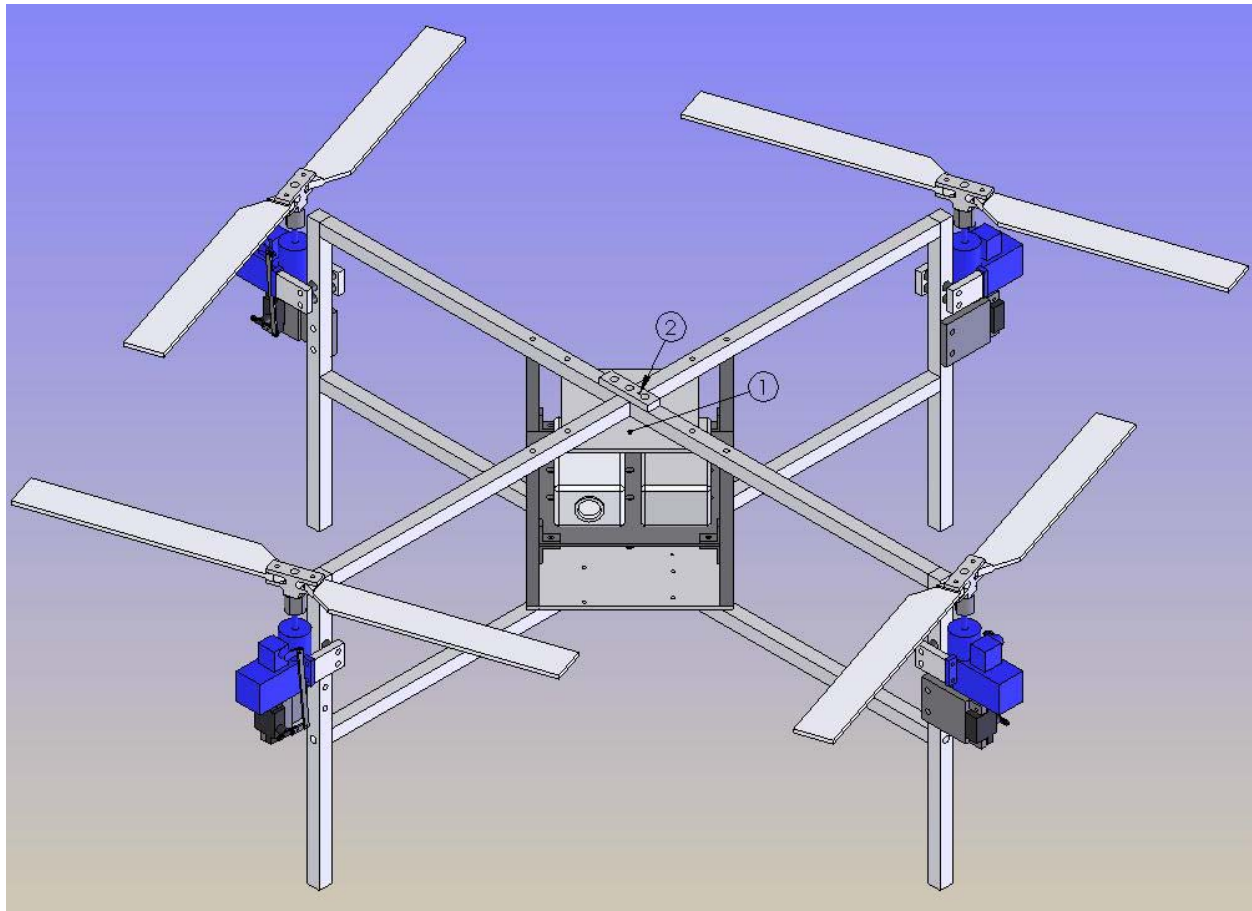
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## Final Assembly

### Parts Required

- Main Assembly
- GPS
- Accelerometer
- Gyroscope
- Digital Compass
- Double-Sided Tape
- ~12x Nylon Cable Ties, 8"
- Great Planes Silicone Fuel Tubing Standard

### Procedure



*Figure 10: Final Assembly*

1. Mount the GPS using sturdy double-sided tape at the location shown by (1) in Figure 10. The GPS will extend over the edge of the plate slightly; this is normal and acceptable.
2. In the top main bracket and horizontal long top frame rail are two small holes, shown by (2) in Figure 10. Using appropriate standoffs, mount the gyroscope to these holes. The holes are threaded for #2-56 screws.

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3. On the bottom side of Controls Compartment – Top Plate are two holes. Stack the accelerometer and digital compass using appropriate standoffs and mount to these holes, which are threaded for M4x0.7 bolts.
4. The fuel lines must remain fairly level between the fuel tanks and engines. Cut a short segment of fuel line to run from each fuel tank to a y-shaped connector. From the y-connector, run a long fuel line to each engine. Secure the fuel lines to the upper frame rail using cable ties, but do not tighten. Leave the cable ties loose enough that fuel lines remain level between fuel tanks and engines.
5. Mount the rotation sensors to the vertical frame rails using double sided tape. Fabricate a thin piece to rotate through the sensor, and attach to the drivetrain.
6. Secure all wires to frame rails using cable ties.