TILT

RACING DRONE

INSTRUCTION MANUAL

Building the TILT drone

Process of building the TILT is common to all versions current versions: the parts may differ (it will be specified when 3DP and PRO versions use different components) but assembly remains the same. Please follow the steps given below. You might find extra screws in most steps than the ones strictly necessary OR very similar lengths than the ones stated in this manual but that should still be suitable.

NOTE: Please refer the **Getting Started** document for the detailed description of the part names and their functions.

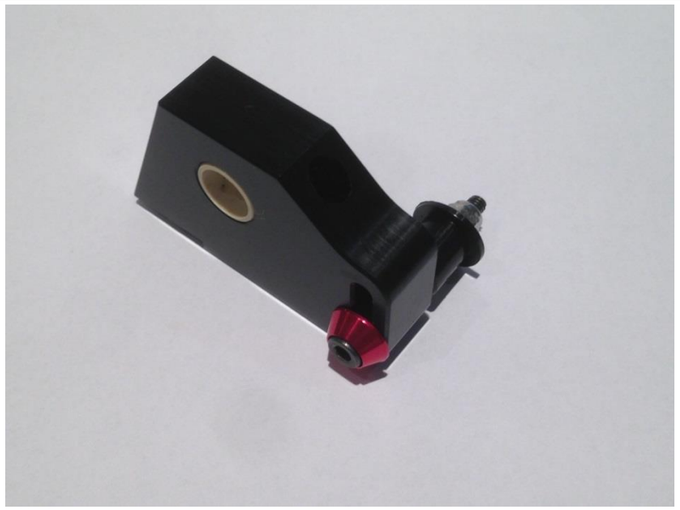
<table>
<tr><td colspan="3">Step 1</td><td rowspan="2"></td></tr>
<tr><td>PARTS

• 4x polymer bearings (large)
• 2x arms support RIGHT
• 2x arms support LEFT</td><td>HARDWARE

• None</td><td>  </td><td>Insert the polymer bearings on each arm support part (4 pieces, two left-hand and two right-hand) and insert it until it gets flushed on the other side. Use a 9 or 10 mm drill bit or similar to insert it as it goes press fit.</td></tr>
</table>

<table>
<tr><td colspan="3">Step 2</td><td rowspan="2"></td></tr>
<tr>
<td>PARTS

• Same as step 1
• 2x polymer bearings (small ones)</td>
<td>HARDWARE

• 2x screw M3x30
• 2x lock nut M3
• 4x washer for M3
• 2x split washer for M3
• 2x 10mm Nylon cylinder</td>
<td> 
  </td>
<td>Install both tensors, one on a right-hand arm support and the other in a left-hand one. Do not tighten them yet.

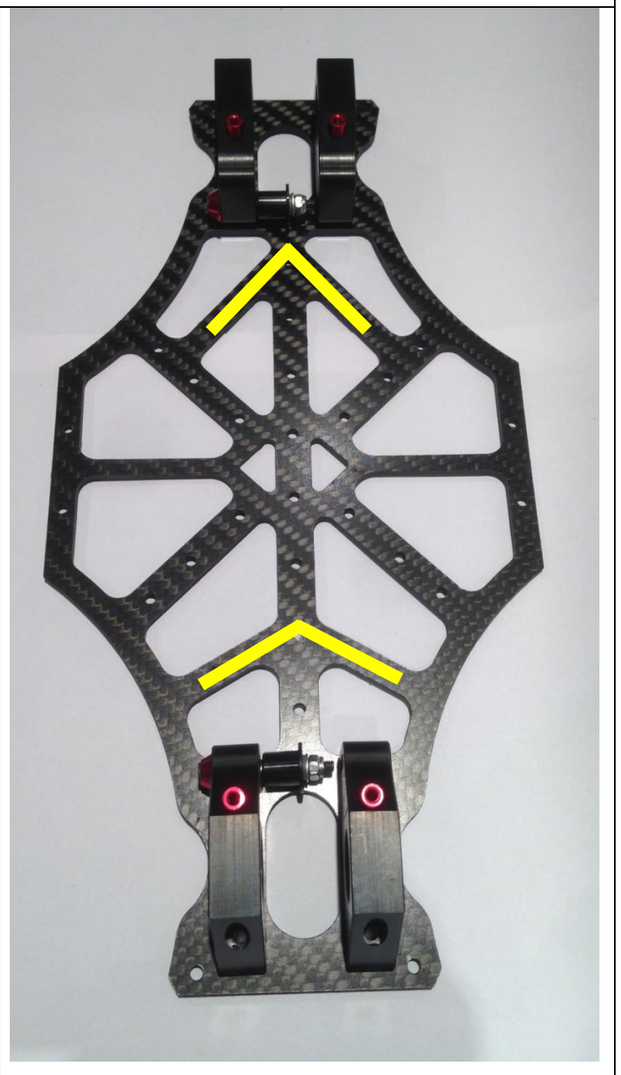
NOTE: you’ll find a regular washer for M3 to use instead of the red aluminium parts in the picture</td>
</tr>
</table>

<table>
<tr><td colspan="3">Step 3</td><td rowspan="2"></td></tr>
<tr>
<td>PARTS

• Same as step 2
• 1x base plate
• 4x 20 mm aluminum standoffs</td>
<td>HARDWARE

• 4x screw M3x20 (PRO version)

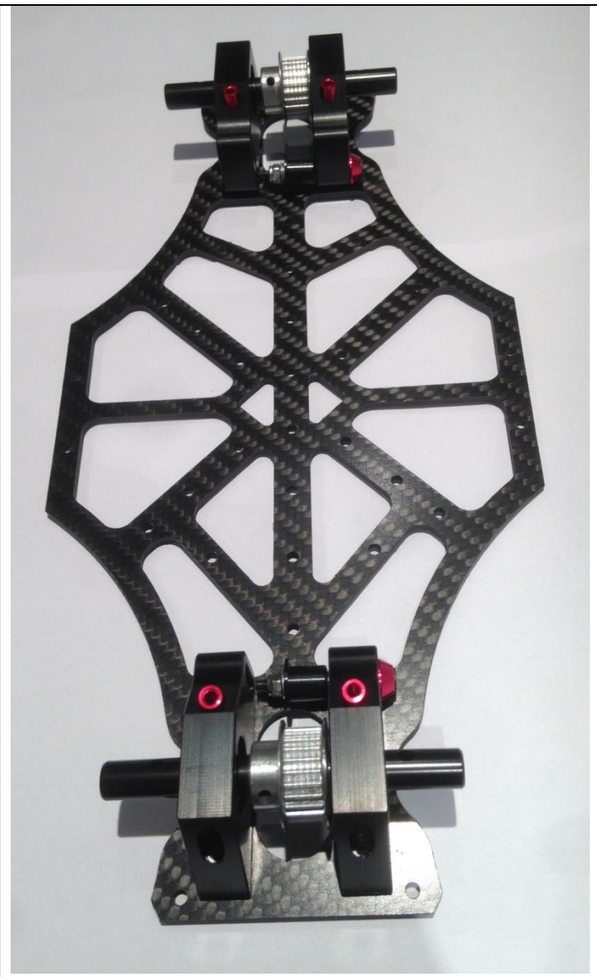
———————

• 4x screw M3x25 (3DP version)</td>
<td>  </td>
<td>Mount all four arm supports with the tensors on the base plate. On each arm support, use only the inner screws now.

NOTE: pay attention to the position of the tensors. The base plate has in its design a couple of ‘<u>arrows’</u> marking the forward direction (in picture top is front). In that orientation the tensors must both be on the left.</td>
</tr>
</table>

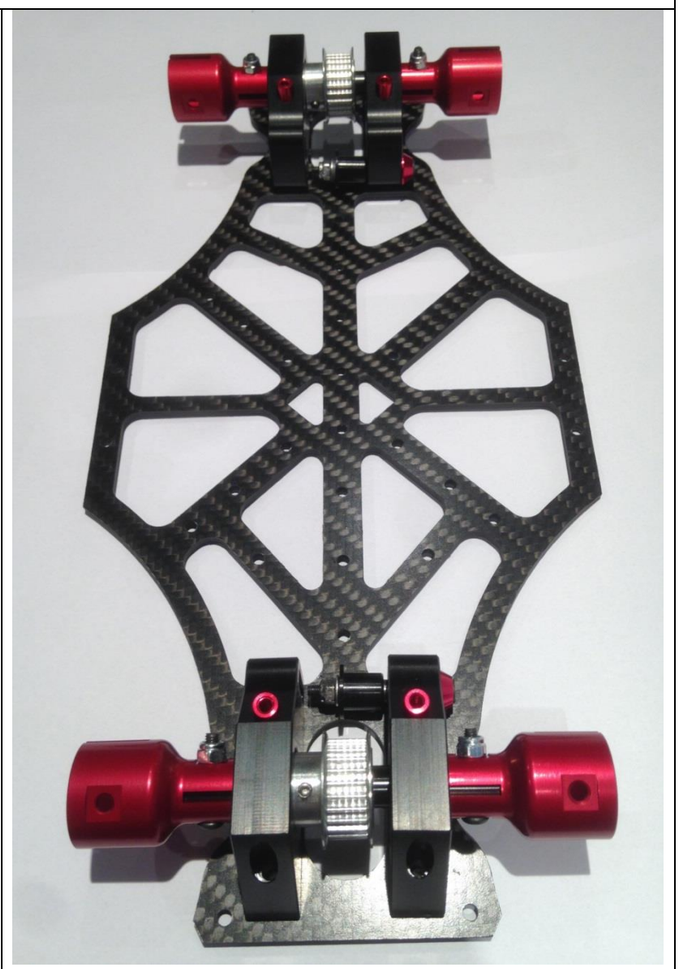
<table>
<tr><td colspan="3">Step 4</td><td rowspan="2"></td></tr>
<tr>
<td>PARTS

• Same as step 3
• 2x 8mm diametre shaft
• 2x pulley with 8mm bore *</td>
<td>HARDWARE

• 4x set screw M3 (long)</td>
<td>  </td>
<td>Install the shafts with the pulley in both front and rear arms supports. Do not tighten the pulley set screws yet, keep the pulleys completely loose.</td>
</tr>
</table>

<table>
<tr><td colspan="3">Step 5</td><td rowspan="2"></td></tr>
<tr>
<td>PARTS

• Same as step 4
• 4x arm connector</td>
<td>HARDWARE

• 4x screw M3x16
• 4x lock nut M3</td>
<td>  </td>
<td>Place the arm connectors in the shafts and tighten well the screws.</td>
</tr>
</table>

Step 6

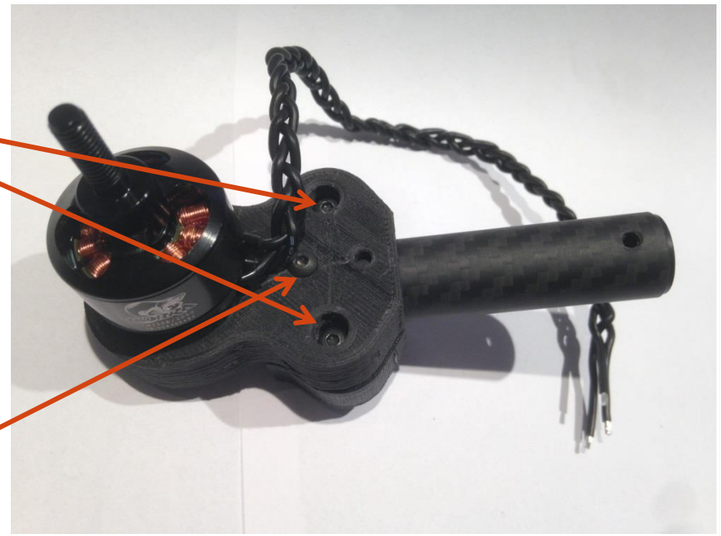
PARTS

- 4x motor mount
- 4x motor mount clamp
- 4x brushless motor
- 4x carbon fiber tube

HARDWARE

- 16x screw M3x6
- 8x screw M3x20 *
- 8x lock nut M3

* the mounts and tube have extra bores that can be used for positioning and even keep them installed

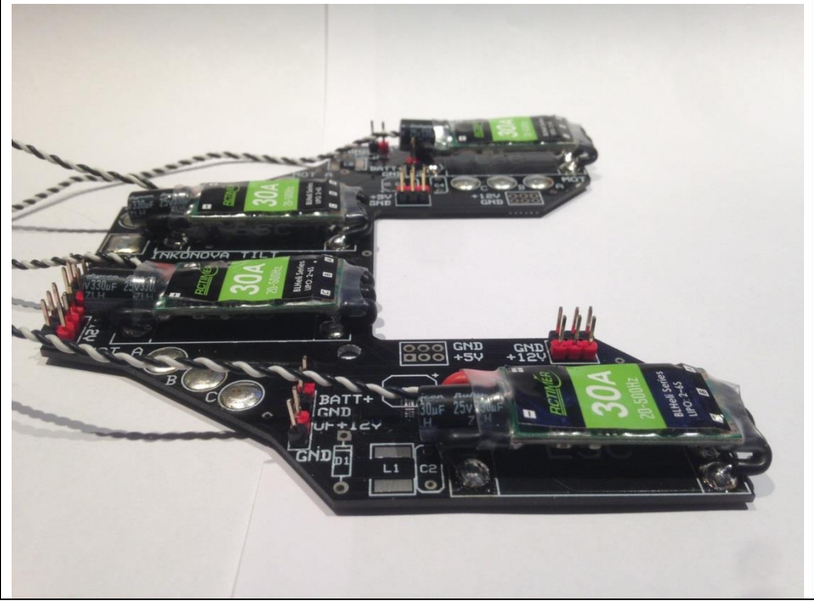


Mount the each motor in a motor mount with the M3x6 screws (4 on each motor) and thread lock (medium/blue). Then add the motor mount clamps (the bottom part of the motor mount assembly) and the carbon fiber tubes inserting them until the end of the mounts. Do not tighten the M3x20 screws yet, keep them tight but allowing the tube to rotate

<table>
<tr><td colspan="3">Step 7</td><td rowspan="2">Mount the arms in the arm connectors and tighten the screws.</td></tr>
<tr><td>PARTS
Same as steps 5 and 6</td><td>HARDWARE
4x screw M3x25
4x lock nut M3</td><td>  </td></tr>
</table>

<table>
<tr><td colspan="3">Step 8</td><td rowspan="2"></td></tr>
<tr><td>PARTS

• Refer to the PDB manual for detailed instructions</td><td>HARDWARE

• Refer to the PDB manual for detailed instructions</td><td>  </td><td>If you have purchased a PDB refer to the PDB manual for detailed description on how to solder the PDB components.

The picture shown here is just orientative of how it should look like prior to mounting the PDB to the frame</td></tr>
</table>

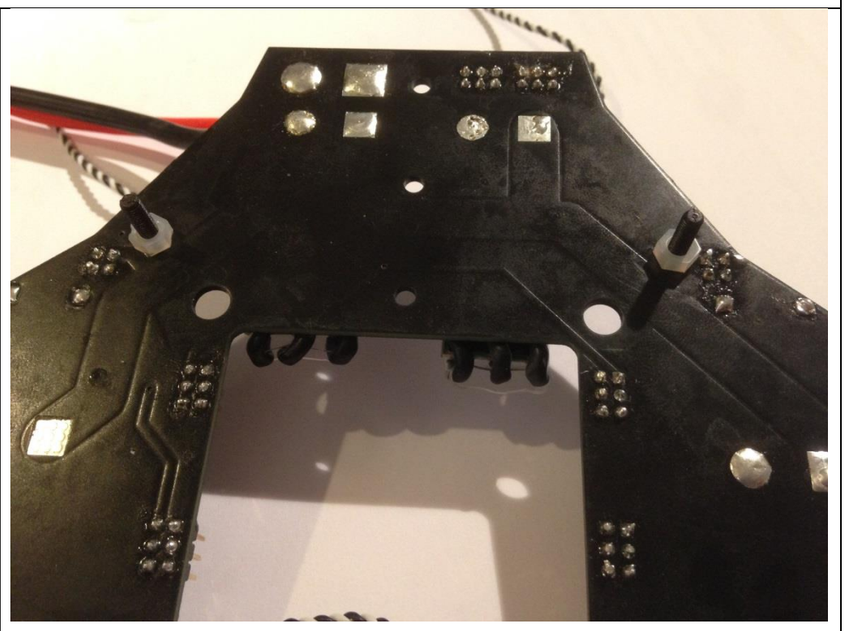
Step 9

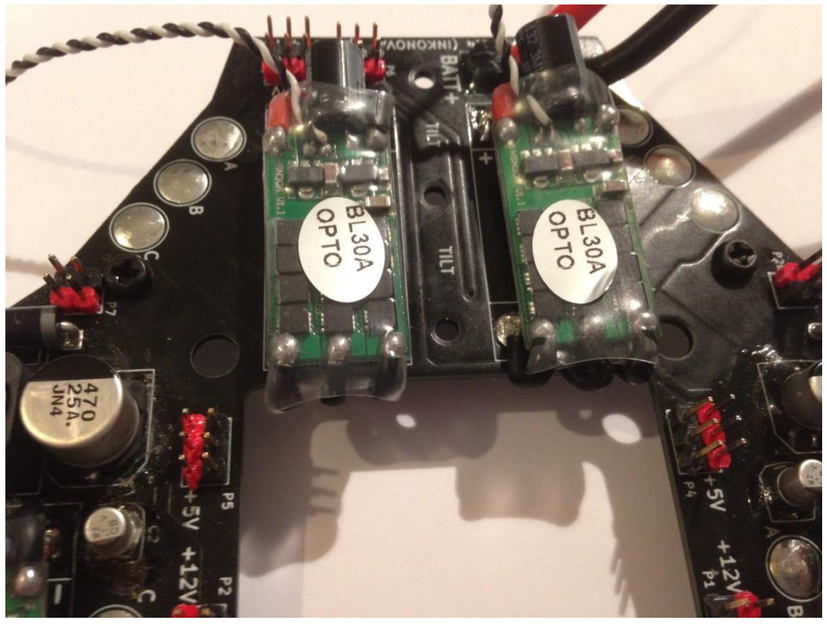
PARTS

- Same as step 8

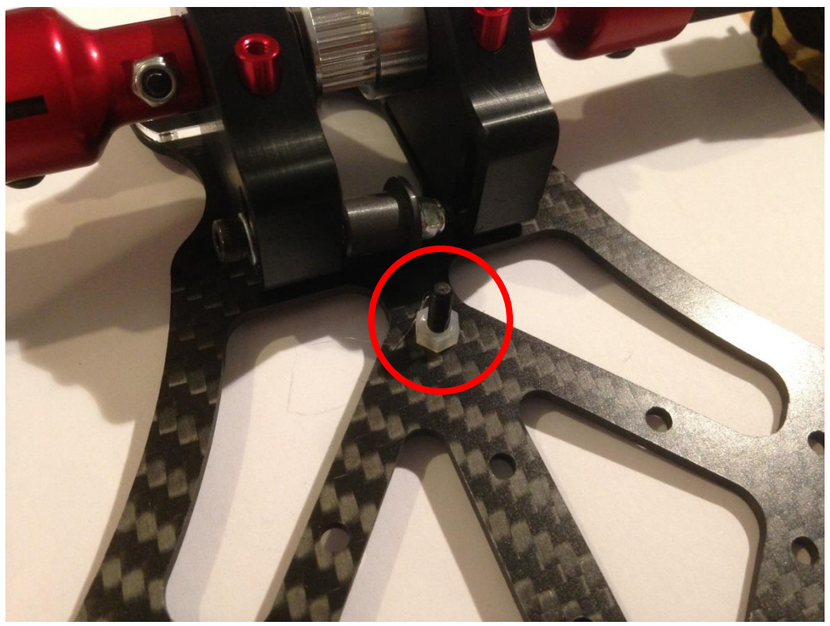
HARDWARE

- 2x screw Nylon M3x12
- 2x nut Nylon M3



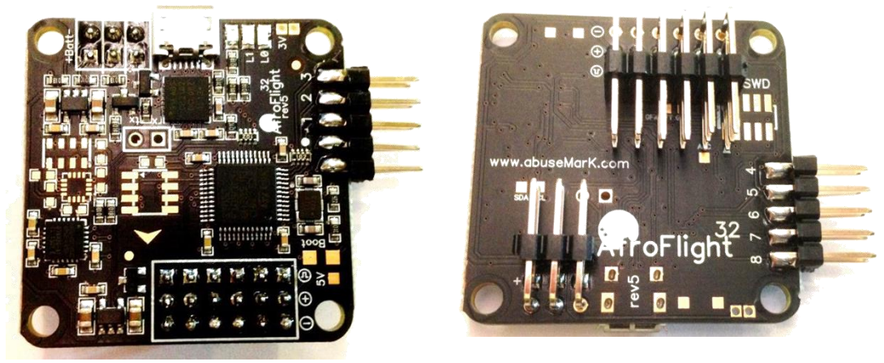


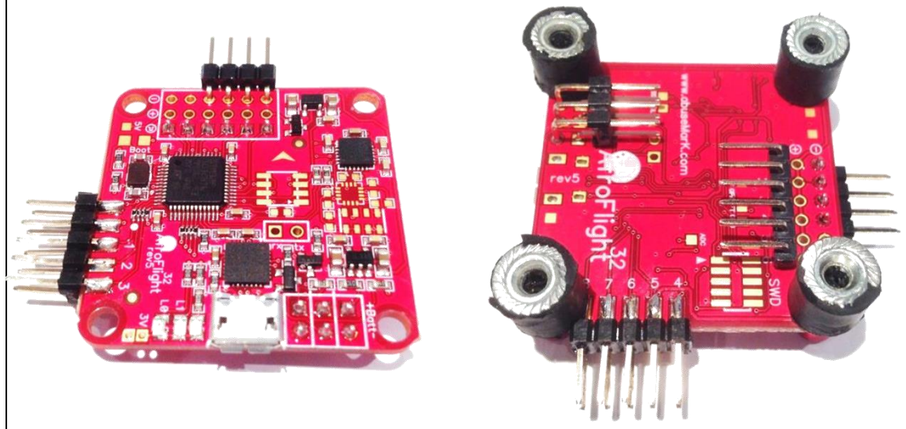
Install the two Nylon screws and nuts as shown in the pictures. The length supplied is to be used with landing legs. If you do not want to use landing legs you can cut the Nylon screws to a suitable length. The nuts are here important as they serve as spacer to avoid the exposed bottom PDB pins to touch the carbon fiber base plate and create dangerous shorts. In the actual design we do recommend to use Nylon screws if using aluminium landing legs.

<table>
<tr><td colspan="3">Step 10</td><td rowspan="2"></td></tr>
<tr><td>PARTS
Same as step 7</td><td>HARDWARE
1x screw Nylon M3x12
1x nut Nylon M3</td><td>  </td><td>Install the Nylon screw and nut as shown in the picture. This screw will be used to hold the PDB and the nut as spacer to avoid shorts. If not using landing legs, the screws in step 9 can also be installed in this way.</td></tr>
</table>

<table>
<tr><td colspan="3">Step 11</td><td rowspan="2"></td></tr>
<tr>
<td>PARTS

• 1x Naze32 flight controller board</td>
<td>HARDWARE

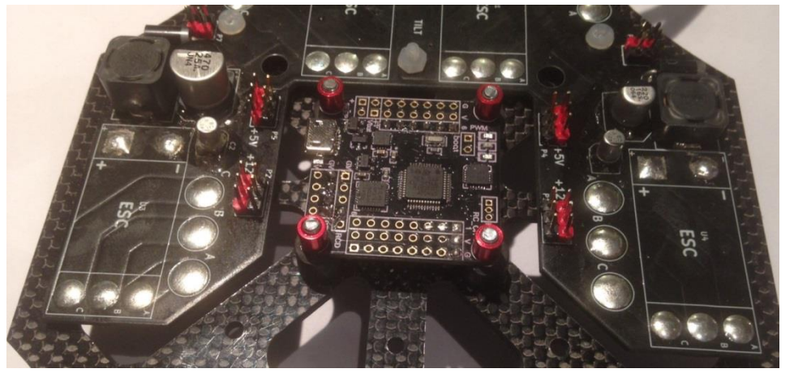
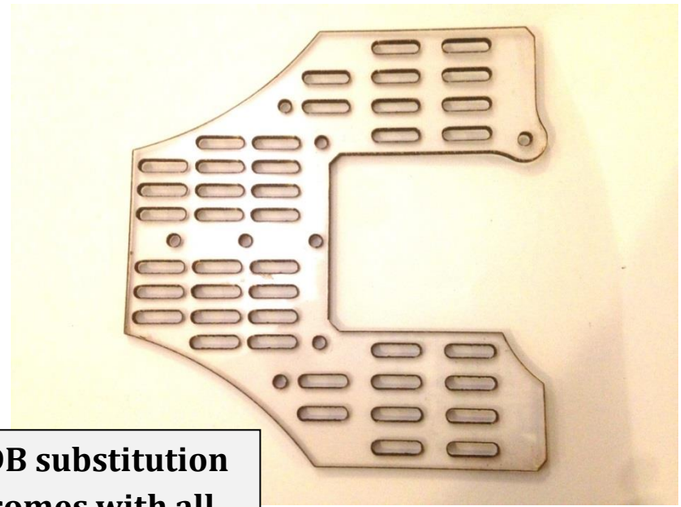
• 4x screw Nylon M3x12 (to be vut to about 6 mm long)
• 4x standoff Nylon 10 mm long Nylon</td>
<td> 


</td>
<td>Solder the pin headers to the Naze flight controller board as shown in the pictures with the black Naze32 board (headers supplied). Cut the Nylon screws to about 6 mm long and install the standoffs in the flight controller.

If you want a low profile headers setup, you can use the red Naze pictures as example (rubber dampeners not included in the kit)</td>
</tr>
</table>

<table>
<tr><td colspan="3">Step 12</td><td rowspan="2"></td></tr>
<tr><td>PARTS

• Same as steps 9, 10 and 11</td><td>HARDWARE

• 4x screw M3x6
• 3x Nylon nuts</td><td> 
 
PDB substitution (comes with all frames)</td><td>Mount the flight controller with the M3x6 on the base plate (the picture here is just orientative) and the PDB or PDB substitution with the Nylon nuts on the already installed Nylon screws (for the PDB substitution you do not need the nylon nuts as separators as there is no shortcircuit risk).

We recommend insulating the bottom side of the PDB with electrical insulation tape. It is not mandatory as the PDB and solderings should not touch the frame (CHECK!). We used Kapton (Polyimide) tape to insulate the PDB from the carbon fibre chassis.

NOTE: use tape with “low noise” glue when possible. Some insulation tapes can cause an increase in the noise in the system. Using good quality tape with suitable glue properties is good practice.</td></tr>
</table>

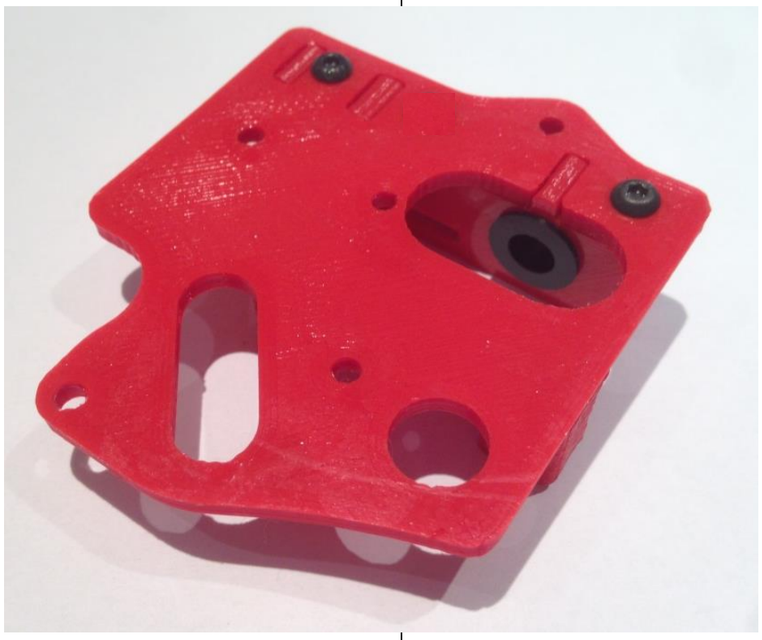
Step 13

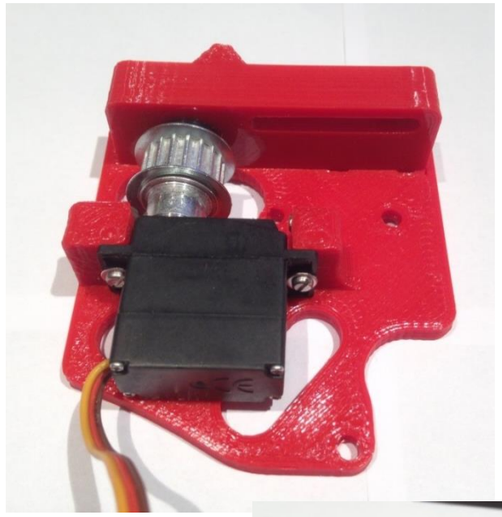
PARTS

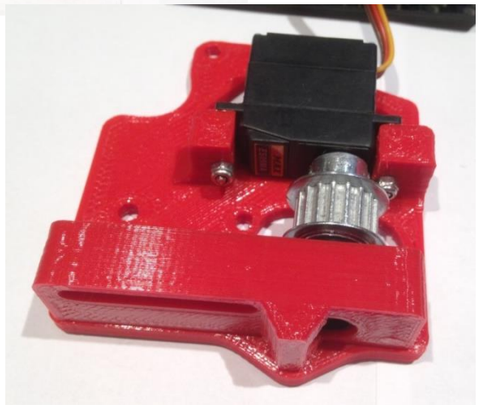
- Servo base
- IGUS housing
- Servo
- 1x polymer bearings (small)
- 1x Nylon cylinder 15 mm

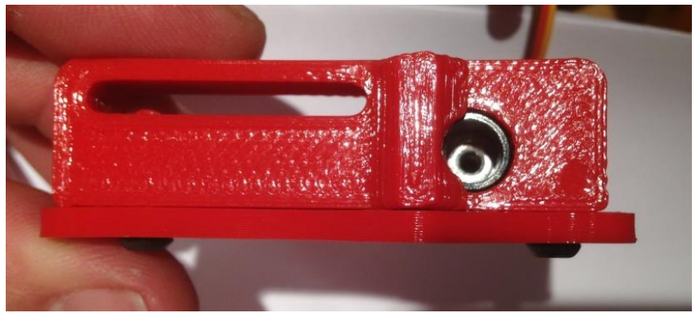
HARDWARE

- 2x screw M3x6
- 1x screw M3x20
- 2x screw M2x12
- 2x washer M2
- 2x lock nut M2
- 2x set screw M3 (short)









Install the polymer bearing in the IGUS bearing housing. Then, screw the servo bearing housing into the servo base with the M3x6 screws (keep the middle bore empty). Install the servo pulley in the servo with the set screws and then, the servo in the base with the M2 hardware. **Ensure the servo pulley is aligned with the polymer bearing.** Add the nylon cylinder through the bearing and screw the M3x20 screws to the pulley through the Nylon cylinder (use thread lock here and do not tighten excessively).

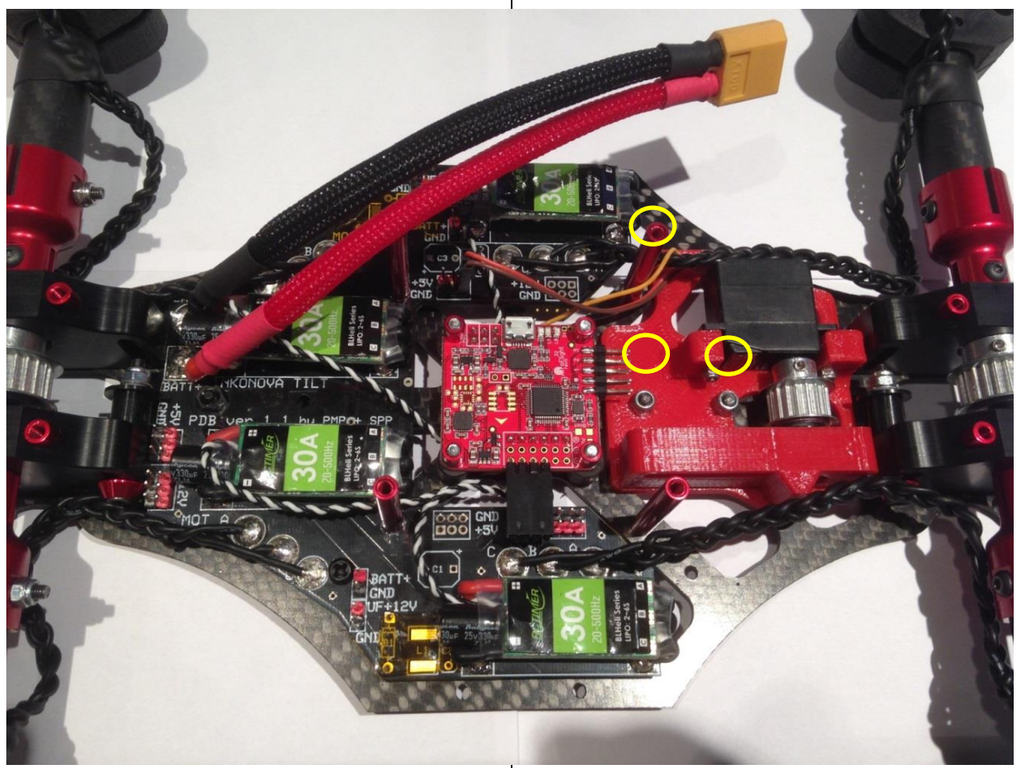
Step 14

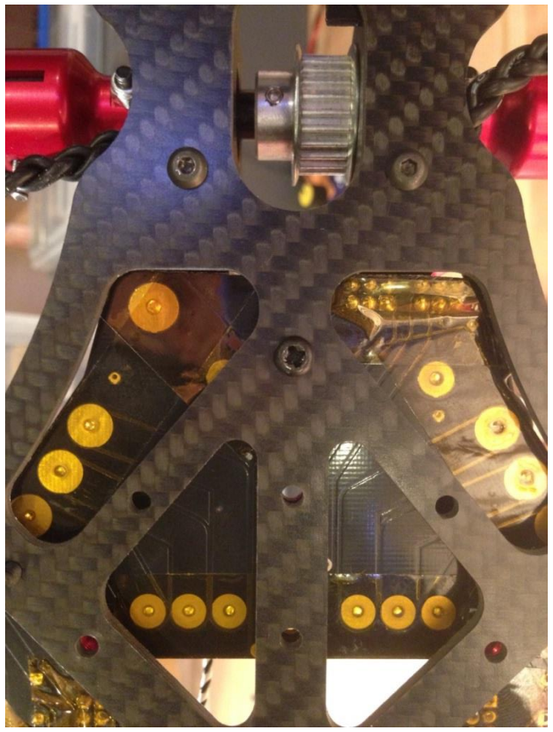
PARTS

- Same as step 12
- Servo asembly
- 4x stand-offs 35 mm

HARDWARE

- 7x screw M3x10
- 3x lock nut M3





Install the tilt servo assembly to the base plate with the M3x10 and M3 nuts (yellow circles) and the four stand-offs, also with M3x10.

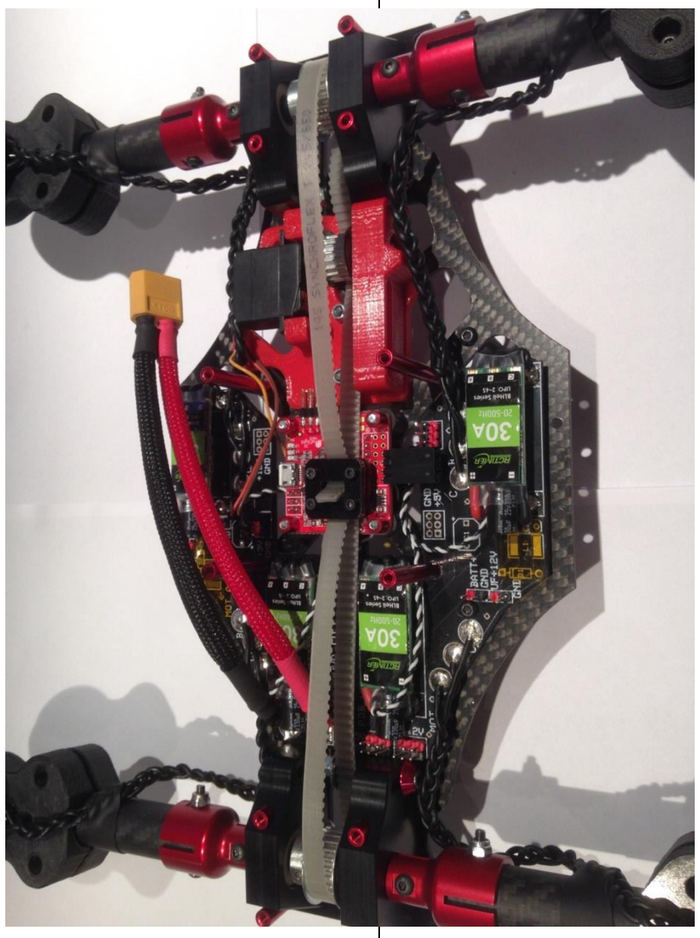
Step 15

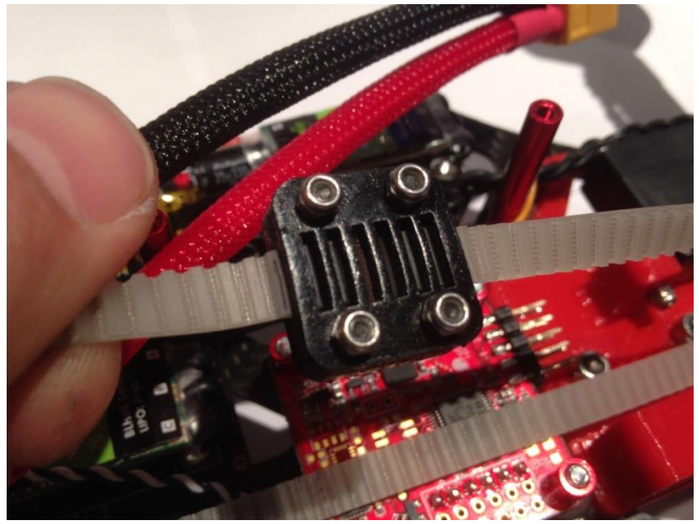
PARTS

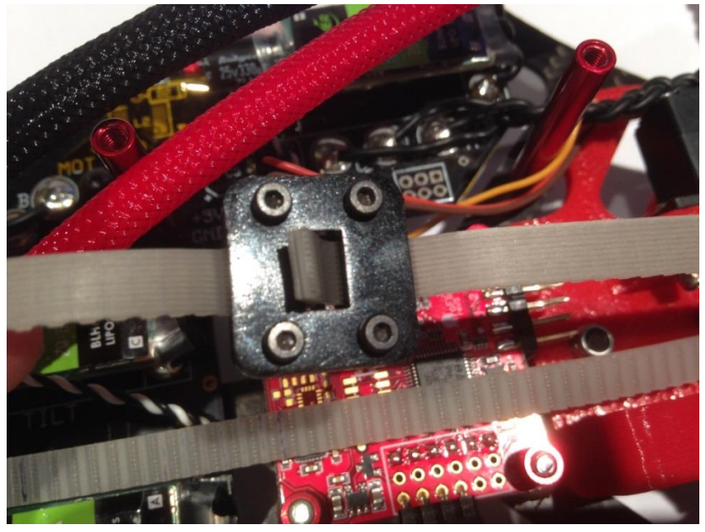
- Same as step 14
- Belt
- Clamp parts A and B

HARDWARE

- 4x screw M2x10
- 4x lock nut M2
- 8x washer M2







Mark 490 mm span in the belt with a marker leaving similar belt length on both sides. Pass the open belt through the pulleys as shown in the picture.

Check the arms support tensors are loose and on the bottom of their travel range.

Install the belt clamp ‘tightening’ the belt until the 490 mm marks are being nearly covered by the clamp parts. Ensure the belt teeth match the clamp cavities.

Step 16

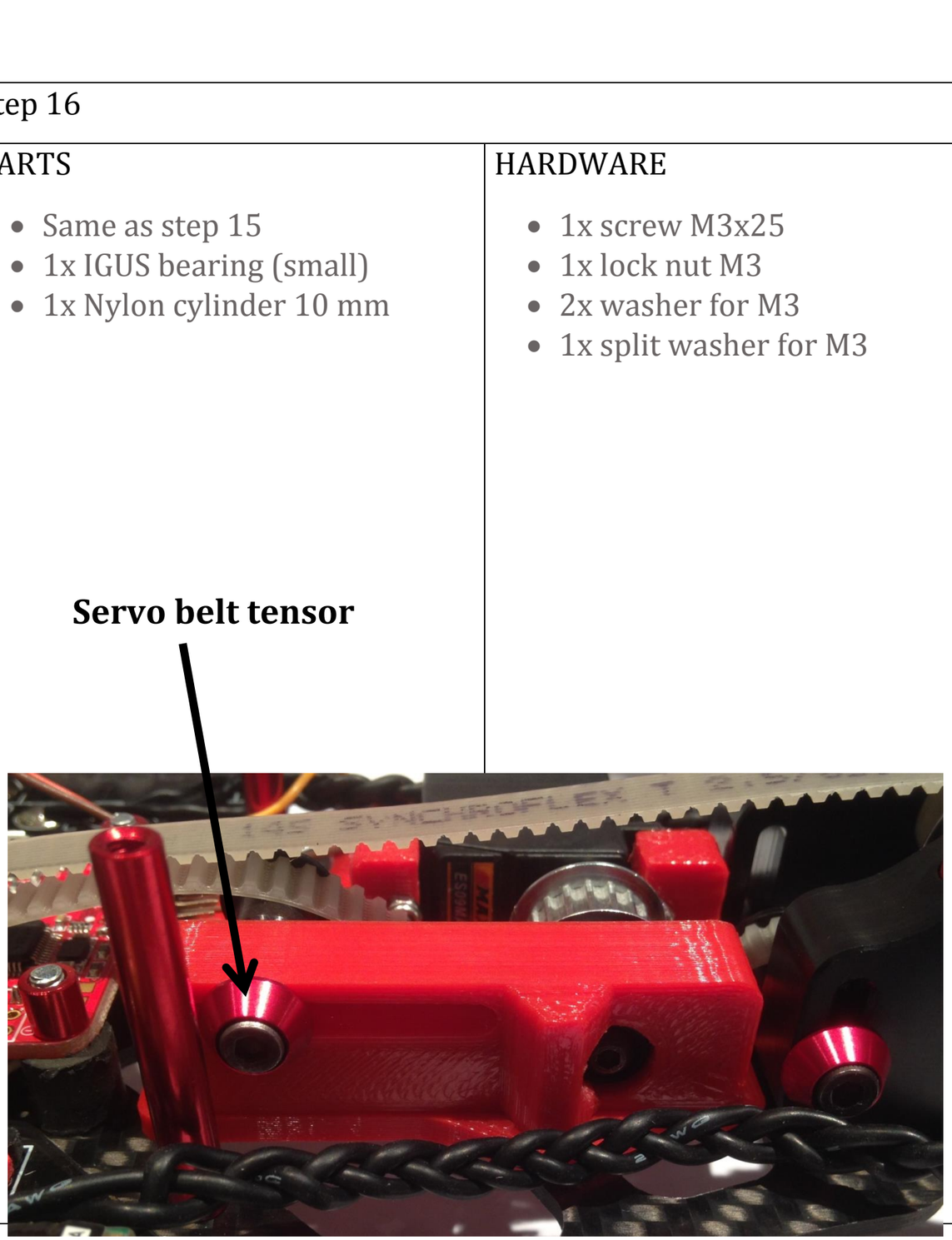
PARTS

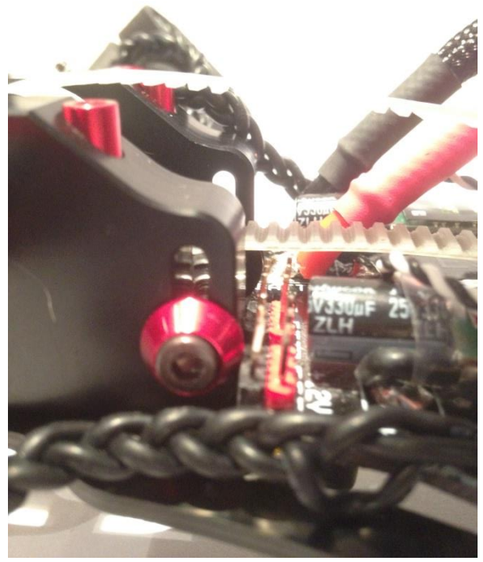
- Same as step 15
- 1x IGUS bearing (small)
- 1x Nylon cylinder 10 mm

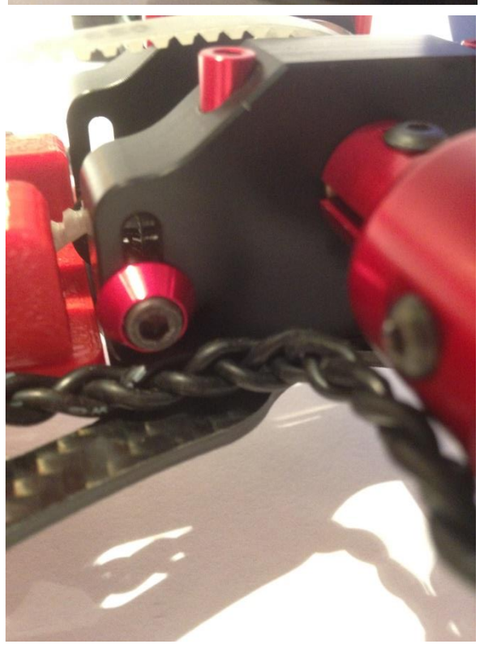
HARDWARE

- 1x screw M3x25
- 1x lock nut M3
- 2x washer for M3
- 1x split washer for M3

Servo belt tensor







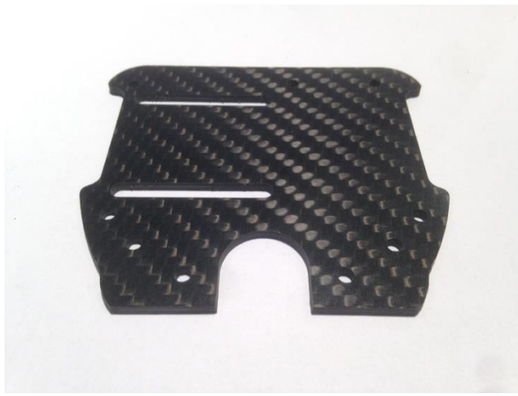
Install the third belt tensor in the servo assembly with the M3x25 screw and one washer (**instead of the red aluminium part in the picture: not provided**) and on the other side of the 3D printed red part, insert first the split washer, then the Nylon cylinder, then the IGUS bearing, the washer and finally the M3 lock nut.

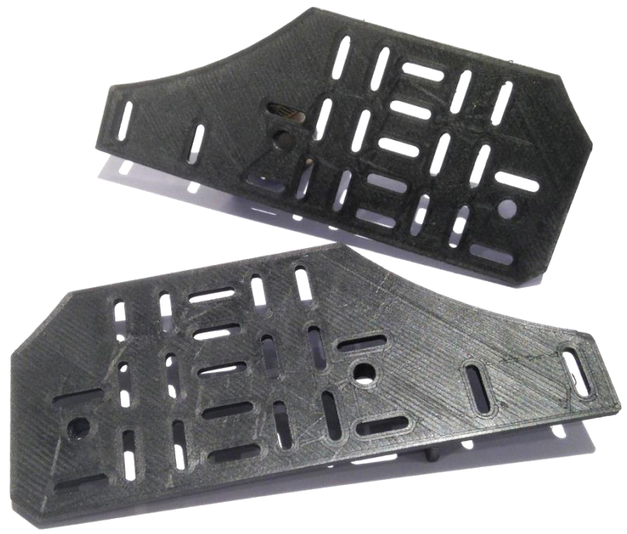
Lift the arm support tensors to the middle approx. and keep the servo belt tensor loose for now.

<table>
<tr><td colspan="3">Step 17</td><td rowspan="2"></td></tr>
<tr>
<td>PARTS

• Same as step 16
• Tip dummy plates or front camera plate and/or rear tip plate</td>
<td>HARDWARE

• 4x screw M3x20 (PRO version)

• 4x screw M3x25 (3DP version)</td>
<td> 
  </td>
<td>Add the tip dummy plates (acrylic) or carbon fiber camera plates in the front and back at your convenience: they are placed in the gap below the arm supports using the two exterior screws.</td>
</tr>
</table>

<table>
<tr><td colspan="3">Step 18 (optional)</td><td rowspan="2"></td></tr>
<tr><td>PARTS
Same as step 17</td><td>HARDWARE
None</td><td>  </td><td>Add the gear platforms that you need (two available). They just slide down in the four central 35 mm stand-offs and serve to place any gear you want (receiver, video transmitter, etc).</td></tr>
</table>

Step 19		
PARTS • Same as step 18	HARDWARE • None or variable upon system	Install the receiver and other gear.

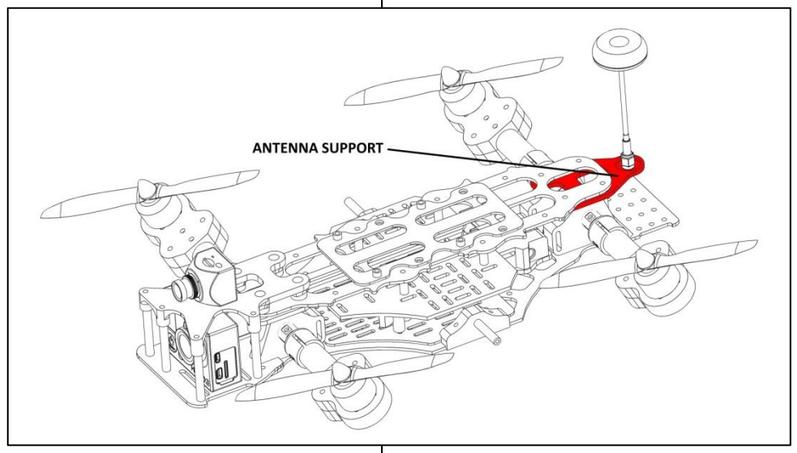
Step 20

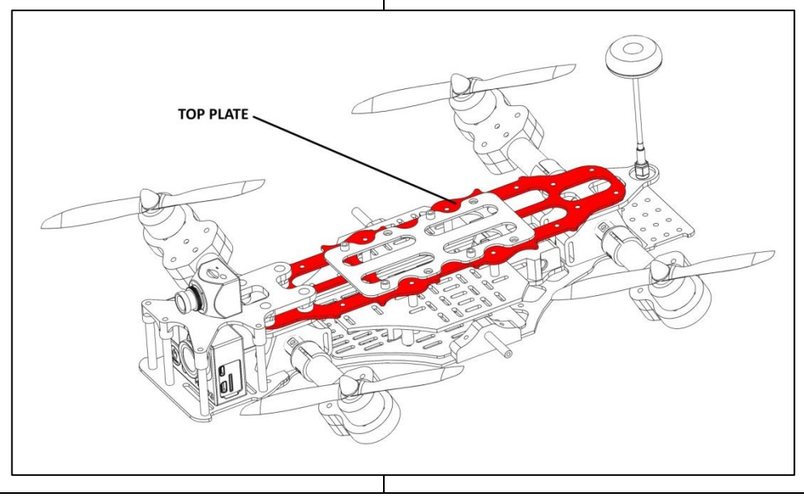
PARTS

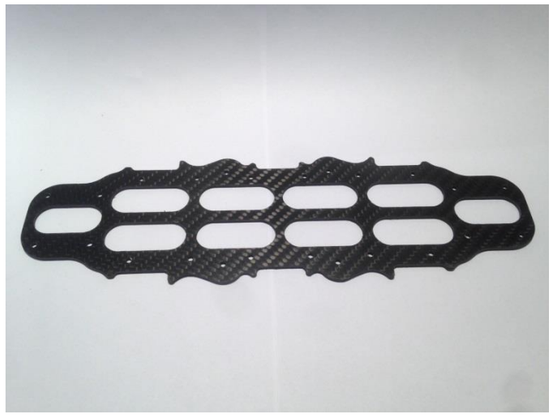
- Same as step 19
- Top plate
- Bridge and antenna support
- Mobius support or Gopro cage

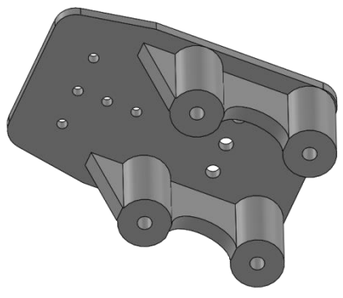
HARDWARE

- 4x screw M3x6
- 4x screw M3x16
- 4x screw M3x20









Place the bridge (front) and antenna support (back) between the front and rear arm supports respectively and the top plate. Screw the top plate with the four M3x6 on the four central 35 mm stand-offs.

Then use the four M3x16 for the antenna support.

Place the GoPro cage (optional) or the Mobius support (comes with all kits) above the front arms supports and use the M3x20 screws.

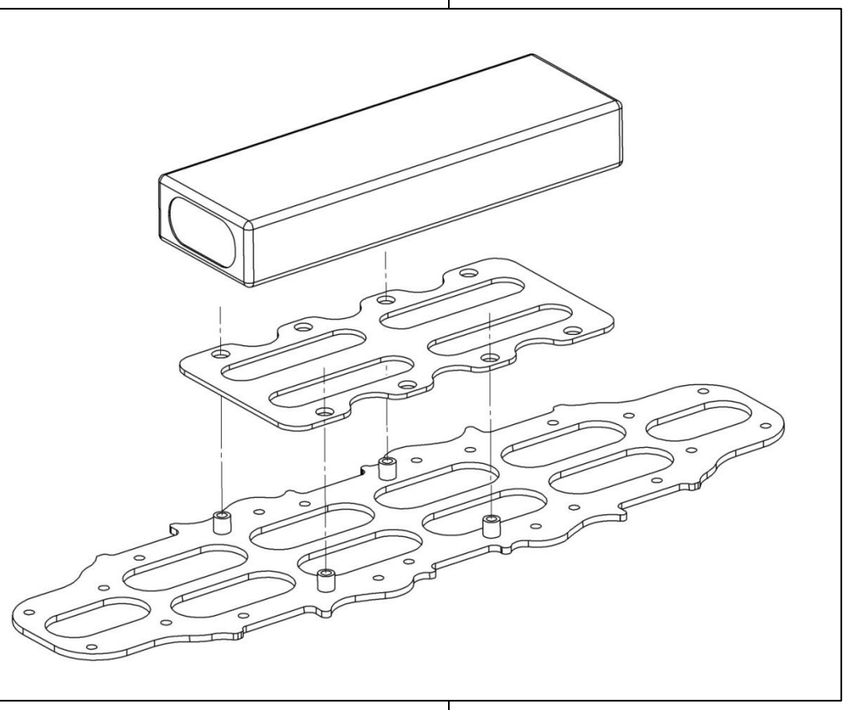
Step 21

PARTS

- Same as step 20
- 4x Nylon cylinder 5 mm

HARDWARE

- 4x screw M3x10
- 4x lock nut M3



Install the 5mm Nylon cylinders in the four bores of the top plate that marked in the drawing. Use the screws and nuts to attach them.

These cylinders serve as pre-defined positioning of the battery plate (one supplied on each kit). The idea is that each battery has its own battery plate attached with Velcro.

Then, place the cylinders on the location that better balances the system and, for each battery you use, fine-tune the battery location on the battery plate via Velcro.

Now you can ensure consistent weight distribution on every battery change and no need to balance every time.

Step 22

PARTS	HARDWARE	**Click in the image below to go to the video of the procedure**
• Same as step 21	• None	

Adjust the belt tensors to the point the belt can go down around 5 mm when pushed with the finger with not much pressure.

Then, switch on the system with RC transmitter and check that the tilt servo works (you must set it up as in the Cleanflight manual, jump to it now an come back here after that).

Step 23

PARTS

- Same as step 22

HARDWARE

- None

NOT OK: those screws should be 90 degrees rotated from what is shown here when the servo is centered.

With the Cleanflight setup (check CF manual PDF) and servo in mid position (i.e. elevator stick centered), tighten the most accessible set screw on each pulley when the arms are in mid position * (do not worry about the motors just yet). Switch off the system and manually rotate the arms to access the second set screw: tighten it.

* **IMPORTANT: do NOT tighten the pulleys' set screws so that the inner screw in the arm connector is horizontal. In other words, do NOT set your mid arms position as in the picture on the left. Make sure the arms are oriented 90 degrees rotated compared to the picture here. Then, and only then, adjust the motor mounts so that the motors are vertical in the arms centre position (next step).**

<table>
<tr><td colspan="3">Step 24</td><td rowspan="2"></td></tr>
<tr><td>PARTS
Same as step 23</td><td>HARDWARE
None</td><td></td><td>Finally, loosen the motor mount screws and, with the tilt servo and arms in the center position, rotate the motor mounts and tighten the screws until the motors are as vertical as you can. Try to ensure this step is properly done to ensure no residual yaw or pitch effects. Use a vertical object as reference, for instance.</td></tr>
</table>

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