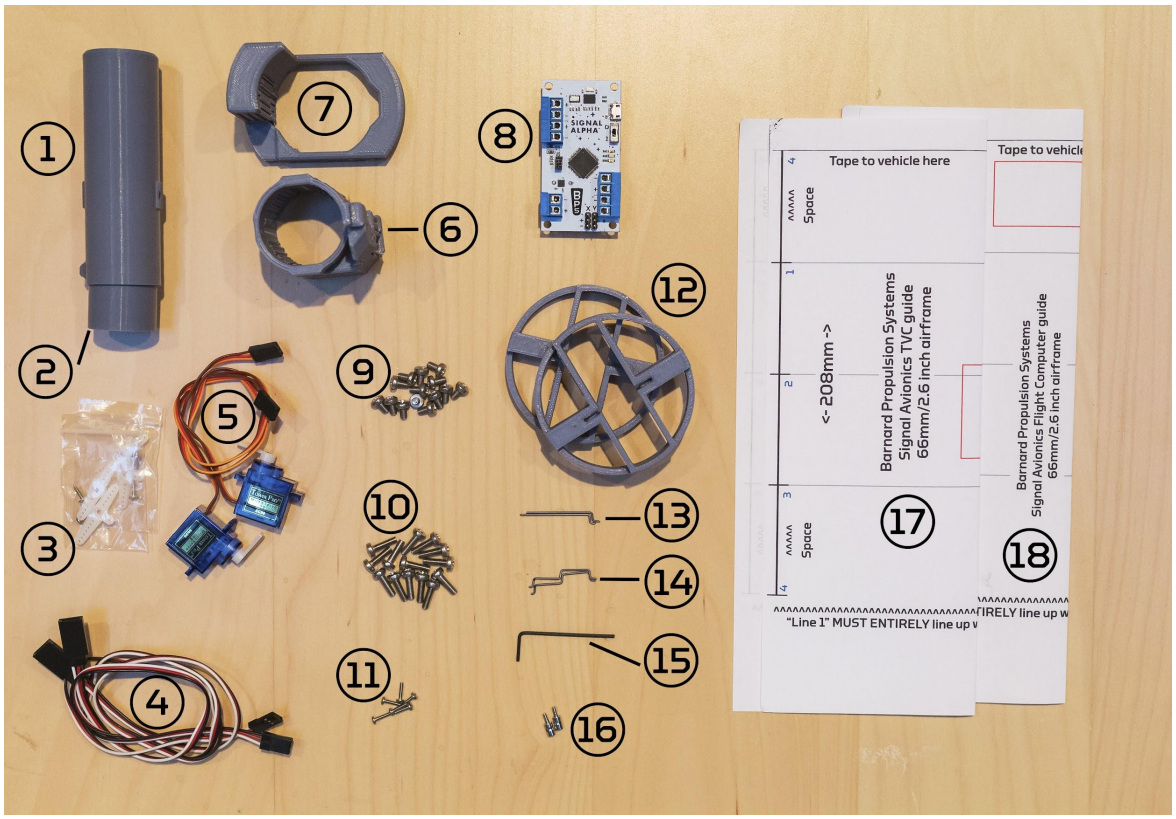
Signal Alpha User Manual

Use with Signal Alpha, running SignalSoft 0.8.2, with R1 hardware.

This document will explain what's in the box, step-by-step instructions for assembly, and some tips and tricks to improve the rocket's performance. Reading this on paper is just fine, but I recommend following along on a computer. There are several linked videos that will help you during the process, as well as download links for all files you'll need. You can find them here: www.bps.space/build-signal-alpha

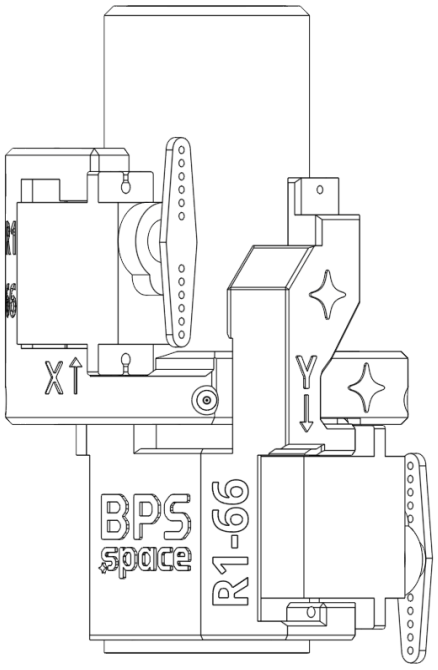
1. What's in the box?

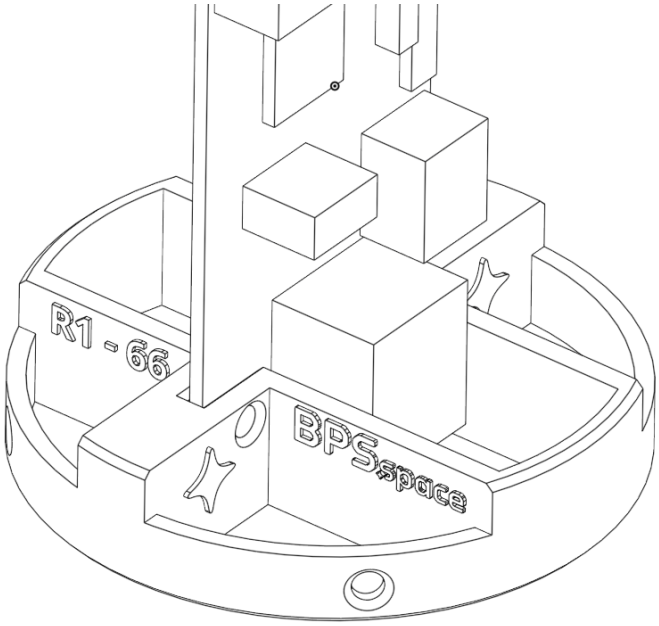


1. 29mm motor mount
2. 29-24mm adaptor
3. Extra servo parts
4. TVC extension cables
5. TVC servos
6. TVC inner gimbal
7. TVC outer gimbal
8. Signal Alpha flight computer
9. M3.5 x 6mm screws
10. M3.5 x 12mm screws
11. M2 x 8mm screws
12. Flight computer mounting brackets
13. 2x straight pushrods
14. 2x bent pushrods
15. 1.5mm hex wrench
16. 2x linkage stoppers
17. TVC drill/cut guide
18. Flight computer drill/cut guide

2. Pre-assembly notes

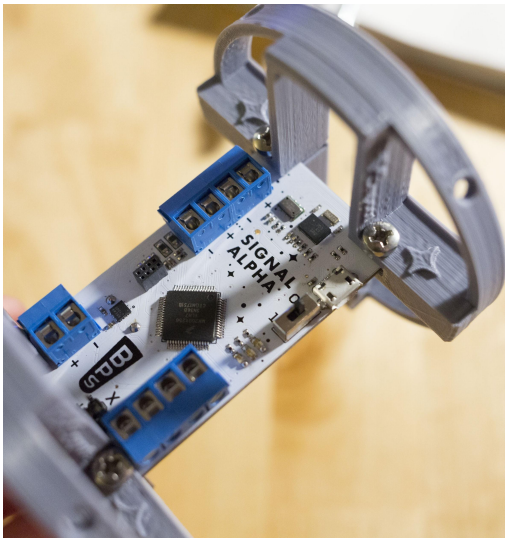
When building your rocket, pick 1 direction or orientation to define as the ‘front’ or ‘forward facing side’. Most rockets are round and don’t technically have sides, but defining this as a reference will help you line up all the internal components of your vehicle. Every 3d printed part has at least one star on it. The stars should ALWAYS face forward; if your rocket were see-through, you would be able to see all the stars from the front. Most 3d printed parts will also indicate revision and airframe size. I.e. “R1 - 66” or “R1 - 77”.





3. Flight computer assembly

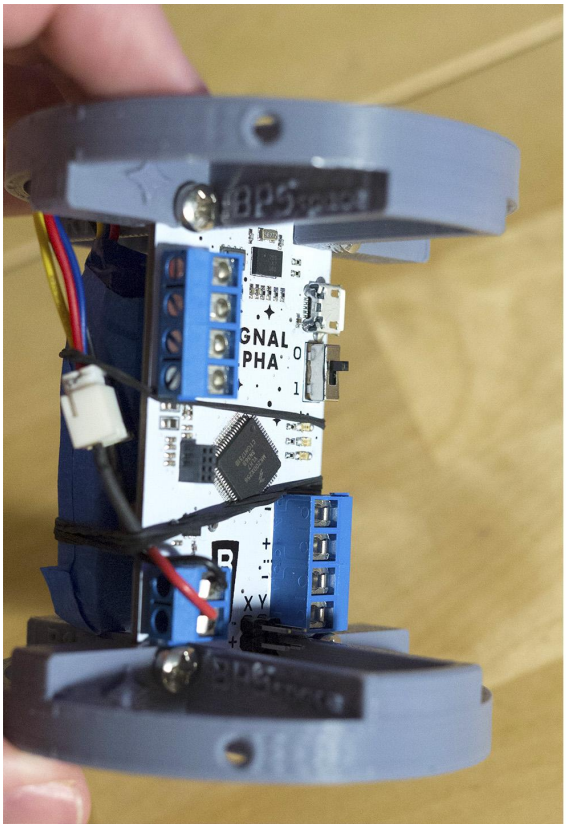
1. The two included brackets go on the top and bottom of the flight computer. Paying attention to the stars and orientation of the text, place these on the top and bottom of the flight computer. The stars, blue terminal blocks, and “Signal Alpha” text should all face the same direction. The fit should be very snug.
2. Use 4 of the M3.5 x 12mm screws to secure the flight computer in place, they should go all the way through the center beam of the mounting bracket.

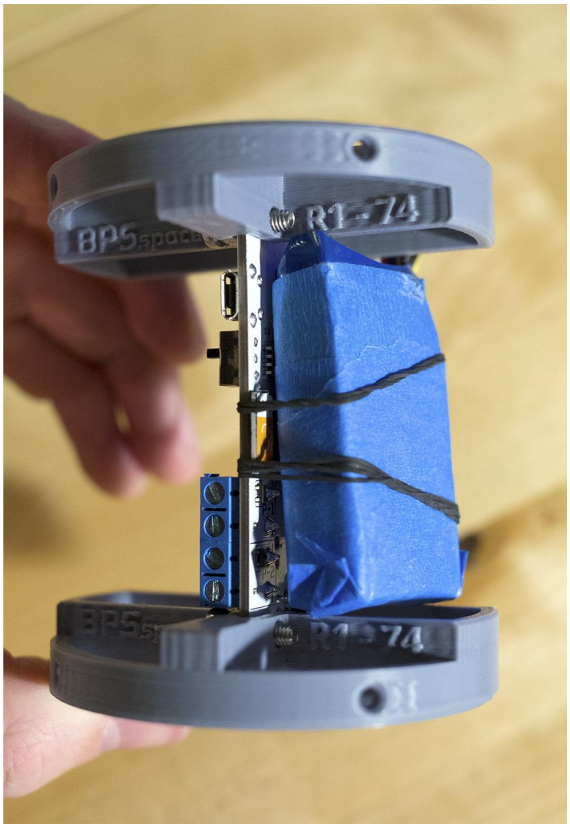


4. Flight computer power

To power Signal Alpha, you'll need a power source of at least 7v connected to the "Batt" power terminals; 9v batteries or 11.1v LiPos are ideal.

1. Attach the correct + and - leads of the battery connector (not the battery) to the Batt terminal block. Be careful to not reverse the polarity of the computer's power.
2. Connect the leads of the battery to the battery connector, and flip the power switch on Signal Alpha from 0 to 1. The computer should boot up and start making noise. Shut it down if it does, we'll set this up later.
    a. If the computer doesn't start up, make sure the battery is wired correctly and try again. If it still doesn't turn on, head to the troubleshooting section at the bottom of this document.
3. Secure the battery to the flight computer or mounting brackets. Several rubber bands wrapped around the whole computer and battery work well. They can also be used to keep the SD card from falling out.
4. Be sure to cover up any exposed metal or leads on the battery or cables; masking tape works well for this. Unexpected contact with parts of Signal Alpha may damage the computer.
5. For ground testing and experimenting, Signal Alpha can also be powered through the Micro USB port. It's worth noting that most computers limit their USB current at 500ma, which may not be enough to drive intense TVC motion.





5. Flight computer setup

Lastsly, the flight computer needs is a Micro SD card with a configuration file on it. The configuration file is available for download here: www.bps.space/build-signal-alpha. In order, the available settings are:

1. **TVC calibration mode**
    a. Enable/disable
    b. TVC X servo center-point
    c. TVC Y servo center-point
2. **Pyro channel check mode**
    a. Enable/disable
3. Pyro channel 1 trigger
4. Pyro channel 2 trigger
5. Pyro channel 3 trigger
6. Pyro channel 4 trigger
7. Pyro on-time
8. **In-flight abort**
    a. Enable/disable
    b. In-flight abort tolerance
    c. In-flight abort safeguard
9. **Thrust vector control PID values**
    a. X axis P gain
    b. X axis I gain
    c. X axis D gain
    d. Y axis P gain
    e. Y axis I gain
    f. Y axis D gain
10. **Thrust vector control low level settings**
    a. PID limit
    b. TVC gear ratio
    c. TVC X drive direction
    d. TVC Y drive direction
11. **Course correction**
    a. Enable/disable
    b. Correction maneuver start-time
    c. Correction maneuver rate
12. Launch detection threshold
13. **Static fire mode**
    a. Enable/disable
    b. Countdown timer
14. **Party mode**
    a. Enable/disable
15. **SD card check val**
    a. This is not a setting, but a safety measure to help ensure Signal has read through the configuration file correctly. If this value is not set to exactly 1.54321, the flight computer will not continue the startup sequence

Once downloaded, place the configuration file (CONFIG1.txt) onto the root of the Micro SD card. Insert the card into the flight computer, start it up! Turn the power switch from 0 to 1. The computer should boot through it's startup sequence for a few seconds and into pad-idle mode. Once the green light slowly flashes and the computer is beeping, turn Signal Alpha off and set it aside - we'll get into that later on.

6. TVC mount assembly

If you're a visual learner, you might benefit from watching this part of the video. It covers TVC assembly from start to finish. Otherwise, the following instructions can also be used without the video.

6a. Motor mount

The motor mount comes in the bag with the servos and TVC extension cables. It can fit 29mm motors on it's own, or 24mm motors with the included adaptor. You'll also need the little silver linkage stopper.

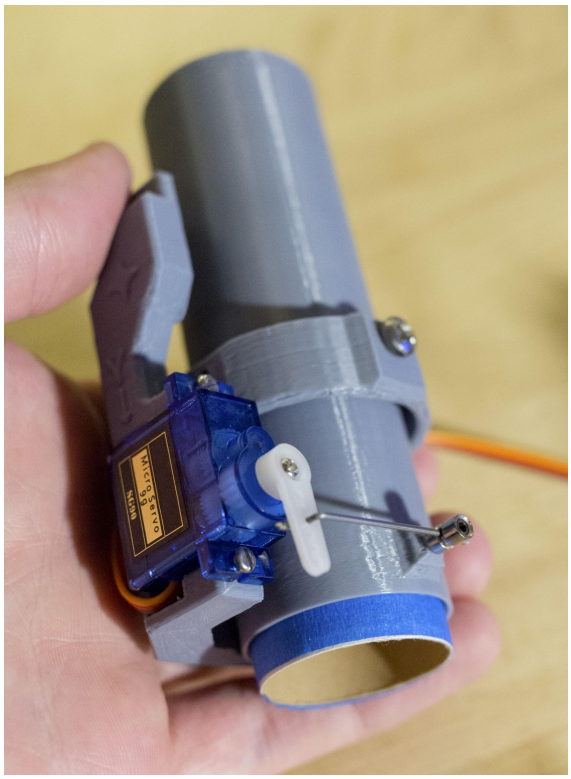
1. Screw the linkage stopper into the motor mount. There is only one hole it will fit well in. It should be quite snug, completely screwed in, and somewhat hard to turn with just your fingers.

2. Cut a small (10cm or so) length of 29mm(or 24mm with the adaptor) cardboard motor mount tube to use as a liner for your motors. Wrap it in tape(masking tape works well) until it fits snug inside the 3d printed motor mount.
3. This part isn't required, but it is helpful. If you have one, insert a spent motor into the mount. The 3d printed part flexes quite a bit without it, but can hold it's structure well once a motor is inserted

6b. Inner gimbal

Next, let's attach the inner gimbal to the motor mount.

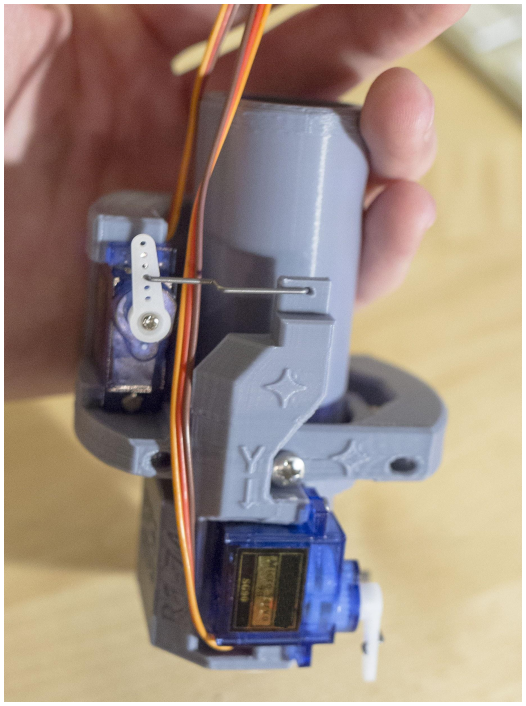
1. Remove the large pieces of support material. This should be fairly easy with a pair of pliers, and it should come out all in one piece.
2. Use a smaller drill bit or long rod to remove the support material inside the M3.5 screw holes.
3. Slide the inner gimbal over the motor tube. Make sure the star on the inner gimbal faces the same direction as the linkage stopper.
4. Screw into place using two of the M3.5 x6 screws. It should be a tight fit. Don't worry about it being tight right now, so long as it's correctly in place
5. Grab one of the straighter pushrods and a servo. Count 3 holes from the attachment point of the servo horn, and insert the pushrod so that it can swing freely.
6. Attach the servo to the inner gimbal using two of the M2 x 8mm screws. The servo horn should be pointing down, away from the center of the TVC mount, along with cable coming out of the servo housing. It should be slightly hard to screw in, but the screws should hold the servo very tightly in place.
7. Finally, use the 1.5mm hex wrench to unscrew the linkage stopper. Insert the pushrod. Align the servo horn to its center position (pointing straight down), move the motor mount to its center, so that it's parallel with the servo, and tighten the linkage stopper. The mount doesn't need to be exactly centered, we'll take care of that later, but do your best. Make sure it's very tight, we don't want this coming loose!



6c. Outer gimbal

This is the last major piece of the TVC mount.

1. Like the inner gimbal, remove the large pieces of support material, then the smaller pieces inside the M3.5 screw holes.
2. Make sure the stars are aligned, facing forward, and slide the outer gimbal into place. The outer gimbal should snap into place, since it's another slightly tight fit. Screw the outer gimbal into the inner gimbal with two M3.5 x 6mm screws.



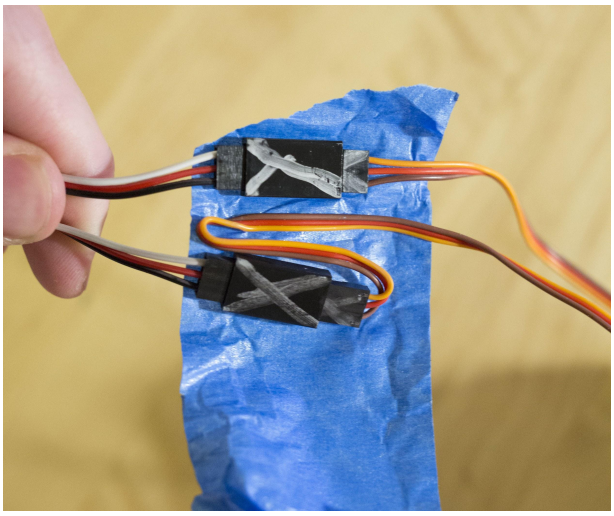
3. Grab one of the the more bent pushrods, and insert into the very top hole of the inner gimbal. This is tricky to do, and may require some force. Be careful not to damage the inner gimbal stem in the process. This part of the video shows how to do it safely.
4. Count 3 holes from the attachment point of the servo horn, and insert the bent side as shown here. The servo and inner gimbal should now be attached.
5. Use the two M2 x 8mm screws to attach the servo to the outer gimbal, this time with the cable and servo horn pointing up. Make sure the servo cable is threaded out toward the motor mount, not away from it. If this isn't done correctly, the cable will interfere with the rocket's airframe. This should be a tight fit - the bottom screw (closest to the center of the TVC mount) will be a little hard to get into place.

6d. TVC extension cabling

The TVC mount is almost finished, but to complete the build, we'll need to take care of some wiring.

1. Thread the TVC Y servo (labeled on the mount) cable up in between the X servo pushrod and the motor mount. It should be in between the two, in the same area as the TVC X servo cable.
2. Use a marker directly on the black plastic headers of the servos, and label them appropriately according to their markers on the TVC mount. Standing upright, Y should be the bottom servo, X should be the top.
3. Do the same for the TVC extension cables - label one X on both ends, and the other Y. It's worth being thorough on this, accidental reversal of the leads will result in an in-flight abort.
4. Connect the TVC extension cables to their respective servos, make sure they connected tight!

5. Fold the TVC X servo cable around the extension cable/servo cable joint, and wrap a good deal of masking tape around the assembly. With the tape wrapped around the wire joint, both cables should have little or no slack when pulled by their extensions.
6. If you were to stretch out the TVC extension cables, they should now be equal length at the end, since the slack in the X cable was wrapped in tape. This is important, slack in the X cable could result in a TVC jam.



6e. Final TVC hardware steps

The TVC mount is built and wired up! Time to get it powered on and tested.

1. Plug the correct TVC extension cables into the flight computer
    a. Use your desktop or laptop to edit the configuration file on the Micro SD card to turn on TVC hardware alignment. This is labeled as ***VCAL:** in the config file, and should be changed from a 0 to a 1.
    b. Save the file, plug the card back into Signal Alpha, and boot up the computer. Your mount should lock into place, somewhat close to center (it's fine if it's not perfect). Take note of where the mount is misaligned.
    c. Use the diagram below to decide whether a positive or negative change is needed on each axis of the TVC mount to center it
    d. Turn off Signal Alpha, remove the card, and open the config file again. You can make these adjustments to the X and Y axis with the ***XCAL:** and ***YCAL:** settings.
    e. Repeat from step 1.a. until the mount is aligned fairly well. It doesn't need to be perfect, we'll fine tune it once the rocket is built.
2. Next, let's put it in party mode! Open up the config file again, turn off TVC hardware alignment, and turn on party mode. Put the card back in Signal Alpha and boot it up.
    a. The TVC mount should actuate positive and negative about 5 degrees on each axis.
    b. The mount may be a bit sticky, this means instead of snapping to 5 degrees and back, it'll still be moving a bit between actuations. To fix this, you can strip the M3.5 screw holes a bit by over tightening by just a few turns. This will help the mount actuate a bit more smoothly. The first time the mount is assembled, this is usually necessary. Make sure you turn Signal Alpha off before stripping the screws.
3. Once the mount is moving smoothly, your hardware is ready to go inside a rocket! But first, we must build the rocket…

7. Using the drill/cut guides

Signal Alpha comes with drilling and cutting guides for the vectoring mount, and the flight computer. These guides will be wrapped around the airframe of your rocket to ensure you place the holes and cutouts in the correct place. If you've already used your provided cutout guide, they can be downloaded and printed on a regular 8.5x11 inch US letter paper, just make sure they're printed at 100% scaling.

You'll want to start out with an empty blank body tube for this to work well, though a pre painted one can work too.

1. Cut off any paper indicated "excess paper, please remove before applying"
2. Wrap the TVC cutout guide around the airframe, pulling it tight. Ensure that "Line 1" can be seen through directly beneath the three tics by the number 4. This is to simply make sure you're using the correct guide on the correct airframe.
    a. I recommend lining up the bottom edge of the paper labeled "dirt" with the bottom of your airframe for most ~10cm long motors. You can move it up or down slightly depending on the length of the motor you use. It's helpful to hold the loaded thrust vectoring mount up next to TVC guide on the airframe to get an idea of where things will sit once you make the cuts.
3. Carefully hold the paper against the airframe and unwrap it enough to apply tape on the edge indicated, "Tape to vehicle here".
4. Once again, wrap the guide around the airframe, this time taping down the other edge of the paper, so the rocket remains covered when you let go.
5. Apply small pieces of tape on the top and bottom of the TVC guide to help secure it a bit more.
6. Follow the same application process with the flight computer drill/cut guide. The most important part here is to line up the small blue numbers between the two guides. 1, 2, 3, and 4 should match up as closely as possible between the papers. You can mount the computer anywhere on the vehicle so long as these numbers are exactly in line with each other.
7. Make your drills on both guides first - these are all for the M3.5 screws. Drill directly in the center of each red dot, through the airframe. If you're using a cardboard or a somewhat flexible airframe, I recommend drilling holes at 2.5 or 3mm, so that the hole taps itself when the screw is inserted. Otherwise, do not drill larger than 3.5 mm.
8. Cut on the red lines with a sharp hobby knife.
    a. On the TVC guide, red lines outline the minimum required cut out area, mostly for the TVC servos and pushrods.
    b. On the flight computer guide, these are simply suggested cutout areas, and are not completely needed. The cutouts allow you to insert and remove the Micro SD card, turn the computer on and off, and observe the LEDS clearly without removing the computer from the rocket. If you prefer not having a hole in the side of your rocket, you can cover this up by making a removable door.

9. If you're building a vehicle with multiple airframe sections, it can be useful to label each "side" on the inside of the airframe; 1, 2, 3, and 4. This can help you line up the different sections during assembly, and is of course vital if the computer and TVC mount are in different sections.
10. That's it! Your rocket is now ready for assembly!

8. Assembly notes

Before putting all these parts together, there are a few things to note.

- By nature, in comparison with traditional model rockets, TVC rockets will be heavy for their thrust. This means they'll have a more energetic impact on landing, which could damage some parts of the rocket. Because of this, I recommend reinforcing the airframe around the TVC mount/bottom of the rocket.
    - To do this, you can use an extra body tube. Cut out sections of the tube to fit around the servo cutouts for the TVC mount - this is where the highest stresses will be felt anyway. Very generously use epoxy, CA, or a strong hobby glue to secure this tubing to the outside of the airframe. Contrary to most cases, the more glue - the better.
    - Your rocket will fly fine the first time without reinforcement, but because of the likelihood of damage to the airframe or TVC mount, I highly recommend taking the time to do it. I do with all of my rockets, and it helps significantly.
- You are welcome to cover up the TVC servos with your own 3d printed or handmade parts! So long as you are very careful not to restrict any of their motion, placing objects or covers over them is just fine.
- The same goes for the flight computer cutouts. The barometer needs to sense the outside air-pressure. As long as your rocket has a few holes to ensure that happens, covering up the flight computer access panel is no problem.
- You can paint the TVC mount - if you're painting your rocket and want to disguise your the TVC cutouts, you can paint the rocket while the TVC mount is inside. The paint will have little or no effect on its ability to vector thrust.
- You cannot paint the flight computer - doing so will cover up the state indication LEDS, and may damage some of the sensors or screw terminals.

9a. Rocket integration

If your airframe segments are longer than the TVC extension cables, you may need to insert the flight computer first. If that is the case, start from step 3, follow through to the end, then complete steps 1 and 2.

1. First, you'll need to attach the TVC mount. Make sure the TVC extension cables are untied and fully extended. With the airframe and TVC mount upside down, cables first, lower the TVC mount into the rocket.
    a. For the 74mm airframe, this shouldn't be very difficult. You may need to wiggle the mount around or have it actuate a bit, but it should otherwise fit quite well.

    b. For the 66mm airframe, it is much harder. What you gain in mass savings by having a smaller airframe, you lose in ease of integration. The mount will need to actuate and slide in at an angle, while the airframe flexes a bit.
2. Once mounted, screw the TVC mount in place from the outside of the airframe.
    a. For a 66mm airframe, use the M3.5 x 6mm screws
    b. For a 74mm airframe, use the M3.5 x 12mm screws
3. Plug both TVC servo extension cables into the flight computer, which should be sticking out the top of the airframe section.
4. While the flight computer is still outside the rocket, thread all available slack in the TVC extension cables up through the flight computer mounting brackets. Use a rubber band or cable tie to keep the slack in the cable managed.
5. Slide the flight computer down through the top of the airframe section. This is a good time to ensure that all the stars between the TVC mount and flight computer are aligned and facing “forward”.
    a. As the computer slides through the tube, keep pulling the TVC extension cable tight to remove slack.
6. Attach the flight computer to the rocket airframe using 8 of the M3.5 x 6mm screws
7. Once more, make sure the TVC extension cables are pulled tight and cannot fall back through the airframe.
    a. This part is critical for a good flight. If the TVC cables have slack, they may end up jamming the TVC mount during flight.

9b. Testing

1. Remove the SD card from Signal and open the config file with your desktop or laptop computer. Turn off all non-flight modes (static fire, pyro channel check, party, etc). Set the P gains for the X and Y axis to 0.25. Set the I gains to 0, and D gains to 0.1.
2. Place the SD card back into Signal and turn the computer on. When the computer boots up, keep an eye on the TVC mount. If you’ve aligned everything correctly, the TVC mount will actuate forward and to the right, with the rocket upright, facing “front”. It will hold this position for several seconds, then move to center. At the end of startup the TVC mount will actuate positive and negative on each axis to the PID limit, then return to center.
3. After startup the computer will load into “pad-idle” mode. During pad idle, the buzzer will chirp on and off every few seconds, and the green LED will slowly blink. This means your rocket is ready for flight.
4. Simulate a launch by lifting your rocket straight up quickly! Keep the rocket very close to upright, simulating a successfully stabilized flight.
5. Signal Alpha is now in powered flight mode. The vectoring mount is actively working to correct the orientation of the rocket. Place a finger on the mount to ensure it’s working in both axes.
6. Now simulate motor burnout by quickly jolting your rocket downward, the exact opposite of simulating launch.

7. The TVC mount will lock up to center, recognizing burnout and shutting down TVC to conserve power. The LEDs will all turn on briefly before shutting off, this indicates apogee detection. Apogee is detected when no upward trend is found in barometer readings.
8. After several more seconds, the red LED will turn on. Signal has now recognized a sustained altitude of less than 5 meters for a few seconds, which it classifies as having landed. The red LED indicates that data is being dumped to the Micro SD card into a .CSV file. It's very important to not remove or wiggle the SD card during this period, as it may compromise the transfer of data.
9. When the data has been dumped to the Micro SD card, Signal will beep several times while lighting up the blue and green LEDs. After this, the SD card can be safely removed.
10. The LEDs will go back to red, indicating that Signal is now wiping the flash memory chip clean, in preparation for another flight. Do not turn Signal Alpha off during this period, it should last about 20-30 seconds.
11. When the flash has been cleared, Signal will alternate beeper sounds and LED colors, between blue and green. This means it's safe to turn Signal Alpha off. Do so, then turn it back on again.
12. This time, right after "launch", pitch the vehicle over quickly, simulating a poor flight. The in-flight abort system should kick in, turning on the buzzer(but not pyro channel 4, all pyros are restricted below 3 meters AGL). The detected abort will also show up in the flight data.
13. Jolt the vehicle down again, then wait for Signal log and wipe the flash memory again before shutting the computer down.

If Signal Alpha moves through all these steps smoothly, congratulations! Your thrust vectoring system is working just fine. If not, head down to the troubleshooting section to diagnose the problem.

9c. TVC fine calibration

Now it's time to really dial things in on the TVC mount. The goal is to get the center position of the mount entirely in-line with the rest of the vehicle.

1. Slide a motor, preferably spent, into the TVC mount
2. Grab a long length of motor mount tube and slide it over the motor - it should be sticking far out of the bottom of the rocket now
3. With Signal Alpha powered down, remove the Micro SD card plug it into your desktop or laptop computer.
4. Open the configuration file and enable TVC Hardware Alignment. Make sure XCAL and YCAL are both at 90 - this is a good starting point
5. Eject from the computer and replace the Micro SD card in Signal Alpha and turn it on.
6. Get your head close to the top of the rocket on one axis(in line with a TVC servo, X or Y) and look down the length of the rocket to the bottom. The motor tube sticking out will

likely not be centered. Use the diagram below to decide if that axis needs a positive or negative modification.
    a. There may be a little bit of play or slack in the mount's position. This is okay in small amounts. If this is the case, gently push the mount back and forth to estimate where the center of the slack is. Use that to judge the alignment of the mount.
7. Do the same for the other TVC axis.
8. Turn off Signal, remove the SD card and open the configuration file up again. Make the appropriate changes, positive or negative to the XCAL and YCAL values.
9. Repeat from step 5 until you can see no obvious errors in TVC alignment. The long motor tube should look like a straight extension from the airframe.
10. Remove the long motor tube, and you're all set!

10. Parachutes and pyros

Your rocket still needs parachutes, and a way to get them out of the vehicle in time. You can't use the motor's ejection change, so you'll need to wire up those pyro channels to black powder charges. If you're unfamiliar with how to build a piston based parachute deployment system, or the required ejection charges, check out this part of the "Build Signal Alpha" series.

11. Tuning

Before you launch your newly built rocket, you'll need to tune it for flight. This involves finding the inertia of the vehicle and running it through a flight sim to generate safe P, I, and D gains. BPS offers tuning services to make this easy for the user - if you've purchased Signal Alpha and are building a custom vehicle, I'll tune your first rocket for free! All that is required on the user's end is a quick test of your ready-to-fly rocket. The procedures and test setup can be downloaded here. You can also watch this video for reference. Once you receive your tuned values back, it's time to fly!

12. Flight tips

With your tuning values loaded and double checked in the settings file, you're ready to fly! Here are a few tips to help the first flight work well.

- Because thrust vectoring keeps the rocket stable, you do not need to launch from a rail or rod. If you want, you can build your own launch pad without them. That said, it becomes complicated to keep the rocket upright on the pad without a rail or rod, without obstructing the rocket at liftoff.
- Do not use a launch rod, use a launch rail.
    - Because the rocket can roll around the launch rod, any type of correction maneuver in the TVC will induce roll on the vehicle, rather than the intended orientation adjustment. Launch rails are significantly more flexible, and may whip the rocket around as it leaves the rail, which can be bad for stability

    - A launch rail solves this - by nature, the rocket cannot roll around the rail. Small corrections are no problem as long as the rocket can move along the rail without jamming. Rails are also quite stiff, so the risk of rod-whip is much lower.
- Always fully charge your batteries before flight!
    - If you're using a non-rechargeable battery, double check the voltage with a voltmeter - it should be at least 1 or 2 volts above 7v, where the computer is at risk of shutting down.
- Fly in low wind.
    - Though weather cocking isn't an issue with TVC rockets, Signal Alpha cannot correct for horizontal drift while under power. It may stay upright, but still drift from the pad.
- Do not launch at more than 30 degrees from vertical.
    - This is identical to the NAR Model Rocket Safety Code. Especially with TVC rockets, launching at a steep angle puts the rocket at risk of falling back to the ground because of insufficient vertical force against gravity.
- Check TVC manually
    - Before each flight, with Signal Alpha powered off, use your hand to move the TVC mount back and forth on each axis. Do this with the rocket vertical, not upside down or horizontal. If you feel any obstruction or potential jam, do not fly the rocket until the jam has been removed or fixed.
- Watch TVC during startup
    - When Signal Alpha moves through startup, pay attention to the TVC mount closely. With the rocket upright, and facing you, the mount should ALWAYS actuate the bottom of the motor toward you and to the right right for a few seconds. If it doesn't move in this way, you have a misalignment or reversed wiring, and should not fly the rocket until it is fixed.
- Every two or three flights, it's a good idea to perform some maintenance and tests on your rocket, just to be safe.
    - Re-check TVC calibration. Especially after a hard impact, the mount can lose alignment by a bit, or become loose. If it's loose, head to the troubleshooting section for fixes.
    - Use a voltmeter to check the pyro channels using Pyro Channel Check mode. They should all cycle through turning on and off.
    - Double check the slack in the TVC extension cables - make sure there's little or no slack in order to avoid a TVC jam.

12. Viewing flight data

You've flown your rocket, and you got it back! Now it's time to look at the data to see how things went.

1. Remove the Micro SD card from Signal Alpha and plug it into your desktop or laptop computer
2. Copy the most recent flight log file to your desktop

3. The .CSV file can be used in most spreadsheet programs or data viewers. Google Sheets is a great option - if you have an account with Google, got to www.docs.google.com/spreadsheets
    a. Create a new spreadsheet
    b. Go to File > Import > Upload. Drag your .CSV flight log file in, and Google Sheets will import all the data
    c. Sheets should automatically recognize this, but if it doesn't, select Comma as the separator character.
    d. From here, you can view or edit any of your flight data
    e. If you want to view it as a plot, select the data you want to view, then go to Insert > Chart
    f. Any data you view should also include the "Flight Time (sec)" column. Once the chart is created, check the box beside "Use column B as labels"
4. If you don't have a Google account(though they're quite easy to create), there are several account-free data viewers as well. https://plot.ly/create/ is a fast online alternative.

Troubleshooting

If you experience an error or anomaly when using Signal Alpha, you can likely diagnose it with this table of causes and solutions. If you experience a problem not listed here, or none of the solutions work, please contact BPS at joe@bps.space.

Problems	Causes/solutions
Signal won't turn on at all with the power connected	• Check polarity of power input • Check voltage of power input - must be above 7v • Check for a possible short circuit on servo outputs • Ensure all nearby metal objects make no contact with exposed contacts on the PCB
Signal turns on, flashes all LEDs once, waits 2-3 seconds, then plays the 2-tone buzzer indication	• Signal is missing an SD card, or it is not connected well - remove and re-insert the SD card
Signal turns on, flashes all LEDs once, and immediately plays the 2-tone buzzer indication	• Signal cannot find the configuration file on the SD card, or did not read it correctly. Double check that it exists, and if needed, re-download the original file here. Incorrect text formatting can cause this.
Signal boots up successfully, but does not enter pad-idle mode, instead going straight to powered-flight mode, with the red and blue LEDs flashing	• The launch detection threshold is too low in the configuration file. Make sure you add 9.81 to the threshold used. Anything less than 9.81 will likely cause this.

Near the end of startup, Signal halts the process and plays the 2-tone buzzer indication	● Reboot the computer. The issue may be small, like the one below, or it may be a serious connection reliability issue with the IMU or barometer. If it persists over multiple startups, please contact BPS.
At the end of startup or static fire countdown, Signal halts the process and plays the 2-tone buzzer indication	● The IMU or barometer has failed self-test function, this is a boot-up timing issue from time to time, and is harmless if it occurs every now and then. Reboot the computer.
After cycling through all LEDs in startup, the blue and green LEDs flash with a beep, then the red light holds for a long time(20-30 seconds). After this the computer alternates between the blue and green LED indefinitely.	● This is not a bug! Signal has detected significant data on the flash memory card, likely from a previous flight, or long pad-idle period. This process is usually executed at the end of a flight, but since your data wasn't dumped to an SD card before shutting down, it is being saved now. Reboot the computer only after the blue and green LEDs start flashing slowly.
The TVC servos don't move at all when Signal is powered on, and can be moved easily with a finger.	● The TVC servos are plugged in backwards. ○ Re-seat the TVC extension cables so the white wire is on top, closest to the X or Y label, with the black wire on the bottom, closest to the '-' symbol ○ If this doesn't work, double check the connection between the servo cables and extension cables. Black, red, and orange/white wires should all match up.
One of the TVC servos does not work function	● Repeat the above steps for the individual servo. ● If everything is wired correctly, you may have a faulty or damaged servo. Please contact BPS
One of the TVC servos seems to move slowly when used in the mount.	● You may have a faulty or damaged servo, see above. ● The TVC mount may be jammed - check for loose debris or wiring near the joints
The TVC mount seems to move slowly, the joints between parts do not move without considerable force	● The TVC mount may be jammed, see above ● The TVC mount may not be worn in, use a drill or screwdriver to over tighten the M3.5 x6mm screws by a few turns to loosen it up
The TVC mount has a lot of 'play' - it's able to wiggle back and forth in one or both axis while not moving the servos. A small amount of this will always be present, but 1.5+ degrees will start to affect the quality of flights	● The TVC actuation points(screw holes) are too loose ● Long term solutions ○ Contact BPS for replacement parts or print files ● Short term solutions ○ Coat the M3.5 screws in a layer of epoxy, CA, or another strong type of glue to make them larger. Wait for the glue to fully dry, and replace them in the mount. ○ Wrap a piece of paper around the screws as they enter the screw holes,

	for the same effect as the glue.
One of the pyro channels isn't working, confirmed through Pyro Channel Check mode	• Contact BPS with detailed photos of the front and back of the flight computer. A component may be damaged or mounted incorrectly.
After a long time in pad-idle, the OnTime(sec) column of data shows an incorrect value	• This is a known bug, and will not affect any of the other readings or functions of the flight computer. It will be fixed in a software update later on.
Something in the SD card data looks odd or out of place. Examples might be columns filled with zeros, large spikes in certain columns, far-from-nominal battery voltage, etc.	• Try replacing the config file with a new one, downloaded here. Poor formatting can cause odd errors in the data. • Contact BPS with the flight or test data you're seeing, and the config file if it persists.

Definitions

- TVC - Thrust Vector Control
- BPS - Barnard Propulsion Systems
- Airframe - the body of your rocket
- Pushrod - stiff 1mm wire attaching servo horn to TVC mount
- Linkage stopper - silver metal round piece

User Requirements

The following constitute the guidelines that you agree to follow when using Signal Alpha. **By not following these, you void any guarantees or warranties of Signal Alpha, and neither Joe Barnard or BPS has any liability.**

- I will use and fly Signal Alpha only during high visibility conditions
- I will not use or fly Signal Alpha under the influence of drugs or alcohol
- I will alert all persons in the general vicinity of the rocket before I launch
- I will ensure an audible countdown to ignition is conducted from at least 5 seconds
    - Depending on the situation, radio communication is also acceptable for this
- I will never launch a rocket in the direction of people, property, or anything other than open space
- I will never launch a rocket with the intent to harm
- I will only launch rockets in accordance with FAR 101 by the FAA, the NAR's MRSC, and the Tripoli Safety Code.