INTRODUCTION:

Most recent changes to this document are highlighted in GREEN from the last revision.

This brief packet amplifies what is mentioned in the Naza Users manual and hopefully will help clear up some basic questions. In the military there is a term for information like this called *GOUGE*. Many times people would take a complicated flight manual and come out with their own *GOUGE* to put it into simpler terms. Hopefully the information contained below will answer some basic questions for folks new to the Naza and GPS. The gouge will cover the basics that are most often mentioned in the GPS Owners thread that people have trouble with. It seems the most often discussed issues on the thread are: C.G., magnetic declination, X, Y, Z settings, compass calibration, and toilet bowl effect. These topics are mainly addressed in this gouge packet.

Since the Naza may be used on quadcopters, hexacopters, etc. we will refer to them all as *aircraft* from here on out.

If you notice bad or wrong information in this gouge, contact me ASAP via a PM so it can be fixed as to not put out bad information. You can find me here:

http://www.rcgroups.com/forums/member.php?u=31903

Keep in mind; this is only "GOUGE". Those that provide input to this gouge are not in any way responsible for results based on information contained within this gouge. As versions are revised, information will be added, graphics added and improved.

GETTING STARTED:

The Naza Flight Controller is compatible with many different ESCs however there are some that will not work. If you are not going to use DJI components, it is recommended to review the NAZA CONFIGURATION SPREADSHEET in the links section below to ensure your choice of ESCs will work. DJI ESCs are configured to work well with the Naza. If you use another brand for your ESCs, you may have issues getting your Naza to arm. Also, your ESCs will most likely require calibration to ensure they all are set to the endpoints of your transmitter.

Connect Naza Flight Controller, GPS, VU, etc. in accordance with user's manual.

Note: In order to utilize full functionality of all flight control modes, intelligent orientation control, pilot initiated fail-safe, etc.; your radio will need to have the right amount of switches and capability for setting mixes. A three-position switch is required for the three different flight modes. Another three position switch is required for the two different intelligent orientation control modes. Radios that do not have three position switches may still be utilized but will require additional mixing or certain functions may not be used.

If you read the RC groups thread on the Naza GPS, you will find a wealth of information. Keep in mind you will have to do some serious reading and researching as there is a lot of information. Utilize the search function of the thread. Try to figure out your issue by reading this packet, user's manual, or the thread before posting your question.

http://www.rcgroups.com/forums/showthread.php?t=1666903

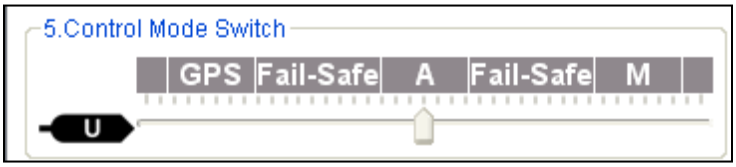
Keep in mind the hovering accuracy in GPS mode is +/-.8 meters vertically and +/- 2.5 meters horizontally. The Naza and GPS sell for $400. For that price, you get a very accurate system. Some people on the thread complain all day long about how it will not hover EXACTLY in one spot. What do you expect for $400? If you must hover EXACTLY in one spot, there are other high dollar alternatives you can purchase. The Naza and GPS are what is referred to by DJI as "hobby grade" use.

TRANSMITTER SETUP:

If the manual or this packet were to list how to set up every possible transmitter with your Naza, it would add hundreds of pages. The Naza GPS thread explains how to set up the more common Futaba, JR, and Spektrum transmitters.

There are some terms you should be familiar with when setting up your Naza. Fail-safe seems to be the biggest issue and question often posted in the threads. Some transmitters and their receivers have the capability when signal is lost to go into a fail-safe mode. Some fail-safe modes vary from brand-to-brand. Fail-safe may just be simply reducing the throttle to a predetermined setting or it may be a combination of predetermined stick and switch positions. Fail-safe may be initiated on the Naza a few ways. It can be initiated by a switch position if set up properly, turning off the transmitter (not recommended), or actually losing signal.

When setting up flight modes in the Naza Assistant software, you will see areas called FAIL-SAFE.



When you set up servo travel, flap position, or whatever means you use to set different flight modes you may notice the slider arrow causing the Fail-Safe word to light up blue in the assistant. Some users will set up their radios with a mix to fool the transmitter to moving the same channel that drives your mode selector to go into the FAIL-SAFE area when a switch is selected. You can also take this a step further and program (bind) your receiver to going into the FAIL-SAFE mode when you lose transmitter signal. When you bind your transmitter to put the control mode in a FAIL-SAFE situation, ensure your throttle is set greater than 10%, many use 40%.

It is a good idea to setup a switch to cause FAIL-SAFE on your transmitter. This way, if you are flying FPV and lose video signal you can simply flip a switch and the aircraft will enter FAIL-SAFE mode. It can be set to land automatically or return home and land. If set to return home and land for example, you could flip the switch and wait for the aircraft to get close enough to you to visually take over or allow it to just land itself. This is a very handy feature and many like to use it to show what the Naza can do to their friends and other flying buddies. It is recommended to perhaps test this feature once or twice and then only use it if you need it.

Another helpful feature the Naza GPS has it called Intelligent Orientation Control (IOC). It isn't crucial to set this up and use but it may be useful to you. There are two settings IOC uses called Course Lock and Home Lock. Course Lock is basically setting up your aircraft to fly one direction even though that direction is not where the aircraft is pointed. Say you wanted to keep your aircraft facing the heading of due east to film something but you wanted to move the aircraft to the north while filming. This could be done two ways really. Point your aircraft to the east by using the rudder and move your aileron stick left to fly towards the north. You could also put your aircraft in COURSE LOCK mode and set up the direction to LOCK the COURSE east. Then, when you move the right stick forward, the aircraft will move forward but keep the course locked on due east. It is hard to explain and even wrap your head around it until you see it work. It may confuse you even more to use this feature. I would think it would be mainly used for those using their aircraft for taking video of an object. The other IOC feature is called HOME LOCK. This feature is also not needed but very useful. An example of when you might use HOME LOCK would be if you are flying at a distance from you that it difficult to know what directing your aircraft is facing and you become disoriented. You can simply turn on HOME LOCK and when you pull back on the right stick the aircraft will come directly back to the home position no matter what direction the aircraft is facing. In HOME LOCK there isn't really a front or back to the aircraft. Back comes back to home, forward moves away from home, left moves left of home, right moves right of home. Another example is if you are flying FPV and lose video. Initiate HOME LOCK and pull the right stick back. The aircraft will come back to you. This may be safer than initiating a FAIL-SAFE to return home or land. Once the aircraft is 10 meters or more away from where it was initialized at (home position) you can use HOME LOCK. When the aircraft is less than 10 meters from its home position, it will automatically revert back to flying normally as if no IOC mode is selected. Be ready for this. Don't fly the aircraft in HOME LOCK mode when less than 10 meters from you as it may confuse you. Refer to the Naza Users manual for more information on IOC modes. Again, it isn't necessary you use the IOC function but is very handy depending on your application.

There have been a few users that have had issues getting their Flight Controller to arm. Many times it was due to the trim setting on their transmitter. If you trim your aircraft in flight, then next time you go to arm it, it may be out of range for that channel and won't arm. You can see this happen when you have your aircraft hooked to the assistant software. Enter the TX Calibration page in the assistant software. Notice how your R-E-A are all green because the controls are all calibrated properly. If you trim any of those channels too much, you will put that value out of range and the Flight Controller wont arm.

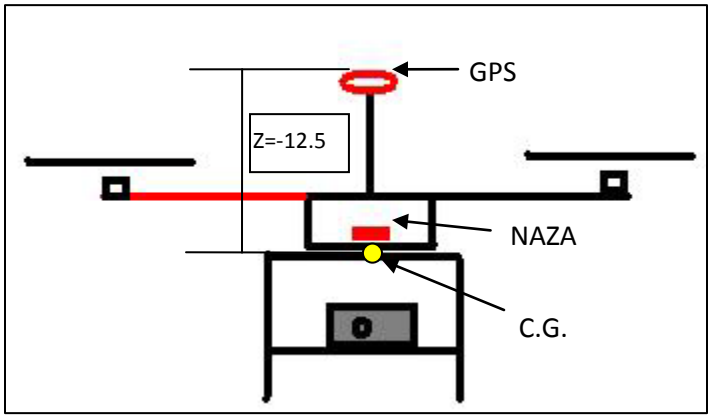
CENTER OF GRAVITY:

RC Groups contains a wealth of information on finding the C.G. of your aircraft. Keep in mind your flight controller (FC) should be installed as close as possible to the C.G. Unlike C.G. on an aircraft, it is important to know where your C.G. is in relationship from top to bottom of the aircraft, not just front to back. The top to bottom location is important for the FC to know where the GPS antenna is located in relationship to the C.G. Operators that have not provided correct data in the assistant software may notice what is referred to as "toilet bowl effect". This issue may also occur if the GPS antenna is not set to the correct magnetic declination.

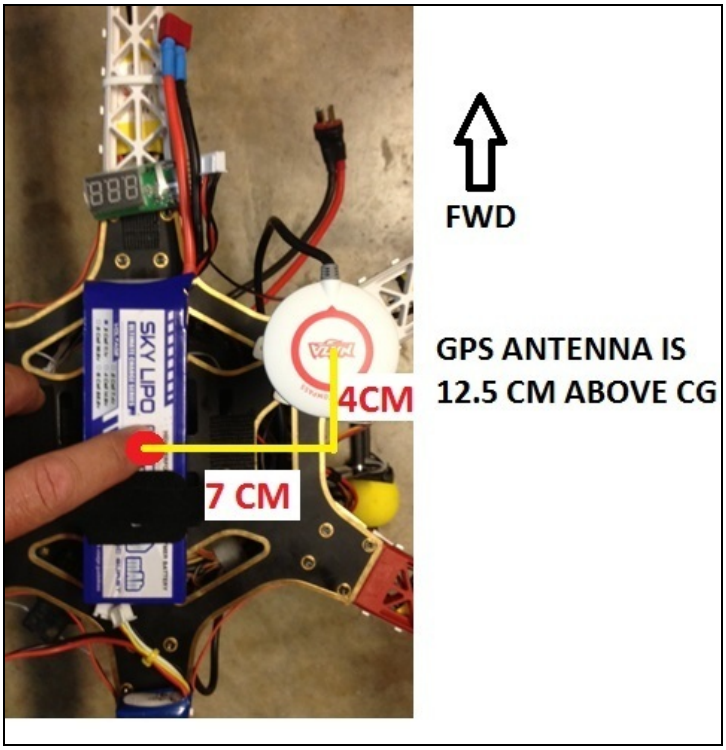
Chances are your aircraft's C.G. isn't exactly in the center and in the middle of where your flight controller is located. This would be especially true if your battery is attached above or below the flight controller. For example if your battery, landing gear, camera gimbal, and camera are all attached to your aircraft you would expect that the C.G. would most likely be below the flight controller. The Naza must know this relationship to make precise calculations.

Look at the picture below. Notice the C.G. is below the Naza flight controller. The X and Y values may be in the middle of the aircraft however the Z value will be different. The relationship between the GPS antenna and the C.G. is 12.5 cm in this example. Since the C.G. is below the antenna, the value should be a **NEGATIVE** number. You can't enter decimal places in the Naza Assistant software so just round up.

Some users have found that entering their X, Y, and Z has put them in the ballpark of a good flying aircraft but additional adjustments of the value Z was needed. Some trial and error flights will be needed.



THIS EXAMPLE SHOWS THE Z VALUE ONLY
IF THE GPS IS ABOVE THE C.G. POINT, Z WILL ALWAYS BE A NEGATIVE NUMBER



NOTICE THE GPS ANTENNA IS FORWARD AND RIGHT
OF THE C.G. THEREFORE BOTH X AND Y VALUES
SHOULD BE POSITIVE NUMBERS

MAGNETIC DECLINATION:

There are only a few locations on Earth where it points exactly to the True (geographic) North. The direction in which the compass needle points is known as Magnetic North, and the angle between Magnetic North and the True North direction is called **magnetic declination**.

Magnetic declination varies both from place to place, and with the passage of time. As a traveler cruises the east coast of the United States, for example, the declination varies from 20 degrees west (in Maine) to zero (in Florida), to 10 degrees east (in Texas), meaning a compass adjusted at the beginning of the journey would have a true north error of over 30 degrees if not adjusted for the changing declination.

Many Naza GPS users find their magnetic declination and adjust their GPS antenna to account for their declination before they fly for the first time with their Naza GPS. If your location has a **POSITIVE** declination then turn your GPS to the **RIGHT** the number of degrees of declination for your area. If your location has a **NEGATIVE** declination then turn your GPS antenna **LEFT** the number of degrees of declination for your area.

Many Naza GPS users attach their GPS antenna or mount with Velcro or Shoe Goo. This will allow them to fine tune their antenna before making more permanent and secure. Some users simply leave their GPS attached by Velcro alone.

It may take some trial and error flight tests and hover tests to get your angle set correctly. What may work for others, may not work the same for you. The GPS antenna is also a magnetometer and is very sensitive to metal and anything that may cause magnetic interference. This is why it is very important to calibrate your compass anytime you make changes to your aircraft. Some users have made no adjustments to the angle of their GPS and their aircraft flies just fine. All aircraft are different and you will have to do some testing to find what works best for you.

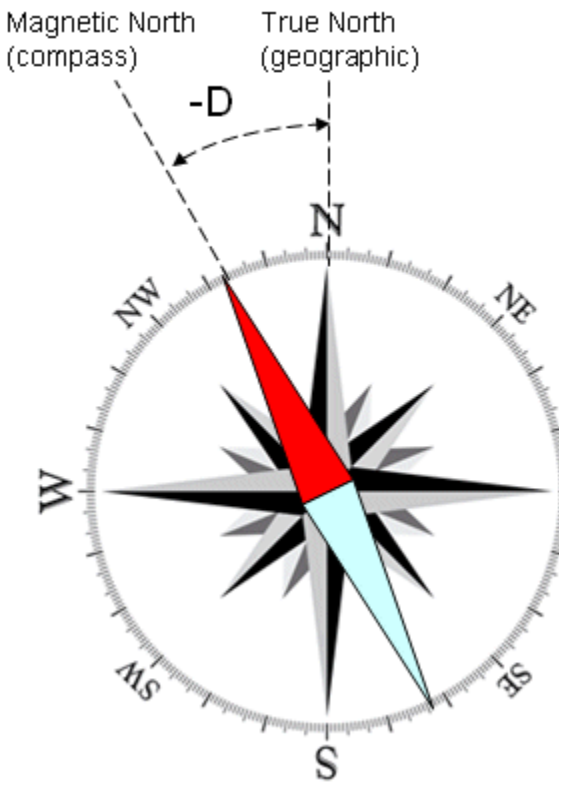
The Naza Users manual addresses what to do if your aircraft drifts while flying in a straight line. The GPS antenna will have to be adjusted left or right to correct this problem. You may also need to adjust your antenna to correct "toilet bowl effect". When you flight test your aircraft ensure you have calibrated the compass first. Ensure you are flying in an open area free from objects that may influence the magnetic compass (noting in your pockets either). Ensure all your accessories on your aircraft are powered up (video transmitter, OSD, cameras, lights etc). Put your aircraft in a hover and note any abnormalities. Then fly it in a straight line for about 50ft or so. If it drifts to the right, then turn the GPS to the left a tad (and opposite if it drifts left) and calibrate again. There is no need to power down the aircraft to do this. Then fly it in a straight line again, and repeat the process. Keep doing it until you go forward in a straight line. Now once again hover and ensure that you don't notice any toilet bowl effect.

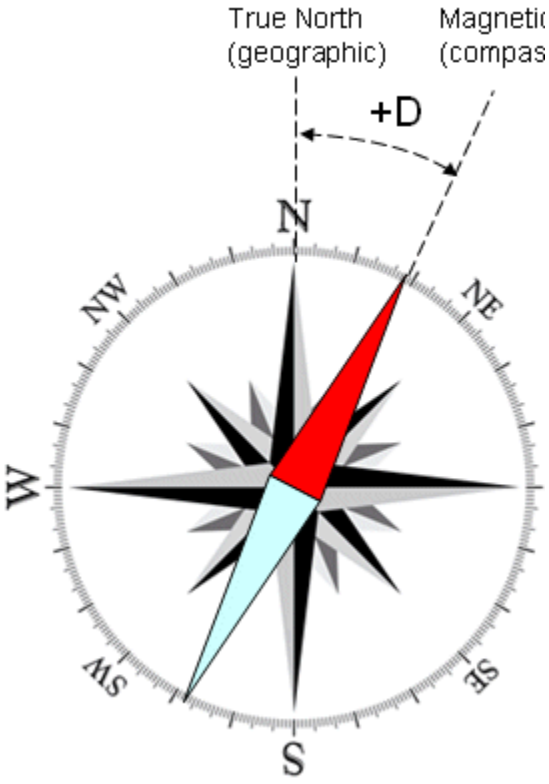
THIS QUADCOPTER IS FLOWN IN A LOCATION
THAT HAS 10 DEGREES EAST (POSITIVE) DECLINATION.
NOTICE HOW THE GPS IS ROTATED RIGHT 10 DEGREES

http://magnetic-declination.com/

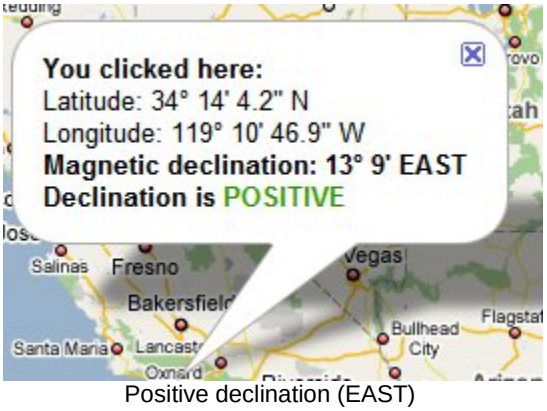
If the compass at your place is pointing **clockwise** with respect to the True North, declination is **positive** or **EAST.**

If the compass at your place is pointing **counter-clockwise** with respect to the True North, declination is **negative** or **WEST.**





Negative declination (WEST)



Positive declination (EAST)

COMPASS CALIBRATION:

Always do the calibration with everything you intend on being aboard your aircraft and fully powered. This includes camera, video equipment, battery packs, lights, etc. If you travel a significant distance (keep in mind magnetic declination) I would recalibrate your compass. Also, make sure you have your radio transmitter, cell phone, pocket change, watch, etc, away from your aircraft when calibrating the compass. These will alter your calibration and cause issues.

In order to enter compass calibration mode, you must have your mode selector set in the assistant to have at least MANUAL and GPS mode. If you only have a two position switch and are using GPS and ATTI only, adjust the travel in your radio settings to allow MANUAL and GPS. Once you have your compass calibrated, you can put your modes back to GPS and ATTI.

The Naza manual says to cycle your mode selector 6-10 times to enter compass calibration. Many have found the best luck with getting into the calibration mode by starting out in the MANUAL mode and cycling to GPS and back to MANUAL 6-10 times quite quickly. Cycle your switch 6-10 times quickly then stay in one mode and you should notice your VU display constant yellow. Hold your aircraft out in front of you HORIZONTALLY and rotate your body 360 degrees while holding the aircraft in front of you. Rotate slowly and slow down your rotation when you get close to your original staring point. You should then see the yellow light turn steady green. Rotate the aircraft on its side (either side) so the top and bottom are now horizontal in front of you. Once again, rotate 360 degrees slowly. Once you end up on or near your original heading, you should see the green light go out. This means the calibration completed successfully. If you get a blinking red light start over. Refer to the Naza Users manual for more information.

VOLTAGE MONITORING:

Many have posted issues with their aircraft doing odd things as far as rolling over and crashing, sluggish maneuvering, yawing issues when adding or removing power. Some of these issues may be attributed to weak or bad batteries. You should know how much power you are pulling in your aircraft. Even though you have new batteries in your aircraft and they are what you think is a high C rating, they may not be enough. You may have a fresh battery that is starting out with let's say 12.5 volts. After only 30 seconds of flight time the voltage is very low and it auto lands. If you check the voltage it may still look OK but with a load it is not. This is because the battery can't handle the current draw for some reason. Perhaps it is not rated for it or the battery is just simply shot. If you are in this hobby you should be familiar with LiPo batteries and their limitations. Never run them below 3.3 volts per cell. Many like to never let them go below 3.5-3.7 a cell. This makes their life (number of cycles) last longer. Normally the difference between NO LOAD and LOAD is only .4 - .5 volts in a good strong battery on a quadcopter. Even when the battery is low on voltage (3.7 volts per cell) the LOAD should only or may only be .5 volts. Keep in mind this value may not be accurate if you are running 8 motors or 4 high current draw motors or props. This is just a ballpark value that is what most see and use. If you experience a large loss between NO LOAD and with a LOADED, you may have issues. Setting up the voltage monitoring is your preference. Many like to be warned by the FIRST LEVEL OF PROTECTION way in advance. They know when they see this they have X amount of time remaining to land. Many will set their SECOND LEVEL OF

PROTECTION at a value that will allow the aircraft to land safely without hitting LOW VOLTAGE CUTOFF or damage their battery by allowing it to get below 3.3 volts per cell.
When first setting up your aircraft, try to use a watt meter to determine if you are using the right battery. You can do research on C rating on rcgroups.com. You may also want to fly with a voltage display on your aircraft. This way you can quickly determine your NO LOAD and LOAD values. Once everything is set, you may choose to remove it.

GAIN SETTINGS:

The gain settings in the autopilot section of the assistant will be different for almost everyone. Different variables effect what gains are required or preferred. You could have two identical 450 frames with the same hardware on both. One person may like to run their gains much higher than the other person even though both machines are the same. Some like to adjust their gains for the type of flying they will be doing. Finding what works best for you will take flight testing and adjusting. Many may find the stock settings are fine for them and never adjust them. You may adjust your settings by 10-20% and find it difficult to notice a difference. Look at the NAZA CONFIGURATION SPREADSHEET in the links section below for what some users have set for gains to give you an idea on what may work for you.

LINKS:

DJI HOMEPAGE:
http://www.dji-innovations.com/

NAZA GPS DOWNLOADS:
http://www.dji-innovations.com/products/naza-multi-rotor/downloads/

NAZA GPS OWNERS THREAD:
http://www.rcgroups.com/forums/showthread.php?t=1666903

MAGNETIC DECLINATION INFORMATION:
http://magnetic-declination.com/

STEP-BY-STEP NAZA SETUP VIDEO
http://www.youtube.com/watch?v=FMMk7LVjigU

FUTABA T8FG FAIL-SAFE SETUP WITH DJI NAZA, WK-M
http://www.youtube.com/watch?v=LCCFsq44IpA

HOW I USE HOME LOCK AND RETURN HOME WITH NAZA GPS
http://www.youtube.com/watch?v=-CxB3CgpboQ

SETTING UP THE WOOKONG M CENTER OF GRAVITY
http://www.rcgroups.com/forums/showpost.php?p=21888105

NAZA CONFIGURATION SPREADSHEET
https://docs.google.com/spreadsheet/ccc?key=0Au16aK6Q-0p0dENkdXVGVHJLRm5fRTFQdjBZbUhxZ3c#gid=0

NAZA SPECIFICATION SPREADSHEET
http://www.rcgroups.com/forums/showpost.php?p=22279028&postcount=3314

IOC VIDEO
http://www.youtube.com/watch?feature=player_embedded&v=UEI84W6BzuE

IOC VIDEO SHOWING HOW TO SAVE NEW HOME POSITION AND COURSE POSITION
http://www.youtube.com/watch?feature=player_embedded&v=Ub8kfZGonZY