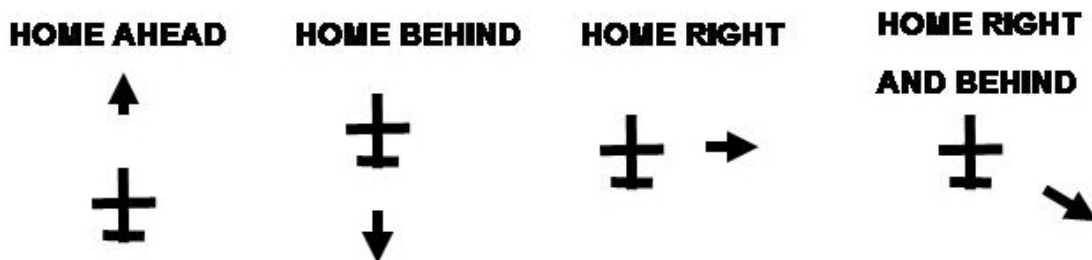


The Green Arrow Explained

by Clem Wehner

While it seems mysterious to a lot of people, the green arrow would be immediately recognized by full-scale aircraft instrument-rated pilots as the “Bearing Pointer” on their flight instruments. The Bearing Pointer simply points to the station being used for navigation, like a VOR station. In our case, the green arrow points to our ST control transmitter which the system considers “home”. The key to understanding the green arrow is the little plus sign or cross in the middle of the screen. (\pm). It’s not just for marking the center of the screen, it’s much more important than that.

The use of the cross and the green arrow, like those used in airplane instruments, provides an excellent tool to maintain awareness of the drone’s position in relation to home. The ST’s screen presents what’s called a “God’s-Eye View”, looking down on the earth from above. The little cross represents the aircraft with the top of the cross **always** being the nose or front of the aircraft, the bottom being the tail, and the crossing line being the wing, or the sides of the aircraft. It may help to imagine a tail on the cross like an airplane’s tail (\pm). Looking down from above, the green arrow is positioned on the screen where home is in relation to the aircraft (cross). If the green arrow is above the cross, home is in front of the aircraft. If it’s below the cross, home is behind the aircraft. If the green arrow is to the right of the cross, home is on the right side, etc.



As you fly, the green arrow will move. To visualize why, think of being in an airplane flying towards an airport. When you are heading to the airport, but still far away, you’ll see the airport out the front windshield. As you fly past the airport, it will appear to move in your view, first in the windshield, then the front side window, then directly off the wing, then in the rear side window. As you get far past the airport, it will move to the rear window. The green arrow is just like that. As you fly the Typhoon, the green arrow will move on your screen to represent where home is in relation to the front of the drone. Remember, the front of the drone is the top of the little cross and is **always up** on the screen. It does not turn. The world below rotates around the cross. Think of it this way: if you were in a helicopter hovering high above the earth and pressed the rudder pedal to pivot around a point, the world would appear through the window to rotate under you. Same with your screen, the world rotates below the little cross. Turn on the camera and point it straight down, then hover the drone and yaw it with the left stick. You’ll see the image of the earth below rotate under the cross. As the earth rotates in the screen, the

location of home and the green arrow will also move around the screen because the location of home is moving in relation to the front of the drone.

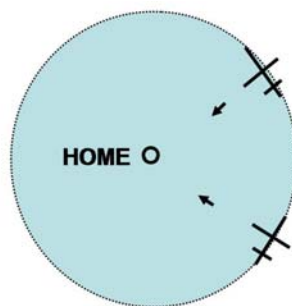
Note that nothing in our system shows the direction that the front of the Typhoon is pointing in relation to earth's north (the compass heading). The green arrow only tells you the bearing of home in relation to the front of the drone. You could be heading in any compass direction, but if the drone's front is facing home, the green arrow will be above the cross on the screen.

Because the green arrow on the screen does not change distance from the cross as your distance from home changes, the actual distance is shown on the bottom left of the screen in the DIS box. The green arrow simply points to home. This arrow, cross, and distance display are the same indications as on a full-scale aircraft's instruments. That's probably why the typhoon designers created our system the way it is. But, full-scale aircraft also have a compass heading indicator. Hopefully one day, Yuneec will give us a heading indicator on our Typhoon system.

So what can you do with the cross and green arrow displayed on the screen?

1. You always know where home is in relation to the front of your Typhoon. Just turn toward the arrow until it is on top of the cross and you'll be heading directly to home. Of course, drones can fly sideways or backwards so you could also just push the right stick toward the green arrow and the drone will fly sideways or backwards towards home.

2. You can fly a perfect circle around yourself using just the cross and arrow as full-scale aircraft with simple, non-digital instruments do. Here's how: fly off until you are at the radius of the circle you want. Turn toward the arrow using the left stick for yaw, until the arrow is at 90 degrees in relation to the front of the aircraft, which is off the right (or left) side. Start flying forward by pushing the right stick forward and you'll notice the green arrow will start falling below the 90 degree point. Turn a little toward the center of the circle using the left stick just enough to keep the arrow right on the 90 degree point. If you do this, you will fly a circle around the transmitter.



Don't turn by moving the right stick sideways or you'll fly sideways and make the circle diameter smaller. Keep an eye on your distance reading. If you're drifting closer, turn a little bit outward until you are at the right distance again, then resume keeping the green arrow at the 90 degree point. Full-scale aircraft often fly approaches in instrument

weather conditions using this technique to circle around a city, mountain, etc until they are lined up properly to turn onto final approach. They don't fly a full circle, but only that portion of the circle needed to get them around the obstruction. A portion of a circle is called an "arc", so this procedure is called "flying an arc". Try it, it's fun and a great way to learn about flying using the green arrow.

3. Can you use this to fly a nice square or rectangular pattern around yourself as if you were flying a search pattern? No, since you don't have a heading indication, you don't know where the front of the drone is pointing. So when you turn at one corner of a square flight pattern, you don't know how much you've turned and where the nose is pointing. Of course, if the camera is on and pointed straight ahead, you can look at the ground and estimate how much you've turned. But it's hard to make a precise 90 degree turn without a heading indicator. We sure need one.

While you're likely never to use the green arrow and cross for anything exotic, its real value is in staying oriented and knowing where home is so you can manually fly right to it. That's what the green arrow and cross are all about. It's not mysterious at all.

Author information: Clem Wehner is a retired US Air Force pilot, flight instructor, and commercial multi-engine instrument pilot. He's also been flying radio controlled model airplanes and helicopters for over 50 years. He got a Typhoon H in October 2016 and lives in Lawton, Oklahoma, USA. (ClemWehner2@gmail.com)