Telemetry 101

Mastering the communication between you and your multirotor

TEXT & PHOTOS BY **JOHN REID**

One of the really nice features of modern-day remote-control radios is the fact that they can send signals to an RC multirotor to control it. Plus, they can receive signals back from the same aircraft, allowing us to monitor important information about that aircraft. This feature is what we refer to as telemetry. We can use this to monitor information from a variety of sensors that we install on our aircraft. This allows the pilot to keep track of the aircraft, monitor external things around the quad, and have real-time information on key components of the multirotor, such as battery levels. Let's take a look at some of the functions that can use telemetry to help adapt the multirotor to fit our needs.

Having complete telemetry connection to the multirotor and real-time readouts on the transmitter/ground station give pilots complete control over the multirotor.

te·lem·e·try (te-lĕm´ĭ-trē)

The automatic measurement and transmission of data from a distant source to a receiving station

Telemetry features

First, you must have a radio transmitter that can send and receive signals; most modern-day 2.4Ghz systems have that capability. The multirotor now only needs a receiver that can also transmit information gathered from sensors onboard the aircraft back to the transmitter. Again, this is something most modern 2.4Ghz radios have as standard features. Now that we have that, let's look at some of the things we can use this system for.

Flight battery

Perhaps the most important telemetry feature that you can have on your aircraft is a sensor that monitors the current status of your flight batteries. Flight batteries are the key component for ensuring that the quad stays in the air, making this a vitally important telemetry item. The current status of the battery lets you know just how much time your multirotor can spend in the air and when you will need to land the aircraft. Most pilots will have this function incorporated with some type of alarm on the transmitter, which will notify them when the battery power level gets too low.

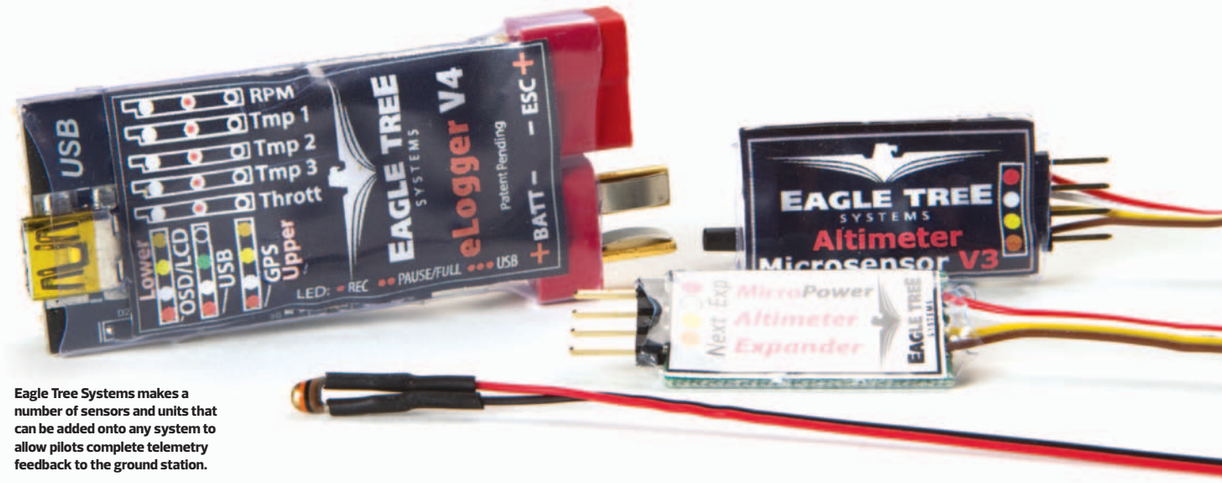
It is a good idea to set alarm thresholds to a value above the cutoff limit of the battery so that the pilot will have enough time to bring the multirotor back to land. Of course, the quality and age of your batteries will determine how low you should set this number. Older batteries die out much quicker and will need a shorter flight time, while newer, high-powered batteries will last longer and give better flight performance. Telemetry can also help you determine the health of your battery. If it seems that the battery is draining quicker than it did when new, for example, this might be an early warning that one of the cells is going bad and should be checked and fixed now, before it becomes an issue.

Other information needed

Some telemetry features will require the use of sensors that are designed to monitor certain data and give feedback to the transmitter. These sensors send constant and current information on things like battery voltage, temperature, rpm, G-force, altitude, and attitude. With the exception of rpm, which is not needed as much on multirotors because the motors tend to spin at different speeds while flying, the pilot can monitor his aircraft using all of these telemetry items.

Pixhawk's flight controller has many telemetry plugs, which allow pilots to customize the telemetry features that they want to receive from the multirotor.

AFTERMARKET PRODUCTS, LIKE THOSE CARRIED BY EAGLE TREE SYSTEMS, OFFER TELEMETRY SYSTEMS THAT CAN BE ADAPTED TO ALMOST ALL BRANDS OF RADIOS.



Eagle Tree Systems makes a number of sensors and units that can be added onto any system to allow pilots complete telemetry feedback to the ground station.

The Hitec Advance telemetry system allows for a number of different add-on sensors that can monitor just about every function on your multirotor/aircraft.

ABOUT THE ONLY DOWNFALL TO GPS IS THAT IT REQUIRES A CERTAIN NUMBER OF SATELLITES TO CALIBRATE ITS LOCATION, WITHOUT WHICH YOU CANNOT GO INTO GPS MODE. AS SUCH, THIS FEATURE IS PRACTICALLY USELESS IF THE DRONE IS FLOWN INDOORS.

In addition, having the ability to log this data onto a spreadsheet or something of that sort will provide a good maintenance record. In most cases, there is no need to purchase additional equipment because there are a good number of radios/transmitters that already incorporate this type of telemetry. Aftermarket products, like those carried by Eagle Tree Systems, offer telemetry systems that can be adapted to almost all brands of radios.

GPS

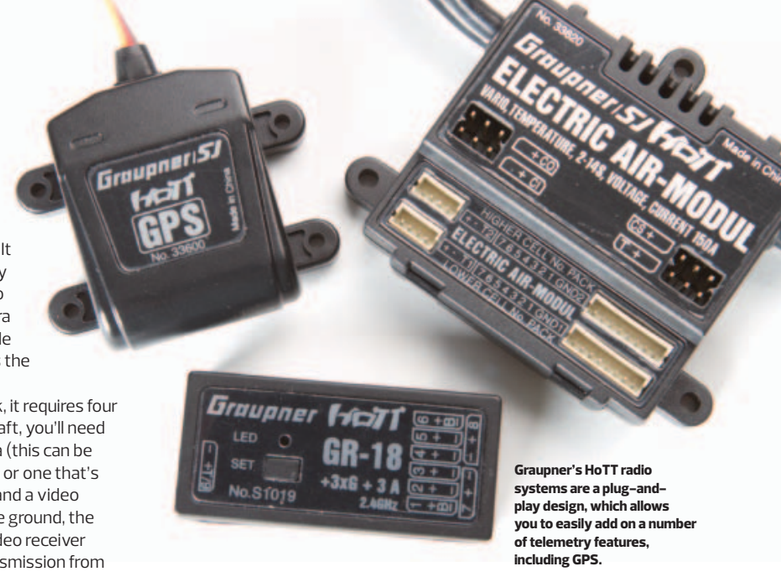
Perhaps the number one telemetry feature on a majority of multirotors sold today would have to be a global positioning system, or GPS. By using the GPS satellites to locate the exact position of the multirotor, the onboard transmitter can relay the exact positioning of the multirotor back to the ground station/transmitter for the pilot to observe. There are many different types of readouts available from this information, such as distance, height, speed, direction of travel, and exact location on a map overlay. Most of this information is based on using the transmitter/pilot as a reference point for all the data.

GPS can also be incorporated into the stabilization system of the multirotor to keep the aircraft level and at an exact point in three-dimensional space when the control sticks are released. It also allows the pilot to program waypoints, which, depending on the system that you own, could make your multirotor completely autonomous. Waypoints allow the pilot to program certain positions in space to which the aircraft can fly. GPS can also be used to lock in such things as photography or videography waypoints so that, once the multirotor reaches these spots, it will automatically record or photograph from that location. Because GPS is also used to assist the stabilization of the quad, it will provide rock-steady video.

About the only downfall to GPS is that it requires a certain number of satellites to calibrate its location, without which you cannot go into GPS mode. As such, this feature is practically useless if the drone is flown indoors.

At the start of the flight, GPS takes a fix on its takeoff point and/or the location of the transmitter. From there, it can calculate the speed and distance from that point. When incorporated with voltage monitoring, a parameter can be set so that when the battery hits a certain voltage level, the GPS can take control of the multirotor and fly it back to the takeoff point. Return to home is one of the most useful features on many multirotors. It allows the pilot to flip a switch and have the aircraft return to its takeoff point. This is especially useful when the pilot becomes disoriented or the multirotor is too far away to ascertain its flying direction.

Eagle Tree's Vector flight-control system utilizes GPS and has many telemetry features that are easy to add on. It also has a fully configurable OSD (on-screen display) built in.



Graupner's HoTT radio systems are a plug-and-play design, which allows you to easily add on a number of telemetry features, including GPS.

FPV

First-person view (FPV) is another form of telemetry that allows a video transmission back to a ground station, which can be attached to either a monitor or a pair of goggles. This allows real-time video of the aircraft as it travels through the air. This video feed can be used by the pilot to navigate the aircraft with the feeling of sitting inside the cockpit. It can also be used by a second person to position the camera onto a subject while the pilot navigates the multirotor.

For FPV to work, it requires four items. On the aircraft, you'll need to mount a camera (this can be a separate camera or one that's already onboard) and a video transmitter. On the ground, the pilot will need a video receiver to decode the transmission from the aircraft; this can be a separate unit or one that is incorporated into the monitor or set of goggles. And finally you'll need goggles or a monitor, which will give you the ability to watch the video to navigate the aircraft where you want it, or they can be used by the camera operator to position the camera to frame up the shot.

RECENT DEVELOPMENTS IN TECHNOLOGY HAVE ALLOWED VIDEO SIGNALS TO TRANSMIT IN REAL-TIME WITH LITTLE TO NO LAG TIME AND WITH HIGH-QUALITY VIDEO OUTPUT, SUCH AS HD 1080P.

Using first-person view (FPV) allows pilots to be completely immersed in the feedback coming from the multirotor, giving the feeling of actually sitting in the cockpit.

Most FPV pilots/camera operators work in real time, so the video transmission must be compressed to transmit quickly. This can reduce the video quality that is seen on the ground through the monitor or goggles. Recent developments in technology, however, have allowed video signals to transmit in real-time with little to no lag time and with high-quality video output, such as HD 1080p. This type of video telemetry allows for a real-time heads-up display on the ground, which enables the pilot to see a wide variety of data being relayed back instantaneously to the ground from the multirotor.

Final words

In many ways, telemetry has changed the way that pilots operate their multirotors, giving them the freedom and security to travel some distance away while still having all the key factors needed for a safe flight. The ability to monitor just about every component on the aircraft in real time from the ground eliminates guesswork and makes for a safe and enjoyable flight. This technology has allowed pilots to capture images and information from locations that were just not possible only a few years ago.