The Invasion of the Drones

Like it or not drone technology is not only here to stay, we are confident that in the very near future, the infiltration of drone technology will completely revolutionize how we even think about the term “experimental aircraft.” It wasn’t many years ago, that those of us involved in the RC (radio control) model aircraft industry, started tinkering around with some of the new, electric powered, micro helicopters.

With the advent of the new lithium batteries, the industry was awash with innovative new electric powered aircraft, helicopters, and then, the new introduction of the “quad copter.” This forever changed the model aviation industry. Most of us that became involved with the first iteration of drones learned to fly them through the use of simulators and lots of practice. In the early days of the quad copter, and long before electronic gyro stabilization an integrated GPS had been perfected, the skills necessary to master one of these little monsters was quite substantial. This usually involved a significant number of crashes followed by Tourette’s laden profanities. If your resolve, persistence and wallet held out, it became possible to not only become proficient, but really master these little machines. They proved to be quite agile and capable. If you grew up flying radio control aircraft, the transition was significantly easier. But for many a novice, the challenge and the cost proved to be just too much to be enjoyable.

In recent years the technology on the quad copter type drones has improved to the point that a new operator, without prior experience, can become proficient in short order. In fact, the new technologies allow the aircraft to virtually fly themselves without any intervention from a pilot what-
sover. DJI (Da-Jiang Innovations) is arguably one of the most prolific manufacturers of drones. This Chinese company sells a variety of drones. Their entry-level drones cost only a few hundred dollars while there commercial drones can often run tens of thousands of dollars. We purchased The DJI Inspire 1, (Figure: 1) solely for the purpose of commercial photography and video. It is a professional grade drone with amazing capabilities and 4K gyro stabilized video quality worthy of a feature-length film. Often times, when on a photo shoot, I will grab one of the many onlookers and ask them if they want to fly it. The response is usually the same, “I don’t know how to fly a drone.” I promptly hand them the controller and say “I’ll teach you.” “Push that button that says takeoff.” “Now push that button confirming that you want to takeoff.” Magically, the motors begin to spin up. Seconds later the craft lifts off the ground and begins a climb. Simultaneously the landing gear booms retract into the flight position, and at about 5 feet off the ground the Inspire 1 settles into a hover so stable you might think the aircraft was on a tripod. “There now, that wasn’t so hard was it,” I say. “Wow,... that’s so cool” is the typical response. Automatically keeping the Inspire 1 stable and steady during flight is an advanced Inertial Measurement Unit (IMU). The IMU incorporates both a 6-axis gyroscope and an accelerometer to monitor changes in tilt and movement. In addition, a Vision Positioning System utilizing both visual data and sonar waves that detect both variations in patterns on the ground as well as altitude. If that wasn’t enough, the Inspire 1 utilizes an intelligent GLONASS + GPS system, providing pinpoint positioning of the aircraft. The Electronic Speed Controllers (ESC’s) are what control the aircraft’s every movement by providing precise power adjustments to each of the crafts four brushless electric motors. The logarithm that controls the ESC is nothing short of amazing. All of the flight parameters, like torque, that would otherwise require a veteran pilot’s expertise are automatically taken care of. Flight transitions are smooth and accurate and the controls are very easy to manipulate. Forward and backward, as well as, left and right on the right stick. And up and down altitude control, as well as, left and right yaw control on the left stick. Pick an altitude; the aircraft will stay there until you decide to change it. This, regardless of the other inputs to the controls. Let go of the controls at any point in
time, and the aircraft makes an immediate transition to hover flight and stays there until you provide additional input. Put the controller on the ground, walk away, come back 10 minutes later, the aircraft will be right where you left it. All of this amazing capability within this little package is impressive by itself, but we are just scratching the surface. The DJI Inspire 1 is primarily a camera platform. DJI offers a whole series of interchangeable cameras, including an infrared camera capable of night vision. All of these cameras operate on a gyro stabilized gimbal that provides shake free video that can only be comparable to video achieved on a tripod. Check that, better than a tripod. Because of the gyro stabilization, the video footage is superior to a camera on a tripod being manipulated by an operator. We often use the camera and gyro stabilization on the Inspire 1 as hand held video platform because of its superior stabilization capability. The Inspire 1 also has the capability of dual operators. One operator flying the aircraft and the other operator controlling the camera functions. (Figure: 2) The camera operator can also manipulate the camera through FPV (first person view) goggles. During filming, the operator dawns the “virtual reality” goggles and now the camera operators head movements control the position of the camera. The quality of the video footage is now seamless and natural. But wait, there’s more. The DJI controller interfaces with an iPad (or android device) for its primary operating functions. There are several apps that allow us to interface with the Inspire 1. The DJI Go app is the default app, very powerful in itself. And then there are several third-party apps that bring the operation of the Inspire 1 to an entirely new level. The most common apps, and the ones that we use, are the Litchi, and Autopilot apps. Utilizing these apps we have a graphical interface very similar to that of a EFIS or MFD utilized in most modern aircraft. We have Google Earth map interface showing the exact location of the drone as well as a first-person view of what the camera is seeing during flight. The app contains a myriad of screens allowing us to monitor and control the operation of the aircraft as well as monitoring and warning functions for the batteries on the aircraft and the controller. In addition there are screens for controlling, and operating camera settings just as though you had a digital SLR camera in your hand. Utilizing the Litchi app (Figure: 3) or Autopilot app we can create a complete flight plan on our desktop or ipad by selecting waypoints, altitude positions, camera orien-
tation, speed, heading, etc. We can then upload the flight plan to the iPad. And then, with a single push of a button, the Inspire 1 will fly the entire mission, waypoint to waypoint, taking video and pictures at the preprogrammed locations, then return to the home location and conduct a landing and engine shutdown, all autonomously without any outside intervention. In fact, in the event of loss of signal from the controller, or with a single push of a button by the operator, the aircraft will autonomously climb to a the designated safe altitude and then return to home and land itself. The flight plan that you create can be saved and re-downloaded to duplicate the flight again in the future. Software and firmware updates are now commonplace and easily instituted keeping the drone and controller in tip top shape as new innovations are incorporated. The industry is innovating at a frenetic pace with several thousand drone manufacturers now bringing new products to market. Only a few years ago, human caring drones were a thing of science fiction. That can no longer be said. There are many manufacturers currently working on human carrying drone technology. One of the more interesting projects is the EHang 184. (Figure: 4) This Chinese company cut its teeth on manufacturing drones for the hobby industry and it didn’t take long for the company to see the advantages of utilizing their technology in a much more ambitious enterprise. The EHang 184 is an 8 motor electric powered single person drone, or as they like to advertise it, an “air taxi”. Their ambitious goals for the aircraft show only a glimpse of what’s to come in the future. When you climb into the cockpit of this aircraft you notice an immediate disconnect from what a pilot would normally be looking at. Void of all flight controls and sporting only an instrument panel that consists of a touchscreen reminiscent of that on the DJI Inspire 1. (Figure: 5) All of the technology that flies this craft, is essentially an enhancement on the technology built out of their experience with the smaller hobby versions of their other drones. And after having experienced this same technology first hand, with all of its redundancy, dependability and reliability, we can assure you, this is the future.

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