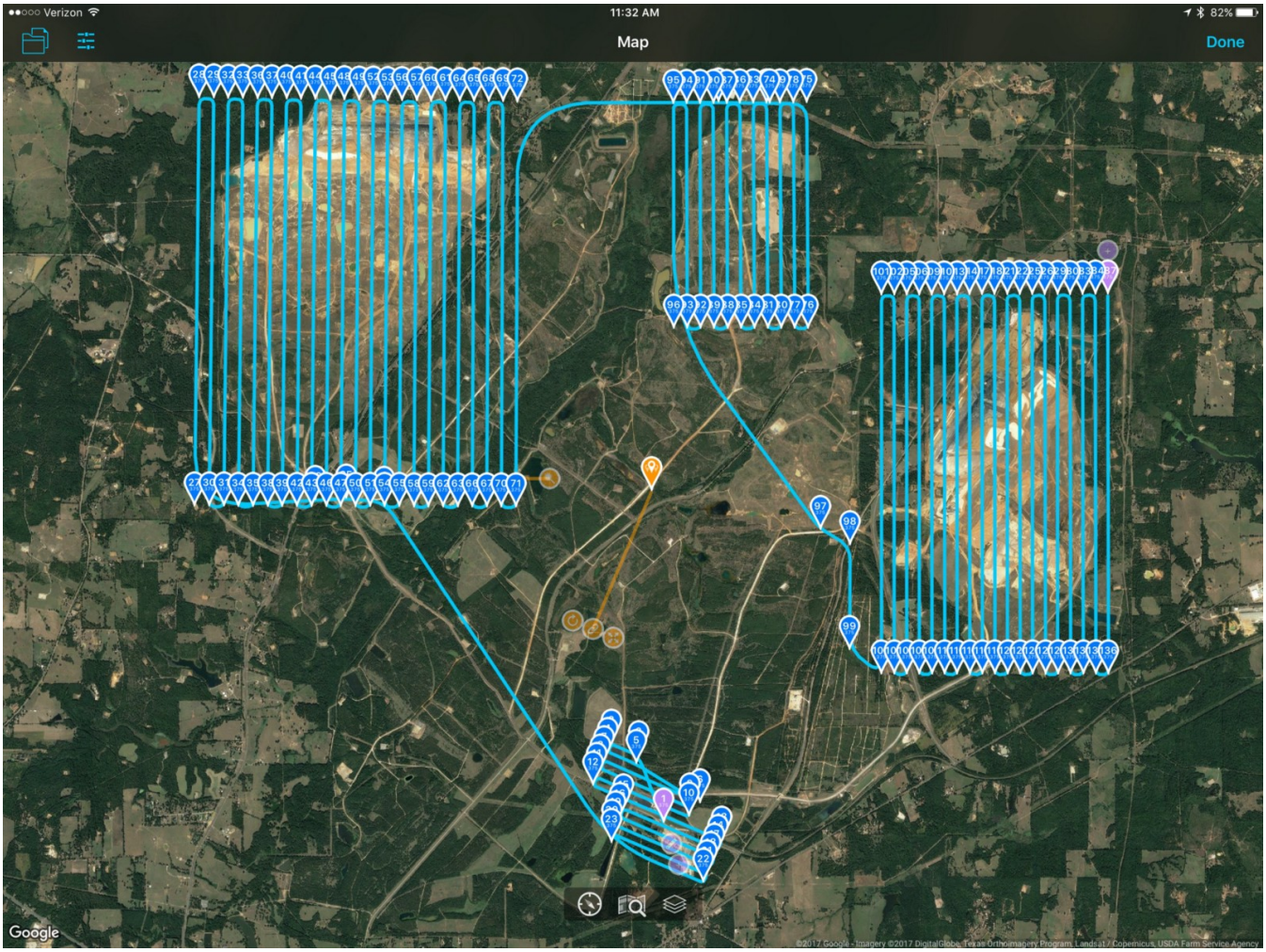
Autonomous & Waypoint Flight—A Primer



The main thing that distinguishes a drone from other remote control flying machines is autonomy. That is, drones can fly themselves with no human involvement. If it can't do that, it's not a drone.

Autopilots make this possible, but if you remember the movie *Airplane*, you know autopilots are nothing new. Airplanes have been able to execute waypoint flight (autonomous flight) for decades now, and even though autopilots run most of the flight these days, that doesn't make them drones. Planes still require human operators to handle at least some of the flight, but as autopilot technology approaches 100% reliability, human involvement will decrease. Soon you might be flying by drone and not even know it. Boeing hopes to test a fully-automated passenger plane next summer.

LINK: https://www.wired.com/story/boeing-autonomous-plane-autopilot/

For decades, though, autopilots were so large and expensive they've only been used in planes big enough to carry them. But somewhere around 2006 we saw the (oxymoronic) Big Shrink: Autopilots suddenly got exponentially smaller in size and cost, enabling anyone with the know-how and patience to put one on small-scale remote control (RC) copters and planes so they'd fly themselves. "Flying"

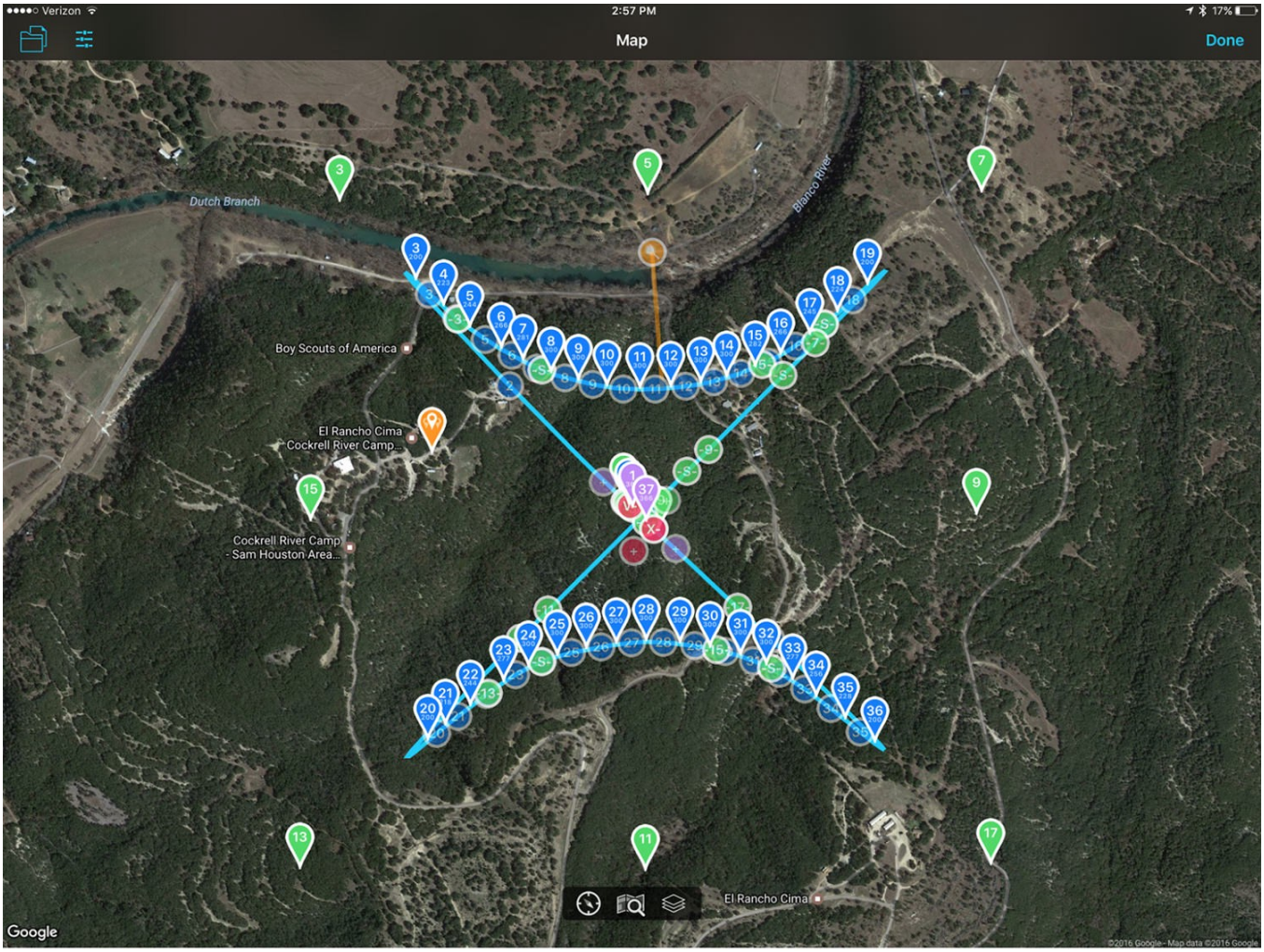
being relative in those days. But the Big Shrink wasn't top-down—military drones to smaller drones—it was a lateral move. Smartphones did it.

Several of the internal components that make smartphones so useful and versatile—accelerometers, magnetometers, GPS, compasses, microprocessors—are also some of the major components in autopilots. Smartphones demanded these sensors be small and cheap, so they got small and cheap really quick. RC enthusiasts and engineers took up the effort to make small autopilots more reliable, and within just a few years consumer drones were flying autonomous waypoint missions and, soon after that, carrying action cameras from point to point.

Waypoint flight might at first strike us as academic. After all, it takes and deep and probably superhuman expertise in an array of physical and computer sciences to be able to design, program, and build a small drone that can fly itself from one preselected point in space to another, with an accuracy of just a few feet. It took years of contributions of thousands of engineers and enthusiasts from different disciplines around the world to perfect the flight codes and autopilots that now make autonomous flight reliable and easy enough that consumers can execute a mission with a tap on their iPhone.

But why have this rabid, global pursuit of autonomy if it's just an academic exercise, a computer geek's favorite party trick? This question brings us up to today. When you combine the power of reliable and accurate autonomy with the capability to carry high-end cameras and other sensors, then link it all straight to cloud processing, drones can move out of the consumer "flying camera" world and into the world of real machines. Flying robots.

Today drone systems can map out autonomous waypoint missions that will cover virtually any selected area, then execute that flight with timed, precision data capture to automatically collect all the data you need to create high-resolutions orthomosaics, 3D models, and data-rich panoramas. Swap in different sensors for infrared, near-infrared, and multi- and hyperspectral data. The system links directly to the cloud for automatic processing and integration into your existing business and analytics systems.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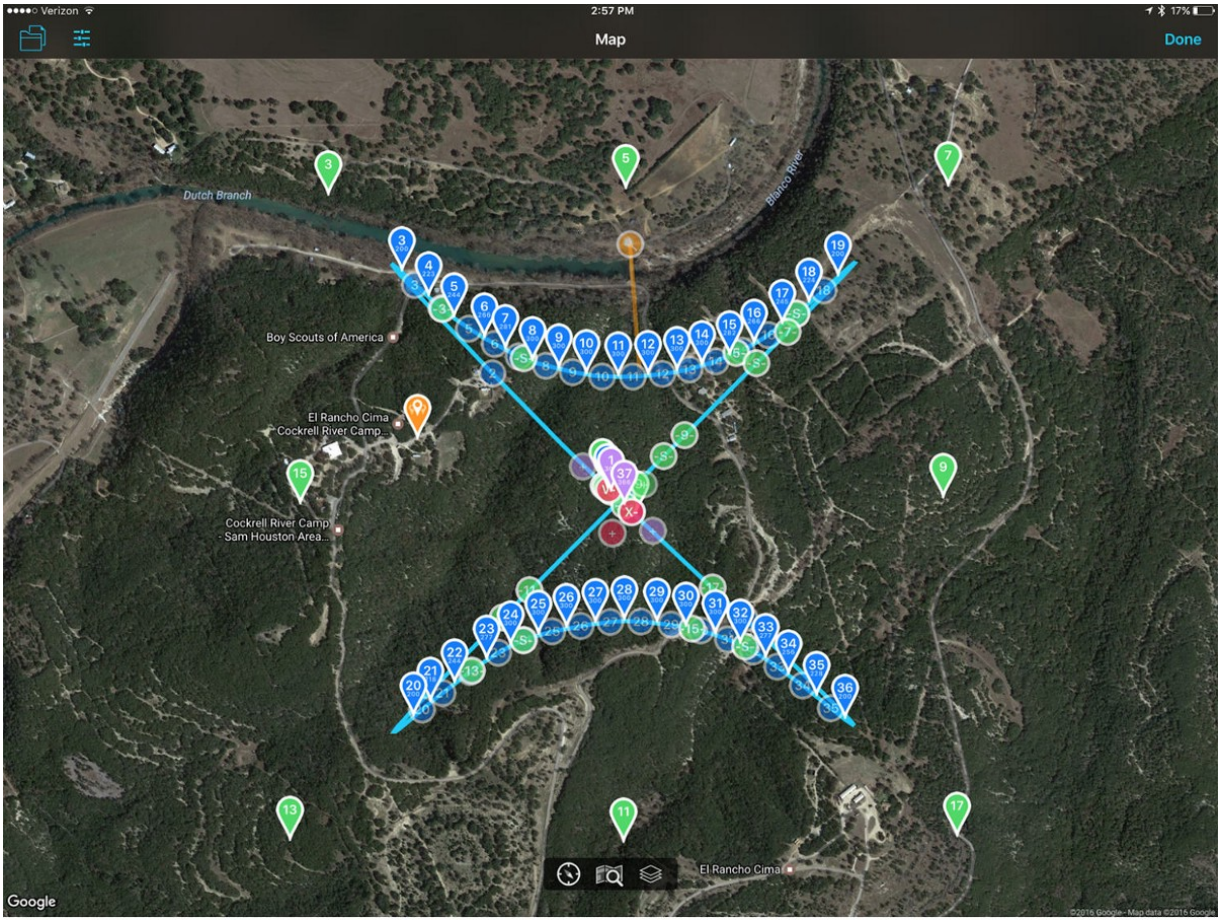

This all only takes a few taps on your mobile device. You can even use your finger to circle the area you want to map, and the system will generate the perfect mission at the perfect height for the resolution and scale you want. Save these missions and repeat them as frequently as you like, any time you like. Or have someone do it for you. In the not too distant future you'll be able to set timed and repeated aerial data capture just like you set your alarm—a "drone in a box."

This steady movement away from custom hardware continues in step with broader trends in robotics, which we're also involved with. In the future, drones will incorporate advanced technology from a wide range of fields: robotics, sensors, data processing, and beyond. Specifically, innovations in autonomous flight, computer vision, machine learning, and neural networks (AI) will lead to near-total independence from human operators, which to the end user means "easy." Even today we've begun "teaching" neural networks to prepare for coming advances in autonomy, capture, and processing.

In the last five years drones have crossed over from the realm of engineers and DIY enthusiasts to the shelves of consumer electronics stores, and now they've made significant headway into the commercial and industrial market. Along the way they've gone from frankenstein's monsters made of RC parts to ready-to-fly consumer goods outfitted with sense-and-avoid safety technology and premium cameras. One day drones will become as seamlessly integrated into business systems as a space bar is into your keyboard and we're working to take you there.

This article was written w/ Roger Sollenberger.