Do It Yourself GIScience

DIY GIS column by Eric Wolf

In this first installment of Do It Yourself GIScience (DIY/GIS), we're going to take a lesson from Benjamin Franklin and go fly a kite. Aerial photography predates the invention of powered flight by almost half a century. Before the airplane, balloons and kites were regularly used to capture all sorts of aerial photographs. In a return to these older ways, the hobbyist, the artist, and the occasional professional or researcher, can employ inexpensive digital cameras to create his or her own aerial imagery. This article will show you how.

Parisian bohemian Gaspard-Félix Tournachon, aka Nadar, took a camera aloft in a hot air balloon in 1858 to capture the first ever aerial photograph. Later, the first aerial photography patent issued by the U.S. Patent and Trademark Office was awarded to James Fairman, for a camera system suspended from a kite or balloon. And while some claim that British meteorologist Douglas Archibald first successfully captured imagery using a kite, it was Arthur Batut's book, "*La Photographie Aérienne par Cerf-Volan*," published in 1890, which described how to use a kite as a platform for aerial photography.

In the aftermath of the 1906 San Francisco earthquake, George R. Lawrence lifted a 49 pound panoramic camera above San Francisco with a train of 17 kites tethered together with piano wire. In 2006, Scott Haefner of the U.S. Geological Survey reproduced Lawrence's famous image using modern KAP equipment—a three-pound Hasselbad camera lifted by a single, six-sided Rokakku dako kite. Haefner had to abide by Federal Aviation Authority (FAA) regulations, something that Lawrence didn't have to worry about. Another reproduction was made using a replica of Lawrence's original camera built by Ronald Klein and mounted onto a helicopter. Using a helicopter enabled Klein to position his camera exactly where Lawrence's photo was taken.

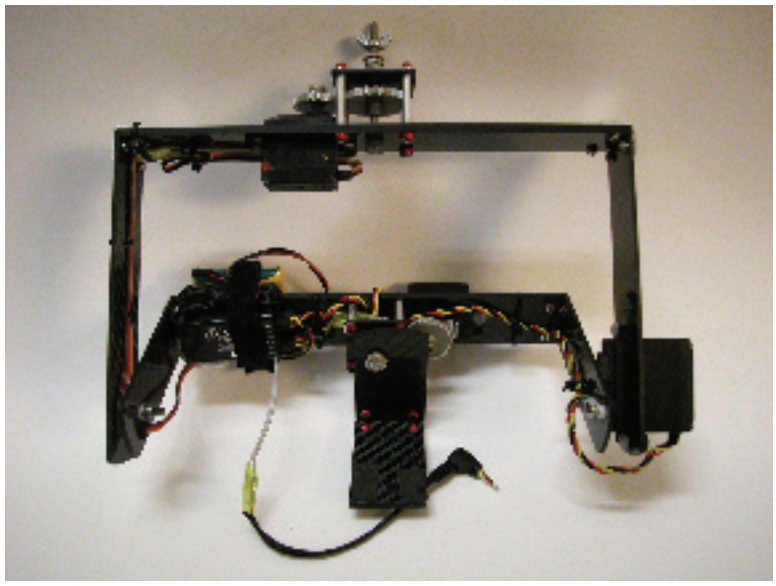
Taking your own aerial photographs with a kite or balloon is relatively easy and inexpensive. Digital cameras can

DIY aerial photography

Caricature of Gaspard-Félix Tournachon, aka Nadar, capturing some of the first aerial photographs.

George R. Lawrence's panorama of San Francisco after the 1906 earthquake. The 49 pound camera was lifted by a train of 17 kites.

Scott Haefner's 2006 recreation of the Lawrence photo. FAA regulations prevented Haefner from achieving the same altitude as Lawrence.



L-R: Scott Haefner's fully remote-controlled rig carrying a Canon D70s lifted by a Sutton FlowForm kite, close up of Haefner's rig, my simple, manually adjusted rig with an Olympus C-60 (from eBay!) with fisheye lens.

be purchased for under $100, and they can take hundreds of photos. This is a huge improvement over the days when the kite had to be brought down after 36 shots to reload the camera—or when the film needed to be replaced after every shot, as Lawrence had to do!

Besides the camera there are three other major issues to consider before you start flying aerial photography: 1. How to attach the camera to the kite or string; 2. How to aim the camera; and 3. How to trigger the shutter.

Once again, we turn to history for a proven method to attach the camera. Sometime around 1912, Pierre Picavet constructed a system for suspending a camera rig from a kite line. This Picavet suspension system, with its cross-members and a single, continuous support line, is still used. Detailed instructions for threading the support line can be found online. A rig can be constructed from parts found in a hardware store for under $10 or purchased from various kite aerial photography (KAP) suppliers.

Aiming and triggering the camera can be simple or complex, depending on the method used. Some KAPers use remotely controlled "servos" to position the camera and a video downlink to check the aim before triggering the shutter. These systems can produce excellent imagery, if focused on exactly the desired subject. However, they also require greater skill to operate them. One must simultaneously aim the camera and fly the kite—not an easy task! Maybe that is why some KAPers use a camera in a fixed position which is equipped with an intervalometer to trigger the shutter every x number of seconds.

This method is, perhaps, the best to start with because the rig is much easier to construct, and it allows the novice KAPer to focus more on flying the kite. The camera can be oriented by repositioning the kite, and, often, unexpected images are captured, which could turn out to be a pleasant surprise. More experienced KAPers may want to try Brooks Leffler's flying kits. The master KAP rig builder's solution was to create a series of kits combining a servo with an intervalometer, and allowing the camera to be automatically rotated a certain number of degrees after each image has been captured.

I left an important detail for the end—the kite or the balloon (or the pole!). Kites are by far the least expensive means to lift a camera but they are limited by wind conditions. Naturally, in an area with unpredictable winds, kites are not the best choice. A large helium-filled balloon provides a stable platform in calm conditions, but helium is expensive and difficult to store. More exotic options would be a small blimp or a balloon–kite hybrid.

A simple way to lift a camera is to attach it to the end of a long pole. Pole aerial photography is relatively unaffected by wind and generally carries less risk of damaging the camera. Moreover, with decreased risks come decreased rewards: you are unlikely to lift a camera much more than 30 feet above the ground with a pole.

Within the U.S., the FAA establishes regulations on air space use. This may or may not come as a surprise, but the FAA isn't too keen on kites and balloons potentially snarling air traffic. The regulations seem to say that if a kite or balloon is

small enough, it is exempted. However, FAA spokespersons have stated repeatedly that kite and balloon operators are liable for any damage caused to persons and property by their activities. This means that if a plane or helicopter hits your kite and crashes, you could be in some serious trouble. FAA regulations prohibit flying kites and balloons more than 150 feet above ground, if this is done within five miles of an airport or heliport, and not more than 500 feet above ground elsewhere. My advice? Contact your nearest air traffic control tower and request a pilot's Notice to Airmen (NOTAM) be issued to let others know where and when you intend to fly.

I have avoided discussing remote control airplanes, helicopters, and other "unmanned aerial vehicles" (UAVs) on purpose. UAVs are very expensive—typically costing several thousands of dollars in order to lift a camera. They are also much harder to operate than a kite. The FAA has established even more restrictive regulations for UAVs. If you are already a remote control aircraft pilot, then you may want to explore this option further, but if you're just starting out, I highly recommend you go fly a kite!

This brings us to the end of this first DIY/GIS column. I don't have room for full walk-throughs here but there are several resources online which you can google if you want to try aerial photography "the old way." In future columns, I will cover neogeography, free and open source software for GIS, and the Web 3.0.