

The account below, by kitemaker (and new AKA member) Chuck Donaldson, illustrates most directly how kitemakers can benefit from Drachen's archive. It also involves a historic kite site, the Blue Hill Meteorological Observatory in Milton, Massachusetts (www.bluehill.org). Opened in 1885, Blue Hill is the oldest continuously operating weather observatory in the United States, comparable to the Lindenberg Observatory in Germany (the hundredth anniversary of which was featured in *Kiting's* Winter 2006 issue).

According to the Monthly Weather Review, reporting in September 1896, "kites were first employed at Blue Hill Observatory in observations of atmospheric electricity, by Mr. Alexander McAdie, in the summer of 1885. The kites used were coated with tin foil, and served as collectors; the current passed down a copper wire to the electrometer at the ground." On August 4, 1894 at Blue Hill, William Eddy flew a modified thermograph and a barograph to an altitude of 1,430 feet, the first self-recording instruments flown by a kite. In the years from 1894 to 1909, kites enabled the first routine measurements of temperature, humidity, and wind in the lower atmosphere. Because of this pioneering work with kites by Blue Hill's director, Abbott Lawrence Rotch, observatories around the world pursued similar efforts: the US Weather Bureau set up observatories at Pikes Peak, Colorado, and Mt. Weather, Virginia, in addition to seventeen kite stations in the central and eastern United States. Data-gathering activity with kites crested in July 1908, when balloons and kites were sent aloft from forty-four stations on land and sea in both northern and southern hemispheres. Kites continued to be used at Blue Hill until 1915; by the early 1930s, all meteorological observations with kites in the United States had come to an end.

Drachen was thus delighted to play a modest role in Chuck Donaldson's replication of a historical kite from the Blue Hill "stable."

This story is about building a replica of an historical Blue Hill kite. There were several internationally renowned Blue Hill kites, including one that was patented as the Blue Hill Kite. I decided to replicate a Clayton/Hargrave Cellular (Box) kite, named for H.H. Clayton, Blue

Hill's technical genius, and Hargrave, inventor of the box kite. This kite was a major player in the evolution of controlled flight during the 1890s: S.P. Langley and the Wright Brothers visited to observe Blue Hill's kite flying operation for their aeronautical research. In addition to its curved wing-like forward cell panels, the kite had vertical panels in the rear cell by which it could be steered.

A "mule of the air" is what I affectionately call the Clayton/Hargrave. It carried weather-recording instruments aloft nearly every day and could lift more than one hundred pounds in a 20 mph wind. Steel "piano" wire (instead of the more common flax string) was used for the tether, which permitted these kites to be deployed in high-tension "trains" of four to ten kites. In 1900, one of these trains reached a then-record height of more than 15,000 feet.



The original Blue Hill Box Kite. Photo from Drachen Foundation archives.

I was hardly a kite novice when I took on this project. My kiting experience had begun when I was a lad of twelve. Here's how my brother, Jim, tells the story of my initiation. I was given a kite, on that day, as a birthday gift. I couldn't wait for the wind to blow hard enough to lift this newfound miracle of technology (diamond kite with a knotted rag tail) high into the wind. We had an open field near our home so I took my kite and my 50 feet of string and began running wildly back and forth — trying to get the "heavier than air" craft into a breeze. Regardless of my direc-

With this issue the Drachen Foundation begins contributing to *Kiting* a series of articles about kite history. The Drachen Foundation is a non-profit educational corporation, established in 1995 and devoted to the increase and dissemination of knowledge about kites worldwide. Drachen plans articles not just about kite developments and events throughout history but also about the current activities of historical kite researchers, restorers, and replicators. The series will also feature resources from the Drachen Foundation archive (maintained at its study center in Seattle) available to support the kite community in its historical investigations.

tion or speed, the kite never reached a height above about six feet. Exhausted, I was forced to wait for suitable meteorological activity.

The day after the no-wind day was glorious. The breeze had kicked up and I was raring to go. Out I went with my kite. Immediately, it took off and flew up to the maximum height that the length of string would allow. What great fun! Well, it was fun for about five minutes. I soon was bored and began thinking, "If 50 feet is fun, 500 feet will be a total scream." I reeled in my kite and went searching for more string. I found some fishing line at home, but that was not enough. I went to the neighbors and got donations of fishing line from several.

I don't know how many feet of fishing line I had, but suffice it to say that later that afternoon my kite went out of sight — literally. It got so high that I could see only a speck. Unfortunately, an undiscerning adult had given me some 3-lb. line and it snapped. So, somewhere, some kid would be flying my kite — or maybe it got into the jet stream or maybe it went into low earth orbit. Who knows? The loss was probably a good thing because I was already beginning to think about sending up a pilot with my kite — Snoopy, my pet rat, was going to make history.

Some forty-five years later, after retiring from a wonderful career in technology research of one form or another, I found myself with nothing much to spend creative energy on but minor construction projects. Then I visited a kite festival near my home in Boston and my spare time was gone. I was amazed at what current technology enabled kites to do, in some aspects, such as high lift/drag, that had interested me for a long time.

While kite searching on the Internet, I was happy to find that the Blue Hill Weather Observatory (www.bluehill.org), legendary for its use of kites in research,

Blue Hill Kite Replica

was also in the neighborhood. A few days later, I visited the Observatory and volunteered my handyman help to Don McCasland, Program Director there, in exchange for learning the history of the place and sharing the stunning view. After hanging around a while, I noticed that Blue Hill had lots of pictures of kites but no original or replica kites as used in the early days (1890s). Don wanted to display a replica Blue Hill kite at the Observatory, but had no funding. I volunteered to build the kite if Blue Hill would pay for the materials. Don agreed, and I was in the kitemaking business.

Decide which kite to build, study the blueprints, build a historically accurate replica. Simple enough. Our key objective was to make the kite as historically accurate as time and money would allow. We settled on an 8'x8'x2.5' model, the largest of the kites most commonly used at Blue Hill. Study the blueprints? No blueprints, no description, no data. Everything had been moved to a Harvard storage area years before and was unavailable due to renovation. I offered to go to Harvard and find it myself, made calls to everyone remotely connected to the storage area to no avail.

While I was digging dry kite data holes, Don got a call from John Pickle, Global Manager, Technology, Museum of Science, Boston. John was interested in procuring a Blue Hill kite for the new Meteorology exhibit to be opening soon at the Museum. I knew that the Museum had several original record setting, human-powered airplanes hanging in its entrance hall and felt that if there were an original Blue Hill kite still in existence, it should hang there, too. Don and I agreed that a Blue Hill kite in the Museum would not only aid in teaching the history of kites in weather research but also spread knowledge of, and interest in, the Blue Hill Observatory.

What better way to start your kite building career than to build one for the Museum of Science? So I volunteered to make another kite that I didn't have the plans for.

What to do? Luckily, Don remembered that he and Scott Skinner, President of the Drachen Foundation and Blue Hill board member, had discussed building a kite a few years earlier. He advised that I contact Scott and the Drachen group for assistance in researching construction techniques. Scott knew exactly where to direct me, but the resource he suggested

find a copy of this book. Any assistance that you may be in helping me gain (buy or borrow) access to the data in this book is needed ASAP."

Scott knew that the DF Archive had a photocopy of the "big book" (ironically, made originally at Harvard); he could even specify the pages needed for the project. He asked the DF Study Center in Seattle to assist. Within a week I had twelve pages of notes, tables, and construction details on a Hargrave box kite as modified by H.H. Clayton for Blue Hill use.

The pages from Drachen made it clear that no metal clamps or nails were used in the construction of this kite. It was put together with glue, string and wire. The frame was made of 3/4"X3/4" clear spruce; fastenings were bone glue (I substituted Elmer's) and shoe thread (which I learned is a wax-impregnated string with a breaking strength of about 40 pounds). The builders had used many fabrics and many wind-proofing techniques, but primarily cotton cloth soaked in diluted shellac. Their tethering incorporated automatic tension overload protection from gusts of high wind. The lower or rear part of the bridle was constructed with a rubber "bungee" cord so that too much tension would cause the rear of the kite to rise in relation to the nose and thus decrease the angle of attack and lift.

Work started in my basement and went very well until my wife, Alice, asked me how much of an 8-foot box kite could go through a 4-foot by 2.5-foot basement bulkhead door and stairs. I moved my Construction Department to the garage for technical reasons.

About two hundred hours later, the kite was finished, sitting in my garage, too big to do anything but sit or fly. Don rented a U-Haul, we partially disassembled the kite, and, two trips later, reassembled it at the

Museum for hanging by John's staff. Truly a labor of love. The only signatures on the kite are those of my brother and brother-in-law. But that's another story.

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Top to bottom: Frame of one cell. Completed rear cell. The almost-completed kite. All photos by Chuck Donaldson.

was not readily available. I emailed, "Scott, you refer to the big book, Blue Hill Meteorological Observatory, 1887-1902, as having a lot of specifications for the type of kite that we plan to construct. My problem is that I cannot