Conquest of the Air

In aviation's early days, Harvard pioneers advanced aeronautics and brought flight to the masses.

by John Lenger

The Harvard-Boston Aero Meet of 1910 featured speed races from "Harvard Aviation Field" twice around Boston Light, pictured at the left edge of a souvenir pennant (top). British aviator Claude Grahame-White (flying his Blériot monoplane at right) won the $10,000 *Boston Globe* prize for the best time over the 33-mile course: 34 minutes and 1.2 seconds. At right is the seal of the Harvard Aeronautical Society, which was organized on November 11, 1909, and formally incorporated in 1910.

Orville Wright's historic first flight lasted just 12 seconds. The Wright *Flyer* traveled 120 feet, a skip across the sand at Kitty Hawk's Kill Devil Hills. The Wright brothers got their biplane in the air three more times on December 17, 1903, eventually improving to a distance of 852 feet and a time of 59 seconds. Yet on the last flight, with Wilbur at the controls, wind caught the plane and flipped both the machine and one of the Wrights' unfortunate helpers, J.T. Daniels, over and over. Daniels was badly bruised, the *Flyer* destroyed.

Celebrations marking the centennial this year of the Wright brothers' achievement may gloss over the early troubles of heavier-than-air flight, presenting the transition from a biplane in a one-minute, one-man sortie to transcontinental jumbo jets as a minor jump. It wasn't. That first day of flight served as a blueprint for the first decade: breathtaking technological advances that were punctuated by catastrophes or near-misses. Entrepreneurial adventurers saw flight as the future, while the general public wondered whether flying would ever amount to anything more than what the *San Francisco Chronicle* characterized as "an exotic sport."

As aviation pioneers strove to improve their technology and to overcome public skepticism, an unlikely group of champions stepped forward: Harvard scientists, alumni, and students who banded together as the Harvard Aeronautical Society in 1909. Led by a pioneering professor, they organized the second aviation meet to take place in the United States. The Harvard-Boston Aero Meet of September 1910 did more than any other early effort to sup-

port aviation and to introduce the general public to the possibilities offered by heavier-than-air flight, from the pleasures of passenger travel to the threat that airplanes presented as weapons of war.

THE STORY of Harvard's aviation efforts properly begins in 1884, when 23-year-old Abbott Lawrence Rotch began building a private observatory atop Great Blue Hill in Milton, Massachusetts, about 10 miles south of Boston. A grandson of Abbott Lawrence, the merchant and statesman whose generosity established the Lawrence Scientific School (today the Division of Engineering and Applied Sciences), and a cousin of future Harvard president Abbott Lawrence Lowell, Rotch was an MIT engineering graduate, class of 1884, who decided midway through his studies that he didn't want to be an engineer. He was fascinated by weather, however, and decided to make it his life's work.

The director of the Harvard Astronomical Observatory, Edward C. Pickering, was among those who realized quickly that Rotch was doing important research. Only two other mountaintop meteorological stations existed in the United States, at Pike's Peak and Mount Washington, whereas Europe boasted several and its scientists led the fast-growing field of meteorology.

Soon after the Blue Hill Observatory opened in 1885, it became a Harvard "department," though Rotch owned it and paid the bills. In 1888, Harvard named him an assistant (unpaid) in meteorology and in 1891 awarded him an honorary master's degree. A committed and meticulous scientist, Rotch was the first to collect cloud data in the Northern Hemisphere and pioneered atmospheric studies using enormous kites and weather balloons. He traveled the globe, ascending in balloons to make weather observations and publishing his findings in three languages. In 1906, Harvard named Rotch its first professor of meteorology (still without salary). In 1907, he became the first president of the Aero Club of New England, a group of prominent Bostonians who had met informally since 1902.

WHILE ROTCH'S STAR WAS RISING, the Wright brothers were having their ups and downs. Their most difficult task at first was to convince anyone that they had flown. In the spring of 1904, they invited reporters from every newspaper near their home base

Claude Grahame-White, pictured in his "fog and rain costume" (below), was the idol of thousands. One spectator would later write of the pilot's dashing demeanor, "I concluded that the best guarantee for making it with the ladies was to be an English pilot with a hyphenated surname." Blue Hill Observatory (lower left) provided important weather data. Perhaps because of the huge costs of mounting the 1910 aero meet, the 1911 souvenir program was sold for 10 cents a copy.

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NATIONAL AIR AND SPACE MUSEUM/SMITHSONIAN INSTITUTE


SCIENTIFIC AMERICAN

A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

NEW YORK, SEPTEMBER 17, 1910

370

Aeroplane in the Wrights biplane at the Harvard meeting.

THE BOSTON INTERNATIONAL AVIATION MEETING —(See page 270.)

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A September 17, 1910, cover story in *Scientific American* declared, "The Harvard aviation meeting is the most important thus far held in the United States." The meet was a mixture of serious science and crowd-pleasing fun, as one youngster (top right) discovered. Eighteen-year-old Cromwell Dixon had a hard time, though, with his dirigible (center)—when his motor stopped, he nearly drifted out to sea, which would have meant certain death; some saw Dixon's predicament as a just reward for defying President Lowell's order that no flights take place on Sunday. The button above was given by Claude Grahame-White to Charles H. Taylor Jr. after Taylor flew with him. Grahame-White made extra money by charging passengers up to $500 for a 15-minute flight.

dazzling Europe. With the first air meet in the United States scheduled for January 1910 in Los Angeles, the Harvard Aeronautical Society sprang to life on November 11, 1909. Most Americans still had not seen an airplane in action and flying was still tagged as a dangerous, if thrilling, adventure.

From the start, the aeronautical society aimed to be more than an enthusiasts' club. The society sought to "promote the advance of aerial navigation [and] to contribute both in theory and practice to the conquest of the air." Any present or former member of the University was eligible for membership; 250 joined at once. Rotch was the founding president. That September, his skybreaking book, *The Conquest of the Air*, had been published. It presented, in layman's language, the science underlying aerial navigation by airplanes and balloons, capsulizing the short history of flight and offering a look at its future. The book went through three printings within a year.

Once begun, the aeronautical society moved quickly, with a "cinematograph lecture" in December 1909, plans for lectures every two weeks by Rotch and a few of his Harvard colleagues, and even a scheme to build an airplane from scratch. These efforts were the first at a major university and attracted considerable press attention. "Harvard to Build an Aeroplane" announced the Atchison, Kansas, *Globe* for January 31, 1910; the *New Haven Palladium* editorialized on January 22: "The higher scientific minds of those connected with the universities are just what is needed to further develop the flying machine and other universities should follow in the footsteps of Harvard."

Prominent Bostonians, meanwhile, sought to do more than support student experiments with rudimentary airplanes. New England would not have its first recorded flight until William Hilliard of Boston took off on April 17, 1910, but already plans were stirring for something big. An editorial titled "Boom the Airship" in the Woonsocket, R.I., *Call* in May 1910 summed up the sense of urgency about getting into the aviation game:

> Harvard's Aeronautical Society is endeavoring to interest prominent aviators in an airship meet.... It would be a pity to let this exhibition of interest in a pertinent subject fail for

of Dayton, Ohio, to observe a flight, only to fail for two consecutive days to get their plane off the ground. The federal government did not, in fact, grant the Wrights a patent for a flying machine until 1906.

As they sought likely customers among the U.S. and European militaries, the Wrights feared they would be overshadowed by young aviators such as Glenn Curtiss, who on July 4, 1908, became the first American officially to fly more than one kilometer and who would, in fact, emerge as their greatest competitor for airplane contracts. In August 1908, the Wrights amazed audiences in France with their flying, generating international headlines, yet just a month later, in a trial flight for the U.S. Army at Fort Myer, Virginia, Orville Wright crashed because of mechanical failure. His passenger, Lt. Thomas E. Selfridge, became the first aircraft fatality; Wright nearly became one himself.

The French city of Rheims hosted the world's first international aviation meet in August 1909,

lack of support. The United States produced the aeroplane, which is apparently the airship of the future; yet there has not been here anywhere near such a development of interest in man [sic] flight as has been seen in Europe.

The answer, declared the *Call*, was "to get up good meets and then more good meets." Boston's leaders saw aviation as an industry that would yield enormous benefits to communities smart enough to get in early.

PLANS PROGRESSED QUICKLY for a Harvard-Boston meet from September 3 to 13, considered the best dates for favorable weather according to Rotch's Blue Hill Observatory. Because Soldiers Field, where the aeronautical society had hoped to host the meet, was too small, organizers leased about 700 acres of Squantum Peninsula (which juts into Boston Harbor, separating Quincy and Dorchester Bays), and christened it "Harvard Aviation Field."

Bostonians raised some $50,000 for the meet, including more than $40,000 in prize money for contests in speed, distance, flight duration, altitude, accuracy in landing, and for dropping plaster "bombs" into the funnels of a fake battleship. Gen. Charles H. Taylor, founder and publisher of the *Boston Globe*, put up a $10,000 prize for the fastest time for a nonstop flight from the airfield twice around Boston Light, a trip of 33 miles. (The *Globe*'s front page for August 16 proclaimed, in inch-high capital letters, BOSTON-HARVARD AERO MEET WILL BE GREATEST OF YEAR.)

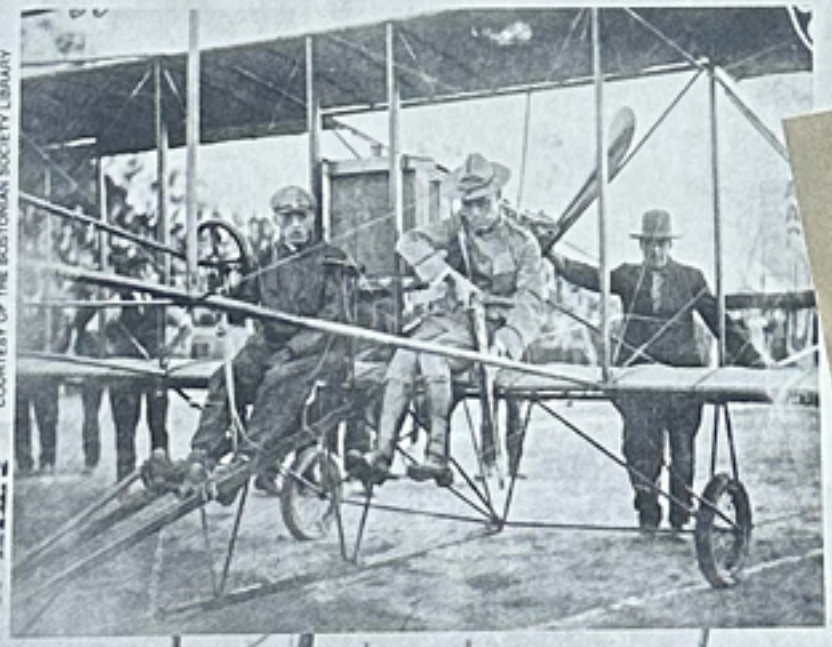
Despite the prize money and the publicity, organizers weren't sure until September who would compete. Rotch knew Wilbur Wright, and two flyers under contract to the Wright Company, Walter Brookins and Ralph Johnstone, signed up early, as did the Wrights' competitor, Glenn Curtiss. Britain's best pilot, Claude Grahame-White, and A.V. Roe, a future manufacturer of British warplanes in World War I, were later entries. Grahame-White did not disappoint. "Grahame-White Thrills in First Boston Flight: Moves Over the Harbor Like a Great Bird and Returning, Alights Gracefully" read the *Globe*'s lead headline on September 3, the opening day of the meet.

Another headline read simply "Flights Hypnotize." A daily column, "The *Globe* Man at the Meet," noted:

> The person who has not seen a flight before tiptoes breathless on first witnessing the marvel of a machine leaving the ground. This afternoon when the first machine went up, a policeman from one of the suburban details on duty at the grounds quite lost his official reserve, and danced up and down like a boy at a ball game. "Gee, but that's great!" said he. "Ain't that great? Why, that's the greatest thing I ever saw in all my life." And the good man was on duty all the time.

"Aeroplanes" were still so novel that newspapers felt the need to report that planes made a lot of noise.

Thousands streamed to Harvard Aviation Field each day. Crocker Snow '26, then a five-year-old, who would become a New England aviation legend, would write 87 years later in his autobiography, "Remembering Claude Grahame-White's popularity at the Harvard-Boston Aero Meet, I concluded that the best guarantee for making it with the ladies was to



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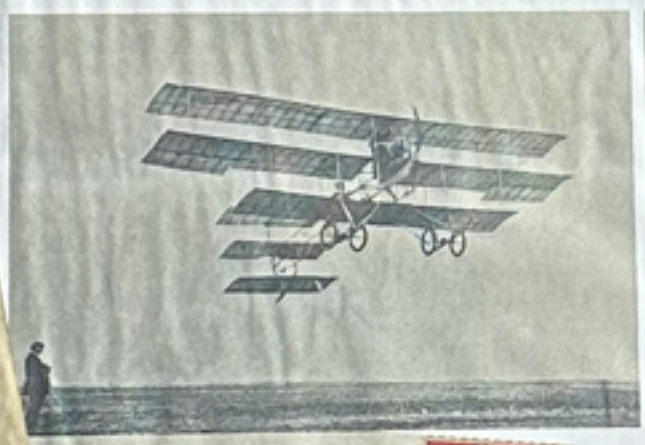
During the 1910 aero meet, pilots competed in a bomb-dropping contest by aiming plaster "bombs" at a small-scale battleship replica (below right); both the U.S. Secretary of the Navy and the Russian ambassador to the United States were impressed by their accuracy. Pilot Charles Willard, a crowd favorite from Melrose, Massachusetts, took aloft Lt. Jacob Fickel for aerial target practice (below left). A month before, Fickel had fired the first-ever shot from an airplane, at Sheepshead Bay racetrack near New York City. Spectators turned out for the meets in their best clothes (bottom); the most affluent flaunted their new-fangled automobiles.



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The aero meets were civic events, attended by political luminaries who fêted Claude Grahame-White and other aviators at celebratory dinners (top left). Boston newspapers had a field day; the *Christian Science Monitor* produced the special program shown above. The aero meets also were a testing ground for experimental designs, such as A.V. Roe's triplane, which came to grief (top center and right). The Harvard Cup (above, right) for the amateur class of the bomb-dropping contest was won by Clifford B. Harmon, a millionaire aviation enthusiast who made the first successful flight across Long Island Sound.

be an English pilot with a hyphenated surname. I learned later, to my delight, that just being a pilot was enough."

Grahame-White emerged as the hero of the air meet not just because he won more contests than anyone else, but also because he played the public-relations game perfectly. Boston mayor John F. Fitzgerald went flying with him and declared afterward, "[I]t struck me that in a way, aeroplaning is safer than automobiling, for if anything had happened there seemed to be very much turf for one to glide down to and alight upon safely. It is my opinion that aeroplanes will shortly be so perfected as to be safer than autos." Grahame-White and other aviators also flew adventurous society ladies and female newspaper reporters. The message was clear: if flying was safe enough for women, children, and VIPs, it was safe enough for everyone.

Estimates placed the number of spectators at the meet at more than 1 million, counting paying customers and those who watched from other vantage points, including boats in the harbor and their own front yards. President William Howard Taft came with his family. The event was so popular that it was extended for two days, pleasing those disappointed that no flights had been held on Sundays at the insistence of Harvard's President Lowell. Aviators spent the extra two days after the official end of the competition on September 13 engaging in light-hearted events such as an egg-dropping contest. The meet had achieved its purpose of promoting aviation to the public.

Public relations wasn't the only item on the air meet's agenda, of course. The Harvard Aeronautical Society had set out to serve science. The records for speed, flight duration, altitude, and so forth that were so widely reported at the time seem pedestrian today, and were broken within a few months. Yet science was served in several important ways.

The electrifying topic at the meet was neither passenger flight nor sport, but war. The thought that an airplane, balloon, or dirigible could fly undetected across borders and attack cities from the skies terrified government leaders and common people alike—and governments feared being left behind in what amounted to an early arms race. Abbott Lawrence Rotch had noted in *The Conquest of the Air* that Germany had spent $670,000 the previous year developing dirigibles for warfare, while France had spent $280,000 and England and Austria each $27,000. Airplanes' potential as weapons of war was demonstrated conclusively at the Harvard-Boston meet as aviators successfully bombed a mockup of a miniature battleship. Wilbur Wright participated in the bomb-dropping contest, helping his aviators, Brookins and Johnstone, to finish in the prize money behind Grahame-White. When a U.S. military attendee challenged the pilots to bomb from 1,800 feet (contest rules required 100 feet or more), Grahame-White rose to the occasion. A *Globe* reporter wrote of the meet's organizers, "there is not a man among them but believes the aeroplane will prove the greatest war-maker and the greatest peace-maker of the ages." Among those watching were the Russian ambassador and a young Harvard alumnus who would serve as assistant secretary of the navy during World War I and as commander-in-chief during World War II: Franklin D. Roosevelt, A.B. 1904.

The meet offered not only a primer on destruction, but also important lessons about safety. Weather data played a significant role in gauging the prudence of flying, and rescue boats were stationed along flight routes in case of trouble over Boston Harbor. A team of Boston's leading physicians was on hand at a field hospital. Aviators, led by Grahame-White, preached about the necessity of preflight safety inspections. Though several airplanes were wrecked because of clumsy landings, not a single aviator was injured.

Finally, the meet served as an important proving ground for airplane design. Biplanes were then the dominant style; although monoplanes had made some impressive flights, flyers were not sure which type was better. (A.V. Roe even brought a triplane, which was destroyed on landing.) Grahame-White piloted both a monoplane, which won him the *Boston Globe*'s $10,000 prize because of its stability in the wind, and a biplane, which he wrecked in high winds.

THE HARVARD-BOSTON AERO MEET of 1910 was a success in every respect except the financial: it lost $22,000, mostly because of expensive improvements to the aviation field. That dashed the hopes of Rotch and others to use any profits to fund a department of aeronautics at Harvard, but the aeronautical society forged ahead, organizing a second meet from August 26 to September 4, 1911. This meet drew another famous English pilot, Thomas Sopwith, creator of the legendary World War I fighter, the Sopwith Camel, as well as Earle L. Ovington, a Boston native who became this country's first airmail pilot. The following year, William A.P. Willard, who had helped manage the two Harvard-Boston meets, organized a Boston Air Meet at Squantum. It was the first in the United States at which female aviators competed. On July 1, America's first licensed woman pilot, Harriet Quimby, took Willard up as a passenger during an attempt to break Grahame-White's speed record twice around Boston Light. With a thousand spectators watching, first Willard, then Quimby pitched out of the plane; they fell a thousand feet to their deaths. The tragedy effectively ended the era of air meets in Boston.

Rotch did not live to see this outcome. He had died of a ruptured appendix early in April, leaving the Blue Hill Observatory and a $50,000 endowment to the University. A private, nonprofit organization now runs operations at the observatory. Harvard honors Rotch through its Rotch professorship of atmospheric and environmental science. Steven Wofsy, the current incumbent, is conquering the air in a twenty-first-century way, chasing air masses with specially equipped aircraft in an attempt to secure the first exact measurements of greenhouse gases in the upper atmosphere.

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Safety was uppermost in the minds of competitors, including a physician, Dr. William Christmas, who declared that his biplane would never crash, even if the pilot became unconscious (bottom left). Trouble is, there is no record that it got off the ground at the Harvard-Boston meet. Promotional materials for the aero meets, like the poster below, declared that they were taking place in Atlantic, Massachusetts, though the area has always been known as Squantum.

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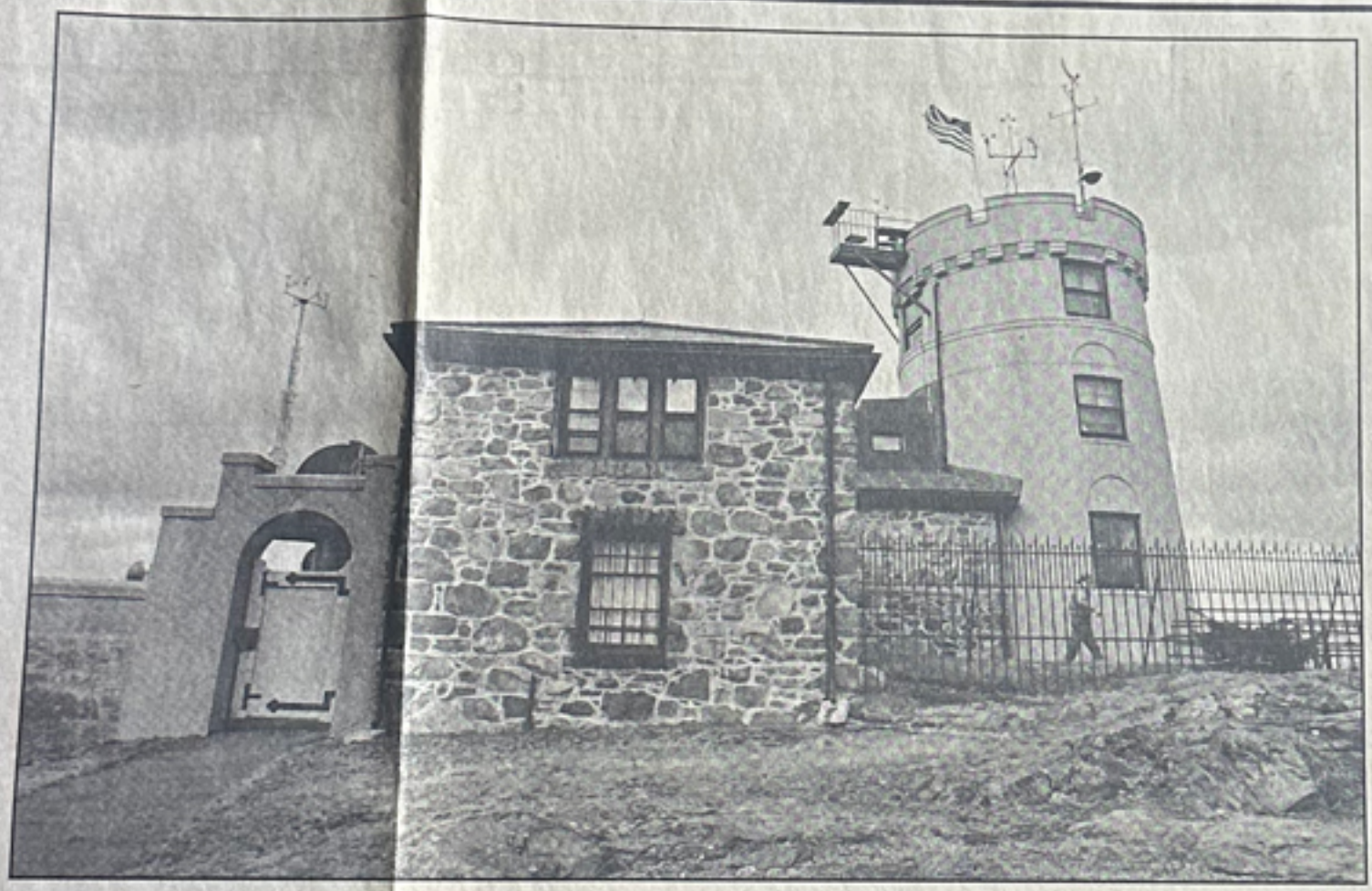

ASSOCIATED PRESS

RAIN OR SHINE, KEEPING TRACK — The Blue Hill Meteorological Observatory, in Milton, Mass., continues its mission of historic climatic record keeping, to maintain and refurbish the facility, and expand public educational efforts in the area of meteorology and related fields.

Keeping eye on weather at Blue Hill

Observatory oldest continuously operating weather station

By GREG SUKIENNIK
Associated Press

MILTON, Mass. — The weather in New England is famous for changing minute to minute.

The Blue Hill Meteorological Observatory, however, remains much as Abbott Lawrence Rotch built it in 1885, right down to the antique weather instruments.

The observatory is the nation's oldest continuously operating weather station, taking daily measurements of air, wind, sun and rain each day since Feb. 1, 1885.

Rain or shine, volunteer observers trek up Great Blue Hill early in the morning and peer into a white wooden box outside the observatory to take readings from the instruments inside.

Visitors can hike up an access road or along trails to the observatory, which is open on weekends for guided tours. The observatory, which resembles a small castle, complete with tower, also welcomes group visits and educational programs for students.

Blue Hill's records are a treasure trove of information. Visitors can scan its bound volumes for weather conditions any day in the past century. They can read observer John Conover's account of the Hurricane of 1938, when the wind hit 186 miles per hour — a gust second only to one recorded on Mount Washington, N.H.

The observatory's long-term goal is to expand its educational offerings for students and the general public.

Since 1999, over 5,000 students have visited the observatory. Its three-year-old science center, equipped with computers tied into the latest weather data, features a program to promote interest in natural science among middle school-age girls.

"This place used to be fairly quiet," says Pat Flynn of the Metropolitan District Commission, which funded the observatory's $1.2 million restoration. "Now it's noisy. That's what we want."

Groundbreaking experiments and advances in weather science, notably the use of kites and balloons to measure conditions at altitude, have taken place here in the past 117 years. Several generations of forecasters learned about measuring and predicting the weather here.

Inside the observatory, visitors can learn about the history of meteorology and forecasting and see how weather data are collected.

In a refrigerator-sized steel cabinet in the observation tower, a bank of computers delivers the latest data to the National Weather Service.

Mounted on the wall in the next room is a mercury column barometer, made in London in 1887 and still in use. It is recalibrated at Smithsonian Institution in Washington every few years.

In an age of satellite imagery, Doppler radar and sophisticated computer models, the Blue Hill Observatory's 19th century data collection methods still play an important role, executive director Charles T. Orloff says.

In the language of forecasting, it's called "ground truthing" — making sure the measurements taken by computerized equipment are accurate. Orloff says the observatory's glass thermometers, hair hydrometer (yup, real human hair) and coffee-can rain gauge give modern technology a run for its money.

"For example, we're discovered their new rain gauges measure less precipitation than actually falls," Orloff explained. "That's why we're still very important to the National Weather Service."

The observatory's century-old records provide a solid benchmark for forecasters studying weather trends, particularly global warming.

Then, there's the prize view. From the tower, atop 635-foot Great Blue Hill, one can see the Boston Harbor Islands, most of the 7,000-acre Blue Hill Reservation and even Mount Monadnock in New Hampshire on a clear day.

Rotch, an engineer educated at the Massachusetts Institute of Technology, had kept weather journals since he was a teen-ager.

He established the observatory on family-owned property in 1885. His family's shipping fortune allowed him to pursue his interest freely, making regular trips to Europe and meeting and befriending other experts in the nascent field.

Rotch and his colleagues studied clouds, noting their shape, speed and frequency. With the use of kites modified for greater stability, they sent instruments high into the air to measure temperature, pressure, humidity and wind speeds.

That continued in the 1930s, when the observatory, under the direction of Charles Brooks, pioneered the development of the radisonde, a weather instrument that is carried into the air by balloon and transmits data by radio.

Meteorologist Mike Iacono, a volunteer observer at Blue Hill, says he's happy to donate his time to a place with such a rich history.

"If you talk to other meteorologists or attend a weather conference, everyone has heard of Blue Hill," he said. ■

DIRECTIONS: Take Interstate 93/Route 128 to Exit 2, Route 138 north. Drive about a mile north and look for Blue Hills Ski Area and the Trailside Museum. The observatory is located atop Great Blue Hill. An access road, which leads to the summit, is not open to public vehicles. Hiking trails also lead to the summit

HOURS: The observatory is open for public tours Saturday and Sunday from 11 a.m. to 3 p.m., and to groups by arrangement with the observatory.

ADMISSION: $3 adults, $1.50 children 5-17. Children under 5 free.

INFORMATION: Call 617-696-0389.